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REGIONAL COMPETITIVENESS IN FINLAND

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Abstract. The aim of this study is to analyse competitiveness of NUTS4-level regions of Finland (85) and to develop a regional competitiveness index. Partly, we use the same framework as earlier competitive studies on national level and focus on factors of production, emphasis on human capital and level of technology, innovation activity and R&D. But also, due to the fact that economic activity is highly concentrated within a country, we also focus on benefits from agglomeration as part of competitiveness.

In order to measure competitiveness of regions we have collected a variety of resource indicators relevant to regional competitiveness and by using these indicators we build an aggregate index of competitiveness and also several sub-indexes measuring just one aspect of competitiveness. The indexes and indicators are tested against, what we see as, outcome indicators to find out what determines the competitiveness of regions. The outcome indicators are regional GDP and taxable income.

We find out that our resource indicators correlate with outcome indicators and that our competitiveness index explains most of the variations in regional GDP and taxable income per capita. However, there is group of regions whose success might be better explained by their special characteristics than by the index. The results presented are preliminary, since this paper is part of the ongoing study.

1. Background and aims of the study

Competitiveness receives a lot of attention. Many times commentators are concerned about loss of competitiveness and policy actions are motivated on the ground that they improve competitiveness. What is being referred to is usually competitiveness of a nation, or sometimes of a city or a region. Strictly speaking, however, competitiveness is microeconomic concept and should be used only in reference to companies. In this sense competitiveness can be easily defined, but that is not a case with a national or regional competitiveness.

Krugman (eg. 1997) is maybe the best known critic when it comes to using competitiveness in a reference to nations. Krugman argues that using term competitiveness is dangerous cause it can lead to protectionism and bad public policy, when using it seems to propose that in world economy benefit of an one nation comes as an expense of another. The same could be said about using competitiveness in a reference to regions.

Others have argued that using competitiveness in relation to countries and regions is appropriate and useful (see for example discussion in Begg (1999)). Moreover, the concept of competitiveness doesn't have to mean that regions are in competition or should compete. However, we can see that economic performance between regions varies a great deal and so does the resources that are used in production. In that sense competitiveness can be used to indicate regions' relative economic fortune. In this study regional competitiveness means the ability of region to foster, attract and support economic activity so that its citizens enjoy relatively good economic welfare.

The purpose of this paper is twofold. First, we construct an index for competitiveness of NUTS-4 level regions in Finland, and second, initially check the performance of the index. The paper is part of the ongoing study and the results presented are preliminary. Our intention is to further develop the index.

The remainder of the paper is organised as follows. The second section briefly reviews previous studies. The third section presents the justification and description of indicators included in the index. The fourth section describes how the index has been con-

structed. The fifth section examines the performance of the index against outcome measures. The last section concludes.

2. Previous studies

There are number of competitiveness studies, and also studies that have calculated a competitiveness index. Perhaps the best-known competitiveness indexes at country level are those by World Economic Forum (1999) and International Institute for Management Development (2000). These and other similar constructs have been influenced by the seminal book by Porter (1990). Porter developed diamond model that argues that a fertile environment for competitive companies, and therefore the competitiveness of the nation, is determined by 1) factor conditions, 2) demand conditions, 3) related and supporting industries and 4) context for firm strategy and rivalry. What also matters is interaction of these elements.

The aforementioned international studies use wide range of indicators that are relevant for competitiveness at country level. Nevertheless, these indicators do not tell much at regional level. Porter and Stern (1999) developed innovation index, also for national level, using fewer indicators and also indicators that are more relevant from a regional perspective. But they focus only on innovation activity, and even if innovation activity is very important, competitiveness of regions probably can not be describe by only using innovation index.

There are also competitiveness studies at regional level. They usually include fewer indicators than do international competitiveness indexes. UK's Department of Trade and Industry (2000) publishes twice a year Regional Competitiveness Indicators. There is also European wide regional study by European Commission (1999). That study included indicators on NUTS-2 level, which is not very interesting for our purposes since there are only five of them in Finland and they aren't meaningful economic units.

Although most of the indicator used in previous studies are potentially very useful, some of them difficult to interpret. In particular, GDP per capita seems rather an outcome of competitiveness than a component of competitiveness. The same applies to

employment rate.

Of course, it is hard to choose what to include when calculating competitiveness index, as competitiveness is an imprecise concept and it cannot be measured directly. Furthermore, in practice, all indicators relevant for competitiveness are intercorrelated and causality is difficult to assess. However, we think there should be effort to distinguish between factors that determine competitiveness and outcome from that competitiveness.

The aforementioned studies also ignore agglomeration as one aspect of competitiveness. Yet, as Krugman (1991) have argued, concentration is the most striking feature of the geography of the economic activity and concentration of economic activity have its benefits. So having production and resources already concentrated on region very likely gives region a competitiveness advantage.

3. The justification and description of indicators included

The purpose of our study is to construct competitiveness index for Finland's regions. For that reason we have to use statistical data and indicators have to be measurable and available for all 85 regions. (Availability condition is not entirely met for all data for all regions, but those defects have only very minor effects.) So indicators we are using in our competitiveness index are based on, loosely using definition of Kresl and Gappert (1995), economic determinants of competitiveness.

That leaves out other aspects of competitiveness that are difficult to measure. Those could include effectiveness of local governance and institutional infrastructure as well as social and cultural aspects.

Next we will introduce indicators in the index and give rationale for their selection. Indicators are grouped in four categories: Human capital, innovation, agglomeration and accessibility. For those categories we have also calculated sub-indexes.

The first two categories can be justified on the basis of growth theories. According to the growth theory the level of production is determined by factors of production, labour

and capital, both human and physical, and level of technology. Because we are trying to make a distinction between determinants and outcomes of competitiveness, it is not appropriate to select labour and capital actually used in production as indicators, but to rather use available pool of labour and capital.

However, the level of physical capital is not used in our index for a number of reasons. There are no reliable data for physical capital at a regional level. In addition the amount of physical capital is supposedly determined more by regional structure of production than by anything else. Also, it is difficult to see differences in availability of new physical capital in different parts of country, so including fixed investments as an indicator is not justified. Instead, we are focusing more on the level of human capital.

For the category of human capital we include indicators that are measures of available pool of labour together with actual human capital indicator. To measure available pool of labour we use shares of working age population (age 15 -64) and young working age population (age 15 -39) in the whole population and labour force participation rate. Human capital is measured by the number of university degrees, educational level of employed and number of students in educational institutions in a region, overall and in engineering. Students include all students at higher educational level than compulsory schooling. The number of students is used to indicate local potential to increase level of human capital. That indicator includes also implicit weighting as longer degrees have more students in any given year than do shorter degrees even if there is equal number of graduates. Students in engineering are included since it is likely to have the most direct impact for future innovation activity in a region.

The second category, innovation, includes indicators relevant for the level of technology. One of the indicators tries to measure technological level directly and others measure innovation activity. The direct indicator for the level of technology is the share of value added produced by high technology and medium-high-technology manufacturing and high-technology services. The division of value-added according to different technology levels is based on the definition used by OECD. The assumption is that the higher is the share of production in high tech sector the higher is the level of technology in a region.

As indicators for innovation activity we use R&D expenditures, patents and share of innovative companies. R&D expenditures and patents are straightforward indicators for innovation activity. Patents are more often used for regional studies for their good availability (see eg. Paci and Usai (2000) for the European regional study). Many times R&D data are seen as resources devoted to innovation activity and patent data as outcome from that activity (eg. Porter and Stearn (1999)). We are using them to complement each other. Not all innovation activity involves R&D expenditure or produce patents. By using both we hope to cover a larger share of innovation activity. We also have unique data set that measures companies engaged in innovation activity. It is based on survey data and includes companies that have had innovative activity within last three years. The limitation of the data is that the extent of innovation activity or its economic significance is not measured, just the number of companies. Patent data have a same kind of shortcoming since the economic significance of patent is not known.

The third category is the agglomeration. Benefits from agglomeration are seldom included in measuring competitiveness. However, concentration of economic activity can have substantial competitiveness advantage. Already Marshall (1920, book IV, ch. X) suggested three kinds of benefits from agglomeration.

The first one is spillover of knowledge. Spillovers are particularly important for innovation and R&D activity and related industries. Even if information can be transferred virtually without any cost, personal and informal communications is the most effective way of sharing information and transferring knowledge. For example Bottazzi and Peri (1999) have shown that geographical concentration of innovation activity does matter and spillovers are more effective within a region.

The second one is wider market for specialised skills. Third one is forward and backward linkages. Linkages can operate through different markets, eg. labour, intermediate and product markets, but the central notion is that the bigger market size increases efficiency and productivity.

Of course, there are also costs and disadvantages from concentration of people and economic activity, but in the case of Finland those are very likely outweighed by benefits.

Measuring agglomeration is a complicated matter. First, there is the issue of boundaries: how are the regions defined. Of course, that is a problem for other indicators as well, but it is most severe in the case of agglomeration since we are measuring something where location is the crucial thing. Second, the type of agglomeration differs by the role of the region in the nation's economy. The capital area has unique functions and special institutions that are located there. On the other hand, there are regions that have a nationally or internationally important plant and where the economic life is concentrated around that plant.

One straightforward indicator of agglomeration is the size of the region, in terms of inhabitants. It measures of the size of market, directly the size of labour and goods market, but indirectly it also measures the size of other markets. To really access benefits from the agglomeration, we should have information about clusters of industries and activities that benefit each other. That could be done statistically and regionally, if we had regional input-output tables, but we don't. Therefore we have formulate alternative measures for agglomeration based on regional differences in production patterns.

The first two are the share of value-added and employed in industries that have potential for agglomeration. That excludes sectors like primary production, local authority and construction. We also have two indicators that are meant to reflect the benefits from wider market for specialised skills. The first is share of employed in business supporting companies, which reflects market for universal specialised skills. The second is specialisation; the share of the biggest industry's value-added in GDP in the region, which reflects market for industry specific skills.

The fourth category includes indicators that measure accessibility of the region. The indicators used are distance from the airport weighted by the size of the airport, road density and the share of export in value-added in manufacturing. Share of export in manufacturing industries could also be placed under the category of innovation, since international trade and export creates personal contacts and thus increases spillovers from other countries, as Grossman and Helpman (1991) argues.

Since we'll try to a make distinction between the determinants and the outcome of competitiveness, we must also have a measure for the latter. GDP per capita is one obvious

candidate, and is often used. However, benefits from the production do not fall solely on the inhabitants of the region. To compensate for this shortcoming we use also taxable income per capita as another indicator for measuring the outcome from competitiveness.

Both those measures have one shortcoming in our data set and that is their timing. The latest data for regional GDP and taxable income we have at the present is from the year 1997. That makes our data a bit inconsistent since most of the resource indicators are from 1997 or 1998. Even if causality surely must run from resources to outcomes with a lag, we don't think that it seriously undermines our effort to use outcomes measures as a selection criteria for competitiveness indicators since in most cases the relative position of regions don't change that much from year to year. We also expect to be able to update our outcome indicators later to correct this shortcoming.

Statistical data for the study is collected on NUTS-4 level (seutukunta). That makes the number of regions 85. NUTS-4 level is the most appropriate level for competitiveness study in Finland, as it corresponds in most cases to the commuting area for towns. A drawback though is that NUTS-4 level regions in Finland have a very wide size range. They include capital area with over one million inhabitants as well as rural areas with less than ten thousand inhabitants.

4. Constructing the index

Before we describe the construction of the index, let us describe how the individual indicators are composed. An indicator should reflect the relative strength (weakness) of a region in a given dimension. On the other hand, it should be useful to have the scales of various indicators roughly similar, because that would help in constructing reasonable weights for individual indicators in the total index. Thus a typical index is of the following form:

$$\text{indicator x's value for region i} = \frac{\text{region i's share in resourse x}}{\text{region i's share in total population}} \ .$$

However, this kind of method is not possible for all measures. In such cases the measure

is related to its mean. In some cases we have taken also natural logarithm in order to reduce the variability. Nevertheless, the idea is that representative region would get unity as its index value.

There are several possibilities to form the index, depending on how individual indicators are weighted in the index. The aforementioned international competitiveness studies by the WEF and the IMD calculate their indexes by taking weighted average of standardised indicators, the weights depend on the nature of data: survey or statistical data. WEF also gives explicit weights to different categories of indicators. IMD doesn't do that, but it has implicit weights based on the number of indicators in different categories.

Another alternative is to estimating weights for each indicator. Porter and Stern (1999) use this method, and in particular linear regression to find the weights. A major problem with this method is multicollinearity. Just running linear regression estimation with a large number of correlated variables doesn't necessarily give very good results.

At this stage we haven't tried to estimate weights. We have instead followed the approach used by the WEF and IMD studies. So our index is a weighted average of indicators and weights for the indicators are the inverse of their standard deviation. Subindexes are calculated in the same way. The method is thus very close to that of the IMD study, which standardised the indicators by dividing them with standard deviation. A difference is that IMD uses absolute differences from average and we use proportional difference from per capita value for the whole country.

That kind of weighting method is used, because calculating this kind of index is like summing up bananas and oranges. It has to be realised that even in the case of unweighted average implicit weights are imposed on indicators. Implicit weights come from the varying distributions of indicators. Indicators with low variance will have less impact to index than indicators with high variance. Also usually, the more specific the indicator is the higher is the variance. That means that specific indicators tend to get more weight in unweighted index at the expense of broader indicators.

5. The results

The competitiveness index constructed correlates strongly with both of the outcome indicators we use. (Table 1). Among sub-indexes, agglomeration has the highest correlation, even higher than the aggregate index. The lowest correlation for sub-indexes is that of the innovation sub-index. That is probably due to the concentration of the innovation activity, but possible also due to quality of innovation data.

Also, all individual indictors display positive correlations with the outcome measures. Yet some questions arise. First, some of the indicators show fairly low correlation with the outcome measures. The most disappointing is the share of innovative companies. The unique survey data on companies engaged in innovative activity should reflect some of the aspects of innovations, which are difficult to capture otherwise. The weak performance may steam at least partly from the fact that the data wasn't originally regional.

Also two indicators representing accessibility of region, weighted distance from airport and road density, perform quit poorly. But together with the share of export in manufacturing industries the sub-index for accessibility performs nevertheless relatively well.

Table 1. Correlations of resource and outcome indicators.

	Standard deviation	Correlation	
GDP-ratio	0.202	with	with
Income ratio	0.106	GDP per capita	income per capita
Index	0.097	**0.85**	**0.84**
Human capital			
Sub-index	0.180	**0.72**	**0.75**
Working age population (15-64)	0.024	0.44	0.45
Young working age population (15-39)	0.086	0.58	0.54
Labour force participation rate	0.044	0.68	0.83
Students	0.400	0.55	0.49
Engineering students	0.599	0.57	0.50
University degrees	0.190	0.71	0.84
Educational level of employed	0.065	0.55	0.61
Innovation			
Sub-index	0.434	**0.62**	**0.59**
R&D expenditures	0.621	0.62	0.52
Patents	0.498	0.53	0.56
Value added share of high and medium high technology	0.630	0.53	0.48
Share of innovative companies	0.359	0.32	0.32
Agglomeration			
Sub-index	0.311	**0.89**	**0.83**
Population density	0.437	0.67	0.76
Share of employed in sectors with potential for agglomeration	0.239	0.81	0.76
Share of value added in sectors with potential for agglomeration	0.247	0.80	0.70
Share of employed in supporting companies	0.260	0.59	0.64
Specialisation	0.838	0.68	0.46
Accessibility			
Sub-index	0.247	**0.68**	**0.73**
Weighted distance from airport	0.760	0.43	0.42
Road density	0.292	0.39	0.52
Share of exports in manufacturing output	0.395	0.51	0.41

On the other hand, some of the individual indicators have as high correlation with outcome measures as the index and even higher that the sub-indexes. For example, labour force participation rate and university degrees have about the same correlation with income ratio as the index. This is not a surprise: it is obvious that regions with high labour participation or lot of people with a university degree have also high income level. The problem is distinction between the resources for and the outcome from competitiveness. For that reason we think that having a number of indicators is likely to give a more robust picture of the competitiveness situation of regions that just few indicators with high correlation with outcome measures.

From Figures 1 and 2 it can be seen how regions lay around the linear regression line obtained by regressing outcome measures, regional GDP ratio and income ratio by the competitiveness index. The visual impression suggests the idea that there indeed is a broadly linear relationship between the index and the outcomes.

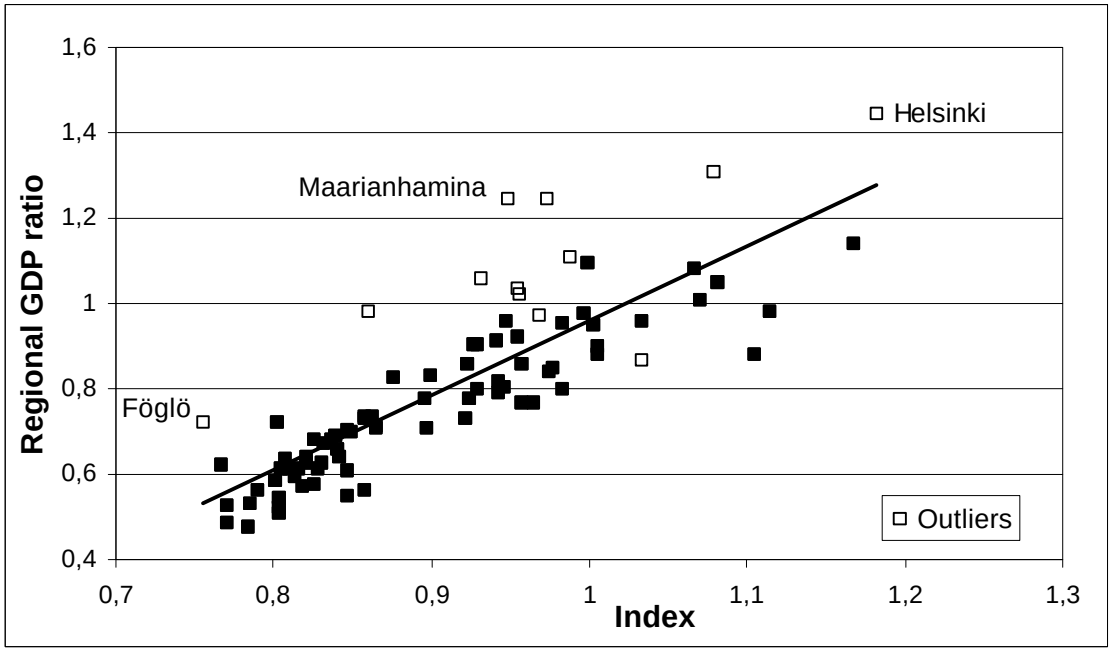
However, there are some regions that stand out from a scatter plot. Those regions mainly have higher GDP per capita than could predicted on the basis of their resources. It is worth examining could explain the performance those regions i.e. what makes them "outliers".

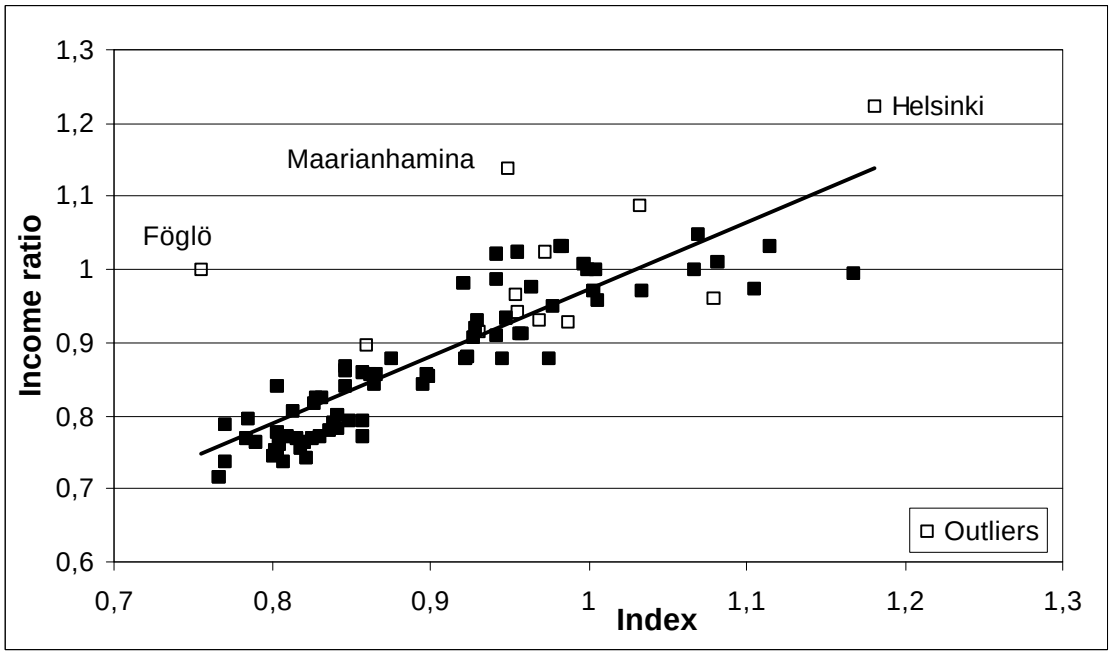
Some of the outlier regions can be identified on the basis of high yearly variability of their GDP ratio. Even if the mean of the ratio remains quit constant over the year there is significant changes from year to year. They are small regions where typically a large plant is located, mainly plants of forest or metal industry. Such one-plant-regions are the regions of Jämsä, Salo, Sydöstebottens kusregion, Kemi-Tornio, Porvoo, Loviisa, Imatra, Raahe, and Äänekoski.

Maarianhamina and Föglö regions can be also seen as outliers, especially related to income rate. Maarianhamina region could be also considered as outlier based on same argument about variability of GDP ratio, and that comes from its reliability on shipping business. But what makes them really different for the rest of regions is that they form the autonomous island province of Ahvenanmaa. They production pattern differs from rest of to Finland as they, together with shipping, tourism is important source of income. They also have a tax border with Finland as they stayed outside EU. Föglö is also ex-

tremely small.

Then there is still one region that stands out, the capital region Helsinki. It is by wide margin the biggest region in the county, and the richest. Its central and unique role gives it advantages that no other region can have.





Figures 1 and 2. Scatter plots for the index and outcome measures with regression line without dummy variables.

The success of these outlier regions can largely be explained by one event it their past rather than anything else. In the case where one factory or company is dominant in the region's economy, the crucial event was the location decision of that one factory. This decision was made in very different environment in the past based mainly on the supply of raw materials and energy. These aren't any more important factors for the competitiveness of region, but for various reasons relocation is not a profitable alternative. In the case of Ahvenanmaa and Helsinki political decision in their past have a significant role in explaining their success.

In order to see how the index performs without the above-mentioned regions, we have run regression with dummy variables for those regions. The coefficients of determination for the regression models without and with dummy variables are adopted in Table 2.

Table 2. Coefficients of determinations for regressions. Only models with all parameters significant at 0,05 level included. Dummy variables are D1: one-plant-regions, D2: Ahvenanmaa, D3: Helsinki.

	GDP ratio	**Income ratio**
Model	R^2	R^2
Index	71.5 %	70.6 %
+D1	79,1 %	-
+D2	76,4 %	82,3 %
+D3	-	-
+D1+D2	84,3 %	-
+D1+D3	80,7 %	-
+D2+D3	-	-
+D1+D2+D3	85,2 %	-

Using dummy variables for the outliers improves the predictive power of the index significantly, predicted variability rises from just over 70 % to over 80 %. For the income ratio Ahvenanmaa seems be the only real outlier. For the GDP ratio the biggest improvement is gained by using dummy variable for all outlier regions. However, the main

improvement seems to come from dummy for one-plant-regions. The dummy for Helsinki region alone is not statistically significant and it doesn't have very big impact even together with other dummies.

It can be argued that the index doesn't explain competitiveness of regions of Ahvenanmaa among Finnish regions. That is hardly a surprise considering the special situation of the island province. Even given its capital role, the performance of Helsinki is fairly good predicted by the index. For one-plant-regions results are ambiguous, they are clear outliers in GDP ratio, but income ratio is quite good predicted by the index. This reflects very likely the fact that the capital share in the value added of these regions with very capital intensive production structure falls largely outside the region.

Conclusion

The competitiveness index developed in the paper seems to capture quite well the relative competitiveness positions of regions, when tested against the regional GDP and income. However, not all indicators performed that well and it should be considered whether to include all of them in the index. Also, for innovation indicators, possibility for improvement of their quality should be considered.

The index and results are preliminary and several possibilities for further work exist. First we could try to estimate the weights of various indicators form a regression of outcome measures on the indicators. The multicollinearity problem associated might be helped, for example, by calculating principal components of the various indicators.

Second one could relate the competitiveness indicators to variables reflecting the growth of economic activity in regions rather than GDP or taxable income per capita in a given year. Such growth measures for outcomes would be interesting from the point of view of understanding where economic activity is concentrating as opposed to understanding welfare differences across regions.

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