Pellervon taloudellisen tutkimuslaitoksen työpapereita

Pellervo Economic Research Institute Working Papers

N:o 44 (June 2001)

CONSTRUCTING AN INDEX FOR REGIONAL COMPETITIVENESS*

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Helsinki, June 2001

*This paper is part of a project funded by the National Technology Agency, TEKES. We would like to thank members of the monitoring committee, Pekka Pesonen (Tekes), Mika Pikkarainen (Ministry of the Interior), Pentti Vuorinen (Ministry of Trade and Industry), Ari Leppälahti (Statistics Finland), Olavi Lehtoranta (Statistics Finland) and Raija Volk, as well as Vesa Vihriälä for their valuable comments.

ISBN 952-5299-38-4
ISSN 1455-4623

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Helsinki 2001

HUOVARI, JANNE - KANGARHARJU, AKI - ALANEN, AKU. 2001. CONSTRUCTING AN INDEX FOR REGIONAL COMPETITIVENESS. Pellervo Economic Research Institute Working Papers No. 44. 23 p. ISBN 952-5299-38-4, ISSN 1455-4623.

ABSTRACT: This paper constructs an index to measure regional variations in competitiveness. Regional competitiveness is defined as an ability of regions to perpetuate and attract mobile production factors. The index contains available statistical indicators that approximate regional variations in human capital, innovativeness, agglomeration and accessibility. We find that the index is highly correlated with traditional long-term indicators of economic well-being, such as per capita GDP and personal income. However, the association between the index and short-term outcome indicators, such as change in production, employment and population is clearly lower than that in the long-term indicators. We conclude that our index, which captures various aspects of competitiveness, is essentially a long-term indicator, and its evolution can be described by traditional terms known as cumulative causation and vicious circles.

Keywords: Competitiveness, Index, Regional.

HUOVARI, JANNE - KANGARHARJU, AKI - ALANEN, AKU. 2001. INDEKSI ALUEELLISELLE KILPAILUKYVYLLE. Pellervon taloudellisen tutkimuslaitoksen työpapereita n:o 44. 23 p. ISBN 952-5299-38-4, ISSN 1455-4623.

TIIVISTELMÄ: Tutkimuksessa kartoitetaan alueiden kilpailukyvyn kannalta keskeisiä ominaisuuksia ja resursseja ja muodostetaan Suomen seutukunnille kilpailukykyindeksi. Tutkimuksessa päädytään siihen, että alueellisen kilpailukyvyn kannalta keskeiset mitattavat resurssit ovat inhimillinen pääoma, innovatiivisuus, keskittyminen ja saavutettavuus. Näitä neljää kilpailukyvyn osa-aluetta kuvaamaan on valittu kolmesta viiteen resurssi-indikaattoria, joista kilpailukyvyn osa-alueita kuvaavat osaindeksit ja kilpailukykyindeksi on laskettu. Osaindeksien antama kuva resurssien jakaantumisesta seutukuntien kesken on hyvin samanlainen. Parhaimman kilpailukyvyn omaavat seutukunnat pärjäävät yleensä kaikilla osa-alueilla hyvin. Näitä ovat keskeiset kaupunkiseutukunnat ja erityisesti yliopistoseutukunnat. Samat seutukunnat ovat yleensä myös taloudellisesti hyvin menestyneitä seutukuntia ja kilpailukykyindeksi korreloikin erittäin hyvin seutukuntien taloudellista menestystä kuvaavien väestöön suhteutetun alueellisen BKT:n ja ansiotulojen kanssa. Vaikka hyvän kilpailukyvyn omaavat seutukunnat ovat kasvaneet viime vuosina keskimääräistä nopeammin, on yhteys kilpailukykyindeksin ja kasvun välillä kuitenkin heikompi. Kilpailukykyindeksi kuvaakin seutukuntien pitkän aikavälin menestysedellytyksiä. Tämä työpaperi on lyhyempi englanninkielinen versio tutkimuksen suomenkielisestä julkaisusta Alueiden kilpailukyky, PTT:n raportteja No. 176.

Avainsanat: Kilpailukyky, indeksi, alueellinen.

CONTENTS

1. INTRODUCTION

Competitiveness receives a lot of attention. Commentators are often concerned about the loss of competitiveness, and policy actions are motivated by a desire to improve competitiveness. What is typically being referred to is the competitiveness of firms, nations or other geographic areas. The competitiveness of firms differs from that of geographic areas, however, and there is a need to clarify the difference between them.

Krugman (1995, 1996, 1997) is perhaps the best-known critic when it comes to using competitiveness with reference to nations. Krugman argues that using the term competitiveness is dangerous, as it can lead to protectionism and bad public policy. The term seems to imply that in the world economy, the benefit of one nation or region comes at the expense of another. Krugman argues that the concept of regional competitiveness is empty and refers to nothing other than the competitiveness of firms within regions.

Others have argued that competitiveness is also a useful concept in the context of national or regional units (Porter, 1996; Begg, 1999). For example, the concept can be used to indicate the relative economic fortune of regional units (countries or regions), as the level of economic activity and resource endowments vary between them. Siebert (2000) argues that the competitiveness of firms is simply a distinct concept from that of geographical areas. He states that competitiveness exists on at least three levels: firms, geographical areas and workers. Regions and countries compete against each other for mobile production factors in factor markets, while firms compete for market shares.

This study adopts the view that regional competitiveness is the ability of regions to foster, attract and support economic activity so that its citizens enjoy relatively good economic welfare. Competitive regions have build a production environment with high accessibility that perpetuates and attracts mobile production factors, and results in fostering the economy. These mobile factors include skilled labour, innovative entrepreneurs and footloose capital. Success in attracting these factors creates external economies, such as agglomeration and localisation benefits, that further enhance the economic fortune of a region.

The purpose of this study is to compare the competitiveness of 85 regional units that closely represent the labour market areas of Finland. In EU standards these units are called subregions and represent the NUTS-4 level. The objective is to collect a measurable set of attributes that describe the resources of population (potential labour force), (actual) labour force, firms, the level of agglomeration, and the accessibility of regions. These indicators are then used to construct a regionally comparable competitiveness index for each subregion.

In constructing the index we loosely follow the example given by comparisons of competitiveness across nations (World Economic Forum, 2000; International Institute for Management Development, 2000). International studies cannot be applied to a regional framework as such, however, since some of the indicators are unavailable or are meaningless at the regional level. These indicators include the efficiency of the public sector and finance, and barriers to foreign trade, as these variables do not vary within a country.

There have also been several regional studies on competitiveness (Chamber of Commerce, 2000; European Commission, 1999; Ovaskainen, 1998; Department of Trade and Industry, 1997; Silander et al., 1997; Pikkarainen, 1996; Kresl, 1995; Mikkonen 1995). A common feature in all regional studies is that they tend to concentrate on a restricted number of aspects of competitiveness rather than providing an overall and coherent general index. Moreover, there have been only a few attempts at incorporating innovativeness as a part of regional competitiveness (Massachusetts Technology Collaborative, 2000; Stern et al. 2000; Cambridge Econometrics, 1998). Similarly, the role of agglomeration has received surprisingly little attention in competitiveness studies. The objective of the present paper is to at least partly address these shortages.

We have built an index that uses statistical indicators available at the labour market level and, we have also measured the innovativeness and agglomeration of regions. Unfortunately, the use of currently available statistical indicators excludes some aspects of competitiveness that are extremely difficult to measure, including social capital.

Our results indicate that regional variations in competitiveness are closely related to those in several output variables, such as per capita GDP and personal income. We also find that the sub-indices of the total index tend to correlate with each other so that subregions with a high value for one sub-index also have high values for other sub-indices. This tends to show that a high level of competitiveness in one aspect helps to improve other aspects, a development which results in a high level of competitiveness overall.

However, the association between the index and short-term change in outcome indicators such as production, employment and population is lower than that in the long-term indicators. We conclude that our index, which captures various aspects of competitiveness, is essentially a long-term indicator.

The remainder of the paper is organised as follows. Section 2 develops a conceptual framework for an analysis of regional competitiveness. Section 3 describes the variables that are operationalised to measure various aspects of competitiveness and describes the construction of the index itself. Section 4 describes the constructed index and section 5 provides the results. Finally, section 6 concludes the paper.

2. A CONCEPTUAL MODEL OF COMPETITIVENESS

Growth theory serves as a natural starting point for a conceptual model of competitiveness. In traditional growth models, production comes from the joining of labour and physical capital with a particular technology, the progress of which is assumed to be exogenous (Solow, 1956; Swan, 1956). New (endogenous) growth models stress that human capital is another essential production factor, as production processes have become more difficult, know-how a more important factor and technological progress more rapid (Aghion and Howitt, 1998). Since within a country, and particularly in Finland, there are hardly any regional differences in the supply of physical capital, the role of human capital becomes even more critical. Geographic areas where highly educated labour is abundant are therefore more competitive than those where it is scarce.

Technological progress is another increasingly important source of growth. Endogenous growth models suggest that technological progress is not exogenous, but endogenously determined by research and development, learning-by-doing and other related processes. These lead to innovations that, in turn, are the channel through which technological progress takes place. In a regional context, R&D conducted in firms is not the only way of enhancing innovativeness. At the regional level, high innovativeness also requires a suitable environment, infrastructure, and co-operation within clusters of firms (Stern et al. 2000; Porter and Stern, 1999). In this context, the presence of other sectors that support the innovativeness of one sector is important (Porter, 1998).

In addition to human capital and innovativeness, the new economic geography provides us a third source of regional competitiveness. Urbanisation, agglomeration, localisation and other benefits accruing from external economies form one of the main channels that transform regional balance within nations (Fujita et al. 1999; Ottaviano and Puga, 1998; Krugman, 1991; Marshall, 1920). The term agglomeration benefits can be seen to comprise both urbanisation and localisation benefits. Urbanisation benefits accrue from the presence of several actors and sectors in the same geographical area. Localisation benefits refer to the utility of firms owing to the presence of other firms in the same industrial sector.

Finally, there is a long tradition of seeing the accessibility of regions to matter for economic development (Hirschman, 1958; Myrdal, 1957). Regions close to markets are better off than those located further away from centres. Accessibility in terms of high quality connections (infrastructure) to centres alleviates the disadvantage of a peripheral location. Accessibility depends on the location of geographical areas with re-

spect to markets and the state of the infrastructure. In other words, accessibility is a factor related to agglomeration, since large agglomerations tend to have high accessibility due to the size of their own markets.

In fact, all these four dimensions of competitiveness are closely related to one another. To begin with, human capital is regarded as a crucial factor for economic growth in a modern knowledge-based society. In particular, human capital is at the heart of innovative behaviour, which is the source of technological progress. Ground-breaking innovations, in turn, usually take place at a higher intensity in large agglomerations than at the periphery (Kangasharju and Nijkamp, 2001; Freeman, 1990). Finally, agglomerations tend to have high accessibility due to the size of their own markets and high quality connections to other agglomerations.

Without radical changes, the development of these aspects is slow. For example, the level of human capital does not improve fast without extensive migration. Similarly, innovations take time to realise and infrastructure cannot be built overnight. Agglomeration, in turn, is a result of long-term competitiveness.

In fact, overall competitiveness is determined by previous competitiveness that has resulted, for instance, in in-migration and growth in employment and production volume, i.e. an increased level of agglomeration. In other words, improvement of competitiveness and growth of geographical areas take place simultaneously, feeding each other, and leaving the direction of causation bi-directional.

There are also other sources of development. These include social capital (Kajanoja and Simpura, 2001; Putnam 1993; Putnam 1995), regional policy measures (Tervo 1991) and possible regional differences in the efficiency of the public sector. We have been forced to leave out these dimensions of competitiveness for reasons of data availability.

3. CONSTRUCTION OF THE INDEX

Our conceptual model suggests that the competitiveness of subregions in Finland is determined by human capital, innovativeness, agglomeration and accessibility. This subsection describes 16 variables that have been selected to measure these four dimensions of competitiveness. Apart from three exceptions, each variable was measured in 1999.

3.1 Variables

Human capital is usually approximated by educational variables (Barro and Sala-i-Martin, 1995). The regional distribution of people with some secondary education is relatively even in Finland. The greatest variation can be found in the number of highly educated, having at least 13 years of education. Therefore, our first variable for human capital is the number of highly educated residents in a subregion. Moreover, not only the stock, but also the stream to human capital is regarded as important. Therefore, secondly and thirdly, a stream to human capital is approximated by the number of students and that of technical students. Finally, we extend here the typical way in which human capital is measured. We consider the characteristics of labour force as an integrated part of human capital. Consequently, we two further variables that capture these characteristics. Our fourth variable is the size of the working age population (15-64) and the fifth is the participation rate, both of which measure the labour supply potential in a subregion.

Since resources devoted to the acceleration of technological progress are seen as a highly important factor of competitiveness, we include the number of patents and the amount of R&D to capture the innovativeness of subregions. As patenting tends to vary strongly between years, we take the average of the number of patents between 1995-1999. R&D expenditures are those measured in 1999. Thirdly, we have a recently developed a measure for the proportion of establishments in a subregion that have been innovative during the years between 1985 and 1998 (Alanen, Huovari, Kangasharju, 2000). This variable measures the number of actual innovations, measured by subject and object based methods. Our final variable of innovativeness is the proportion of value added produced in high technology sectors. Although this is not a direct measure of innovativeness, it tells the proportion of value added that is produced in sectors where innovativeness is even more important than elsewhere in the economy. For reasons of data availability we have measured this variable in 1996.

As suggested by new economic geography, agglomeration and localisation economies are highly important factors of competitiveness. We have used population density as a

measure of the general state of agglomeration. When this variable is transformed into an indicator, it reveals size differences between subregions (see the next subsection). Secondly, we have measured the proportion of workers in sectors where external economies, and therefore the regional tendency for concentration, are large. These sectors include manufacturing, wholesale and retail trade and private services, and exclude agriculture, the public sector and construction. A third variable considers the presence of so-called supporting industries as a vital ingredient for success. We measure this presence as the proportion of workers in business services. Finally, in addition to agglomeration, localisation benefits are also important. We approximate the extent to which subregions can have localisation benefits by the size of the largest sector in subregions.

Ease of access to other areas is traditionally seen as important factor for economic development. We have three variables for accessibility. Firstly, we have measured the road accessibility of subregions with respect to markets as the road distance of each subregion to every other, weighted by the size of subregions. Another variable measures the distance from the airports, weighted by the size of airports. Finally, we have measured the number of existing international connections of firms, as these connections are seen as one of the most important ways in which innovations and new ideas diffuse. This is measured by the proportion of establishments in a subregion engaged in foreign trade.[1]

3.2 Formation of Indicators, Standardisation and the Weighting Scheme

We have two types of variables. One type is comprised by variables of absolute numbers, such as the number of students or patents, and the other contains proportional variables, such as the rate of participation. As the subregions differ greatly in size, we first divide the variables of type I by the population. In practice, these indicators are formed by dividing the proportion of subregion i from the indicator X by the proportion of subregion i from the total population P, multiplied by 100:

$$(1) \qquad \text{indicator } X_i = 100\ (x_i/X)/(p_i/P),$$

where capital letters are the total values for Finland. In the case of proportional variables we simply divide the value for each subregion by that for the whole country, multiplied by 100. For each variable the value 100 refers to whole of Finland, and the

[1] Rail accessibility is not taken into account for three reasons. First, most of the trade between subregions are carried out on roads. Second, rail accessibility is not seen as important factor for competitiveness in a modern economy; road and air accessibility dominate. Third, data were unavailable for rail traffic at the subregional level.

index shows the value for each subregion relative to the whole country. The purpose of each indicator is to reveal the strength of subregions relative to others.

The same mean for each indicator is not sufficient for comparability, however. Without standardisation, the indicators with a larger standard deviation would have obtained larger implicit weight than those with smaller standard deviations. As such, differences in the ranges of indicators would indicate large implicit differences in weights (Figure 1). Without standardisation, the number of technical students (indicator 4) and the amount of R&D (indicator 6) would have the highest weights in the index. This is not appealing, however; we would like each indicator to have an equal weight.

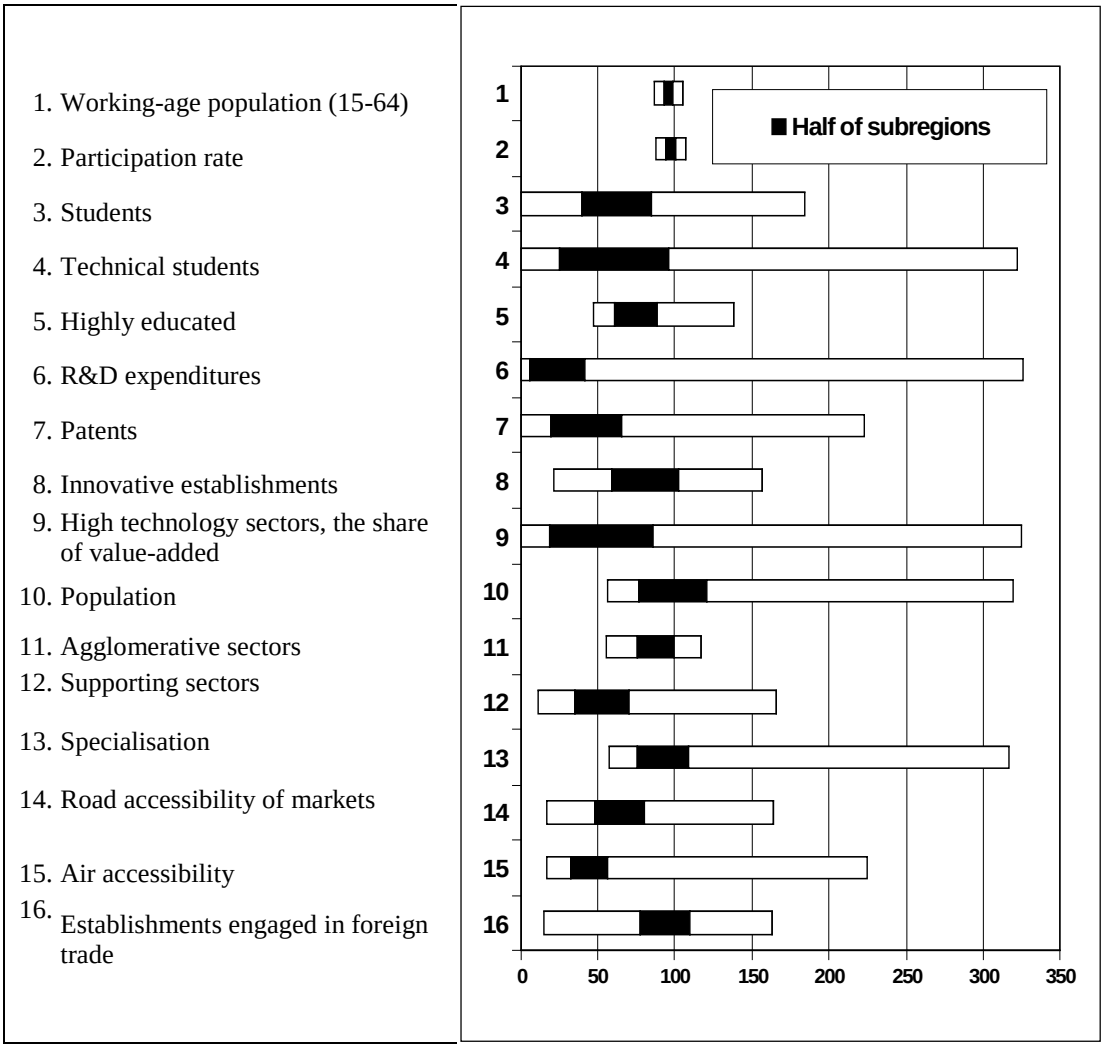

Figure 1. Distributions of non-standardised indicators.

In order to legitimate comparability, we standardised the dispersion of indicators by relating each indicator to its own standard deviation and multiplying all indicators by the same scalar to spread the common range wider. In practice, this was conducted in the following fashion. First, the mean of each indicator was returned to zero by subtracting 100 from the mean value. Then, each value was divided by the standard deviation of the indicator in question. As a consequence, the range of each indicator, as well as that of the total index, collapses. In order, to make the index visually more appealing, the range was artificially spread wider by multiplying each value by an arbitrarily chosen scalar. Finally, the mean was returned to 100.

This standardisation changes neither the information content of indicators, the correlation between the indicators nor that between indicators and various outcome variables introduced below. After standardisation, each indicator has approximately similar weight in indices, and the ranges of the index and various sub-indices are visually easy to read.

In summary, all 16 variables are transformed into 15 indicators (the number of students and that of technical students form one indicator) [2]. There are four indicators for human capital, innovativeness and agglomeration, and three for accessibility. The total index for competitiveness is formed by these four sub-indices. Within each sub-index each indicator has equal weight and within the total index each sub-index is considered equal. In other words, all indices were computed as the non-weighted average of indicators or sub-indices. For example, in the total index the implicit weight of each sub-index is 0.25.

[2] The average of these two variables is one of the indicators in our human capital index. In other words, we think of technical students as having an effect on human capital that is equal to that of the number of all students.

4. DESCRIPTION OF THE INDEX

As mentioned above, the mean of the index is 100, which refers to the whole of Finland. The values for the 85 subregions range from 59.4 to 133.9; i.e. the range is 74.5 index points. Due to the way in which the index is constructed, the level of index scores is meaningless. However, the rank-order and the distances of subregions from each other give valuable information. This section describes the rank-order of subregions and the main features of the index and sub-indices.

4.1 Rank-order of Subregions

The capital subregion, Helsinki, is the most competitive subregion in Finland (Figure 2). The index score for Helsinki is 133.9, whereas that for the least competitive subregion, Kärkikunnat, it is 59.4. The triumph of Helsinki was expected due to its capital status and the fact that more than a quarter of the Finnish population lives there and one-third of value added is produced there. Therefore, it is natural that Helsinki has the highest value for agglomeration and accessibility (Appendix 1). For innovativeness, which is the weakest feature of Helsinki, the subregion is in fifth place behind Salo, Oulu, Tampere and Jyväskylä.

From the total of 85 subregions there are only 10 that are above the average in the competitiveness index. Since a university is located in 7 of them (Helsinki, Turku, Tampere, Jyväskylä, Vaasa, Oulu and Lappeenranta), the success of these subregions is apparently based on human capital. The other three subregions are strong in innovativeness (Salo and Etelä-Pirkanmaa) and accessibility (Porvoo).

The remaining subregions have a lower than average index value for competitiveness. Broadly speaking, subregions in Southern Finland are more competitive than those located in Northern and Eastern Finland (Figure 2).

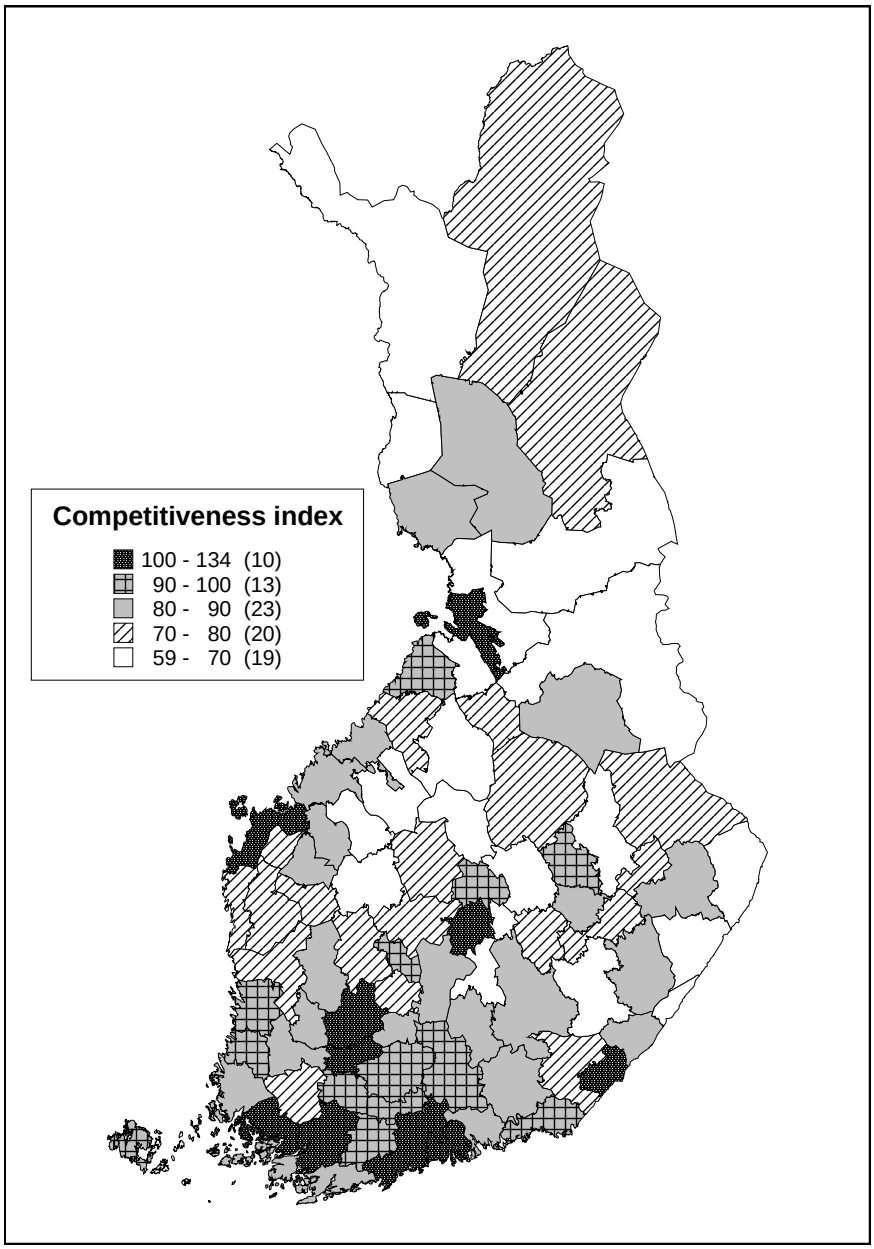

Figure 2. The competitiveness index, 1999.

4.2 Characteristics of the Competitiveness Index

One major feature of this index is that the sub-indices are highly correlated, implying that to a large extent they measure similar things (Table 1). The highest correlation coefficient is that between human capital and agglomeration (0.86), whereas the lowest correlation is found between innovativeness and accessibility (0.64).

Table 1. Correlation matrix of sub-indices

	Human capital	Innovativeness	Agglomeration	Accessibility
Human capital	1.00			
Innovativeness	0.76	1.00		
Agglomeration	0.86	0.80	1.00	
Accessibility	0.68	0.64	0.71	1.00

This indicates that if a subregion has one high sub-index, other indices also tend to be high. This feature of sub-indices is illustrated in Figure 3, which gives the contribution of each sub-index to the total index value. Only 4 subregions have a higher-than-average value for each sub-index, whereas the majority of subregions, 59 of them, have sub-index values that are all lower than the average. There are 22 subregions where some sub-indices are higher and some lower than the average.

We consider this finding to provide evidence that regional development is subject to cumulative causation, since subregions that have a high value in one sub-index also tend to have high values in other sub-indices. This supports the view that the improvement of one aspect of competitiveness tends also to improve other aspects.

Another related feature of the index is that the size of weights does not matter much. When the total index is compared with alternative indices, where the weight of each sub-index in turn is increased to one half (the other sub-indices sharing the other half), the average change in the value of index across the subregions was 2.05 index points. This can be regarded as a rather low figure, as the range of the non-weighted index is as high as 74.5 points (from 59.4 to 133.9). Changes in the weight structure also only slightly changed the correlation between the alternative indices and the non-weighted index, the correlation coefficient being 0.99 on average (the average correlation over four differently weighted indices and the non-weighted one). The same applies to the rank correlation. Alternatively weighted indices changed the rank order of subregions on average by 3.3 steps, which also seems to be a low figure as the total number of subregions is 85. The rank correlation coefficient between the non-weighted and alternative indices is 0.98 on average.

The minor effects of various weights support the result obtained above: the sub-indices are highly correlated. Otherwise, a higher weight on one sub-index would have altered the rank-order and index values of subregions more clearly.

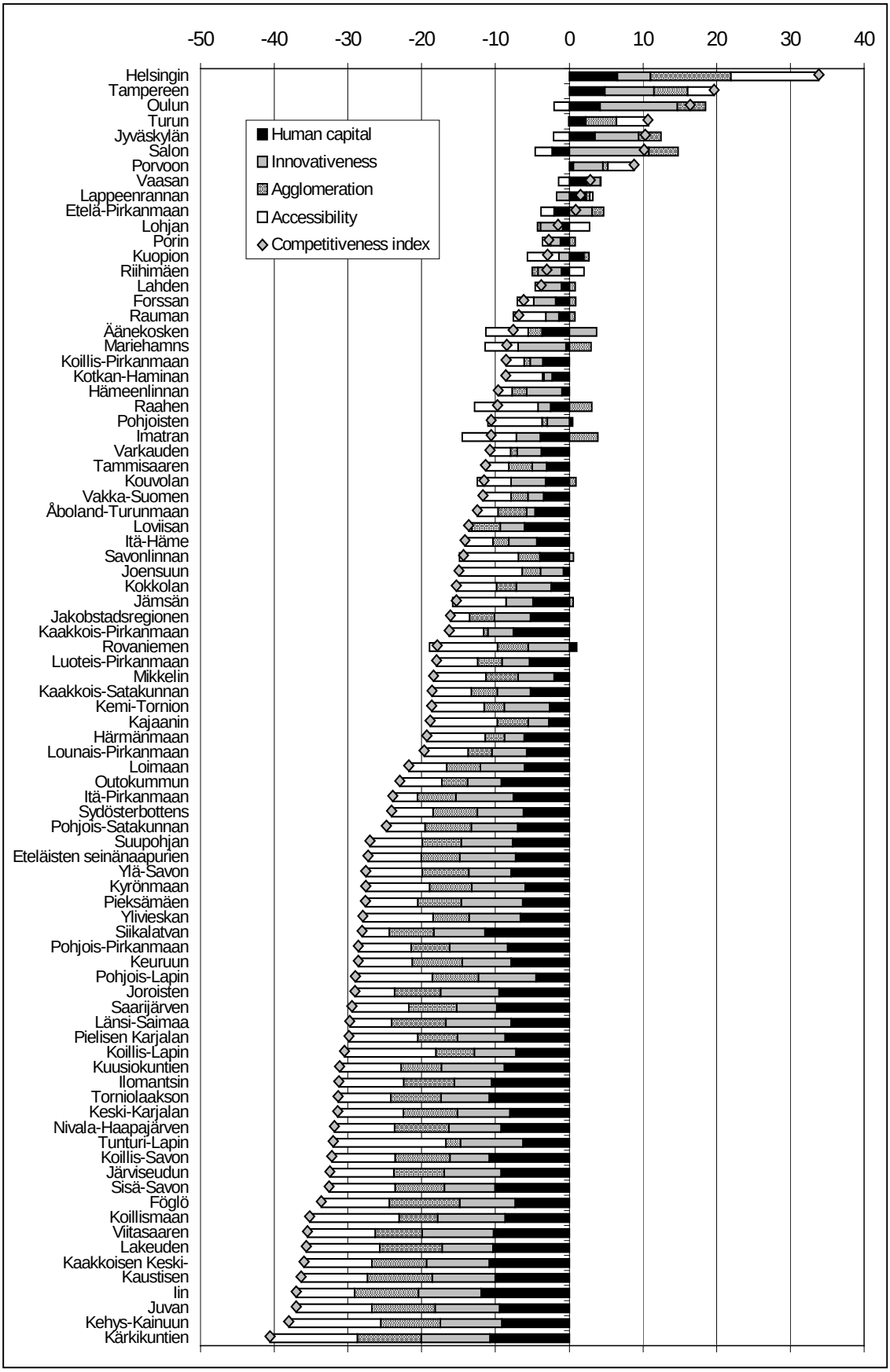

Figure 3. Contribution of sub-indices

There are some clear changes, however. At the highest, the index value for Salo increases by 11.1 index points when the innovation sub-index is weighted at the expense of others. This shows that the competitiveness of Salo is highly dependent on innovativeness, and Salo somewhat lags behind in other dimensions of competitiveness, the total index being above average, however. More generally, the value of the index changes by more than 5 points for only three subregions when human capital is weighted at the expense of others, whereas that of six subregions changes when innovativeness is over-weighted. In terms of agglomeration and accessibility, the corresponding number of subregions is six and thirteen, respectively.

These changes leave the changes in the rank-order of subregions rather small. At the highest, weighting the agglomeration sub-index raises the rank position of Tunturi-Lappi by 22 steps. Otherwise, the five largest changes in the rankings are between 5 and 14 steps. If the rankings are illustrated by a five-category scale, as in Figure 2, even the largest changes would mainly yield only one-class alterations, since the class-size is 17 in a five-class categorisation of subregions.

An implication is that the more the index of a subregion changes due to the alterations in weights, the higher is the potential bias in the index value for a particular subregion. Therefore, our index gives a potentially more biased result for subregions with more uneven sub-indices.

Finally, the competitiveness index appears to be very stable over time. When the index for 1999 is compared to its 1995 counterpart[3], neither correlations nor rank correlations between the index or sub-indices change to any noticeable extent. The mean change in the index value over subregions is 1.3 points and between 1995 and 1999, whereas that in rank order is 2.4 steps (the index range being 74.5 points among 85 subregions). Minor changes between 1995 and 1999 imply that the index illuminates the long-term competitiveness of subregions.

There are a few exceptions, however. While the changes in index values remain rather low, ranging from –4,9 to +7,3, there are a few noticeable changes in the rank positions, due to close distances between the index values of subregions. At one extreme Siikalatva rises 20 positions between (7,3 index points) 1995 and 1999, and at the other Sisä-Savo drops by 13 positions though its index points drop 2.4 points only. One major reason for the rise of Siikalatva is in the accessibility. The proportion of firms engaged in foreign trade has dramatically increased between 1995 and 1999. This is partially due to the small total stock of firms within the subregions; a small absolute change in the number of exporting and importing firms can yield a high relative figure. Sisä-Savo declines because of a minor drop in innovativeness, agglomeration and accessibility.

[3] Note that for data availability reasons both indices, for 1995 and 1999, include identical indicators for patents and innovations.

5. THE INDEX AND REGIONAL DEVELOPMENT

So far we have been describing the construction of the index and some features of it. Now we will check how well the index and sub-indices correlate with most common variables of regional economic well-being and development.

5.1 The index and long-term development

Per capita gross domestic product (GDP) is the most common and perhaps the easiest measure for economic well-being. This measure is not the optimal when the interest is focused on people living in the area concerned. For this reason we also use per capita personal income subject to taxation as a measure of economic well-being. For comparisons we construct our outcome variables in as similar fashion to our indicators. As mentioned above, we expect the correlation to be rather high, due to cumulative causation and related processes. Per capita GDP and personal income describe the outcome of long-term competitiveness of subregions, since the level of the variables tend to be high for subregions that have competitive for a long period of time.

Due to the long term perspective we are able to scrutinise the cross-section correlation of the index and two outcome variables. It turns out that in 1999 the correlation between the index and per capita GDP is 0.79 and that between the index and personal income is as high as 0.92 (Table 2). Correlations between sub-indices and outcome variables are high as well. At the lowest, the correlation between accessibility and per capita GDP is 0.55, whereas at the highest, the correlation between agglomeration and personal income is 0.88.[4]

[4] The correlation between the index and the level of unemployment appears to be negative (-0,80). Among the sub-indices, accessibility correlates the most with unemployment (-0,54); unemployment is the highest in subregions where accessibility is the poorest. Other sub-indices correlate clearly less with unemployment (about –0,30).

Table 2. Coefficients of correlation between the indicators and outcome variables

	Per capita GDP	**Per capita personal income**
The competitiveness index	**0.79**	**0.92**
Human capital	**0.71**	**0.87**
Working-age population (15-64)	0.60	0.74
Participation rate	0.60	0.79
Students	0.49	0.51
Technical students	0.49	0.51
Highly educated	0.65	0.85
Innovativeness	**0.77**	**0.76**
R&D expenditures	0.73	0.63
Patents	0.57	0.64
High technology sectors, the share of value-added	0.61	0.59
Innovative establishments	0.59	0.60
Agglomeration	**0.80**	**0.88**
Population	0.62	0.81
Agglomerative sectors	0.74	0.82
Supporting sectors	0.56	0.70
Specialisation	0.50	0.29
Accessibility	**0.55**	**0.77**
Road accessibility of markets	0.48	0.72
Air accessibility	0.51	0.77
Establishments engaged in foreign trade	0.34	0.39

The correlation between the total index and outcome variables is higher than that between each sub-index and outcome variable; the index measures something more than the sub-indices alone. As far as per capita GDP and separate indicators are concerned, the correlation with R&D expenditures is the highest. In contrast, the lowest correlation is found with the number of business links to abroad. For per capita personal income the correlation with highly educated population is the highest, whereas that with specialisation is the lowest. In general separate indicators correlate more with personal incomes than GDP.

The same finding is shown by the plot of outcome variables (y-axis) against the index (x-axis) (Figures 4 and 5). The subregions are more close to the regression line in the case of personal income that GDP. In a simple regression, the index explains 84% of the variation in personal income. In a GDP regression the index explains 62 % of the variation.

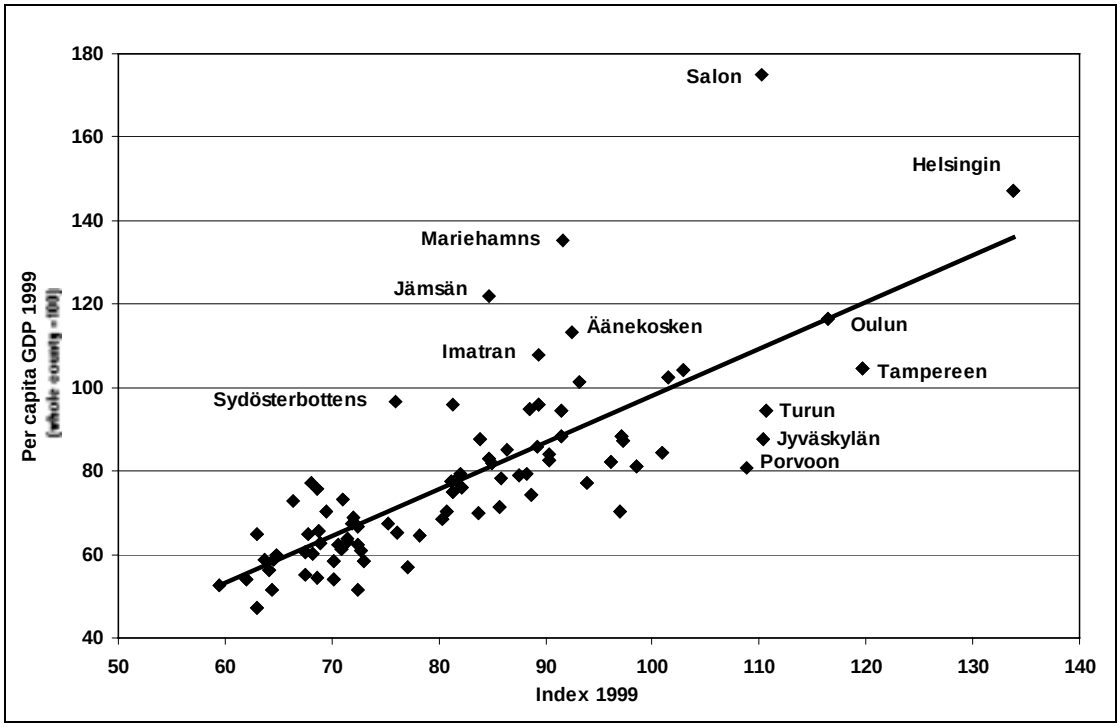

Figure 4. The index and per capita GDP, 1999

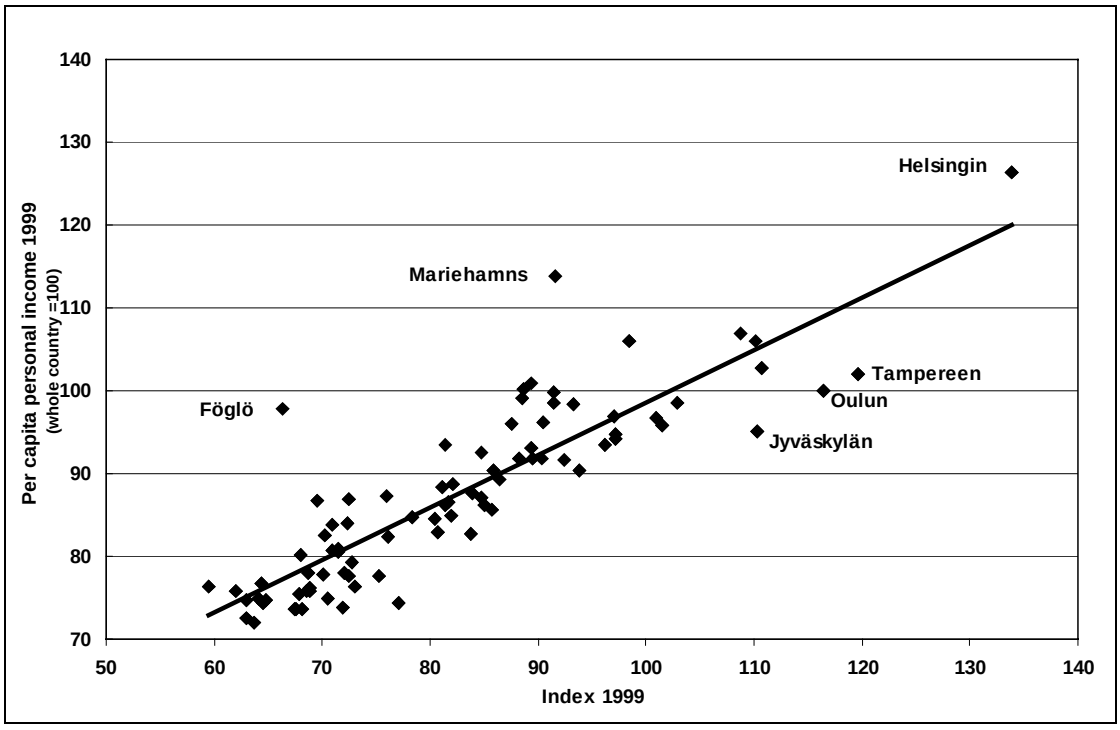

Figure 5. The index and per capita personal income, 1999

A poorer fit of GDP regression is partially explained by a higher annual volatility of GDP than that of personal income. For 8 subregions the standard deviation of per capita GDP between 1990-1999 varied clearly more than for the others (Figure 6). GDP of these subregions depends crucially on one firm. Note that although specialisation is accounted for in the index, dependence on one firm is not. Salo depends on one firm in the telecommunication industry, Jämsä, Imatra, Äänekoski and Sydörterbottens kustregion depend on a single firm in the paper industry, Raahe has a firm in the metal industry, Porvoo has one in oil manufacturing, and finally Kemi-Tornio has one in the paper and the metal industry. When a dummy variable for these subregions is added to a regression of per capita GDP, the rate of explanation rises from 62 to 73%.

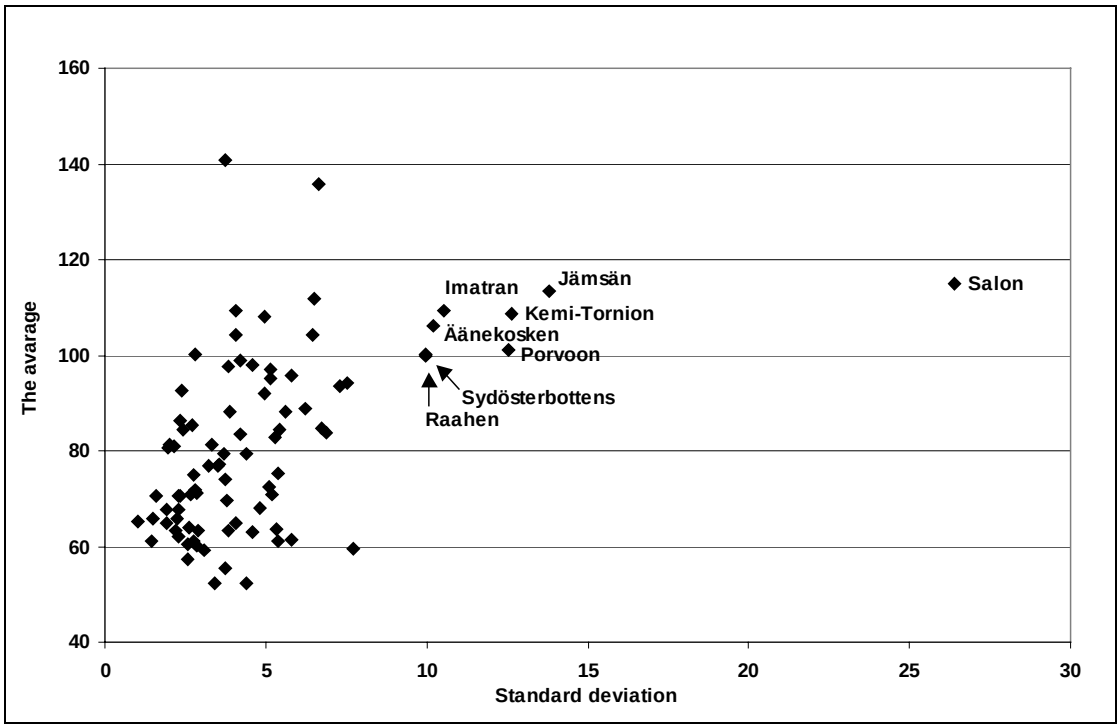

Figure 6. the mean and standard deviation of per capita GDP, 1990-1999

Note, however, that these simple regressions do not reveal the causal relationship between the index and economic development. As mentioned above, we cannot determine which comes first: improved competitiveness or economic growth. Instead, they are interrelated processes and evolve simultaneously. In addition, this simultaneous development is more obvious in some sub-indices than others. For example, the fact that some subregions have formed into centres of agglomeration can be a result of their constantly higher-than-average economic growth in the past. This circularity cannot be taken into account in the above regressions. The mere purpose was that to

describe the extent to which the index and the two outcome variables happen to be related to each other.

5.2 The competitiveness index and the short-term growth

Although our index is essentially a long-term indicator of competitiveness, we have also checked how well it explains economic growth during the past few years. In this context, we are interested in several outcome variables, such as growth in per capita GDP and personal income and the number of employees, and the level of unemployment and migration.

A general finding is that the index is clearly less associated with the short-term variables than the long-term ones (Table 3). The correlation between the index of 1995 and a change in GDP, personal income and employment between 1995-1999 is 0.33, 0.76 and 0.72, respectively. This is as expected, since long-term competitiveness cannot explain short-term shocks or unexpected phenomena. For example, Kangasharju and Vihriälä (2000), using shift share analysis, found that one half of growth across subregions can be explained by regional variations in sectoral composition, and the other half of growth is subject to random disturbance, competitiveness and related factors.

Among several short-term variables the index of 1995 correlates most strongly with the rate of migration relative to the population between 1995-1999, the correlation coefficient being as high as 0.80. Again, the index is less closely associated with a change in per capita GDP than that in per capita income or employment. The same finding also applies to sub-indices. This is also an expected finding, since competitiveness should show up first in employment and then in value added, and personal incomes has less idiosyncratic variation between the years than the value added for small labour market areas. Change in employment is most closely associated with human capital sub-index, whereas changes in GDP and personal income have the largest correlation with innovation. The correlation between accessibility and GDP change is surprisingly low, 0.19 (Table 3).

Table 3. Coefficients of correlation between the indicators in 1995 and chances in outcome variables between 1995-1999.

	Between 1995-1999,change in			
	GDP	Personal Income	Employment	Migration, 1995-1999
Index 1995	0.329	0.756	0.720	0.802
HC95	0.258	0.672	0.712	0.748
IN95	0.437	0.725	0.610	0.700
AGG95	0.286	0.683	0.639	0.664
ACC95	0.200	0.638	0.631	0.768

6. CONCLUSION

In this paper we constructed an index for regional competitiveness. Our index consists of available and measurable statistical indicators for 1995 and 1999. We found that the index is relatively robust in the sense that small changes in the weighting of indicators do not greatly alter the rankings of subregions. When we examined the performance of various subregions, the constructed index was highly correlated with the most natural long-term measures of success and welfare. The correlation with shorter-term outcome variables, such as growth in employment, was also significantly positive, but clearly lower than that with long-term variables. This suggests that our index is essentially a long-term indicator of competitiveness. This is supported by another finding, according to which the index values and rankings of subregions changed only a little between 1995 and 1999.

Our findings suggest that economic success tends to attract and accumulate other positive factors that further accelerate growth and development. In this respect, our findings support early views of regional development, which describe economic development by means of cumulative causation and vicious circles.

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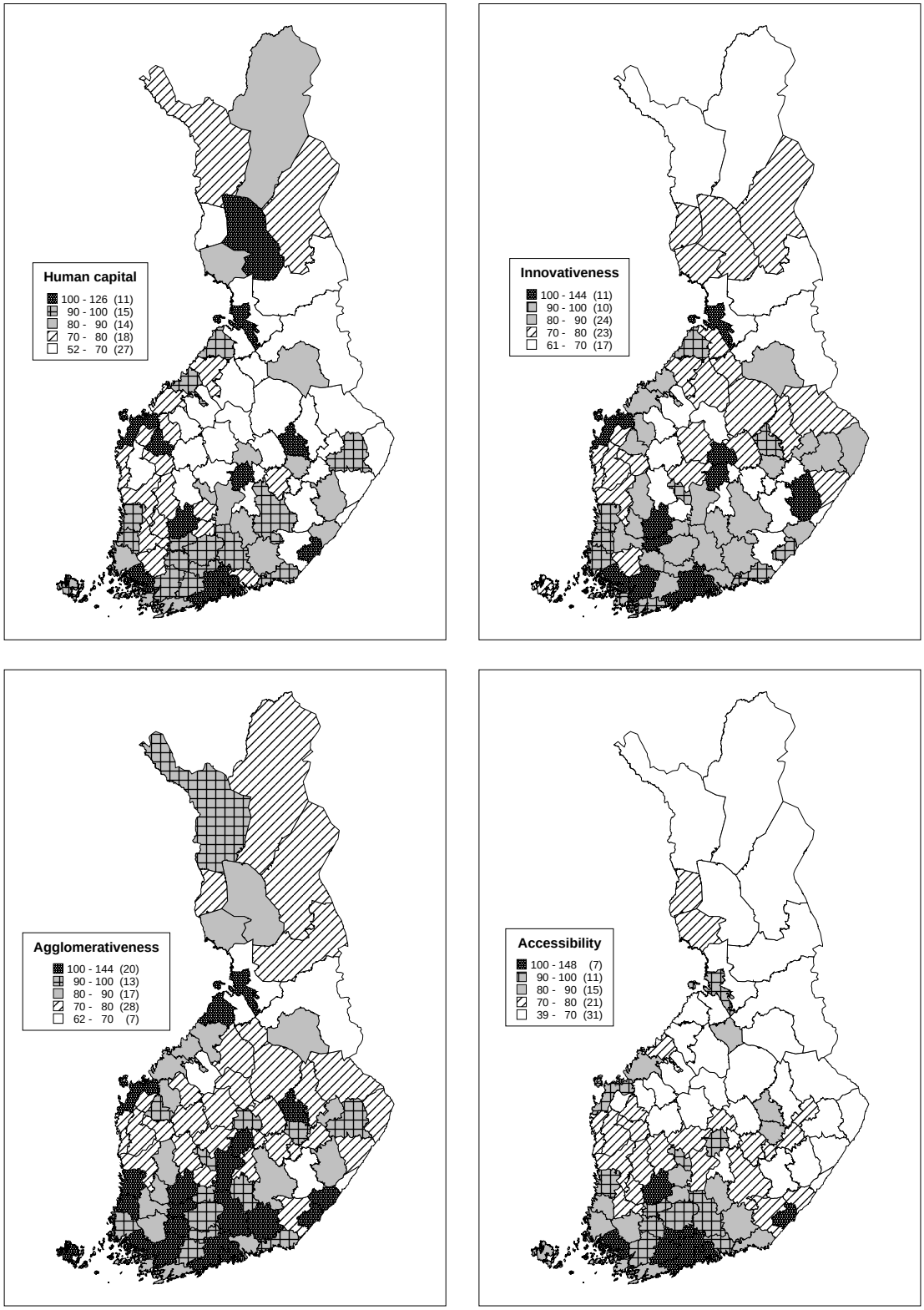

Figure A1. The sub-indices.