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# From Subsidiarity to Success:
# The Impact of Decentralisation on Economic Growth

## Part 2: Decentralisation and Economic Performance

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# 1 Executive Summary

Do regions with more competences perform better than others? Are countries with a higher degree of decentralisation economically more successful than centrally governed countries?

The aim of the study “From Subsidiarity to Success: The Impact of Decentralisation on Economic Growth”, commissioned by the Assembly of European Regions (AER) and produced by BAK Basel Economics, is to seek links between the degree of autonomy of a region, or the degree of decentralisation within a country, and economic development.

The project has been divided into two parts. The **first part** contained the methodology, explained how the Decentralisation Index and the Index family has been drawn up and presented descriptive results of the analysis as well as country profiles. The following summarises the **second part** which deals with the impact of decentralisation on economic performance - explored through theoretical and econometric analysis. The core of the present part is the evaluation of the empirical impact of the Decentralisation Index on the economic performance of countries and regions.

The investigation of the transmission channels shows that there are many arguments for a relevant impact of the vertical organisation of power within a state on the economic performance of countries and regions. The main arguments in a discussion of centralisation versus decentralisation are preferences over space, spatial externalities and economies of scale. The identification of heterogeneous preferences plays a decisive role in consumer efficiency related to matters of “doing the right things” (which is effectiveness). Thus decentralisation fosters economic welfare through greater consideration of citizens’ wishes and needs. The other part that boosts economic growth, producer efficiency, is mainly affected by economies of scale and spatial externalities (spillovers). Both these terms refer to the aspect of “doing the things right” (which is efficiency). In this case the optimal degree of decentralisation is to be found separately for each policy field, because both too low and too high levels of decentralisation can cause welfare losses.

The implication of this analysis is simple and twofold: Decentralisation is not a “yes-no issue”, but there is something like an optimal degree. However, there is not one

optimal degree of decentralisation, but an optimal degree for each public task. This optimum depends on the three factors mentioned above: heterogeneous preferences in space favouring decentralisation, substantial spatial externalities and economies of scale favouring more centralised solutions.

For the empirical part of the analysis two data sets were used: The first data set contains 33 “conglomerates”, with data from all the different types of regions within the EU 27, excluding the small countries Luxembourg, Slovenia, Cyprus and Malta, but including non-EU members Croatia, Switzerland and Norway, as well as the USA, Canada and New Zealand. Conglomerates are identical to countries as long as all regions have the same rights. Four European countries contain two conglomerates: Finland, Italy, Portugal and Sweden. The second data set contains 234 regions in 16 Western European countries (from the highest politically relevant regional tier).

The empirical analysis was conducted by applying multiple cross section regression analysis. Apart from the decentralisation variables, which are at the centre of our focus, the regression equation with economic performance as endogenous variable contains a variety of control variables.

Economic performance is measured both by GDP per capita and GDP growth. The regressions show that decentralisation, amongst other factors, has a significantly positive influence both on the level and the dynamics of economic performance of countries and regions: The higher (ceteris paribus) the decentralisation indicator, the higher the economic performance. This result holds true for both data sets and for most aspects of decentralisation. Further it proves that qualitative aspects of decentralisation are at least as relevant as quantitative (or financial) aspects of decentralisation.

Innovation being the main driver of economic prosperity, we also examined the role of decentralisation for different innovation indicators. Here the picture is more complex: Decentralisation favours industry related or applied research and development (measured by the number of patents). Academic or basic research (measured by the number of scientific publications) tends to profit from a more centralised system.

Finally we investigated the question whether there is an optimal degree of decentralisation which, for theoretical reasons, should exist. The empirical results seem

to support this view. However, the statistical power of this part of the analysis is not high enough for conclusions to be drawn about the “true” value of the optimum.

All in all, decentralisation clearly has a positive impact on the economic performance of regions.

# 2 Introduction

The AER has commissioned the independent economic research institute BAK Basel Economics (Switzerland) to conduct the research project “From Subsidiarity to Success: The Impact of Decentralisation on Economic Growth”. The project establishes a link between the degree of decentralisation of European countries and their economic development. The ulterior aim of the project is to analyse whether regions which assume more Competences are able to develop better than regions that do not. Therefore, a huge amount of quantitative as well as qualitative data has been collected - the latter to evaluate how the principle of subsidiarity is conducted within a country not only on paper but also in practice.

The project has been divided into two parts with two separate technical reports. The **first part** “Creating a Decentralisation Index” contained the methodology applied, the calculation of the Decentralisation Index accompanied by the results of the descriptive analysis and a set of country profiles. The **second part** “Decentralisation and Economic Performance“ is outlined in the present report. It deals with the impact of decentralisation on economic performance - explored through theoretical and econometric analysis.

In the following chapter a theoretical overview is provided: What are the transmission channels from centralisation or decentralisation on economic performance and welfare? In chapter 4 the econometric method applied and the data used in the regression analysis are described. Chapter 5, the core of this part of the study, presents the results of the empirical analysis: What is the qualitative and quantitative impact of decentralisation on economic performance? Chapter 6 concludes the study.

# 3 Transmission channels from Decentralisation to economic performance

In this chapter we focus mainly on the examination of the theoretical transmission channels from decentralisation to economic performance (subsection 3.3) and on the relationship between decentralisation and welfare (subsection 3.4). We start, however, with a short overview on economic growth theories followed by a brief description of the decentralisation index.

## 3.1 Determinants of economic growth

Over the last 50 years the economic science has extended its models explaining economic growth several times. The consequences were not only more authentic explanations of economic interaction but also more ambitious theories. Let us start with a simple neoclassical production function of the Cobb-Douglas type:

$$Y = a * L^{\alpha} * K^{\beta} \quad ,$$

where Y is output (e.g GDP), L the quantity of (employed) labour (e.g. full time equivalent heads), K the quantity of (employed physical) real capital. α and β are unknown parameters and a is a scalar. Usually it is assumed that there are no economies of scale which means $\alpha + \beta = 1$.

This equation was hardly able to describe economic reality. Robert Solow (1956, 1957) showed that investment does not influence the growth rate in the long-run and added a time-invariant technology term, which was assumed to be exogenous:

$$Y = a * L^{\alpha} * K^{\beta} * e^{\gamma t} \quad ,$$

where e is the base of natural logarithms, γ is an unknown parameter and t is a time index variable. The model implies that apart from the effect of using labour and capital, there is an additional effect increasing output by γ each period. For some countries the above model fitted the data quite well. However, it was not possible to explain differences between different countries both in terms of level and growth.

The logical next step was the endogenisation of the technology term. The idea is to have a variable (which varies across time and across countries) measuring the state of technology used in the production process:

$$Y = a * L^{\alpha} * K^{\beta} * T^{\gamma} \quad ,$$

where T is the sum of all technological know-how used in the production process and γ is an unknown parameter. As in general $\alpha + \beta + \gamma > 1$ there will be positive economies of scale. This equation allows for increases in labour productivity (i.e. Y/L) by the use of more or better technology. It also enables explaining cross-country economic differences due to different levels in T.

This extension of the Solow model implies that in the absence of continuing improvements in technology, per capita growth eventually must cease. The underlying reason is that any kind of physical capital is ultimately subject to diminishing returns. Although the extension of the model helps to understand the technology term in the Cobb Douglas function better, the exogenous growth models cannot explain what causes technology to improve over time. Technical progress quite simply happens.

The above model is to a large extent still rooted in the spirit of the 19th century which was dominated by the invention of new technologies and their use primarily in factories. At the edge of the 21st century, however, GDP is produced mainly in the services sector and only to about 25 percent by manufacturing. Focusing on new technologies as the driver of economic growth is therefore not fully adequate. Thus the technology variable T was redefined into a variable which also includes the quality of human capital, the quality of the physical capital as well as the quality of the institutions and the efficiency of the whole production process (Mankiw et al. 1990). To underline this new enlarged meaning we redefine T into R, a variable which is the residual factor that captures all other aspects relevant for the production of GDP (besides L and K):

$$Y = a * L^{\alpha} * K^{\beta} * R^{\gamma}$$

Bear in mind that R, although being the residual factor, is endogenous. Improvements in R include knowledge as the creator of new ideas. The modification of the exogenous growth theory is also known as Endogenous Growth Theory. The new approach illustrates the ongoing shift from a resource-based economy to a knowl-

edge-based economy (Cortright 2001: 2). In contrast to the neoclassical production factors which are characterised by diminishing returns, knowledge has increasing returns. In the neoclassical view diminishing marginal returns imply increasing marginal costs. Considering decreasing returns to factors of production implies that economic growth (per capita) will become slower and slower and eventually stop (Cortright 2001: 3). This concept does not well reflect the historical data of a growing economy. A special feature of knowledge is non-rivalry. Therefore knowledge has partly characteristics of public goods. Knowledge spills over across producers and external benefits from human capital result in increasing returns for factor inputs. As capital accumulates over time, there is no tendency to slower growth in this class of models. Knowledge[1], characterised to be non-rival, makes one single firm's know-how spread over the entire economy (Barro 1998: 5), generating a positive externality and allowing increasing returns to scale.

Another way to introduce increasing returns to scale is through positive intertemporal spillovers within a production unit. Arrow (1962) in his pioneer study observed learning-by-doing effects. As firms produce goods, they improve the production process over time and lower the cost of production. Incorporating this microeconomic observation into a macro growth model framework was the seminal breakthrough in growth theory (Romer 1986). Finally, in models incorporating R&D theories and imperfect competition, firms innovate to gain a form of ex-post monopoly power which maximises their profits (Romer 1990, Grossman and Helpman 1991, Aghion and Howitt 1992). But the innovation activity tends to be not Pareto optimal because "[…] of distortions related to the creation of the new goods and methods of production" (Barro 1998: 6). Hence, in these endogenous growth models, there is ample room for policy makers to improve the level of innovation activity and in turn, this could increase the steady state growth path.

In this type of model, politically defined location factors – such as the quality of human capital, the quantity and quality of physical infrastructure or the efficiency of institutions all being part of R – can positively influence the economic growth path. By logarithmic derivation of the above equation we get (denoting growth rates by g):

[1] In fact only parts of knowledge have a public good character, such as research outputs which are published. Other knowledge is embedded in people's minds or in equipment and therefore subject to rivalry and not public.

$$gY = \alpha \bullet gL + \beta \bullet gK + \gamma \bullet gR$$

For the econometric analysis we will work with a so called reduced form, as there are two empirical problems with the above production functions. First there are scant (comparable) data for productive capital stock on the regional level. Second, in a longer term perspective, output, the quantity of labour and the quantity of capital are determined simultaneously. Estimating a production function can lead to systematic simultaneity biases. Implicitly, there is a function for L and K depending on the same variables R. The reduced form is derived by substituting L and K in the production function by these implicit functions. This results in a simple equation relating all location factors (R) to output (Y) and output change (gY):

$$Y = f(R) \quad \text{and} \quad gY = f(R)$$

Economic performance is directly influenced by the relevant location factors. As the political organisation of a country is part of the political institutions, the organisation of vertical power distribution in a country may add to a higher value of R and of economic prosperity. In this way, decentralisation comes into play as it can clearly be influenced by the resident population of a country or region.

## 3.2 The Decentralisation Index

This chapter summarizes the structure of the Decentralisation Index and explains the aggregates and sub-indices. For further details refer to part one “Creating a Decentralisation Index”.

### 3.2.1 Structure of the Index

The Decentralisation Index indicates the amount of power that the regional tier possesses within a country. The regional tier can achieve scores between 0 and 100. High scores – relative to the other countries in the sample – stand for a high degree of decentralisation whereas low scores stand for a rather centralised state. The Decentralisation Index pools the two aggregates Deciding Decentralisation weighted by 60 and Financial Decentralisation weighted by 40. Deciding Decentralisation indicates the power of the regional tier to make decisions independently from the national tier. Financial Decentralisation indicates whether the regional tier can decide over its financial means independently. The two

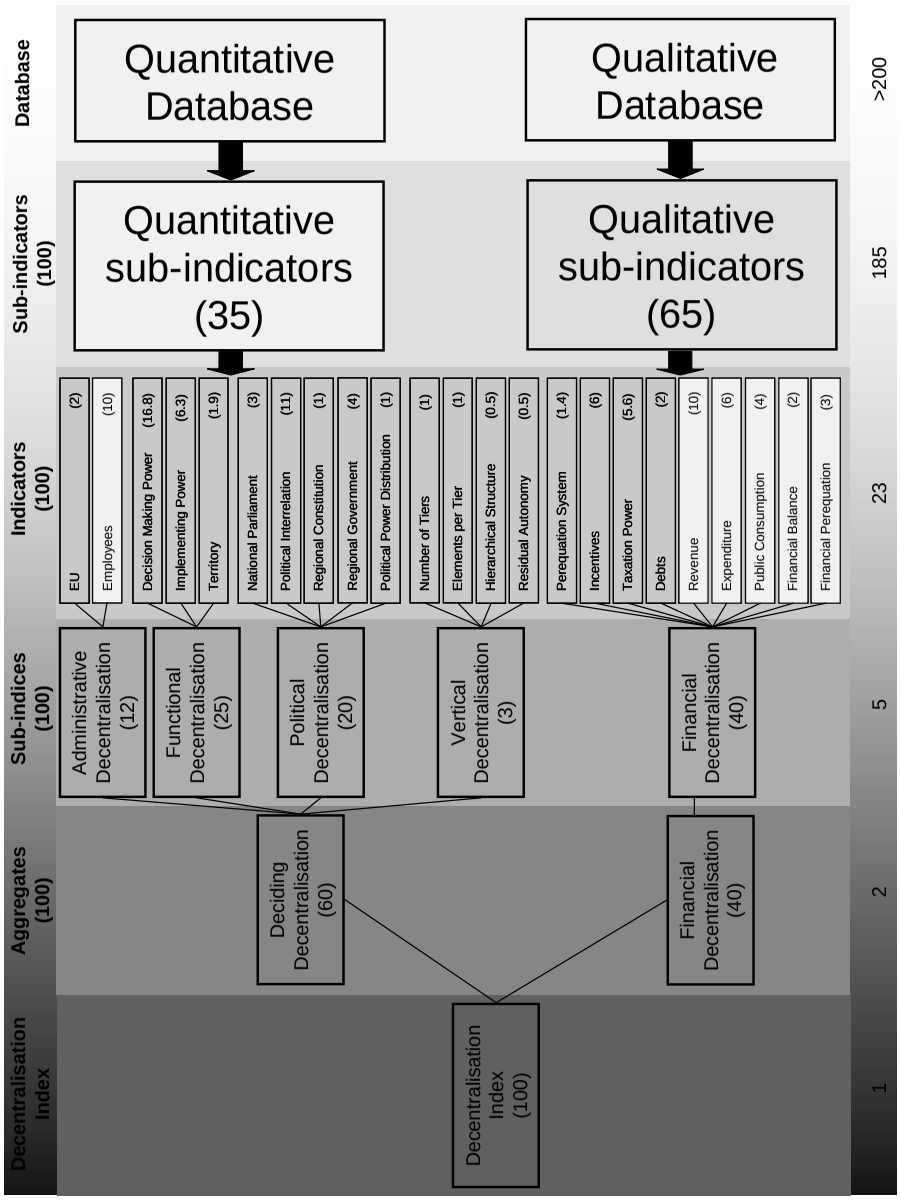
indicators are highly interrelated: the regional tier can only decide independently if it has the necessary financial means at its disposal and vice versa. Again, both aggregates can take values from 0 to 100 where high values stand for a high degree of decentralisation and low values stand for a rather centralised state.

A special feature of the Decentralisation Index is that it takes both – qualitative and quantitative – data into account. With a weight of 65 percent the qualitative sub-indicators are more strongly represented than the quantitative sub-indicators (35%). This weighting was made by subjective estimations for this study because we believe that the qualitative part of the regional power tells more about decentralisation and the autonomy of regions than the quantitative part of the analysis. Due to the fact that this is a very new piece of research, no empirical literature about the weighting of those two elements has been found so that own considerations became a prerequisite. The qualitative sub-indicators are therefore especially highly represented in the aggregate Deciding Decentralisation (83%). In the aggregate Financial Decentralisation, in contrast, the quantitative sub-indicators are weighted higher (63%). The two aggregates are further divided into the five sub-indices Administrative Decentralisation, Functional Decentralisation, Political Decentralisation, Vertical Decentralisation and Financial Decentralisation.

### 3.2.2 Index family

The Decentralisation Index is split into five sub-indices: Administrative Decentralisation, Functional Decentralisation, Political Decentralisation, Vertical Decentralisation and Financial Decentralisation. The first four belong to the aggregate Deciding Decentralisation. The Financial Decentralisation is both sub-index and aggregate. The structure of the index family is illustrated in Figure 1.

**Figure 1: Structure of the Index**




- Columns represent the five aggregation levels: Decentralisation Index, Aggregates, Sub-indices, Indicators and Sub-indicators
- Numbers 1, 2, 5, 23, 185, >200 at the bottom line denote the number of variables at the corresponding level
- Numbers in parentheses indicate the weights of the different variables.
- Column Indicators: White fields: quantitative data; Grey fields: qualitative data
- Source: BAK Basel Economics 2008

#### 3.2.2.1 Administrative Decentralisation

The sub-index Administrative Decentralisation accounts for 12 percent out of the index total of 100. It is the only sub-index in the aggregate Deciding Decentralisation that consists of qualitative and quantitative indicators. The quantitative indicator «employees» for example consist of the regional share of public employees (civil servants) and the regional share of public remuneration. This indicator reflects the manpower resources of the sub-national tier(s) and is well suited for comparisons. Therefore the indicator accounts for 10 percent. The indicator EU – weighted by 2 percent – consists of the qualitative sub-indicators administration and Competences on a regional level.

#### 3.2.2.2 Functional Decentralisation

A very important and therefore strongly weighted (25%) sub-index is Functional Decentralisation. This sub-index pools the indicators decision making power, implementing power and territory. Decision making power measures the regional power to decide in various policy fields and implementing power measures the regional power to implement those policy decisions. Accordingly both indicators reflect regional power with regard to the most common policy fields such as economy, education and research, infrastructure, migration, social services, healthcare policy etc. The indicator territory on the other hand reflects regional Competences to constitute the spatial and administrative territory.

#### 3.2.2.3 Political Decentralisation

A further sub-index is Political Decentralisation (weighted 20%). It contains indicators which include regional representation in the national parliament, election of the regional government, political power distribution, constitutional rights of the regional tier and the interrelation of the regional with the national tier.

#### 3.2.2.4 Vertical Decentralisation

The number of tiers and the amount of elements within the regional tier reflect the geographical division in a country. The hierarchical structure and the residual autonomy of regions capture the formal power distribution among the tiers. The reason for the low weight of this sub-index (3%) is the – compared to other sub-indices – minor explanatory power with regard to decentralisation and autonomy.

#### 3.2.2.5 Financial Decentralisation

The most important sub-index is Financial Decentralisation which accounts for 40

percent. It shows the financial power of the regional tier and integrates quantitative and qualitative indicators. To the qualitative indicators belong (among others) perequation (financial flows between the jurisdictions), the power to levy taxes (financial Competences, e.g. determination and allocation of taxes), financial debts and incentives.

Financial Decentralisation also contains quantitative indicators such as the percentage of revenues, expenditures, public consumption and investment, assets and debt of the regional tier. It also includes information about the amount and direction of financial flows within the perequation system of the country.

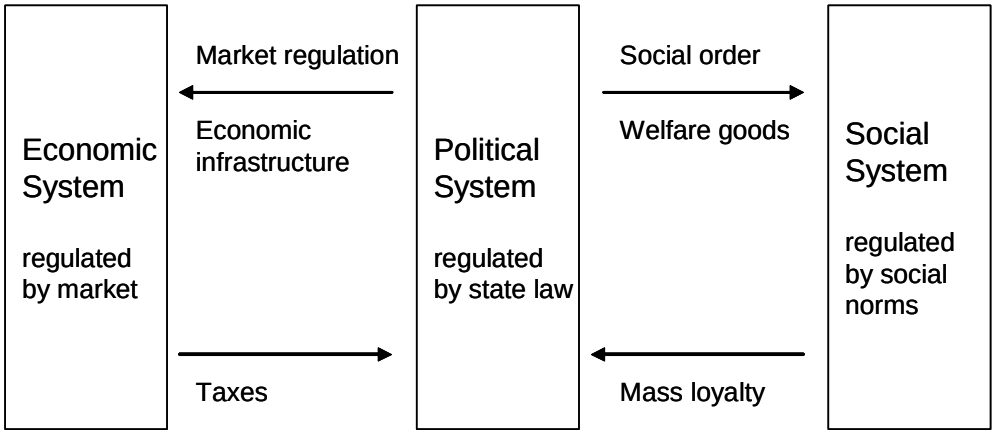
## 3.3 Transmission channels

Investigating the mechanism between decentralisation and economic development, we expose the transmission channels fostering the economy through decentralisation. To this end the feasible transmission channels will be categorised in efficiency (section 3.3.1), inequality (3.3.2) and macroeconomic environment (3.3.3). The classification is based on Musgrave's (1959) work on public finance. He identified three main objectives of government policy: efficient allocation of resources, distribution of income and wealth, and macroeconomic stabilisation. It seems that the transmission channels often work indirectly as will be shown below.

Figure 2 presents the basic relations between the economic, political and social system. By exploring the transmission channels only the economic and political interaction will be considered.

In the following sections we explain the transmission channels individually, starting with the efficiency argument.

**Figure 2: Basic relations**




Source: Linder 2004

### 3.3.1 Efficiency

The economic perspective highlights mainly the efficiency criterion as the key argument in favour of decentralisation. Traditionally, the issue of efficiency implies the basic assumptions of perfect (market) competition such as symmetric information, rational behaviour, absence of market power etc. For a more detailed classification of efficiency, the section is divided into consumer efficiency, producer efficiency and efficiency through competition. The next subsection investigates the economic efficiency from the citizens's perspective before the perspective of the manufacturers and the competition among local authorities is treated.

#### 3.3.1.1 Consumer Efficiency

The first element of consumer efficiency concerns the citizens' tastes and needs (preferences). A local government has more profound knowledge of the population's preferences than a central authority. Decentralised units and especially their decision-making process are abler to take the specific preferences of the local or regional population into account (Linder 2004: 10). The demand for public goods can differ substantially between regions because the preferences of citizens are formed by regional traditions. Individual welfare increases through higher expenditures on infrastructure, social security etc. The bigger the differences in regional preferences within a country, the greater the potential benefits from decentralisation (Oates 1972). By supporting decentralisation

different preferences of the population can be better incorporated into policy. This helps to ensure that an individual's needs will be considered more adequately. From the government's point of view the better notion of the citizens reduces government's costs for information gathering and at the same time improves the quality of information. Hence a better informed regional government (compared to a less informed national government) faces lower planning and decision-making costs (Linder 2004: 10), which enhances regional development. Although regional development is achievable without decentralisation, a strong local government facilitates the improvement of regional development. On the one hand decentralisation enhances innovative solutions for regional problems, and on the other hand regional resources are more easily mobilized.

When local people are involved in different political activities, they are more likely to invest their time and resources into a common project. This generates better results than when the central government decides alone on different political activities alone (Kälin 1999: 49). The citizens have a larger stimulus to engage themselves politically and to express their preferences. A more frequent and more intensive participation of the population in the political process in turn leads to better estimation of individual preferences. It works like a cumulative process. The control of political power such as legislative and executive authority may also be more effective and therefore the trust in authorities might be higher (Linder 2004: 10).

To fulfil the heterogeneous preferences and needs of the regional population (within a country) the regions need sufficient resources. In terms of financial issues, tax collection is limited, as citizens usually have no great willingness to pay money to the state. Consequently, the revenues and expenditures of governments are limited, forcing regional governments to use scarce resources economically. Nevertheless, there are cases where the tax revenues are not sufficient to meet all needs of the population. A central government might deal better with that problem. However, citizens may be more willing to pay taxes to (geographically close) local and regional governments than to (far away) national governments.

Summing up, decentralisation leads in general to consumer efficiency which in turn results in a higher welfare of individuals with a (feasible) positive effect on private investment, savings and work effort and finally producing higher growth (Martinez-Vazquez and McNab, 2003).

#### 3.3.1.2 Producer Efficiency

A government is more producer efficient than another if it can provide higher quality or quantity of public goods with a given budget or supply a given quality or quantity at lower costs. According to Shah (1999) centralised systems in general entail higher administration, coordination and transaction costs. In a decentralised regime administration costs are lower and procedures simpler, because less professionalism is needed and thus it allows employing laic man-power from civil society (Linder 2004: 10).

As mentioned above the citizens of a decentralised state have a better and faster access to necessary information about public goods and services. Also it facilitates regional government efforts to meet specific citizen's needs. This is important because a higher degree of availability of information leads to a better use of scarce resources and higher efficiency. Ter-Minassian (1997: 36) points out: "Decentralizing spending responsibilities can bring substantial welfare gains. Government resources can be allocated more efficiently if responsibility for each type of public expenditure is given to the level of government that most closely represents the beneficiaries of these outlays." Moreover, regional authorities know the regional input markets better and can buy regional services at lower prices.

Another argument concerns the capacity for innovation. Decentralised units have a more stimulating effect on innovation and experimentation in the supply of public goods and services (Thießen 2003: 9, Breuss and Eller 2004a: 37). In decentralised countries, more favourable possibilities exist to carry out experiments because of the lower risk of potential failure due to the smaller number of individuals concerned. This allows for trying out new forms of cooperation between private sector and government as well as testing new instruments such as emission trading within a jurisdiction. The competition between jurisdictions can then promote the use of new ideas.

Aside from the advantages decentralization has some negative effects on producer efficiency. One element is opportunistic behaviour which can be promoted by decentralised structures (Shah 2004). Another disadvantage of decentralised units are higher marginal costs of some public goods. For example the central production of passports or the process of court decisions can be managed at lower cost due to the fact that the procedures are identical (Linder 2004: 10). For some public goods such as national defence, a minimal size of public good is required

because they are indivisible. The provision of such goods in decentralized units is inefficient and makes therefore little sense. Moreover a central regime can guarantee a higher minimal level of public goods through regulatory oversight or conscious use of funds (Shah 2004: 9). An optimal size of operation, in which the benefits of increasing returns to scale are exploited can suggest a joint offer for several regions, so that duplication can be avoided. A certain minimum size is also displayed for quality reasons.

A central regime may also cope with spillover effects in the sense of spatial externalities. That means that the benefits (positive externalities) and costs (negative externalities) of public goods and services are not limited to the inhabitants of the local authority, but also affect residents of other jurisdictions. If the provision of public goods and services leads to spillovers between autonomous local authorities it is not Pareto-optimal. A central authority should be able to internalise such spatial spillover effects (Bahl and Linn 1992).

A further aspect concerns the decision-making process. High co-ordination costs mean high decision-making costs: Therefore the smaller the number of decision-makers the lower the costs of decision-making (Linder 2004: 10). Prud'homme (1994) and Tanzi (1996) argue that decentralisation has a negative impact on economic growth of a country because sub-national governments have difficulties in the coordination of their policies.

If we consider the labour market, we find that a centralised system offers job seekers better career prospects and is therefore more interesting for qualified labour (Bardhan 2002). Also, the resources available for research, development and technology are higher (Prud'homme 1994). Thus centralised units have usually better trained staff than decentralised units. As a consequence regions and municipalities have less well-trained employees which has a negative impact on the quality of work and work performance. That lets the subnational governments appear less efficient.

By considering the aspect of cost efficiency we can conclude that the supply of public services in a decentralised country may be more efficient, because the affected citizens feel the cost of the public services more and therefore force the government and administration to perform well (X-efficiency). For the citizens in decentralised units the whole public supply process is more visible. Because of the

closeness to citizens, they are more familiar with problems and possible solutions and thus have a better control over the executive. Arguments for centralised solutions are spatial spillovers (externalities) and economies of scale in decision making and delivery.

#### 3.3.1.3 Interjurisdictional competition

If citizens have the choice between several jurisdictions (e.g. different regions) the decision may be explained using the well-known Tiebout (1956) model. Citizens can emphasize their preferences by "voting with their feet" and thus maximize their benefits. The elected representatives of the communities must strive to offer public goods and services in an amount and composition which prevents movements of local residents (emigration) and attracts potential residents from outside (immigration). The competition pressure tends to lead to an efficient allocation of public resources. In a decentralised state the wooing of taxpayers leads to a natural barrier for government expenditures, making the government more efficient. Therefore a decentralised system leads to better public goods and lower prices (Linder 2004:10). However, this model does not consider a number of costs which significantly limit the migration between the communities such as the supply of jobs, the attractiveness and accessibility of a community etc. Brennan and Buchanan (1980) constructed the Leviathan model. They assume that the only truly effective constraints of governments in the long run are constitutional rules limiting government's power to raise taxes, issue debt, and print money (Mueller and Bowie 2005:380). If governments maximize their revenues, interjurisdictional competition helps cut the size of their budgets and limit the potentially abusive power of central government (BAK 2007: 14). It may also prevent an overextended or predatory state. Competition happens on different levels: tax rate, tax base, general tax support for companies and (wealthy) individuals etc. According to Tsebelis (1999), competition might imply a “race to the bottom,” driving local tax rates below the level necessary to finance public goods. That might reduce the quality of public services and lead to an underprovision of public services (Thießen 1997) and thus decrease citizens’ welfare. Furthermore, the competition between sub-national units will lead to better solutions and a higher rate of innovation (Barrios and Strobl 2005).

Decentralisation forces politicians to compete, leading to an improvement of local democracy and political accountability (Betz 1996). Voters can use the performance of other regions as a benchmark to judge the efficiency of their own

(Besley and Case 1995). This yardstick competition might positively influence producer efficiency by limiting the oversupply of public goods, empire building, rent-seeking behaviour of politicians and lobbying activities of interest groups (Thomas 1997). Finally Bodman and Ford (2006: 6) indicate the aspect whether competition is efficiency increasing or destructive "is likely to depend on the ability of citizens to compare different government's services and taxes, and keep governments at all levels accountable for their decision."

Getting back to the basic assumptions of perfect competition, one can assume that the criteria for symmetric information, for rational behaviour and for perfect mobility of resources can be better achieved through decentralisation. It seems that decentralisation eases the fulfilment of those assumptions and contributes consequently to a better economic development. A further effect concerns social welfare. The first fundamental theorem of welfare economics purports that any Walrasian equilibrium is Pareto-efficient. In other words, if the individual decisions on a decentralised market system are rational, the market system creates an efficient allocation of resources. The social surplus, consisting of the sum of consumer and producer surplus, will be maximized, or more general: Decentralised systems tend to yield more efficient results.

Having investigated the producer and consumer efficiency as well as the interjurisdictional competition one can assume that the efficiency transmission channels describe primarily the spending side while the competition transmission channel describes also the revenue side of fiscal decentralisation. If substantial economies of scale and spillover effects exist, then producer efficiency rather speaks for a centralised system. In contrast decentralisation is more likely to foster consumer efficiency due to consideration of heterogeneous preferences.

### 3.3.2 Inequality

This section follows the argumentation that decentralisation affects the degree of inequality between regions over time.

Economic inequality refers to disparities in the distribution of economic assets and income. Income is often unevenly distributed in space because of unequal endowments with natural resources and infrastructure which lead to economic clusters in certain regions. Bahl and Linn (1992) reason that when sub-national

units are able to determine their tax base and tax rates, fiscal decentralisation may concentrate resources even more in a few regions. Hence fiscal inequality increases across units since companies and wealthy citizens move to sub-national governments with favourable income redistribution policies. According to Thiessen (2003:5), fiscal decentralisation “breeds social inequality”.

A point in favour of decentralisation is the realisation of fiscal equivalence, which is superior to that of centralised regimes. Fiscal equivalence is given when public duties and taxes are raised only from those citizens who draw utility from public goods and services. If fiscal equivalence is not given, external effects and welfare losses emerge. However, as far as fiscal incidence is concerned, a centralised regime can better guarantee that payers and users of public goods are identical because the number of regional governments is smaller than in a decentralised regime (Linder 2004: 10).

To reduce inequality, governments conduct transfers and redistributive policies in favour of disadvantaged regions. If such perequation systems are too strong, they might weaken the spirit of decentralisation. According to Barrios and Strobl (2005) it is possible that decentralisation first favours economic growth only of a few regions leading to higher regional inequalities within a country. Only later on will the remaining regions also profit and enjoy higher growth rates leading to declining regional inequality. The relationship between welfare (or GDP per capita) and inequality can thus be illustrated with an inverted U-curve (Kuznets curve). In other words: If decentralisation eases the emergence of regional growth spots, then increasing it is the collateral on the way to higher growth rates for all regions.

### 3.3.3 Macroeconomic environment

This section deals with the macroeconomic environment of a country; issues such as stability and distribution will be treated.

An effective economic stabilisation policy can be carried out only at central level: If for example an expansive fiscal policy at the regional level is conducted a big part of the action will be lost through spillovers (e.g. imports) to other regional units. The individual unit will also have no interest to conduct a restrictive policy to combat inflation, because a large amount of the effect spills over to the neighbours. Therefore each regional unit tries to take the position of a free rider. Price stability

can be obtained anyway only by monetary authorities, which are at least on a national level. The regional units below the central government also do not have the appropriate tools for an effective economic stabilisation policy. Hence a completely decentralised country is not able to protect and promote macroeconomic stability appropriately (Prud'homme 1994).

As funding possibilities are limited, regional units are forced to follow a policy of budget balance. This means that when the economy is booming tax revenues flow abundantly and so the budget will increase until an economic downturn cuts spending, because tax revenues decline. Therefore the decentralized units are constrained (practically) to a destabilizing (since pro-cyclical) fiscal policy. Prud'homme (1994) and Tanzi (1996) also dispute that sub-national governments have little incentives to behave counter-cyclical. But Sewell (1996) says that decentralisation has advantages in the perception and the treatment of different shocks to a centralised unit, which has difficulties to react in an appropriate way. According to Bardhan (2002) decentralised governments moreover ensure the cultural and political autonomy and are able to reduce ethnic tensions and separatist movements.

A stable macroeconomic environment signals security and reliability to potential foreign investors. Kotsogiannis (2005) shows that decentralised regimes are associated with lower foreign direct investments for institutional reasons. Therefore more centralised countries signal more stability and thus attract more foreign direct investments – and more investment is known to promote economic growth.

The macroeconomic environment is also affected by the demands and claims of the society. The bigger the society, the more diverse society's demands might be. Bardhan (2002) argues that in heterogeneous societies there are higher preferences for redistribution, which in turn tends to cause higher indebtment because of fiscal decentralisation. The debt then causes macroeconomic stability problems. Controversial are the societal effects on the stability in Treismann (1999:513) who says, that "In more culturally divided states, decentralised political structures lead either to more central redistribution in favour of the more culturally remote regions, worsening central fiscal balance, or to more regional revolt." Hence redistributive policies may be more easily implemented on the level of the central government.

Finally, it can be stated that the benefits of decentralisation under consideration of the macroeconomic environment lie in the appreciation of social diversity and in the handling of sub-national shocks, whereas the central authority should deal with questions of stability and distribution.

## 3.4 The relationship between decentralisation and welfare

In chapter 3.3 we have discussed the transmission channels from decentralisation to economic development and shown that the pros and cons are basically in balance. It became clear that the optimal distribution of power and competences between the national tier and local and regional tiers depends primarily on three parameters: preferences, externalities and economies of scale.

Heterogeneous preferences over space would favour decentralisation of power because the preference matching will be realised more effectively by policy measures being closer to the consumer which in turn increase consumer efficiency. The same will be true for producer efficiency of public spending because the delivery of public services adapted to regional circumstances will occur under higher cost efficiency (Bodman and Ford 2006, Oates 1972, Thießen 2000). The demand for cultural events, for example, may illustrate heterogeneous preferences. The preferences of people in urban regions are different to those of people in rural areas. One reason why people move into the city is the broader cultural offer, which they expect there. In this way urban regions in decentralised countries can react to the diverse needs of the inhabitants specifically and more customised than a central authority. Homogeneous preferences, on the other hand, impose no need on the central government to pass power on to sub-national tiers. Hence the cost of coordination from decentralised policy solutions can be economised because all regions want the same. An example herefore is public security: Regardless of the population, both rural and urban, the inhabitants claim to have guaranteed security.

The second criterion relates to spatial externalities. If they are negligible, decentralisation can be fostered without incurring non internalised spatial externalities which otherwise would lead to a sub-optimal production of public services, inefficiency and welfare losses. The road system may serve as an example because it illustrates both negligible and substantial spatial externalities. Negligible externalities can be illustrated by a local street, which affects only a small and spatially limited part of a region’s population. The local street is of use

only to the citizens living or working along it. Hence spillovers are spatially very limited and remain in general within the region. Thus decentralisation is appropriate since the regional authority knows the needs of the regional population best. Looking at a motorway (Autobahn) or high speed train system, however, the result is different: If it was to be built by local authorities, we would never end up with a useful system, but only with bits and pieces which do not fit together because the spatial spillovers spread out far beyond the delimitations of the subnational unit. Bardhan (1996: 146) supports the opinion that a central coordination is necessary in the case of substantial positive and negative externalities, "which the local authorities may be unable and sometimes even unwilling to cope with." This may result in a too low level of infrastructure. The internalisation of external effects may prefer a central system, which leads to less efficiency losses than a decentralised system (Behnisch et al. 2001, Färber 2001).

The third point is the existence of economies of scale. If there are no economies of scale to exploit, decentralisation of power can precede without welfare losses. Smaller units will be more flexible to adapt to changes over time which again increases efficiency and probably innovation (Breuss and Eller 2004: 70). An example from the educational system is the kindergarten: Because the kindergarten hardly shows economies of scale, it can be organized decentralised. Bardhan (1996: 144) approves the ability of decentralised units to distribute many local public goods in an optimal size. In the presence of high economies of scale, decentralisation will lead to cost inefficiency and low producer efficiency (Prud'homme 1995). Unexploited economies of scale from decentralised production, however, will reduce welfare. Examples of high economies of scale are legal sysems or national defence which are usually dealt with on a national level (with international integration), or research in natural science issues such as the European Organization for Nuclear Research (CERN). The similarities of these goods are a necessary minimum size (high fixed cost) and constant or declining marginal cost, which result in decreasing cost per unit as output increases. A small region does not have the resources and capacities to produce these goods. A small CERN or a small army in every municipality would be highly inefficient.

These considerations are summarised in table 1.

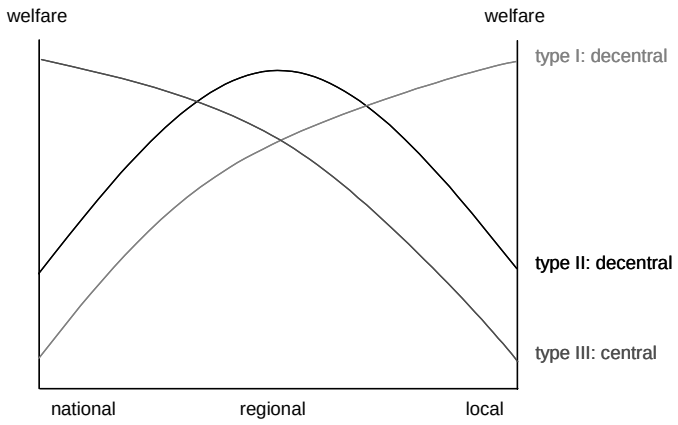
**Table 1: Trade-off between decentralisation and centralisation**

| indicators for de-/centralisation | Power and competences | |
|---|---|---|
| | **decentral** | **Central** |
| **preferences (spatial)** | heterogeneous | homogeneous |
| **spatial externalities** | Negligible | Substantial |
| **economies of scale** | none / low | relevant / high |

Source: BAK Basel Economics

This theoretical framework distinguishes between preferences, externalities and economies of scale and provides two solutions: centralise or decentralise. In fact, there are many political concerns which result in many more optimal solutions which can also lie between the two extreme positions of centralisation and decentralisation. Therefore, all public tasks can be separated into three types. The tasks of type I should be handled on a local level for they display increasing welfare with an increasing degree of decentralisation. Examples are the provision of kindergarten services or local roads. Type II consists of tasks which also should be decentralised but only to a certain degree, say the regional level, because they exhibit a welfare function with a peak. Examples herefore are the organisation of professional schools or the regional road systems. Tasks of type III show diminishing returns from decentralisation and should be managed on a centralised level, in other words by the national tier. Technical university policy or a (national) motorway system may serve as examples for that kind of task. The graphical interpretation of these three types presents itself as follows:

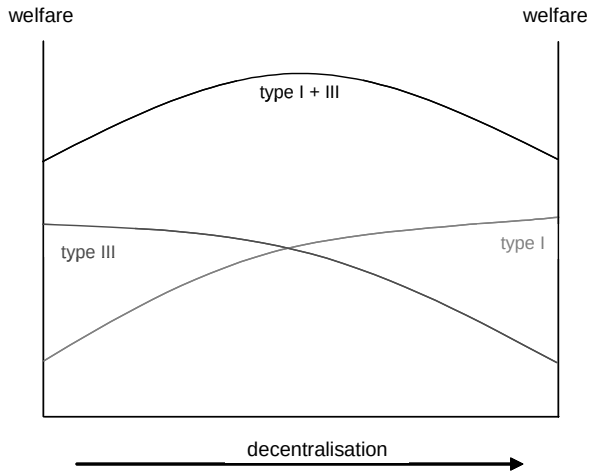
**Figure 3: Welfare economics per policy area**




Source: BAK Basel Economics

The linkage of the three concave curves - which stand for the different types of public tasks - to one aggregated welfare curve results again in a concave curve. It is also economically intuitive to assume that the relationship between decentralisation and economic growth is hump-shaped and that there exists a best degree of decentralisation (see Davoodi and Zou 1998, Thiessen 2003, Bodman and Ford 2006). When starting from a completely centrally organised situation, decentralisation is expected to bring benefits because efficiency gains do possibly outbalance the losses. Moving to a higher degree of decentralisation, growth hindering impacts eventually become more important than the benefits due to diminishing marginal benefits.

**Figure 4: Decentralisation cost/benefit trade-offs**




Source: BAK Basel Economics

The trade-off between costs and benefits from decentralisation derived from theory is presented in Figure 4. In the figure the curves for type I and type III are depicted and added to a welfare curve, which is concave and has an inner maximum. The curve for type I illustrates the gains from decentralisation since an increasing degree of decentralisation leads to higher effectiveness, higher cost efficiency and higher rate of innovation. The counterpart (curve for type III) shows the losses from decentralisation because of unexploited economies of scale, higher coordination costs and not internalised externalities. Adding the third type of task (type II) would result in an even sharper peak.

## 3.5 Conclusions

In chapter 3.3 we grouped the possible transmission channels into efficiency, inequality and macroeconomic environment. The aspect of efficiency seems to give the highest explanatory value of transmission mechanism. Hence in chapter 3.4 we investigated the main arguments for centralisation versus decentralisation which are preferences over space, spatial externalities and economies of scale. The identification of heterogeneous preferences plays a decisive basic role in consumer efficiency regarding matters of “doing the right things” (effectiveness). Thus decentralisation fosters economic welfare through better consideration of citizens’ wishes and needs. The other part that enhances economic growth, producer efficiency, is mainly affected by economies of scale and spatial externalities (spillovers). Both terms refer to the aspect of “doing the things right” (efficiency). In this case the optimal degree of decentralisation is to be found separately for each policy field, because both too low and too high levels of decentralisation will cause welfare losses.

The implication of this analysis is simple and twofold: Decentralisation is not a “yes-no issue”, but something of an optimal degree. And there is not one optimal degree of decentralisation, but an optimal degree for each public task.

Instead of having a different optimal degree of decentralisation for each public task one could think of having a different optimal area (spatial delimitation) for each public task. The subsequent box gives a short outline of this concept.

**Figure 5: A theoretical concept for public services delivery**

**Functional Overlapping Competing Jurisdictions (FOCJ)**

Functional, overlapping and competing jurisdictions (FOCJ) is a theoretical concept for the provision of public goods and services developed by Swiss economists Bruno S. Frey and Reiner Eichenberger (1995). Each public task should be dealt within an optimal spatial delimitation. For different tasks the optimal delimitation may be different. The idea of the concept is to bring together the advantages of democracy and decentralisation against the background of the pros of the unification of European countries. FOCJ can be considered as a theoretical concept and as a system of spatially defined functional perimeter jurisdictions.

FOCJ is the acronym for:

- *Functional:* The new jurisdictions are defined by the tasks to be fulfilled. One FOCUS or perimeter executes only one or very few tasks (functions).
- *Overlapping:* FOCJ are overlapped because each function has probably a different expansion.
- *Competing*: If several FOCJ with identical functions coincide, FOCJ compete democratically with one another for citizens and communities.
- *Jurisdictions*: FOCJ are endowed with enforcement power and may for example levy taxes.

The concept completes the existing Four Freedoms according to the EU (goods, persons, services and capital) by a fifth one, the political competition or in other words the freedom and right of citizens and communities to found special functional jurisdictions. Thereby, FOCJ are able to fit closely to the citizen's preferences and to react flexibly to political problems.

According to FOCJ, government activities must be divided into several tasks which must be reallocated to different FOCJ. A policy task contains for example education, national defence, public transport etc. The fundamental idea behind the concept of FOCJ is that in those policy tasks an optimal functional perimeter across traditional borders exists in order to reach the highest possible economies of scale. These perimeters (FOCJ) also take the spatial demand for public goods and services better into account because the demand may vary due to unequal income and other local factors. The flexible size of the optimal functional perimeter allows for an augmentation of efficiency of the provision of public goods and services among the population.

Although the concept of FOCJ is very appealing we will not pursue this idea further since political delimitations are usually rather strong. This does not mean that existing public authorities (e.g. municipalities) cannot work together to fulfil certain public tasks.

Closing this chapter we highlight the power of decentralisation to foster economic welfare and as Feld et al. (2008: 47) importantly argue, "allows designing regional economic policies to the necessities of a regional economy, and thus increases growth […]."

# 4 Data and Method

In this chapter the econometric method used and the data (apart from decentralisation data) are described.

## 4.1 Econometric method

The purpose of the econometric analysis is to show which factors help explain variances in economic performance between the countries and regions under consideration. As we have deduced different transmission channels from the literature we can assume that there is an impact of decentralisation on economic performance, even though we do not exactly know how it looks like and how strong it is. Another point of discussion concerns the different aspects of decentralisation; some might add more and some less to the economic performance of regions and countries.

To this end, we adopt the Cobb-Douglas production function $Y = a * L^{\alpha} * K^{\beta} * R^{\gamma}$ which was introduced in chapter 3.1 and modified to $Y = f(R)$. The econometric model for economic performance (Y) takes the following linearised form:

$$Y = \alpha + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \ldots + \gamma_1 * Z_1 + \gamma_2 * Z_2 + \gamma_3 * Z_3 + \ldots + \varepsilon ,$$

where the Greek letters α, β and γ are fixed but unknown parameters, ε is an error term, X are various economic and political variables affecting economic performance (such as innovation, accessibility, taxation, regulation or a structural effect). Z could be the decentralisation index, the quantitative or qualitative decentralisation indicator or any other aspect of decentralisation. The variables X and Z are used to explain the variance of performance over the different countries and regions. In the above model, the X-variables serve as control variables, while the Z-variables deserve our full attention: We will derive hypotheses for each γ-parameter and test for its statistical significance in each equation. The statistical relevance of the regional policy variables can then be tested by t-tests.[2] The number of variables for explaining variation in economic performance might be reduced in some equations due to problems from multicollinearity and the loss of degrees of

[2] Student's t-test which is a simple Wald-test

freedom that will most probably lead to insignificant estimates if all variables are included in all in the regressions.

As the decentralisation survey was conducted in 2008, the decentralisation indicators are only available for this (or the previous) single year. That circumstance led to the choice of the method of **cross section regression** analysis using average level information (such as GDP per capita 2001 to 2006) or average rates of change (such as GDP growth 2001 to 2006). If decentralisation data had been available for several years, panel data regressions would also have been possible.

For the estimation of the dynamic equation (growth of GDP) the equation will be modified: to allow weaker regions to catch up and consequently stronger regions to grow below average, the estimation equation will be increased by a so called cohesion term, the level of GDP per capita in 2001 (at the beginning of the growth period 2001 to 2006):[3]

$$g(GDP) = \alpha + \beta*X + \gamma*Z + \delta*(\text{GDP per capita 2001}) + \varepsilon ,$$

The sign of δ is not unambiguous. It might be positive, indicating that strong regions grow faster than weak regions leading to even bigger inequalities in GDP per capita amongst the regions. A negative value, however, leads to a reduction of the differences in the level values: The stronger regions lose part of their lead, the weaker regions manage to reduce the distance and catch up. Thus, a negative value of δ indicates cohesion.

## 4.2 Data

In this section we describe data employed in the analyses. For details of the Z variables refer to the first report. The main source for the Y and many X variables is the BAK International Benchmarking Database 2008.

The database constructed for this project includes indicators of economic performance as well as quantitative measurement of several location factors and framework conditions. For the analyses the variables employed can be roughly divided into **four groups**:

[3] Assuming that δ<0 this term can be interpreted as an error correction term. Omitting such a lagged level term can lead to a systematic bias of the estimated parameter values of β and γ.

a) performance data (left hand variables to be explained)

b) innovation factors

c) location factors (including the structural effect of the shift-share analysis) and

d) decentralisation indicators.

The latter three are right hand variables which shall explain a large part of the performance of countries and regions.

We will use **two data sets**:

1) a country set with 33 observations (conglomerates) from 29 countries

2) a regional set with 234 observations from 234 regions

The first data set deals with data on the country level to answer the question "Does decentralisation (amongst other factors) have a positive significant influence on the economic performance and growth of a country's economy?" The sample consists of 33 entities from 29 countries: EU-27 member states and the non EU countries Switzerland, Norway and Croatia. The EU member states Luxembourg, Slovenia, Cyprus, Malta (and also the non-member states Monaco, Andorra, Liechtenstein, San Marino and Vatican) have been excluded because of their small size. This results in 26 European countries. In addition, three overseas countries have been included as well (USA, Canada, New Zealand). Countries which contain different region types (Finland, Italy, Portugal, Sweden) have been divided into two. For Sweden for example we created Sweden one which encompasses the region of Västra Götaland and the region of Skane because they have a special status. The remaining regions form Sweden two.[4]

The second data set deals with data on the regional level to answer the question "Does decentralisation (amongst other factors) have a positive significant influence on the economic performance and growth of a region's economy?" The sample consists of 234 regions from 16 countries: EU-15 member states (without Luxembourg) and the non EU countries Switzerland and Norway. Globalisation and de-

[4] Belgium is treated as a single conglomerate, as the three regions and the three language communities both cover the whole territory of the Belgium

centralisation are challenging a region's capacity to adapt and improve their competitiveness. It is at the regional level that the pressure to maintain economic growth and social development is felt most. This is why the second part of the analysis focuses on the regional level.

Below a brief overview of the data used in this research and its definitions is provided. For a more comprehensive explanation the reader is referred to the Annex and to the methodology sections of the BAK IBC report 2008.

### 4.2.1 Performance data

Performance in the equation introduced in chapter 4.1 is primarily the level of economic activity and the dynamics of economic activity. We use the following specifications:

- GDP per capita, average 2001-2006
- GDP growth, average 2001-2006

Data for GDP and population are available from the "BAK International Benchmarking Database" for most countries and for all of the 234 regions. Data for the remaining countries are from OECD.

### 4.2.2 Innovation factors

Innovation is most likely the main driver of economic growth and thus of GDP per capita. We therefore include several innovation indicators in our set of X variables.

**Human Capital**

Human capital cannot be measured directly. Instead, indicators for the quality have to be used. A good way to do this is to use the highest level of formal education achieved.

The indicators available are:

- Share of the labour force with a tertiary degree (2006)
- Share of the labour force with a tertiary degree in natural and technical sci-

ences (2006)

Of course, these are incomplete measures since they focus on the formal education usually obtained at the beginning of the working life. They do not reflect non-formal education or the influence of work experience and ability and they ignore life-long learning. Furthermore, differences in the education systems between countries might lead to biased results. Still, these are the best indicators available and are widely accepted in international comparisons.

**Quality of Universities**

An indicator used to measure the top academic potential of universities is the Shanghai Jiao Tong University's 'Academic Ranking of World Universities' ("Shanghai Index"). This ranking comprises the 500 best universities in the world and considers, among others, sub-indices on publications in journals and the number of Nobel Prize winners.

The indicators available are:

- The total number of scores in the Shanghai Index for all universities located in the region (2006)
- The total score from above divided by inhabitants of the region (scores per 100,000 inhabitants, 2006)
- The number of universities in the region included in the Shanghai Index

The total number of scores reflects the quantity of top research available in the region. As networking effects and economies of scale play an important role, the total number of scores is important in itself. Furthermore, in order to attract the best researchers and students possible, a region must become known as a prominent centre for learning with a critical mass of top universities. Of course, this number depends on the size of the regions as well. To take the different sizes of the regions in the sample into account, per capita figures are used as well. This number reflects the 'high quality research' available to every inhabitant and measures more directly the impact on per capita GDP of the innovation potential embodied in the universities. Finally, the number of universities in the regions provides information on the average score of the university – again an issue of quantity versus quality – and the networking options.

A limitation of this indicator has to be kept in mind. The focus of research of a university is a factor which strongly affects the ranking. The Shanghai Index puts more weight on the natural sciences. A university with a focus on social sciences consequently ranks lower.

**Scientific Articles**

Academic research output is usually published in scientific journals. We concentrate on articles in refereed journals, where all papers submitted undergo a peer review by other scientists working in the same field. Thus, published articles in scientific journals comply with a minimal standard for scientific quality. The indicator available is:

- The number of articles in scientific journals (per capita, average 2003-2006)

Articles are measured at the place of the academic affiliation of the author(s), which is usually a university or a research institute. These data are a feasible indicator for scientific output and capacity of a region.

**Patents**

Patents display a crucial incentive for R&D activities because they ensure the right of application to the inventor. Patents are used as indicator for the innovative activity and the potential of economic growth (productivity, jobs, GDP etc.). The number of patents is measured in the year of the respective application but is not counted until it is granted. As there can be several years between the time of registration and the time of approval, valid patent data are available with a significant time lag.

- The number of patents granted (per capita, average 2000 - 2004)
- The number of patents granted in high tech sciences (2002)

Patents are measured at the place of residence of the inventor, not at the place of the patent owner. These data are a feasible indicator for the practical (or industry relevant) research output and innovation capacity of a region.

### 4.2.3 Location factors

**Regulation**

Regulations work through many channels of an economic system, and the relationship between regulation and growth is very complex. The database contains two proxies for regulation.

- The OECD index for product market regulation (2006)
- The OECD index for employment protection (labour market regulation, 2006)

These indicators measure the extent to which policy settings promote or inhibit competition in the areas of product and labour markets.

**Taxation**

Tax burdens can have a strong impact on the decisions of both individuals and companies thereby heavily affecting the allocation of scarce resources.

Taxation is a large field of research and many indicators are available. The choice gets much more limited when the data should be internationally comparable, reflect the complete tax system instead of only one particular issue or tax rate, and fit the economic reasoning given above. We have two indicators fulfilling these conditions, one for company taxation and one for the tax burden on highly qualified employees. The indicators available are:

- Company tax burden (in percentage-points of profits, 2006)
- Tax burden on a highly qualified employee (in percentage-points of gross income, 2006)

Company tax burden measures the Effective Average Tax Rate including all kinds of direct company taxes for a typical profitable investment. Manpower taxation measures the average tax rate for a highly qualified employee (available income after taxes: 100,000 EURO; single). Taxes include the expected tax burden on pensions and social security contributions if mandatory and appropriate (i.e. when it has a tax characteristic).

As in the case of regulation taxation is an issue defined to a large extent on the national level. But again, it is important to regions' prospects for growth. It should therefore be included in an international comparison. Furthermore, depending on the national setting, there are possibilities for regions to increase or decrease the

tax burden, in many countries at least to some extent, in some countries to a large extent (e.g. Switzerland, USA). The indicators used take regional differences into account where appropriate.[5]

**Accessibility**

A region's accessibility is a key factor in a globalised economy. Today, all regions in Western Europe are accessible, but the degree and efficiency of accessibility varies. Without good accessibility, a region cannot profit from the international division of labour to the same extent as other regions and is less attractive for companies and highly qualified workers.

The accessibility of a region is determined by two factors: geographical location and infrastructure. While the geographical location cannot be changed, improving connectivity should be a key policy aim.

For a region's global accessibility, or how well it is connected with the rest of the world outside Europe, the geographical location is less important than its travel-time proximity to one of the large airports of the world.

Accessibility is not a single clear concept; rather, many different things can be subsumed within the topic of accessibility. Here a concept of outbound accessibility is followed, taking into account travel times and frequency for business travellers to reach other regions. As not all destinations have the same relevance the travel times are weighted (with a non-linear function) with the GDP of the destination.

- Continental accessibility (index, sample average 2002=100, 2006)

The European accessibility is measured by calculating travel times from and to almost all big European Cities (approx. 290) by train, by car and by inter-European flights. For further information on these indicators see BAK (2005).

This indicator covers what are usually considered the most important aspects of

[5] Our manpower taxation-calculation for the countries Canada, New Zealand, Australia, Spain, Portugal and Greece is based on the data derived from the OECD Tax Database. For the countries Bulgaria, Estonia, Croatia, Lithuania, Latvia, Romania, Canada, New Zealand, Australia, Spain, Portugal and Greece our calculation of company taxation based on the dataset of KPMG Tax Rate Survey 2007. For further information on these indicators, see BAK (2007) as well as Elschner and Schwager (2003) for manpower and Elschner and Overesch (2004) for company taxation.

accessibility that influence a company's location decision. They do not cover accessibility within the region, e.g. regional road networks and the quality of public transport. This will especially influence the location decisions of companies within the region, but it is also a factor of attractiveness for the region. For example, long commuting times will make a region less attractive for employees which, in turn, might make it difficult or more costly for a company to recruit the necessary labour.

### 4.2.4 The structural effect: Shift share analysis

The structure of the regional economy can have a significant impact on economic performance. Some regions are overrepresented in strong industries (such as investment goods, pharmaceuticals, business services), others in less strong industries (such as agriculture, basic chemicals, construction). This effect can be measured using shift-share analysis.

The shift-share analysis has achieved from its origin a great popularity within regional science. This technique was first developed by E.S. Dunn (1960) as a method for the determination of the components explaining the cross-country or cross-regional variations of growth of economic variables. The variables so decomposed may be gross value added, employment, income, population or a variety of other economic magnitudes.

In its traditional form, the shift-share analysis allows to decompose the growth rate of let's say gross value added in a certain period of time as the sum of three components: a Global Effect, a Structural Effect as well as a Regional Effect.

| | | |
|---|---|---|
| Actual Growth Rate | = | Global Effect (GE) |
| + | | Structural Effect (SE) |
| + | | Regional Effect (RE) |

The Global Effect reflects economic growth of a superior geographic area which in the context of regions is the economic growth of the country to which the region belongs. The Global Effect is identical for all regions and measures therefore the regional growth that could have been reached if the region had grown at the same rate as the superior area. It is expected that if the nation as a whole is experiencing growth, it would have a positive influence on the local area. In another way the Global Effect is reflecting a kind of business cycle element which is equal for all the regions belonging to a relative homogenous economic area.

The Structural Effect refers to differences in growth rates between regions which are related to growth differences between the industries on the national level. Differences in the Structural Effect of regions only occur due to differences in the regional industry mix (at the beginning of the period investigated), so that the Structural Effect reflects the degree to which the region is specialized in industries that are growing faster or slower nationally than GDP. Positive Structural Effects indicate that the industry composition of the region was tilted towards faster growing sectors (at the beginning of the period); negative outcomes for the Structural Effect would indicate just the opposite.

- Structural effect from the shift share analysis (average 2001 to 2006)

As a residual of the decomposition of the regions' economic growth – after the deduction of the Global and the Structural Effect – the Regional Effect remains. The Regional Effect measures the growth component which is related to differences between the local industry's and the national industry's growth rates. It is attributed to all the factors which have a regional dimension. From the focus of our study, the Regional Effect refers to regional differences in the so-called growth factors like innovation capacity, tax system, accessibility and so forth.

In the regional data set we will also test whether regions with the capital of a country perform better than non-capital regions. To this end we define a dummy variable with the value 1 for capital regions and 0 otherwise.

The hypotheses regarding the sign of the first derivatives (the β parameters) can be summarized as follows:

Positive ($\beta>0$): Innovation indicators (human capital, quality of universities, publications and patents), accessibility, structural effect (industry structure) and capital dummy.

Negative ($\beta<0$): Regulation and taxation.

# 5 Empirical Findings

In this chapter the relation between decentralisation on the one hand and economic performance and innovation on the other hand is analysed. For the analysis of this relation, the econometric method of multiple OLS regressions has been applied. The purpose of this method is to show which factors help explain the variance in economic performance among different countries and regions under consideration. The main question of investigation is whether decentralisation - and if so which dimension of decentralisation - provides a statistically significant contribution to explain economic performance of regions and countries.

## 5.1 Decentralisation and GDP per capita

In this chapter we investigate the relation between decentralisation (Decentralisation Index) and the economic performance of a country measured by GDP per capita. A first impression of the data and the relation between them can be seen in a simple correlation diagram:

**Figure 6: Decentralisation and GDP per capita**

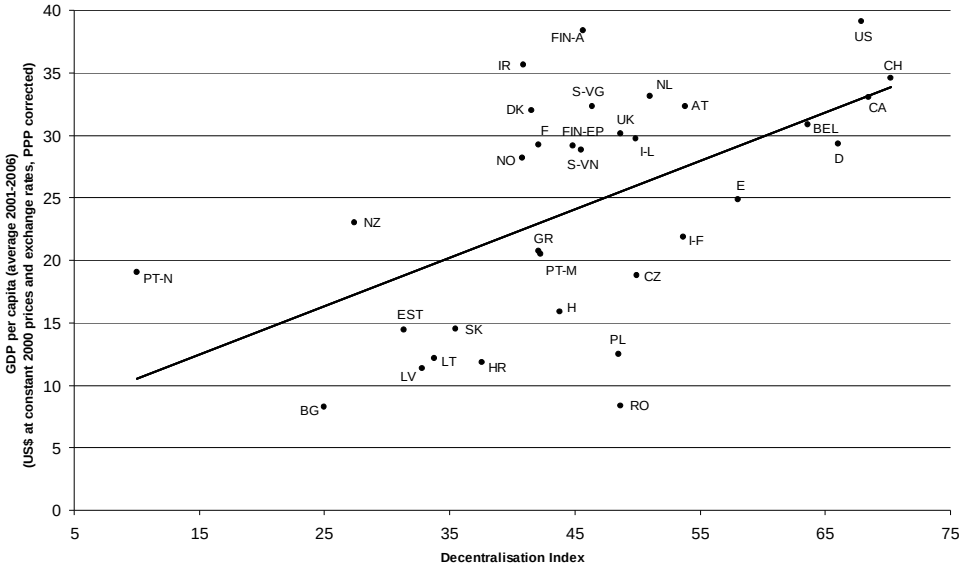



Figure 6 shows a positive correlation between the Decentralisation Index and GDP

per capita. Thus, a high degree of decentralisation corresponds in general with high GDP per capita. This is especially true for the group of the Western European federal countries in the upper right corner of the chart. To the group of Western European centralist countries, belong a few that have only an average degree of decentralisation but an extraordinary high level of GDP per capita, such as Norway, Ireland, Denmark and Sweden. While Norway's high GDP level can, for example, be explained by the well performing oil industry, the high GDP of Ireland is the result of an aggressive and very effective immigration and business policy in recent years (up to 2007). All Eastern European countries have a GDP per capita below EUR 15'000 and not a very high degree of decentralisation, the Czech Republic and Poland, but also Hungary and Romania, constituting positive exceptions.

The subsequent tables show the estimation results of the main regression for the country data sample[6] and the regional data sample. In each of the tables the results for the qualitative and quantitative data are shown separately in addition to the results for the decentralisation index. The equation estimated takes the following form:

$$Y = \alpha + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \ldots + \gamma_1 * Z_1 + \gamma_2 * Z_2 + \gamma_3 * Z_3 + \ldots + \varepsilon ,$$

The decentralisation indicators (Z) are constructed in such a manner that a higher degree of decentralisation goes along with a higher value. Thus we postulate a positive correlation between decentralisation and economic performance.

The first column (Total) of Table 2 shows the result of the multiple regression analysis for the level of GDP per capita of the country sample. It shows that GDP per capita can be best explained using regulation and patents as X-variables. Higher (or less liberal) regulation of the product markets significantly reduces performance, while the number of high tech patents per capita (as an indicator of innovation) has a positive influence. Decentralisation has a highly significant positive influence on economic performance: the higher the degree of decentralisation, the higher (ceteris paribus) the level of GDP per capita.

[6] In this chapter we use the terms „country sample" and „33 conglomerates" as synonyms.

The remaining two columns show the same regressions using instead of the total decentralisation index only the quantitative respectively only the qualitative part of the decentralisation index. The results are very similar, however, it is interesting to note that the qualitative aspects of decentralisation tend to have a bigger impact on performance than the quantitative ones.

**Table 2: Results of the regression analyses for the country sample: Decentralisation and GDP per capita (level)**

| Dependent variable: GDP per capita (average 2001 to 2006) | **Total** | **Quantitative Decentralisa-tion** | **Qualitative Decentralisa-tion** |
|---|---|---|---|
| Constant | 26.37509 *** | 28.35330 *** | 27.03120 *** |
| **Decentralisation** | **0.24662 *** ** | **0.18510 *** ** | **0.24208 *** ** |
| Regulation of product markets | -12.74877 *** | -12.03540 *** | -13.25575 *** |
| High tech patents per capita | 0.06902 * | 0.04331 | 0.09226 ** |
| R-squared | 0.75079 *** | 0.73578 *** | 0.74165 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

Source: BAKBASEL

The results for all three equations are statistically very sound and have a high explanatory power. Altogether we can conclude that decentralisation - amongst other factors - has a significantly positive influence on the performance of a country's economy.

In table 3 the regional sample is used to explain the variance of the level of GDP per capita in Europe. It can be seen that here, too, regional economic performance can be explained by the regulation of product markets (as was the case in the preceding estimation) and additionally by company taxation. The negative sign of company taxation points out that in general the lower the taxes for companies the better the economic performance of a region. Indicators for innovation which explain economic performance of European regions are publications and the Shanghai index, both defined relative to population size. Further explanatory power is provided by an advantageous industry structure of the respective region and the fact whether the region considered contains the capital city of the country or not.

Again, there is a highly significant positive influence of decentralisation on regional

economic performance. The effect – measured by the estimated parameter value – is somewhat lower than in the country sample. This could be attributed to the fact, that the regional sample not covering the Eastern European countries has a smaller variance in decentralisation.

The results using only the quantitative respectively only the qualitative part of the decentralisation index are very similar, however it is interesting again to note that the qualitative aspects of decentralisation tend to have a bigger impact on performance than the quantitative ones.

**Table 3: Results of the regression analyses for the regional sample: Decentralisation and GDP per capita (level)**

| Dependent variable: GDP per capita (average 2001 to 2006) | **Total** | **Quantitative Decentralisation** | **Qualitative Decentralisation** |
|---|---|---|---|
| Constant | 27.62331 *** | 28.78866 *** | 28.38566 *** |
| **Decentralisation** | **0.09459 *** ** | **0.04927 ** ** | **0.10115 *** ** |
| Regulation of product markets | -3.37052 ** | -2.83090 ** | -3.85276 *** |
| Company taxation | -10.78228 | -9.61883 | -11.97483 * |
| Publications per capita | 0.66947 | 0.67905 | 0.66476 |
| Shanghai-Index points per capita | 179.08470 *** | 180.80950 *** | 180.33660 *** |
| Industry structure [a)] | 63.33483 *** | 66.18994 *** | 62.81355 *** |
| Dummy capital city | 6.38699 *** | 6.09848 *** | 6.46010 *** |
| R-squared | 0.52343 *** | 0.51292 *** | 0.52584 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

[a)] structural effect derived from a shift-share analysis

Source: BAKBASEL

Also with the regional data set, the results for all three equations are statistically sound and have a high explanatory power: Decentralisation, amongst other factors, has a significantly positive influence on the performance of a country's economy.

Apart from the total index and the quantitative and the qualitative part of the decentralisation index the decentralisation data base yields a multitude of further information. The equations from tables 2 and 3 have been reestimated using all aggre-

gates (2), sub-indices (5), indicators (23) and ten elements of decision making power and implementing power. This is done to find out which competences or policy fields are of special relevance for the economic performance of the regions?

Table 4 summarizes the results of 96 regressions: for 48 different aspects of decentralisation and two data sets. The table only contains the estimated values of the γ parameter of each equation together with the information of its statistical significance (as above). It can be seen that the parameter values in the country set are in general bigger than in the regional set, as already discussed above. The interesting result is that despite the fact that the 48 different decentralisation variables cover various different aspects of decentralisation almost all signs are positive, many of them in a significant manner. None of the negative signs is statistically significant.[7]

Focussing on the asterisks we can conclude that (with one exception) all aggregates and sub-indices are highly significant. Deciding decentralisation has approximately the same relevance as Financial Decentralisation which is an interesting result. Many aspects of decision making competences (D1 to D9) are significant; this stands in sharp contrast to the results of implementing competences (I1 to I10) which are not significant. This means that only the competences to decide are relevant for the economic prosperity of the regions but not the competence or duty to implement someone else's policy (the decisions made on the national tier). Of special relevance are the fields of health care and of education and research.

Looking at the lower part of the table, the relevance of the financial variables must be put into perspective. Hardly any one of them is significant in both samples. This criterion is only met by the aggregate Financial Decentralisation (but not, e.g., for taxation competences). As for Political Decentralisation it is also met for several indicators. According to the regression results it does matter whether the regions have a strong impact on the legislation process on the national tier (National parliament), whether there is a regional constitution (albeit an indication of the political culture rather than concrete power) or how independent the regional governments are from national authorities. Qualitative aspects seem to play as important a role as purely financial aspects.

[7] This is noteworthy as we would expect in a pure random sample some 5 estimates to be significantly negative. This fact demonstrates in a nice way the positive impact of decentralisation on the level of GDP per capita.

**Table 4: Estimators of the Decentralisation variables for GDP per capita level**

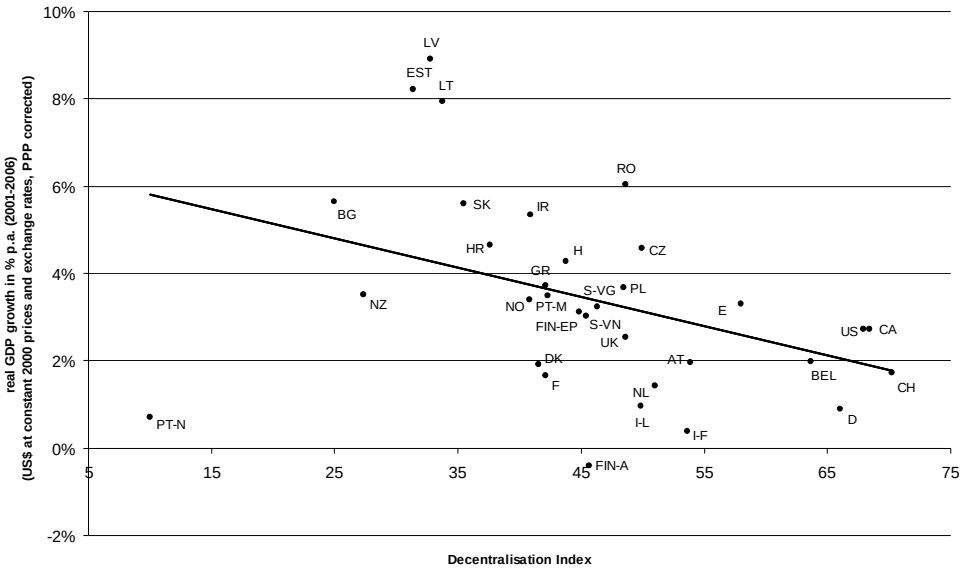
| Dec-Indicator | 33 conglomerates | 234 regions |
|---|---|---|
| Decentralisation Index | 0.24662 *** | 0.09459 *** |
| Qualitative Indicators | 0.24208 *** | 0.10115 *** |
| Quantitative Indicators | 0.18510 *** | 0.04927 ** |
| Administrative decentralisation | 0.14647 *** | 0.04152 ** |
| Functional decentralisation | 0.19922 *** | 0.08387 ** |
| Political decentralisation | 0.16253 *** | 0.07117 *** |
| Vertical decentralisation | 0.08113 | 0.11508 ** |
| Deciding decentralisation | 0.22709 *** | 0.08796 *** |
| Financial decentralisation | 0.24177 *** | 0.09106 *** |
| EU | 0.03373 | 0.02935 ** |
| Employees | 0.12374 ** | 0.02698 |
| D1 Economic policy | 0.04668 | 0.02257 |
| D2 Social policy | 0.12948 ** | 0.02803 |
| D3 Healthcare | 0.10889 *** | 0.03124 * |
| D4 Education & Research | 0.09503 ** | 0.04095 ** |
| D5 Infrastructure | 0.13202 *** | 0.02520 |
| D6 Public order & safety | 0.09473 ** | 0.02732 * |
| D7 Environment & energy | 0.06020 | 0.04836 *** |
| D8 Recreation & Culture | 0.10407 ** | 0.02466 |
| D9 Migration & integration | 0.07073 | 0.04108 ** |
| Total **d**ecision making power | 0.17718 *** | 0.07832 *** |
| I1 Economic policy | -0.00537 | -0.01181 |
| I2 Social policy | 0.00121 | 0.00417 |
| I3 Healthcare | 0.03255 | 0.00870 |
| I4 Education & Research | 0.02951 | 0.00997 |
| I5 Infrastructure | 0.04372 | 0.02063 |
| I6 Public order & safety | -0.00927 | 0.00529 |
| I7 Environment & energy | 0.07853 | 0.02695 * |
| I8 Recreation & Culture | 0.04787 | 0.00875 |
| I9 Migration & integration | 0.01931 | 0.00114 |
| I10 EU policy | -0.01007 | 0.00688 |
| Total **i**mplementing power | 0.03704 | 0.01916 |
| Territorial | 0.07792 ** | 0.02866 * |
| National parliament | 0.10154 *** | 0.04319 *** |
| Political interrelation | 0.10505 | 0.05701 ** |
| Regional constitution | 0.05506 *** | 0.01793 ** |
| Regional government | 0.09139 *** | 0.04315 *** |
| Political power distribution | 0.01741 | 0.02806 |
| Incentives | -0.04080 | 0.02282 |
| Taxation power | 0.11346 ** | 0.03918 * |
| Debts (balance) | 0.03603 | 0.02385 ** |
| Qualitative finance | 0.14443 | 0.08336 *** |
| Revenues | 0.19432 *** | 0.03251 |
| Expenditures | 0.22687 *** | 0.04711 * |
| Public consumption & investment | 0.07390 | 0.03923 |
| Financial balance | 0.03393 | 0.03004 ** |
| Financial perequation | -0.01268 | 0.03364 |
| Quantitative finance | 0.20992 *** | 0.05949 * |

Source: BAKBASEL

## 5.2 Decentralisation and GDP growth

This chapter investigates the relation between decentralisation (Decentralisation Index) and the economic performance of a country measured by real annual growth of gross domestic product (GDP growth). A first impression of the data and the relation between them can be seen in a simple correlation diagram:

**Figure 7: Decentralisation and GDP growth**




GDP growth and Decentralisation are negatively correlated (Figure 7): A higher Decentralisation Index corresponds with a decrease of GDP growth. This result has to be put in the relevant context: Some of the countries in the group of the Eastern European countries with a high degree of centralisation like Latvia, Lithuania, Estonia or Romania have extraordinary high economic growth rates which are typical for transition economies changing from a centrally planned to a free market economy. At the same time, the regions in these countries have almost no autonomy (yet). Nevertheless, they seem to catch-up quickly economically but are lagging behind in terms of decentralisation and an optimal organisation of government which would better suit economic development. The econometric analysis can control for history, transition and other location factors when estimating the impact of decentralisation on economic growth. The most important variable to this end is the level of GDP per capita at the beginning of the measured growth period allowing weaker regions to catch up and consequently stronger regions to grow below

average. The regression equation will be complemented by the level of GDP per capita in 2001 (at the beginning of the growth period 2001 to 2006):[8] Moreover we add a quadratic decentralisation term ($Z^2$)[9]:

$$g(GDP) = \alpha + \beta*X + \gamma_1*Z + \gamma_2*Z^2 + \delta*(\text{GDP per capita 2001}) + \varepsilon ,$$

In table 5 the same sample (country sample) is used to explain average growth of GDP in the years from 2001 to 2006. The results show that the dynamics can be explained by the regulation of product markets as before and additionally by the amount of Shanghai Index points per capita and the share of tertiary educated people in natural sciences as a percentage of total labour force, the latter being indicators for innovation. The signs of the estimated variables are all as expected from the literature. The parameter δ of the variable "GDP per capita in the year 2001" exhibits a significantly negative sign implying convergence effects since the different countries start from different performance levels.

Decentralisation again has a highly significant positive influence on economic performance. In addition there is also a significant but negative influence of the squared decentralisation variable which points to the possibility (proposed in the theory chapter) that an optimal degree of decentralisation might exist: if the degree of decentralisation is too high it might have a negative impact on economic growth. Altogether when evaluating the first derivative of growth with respect to the Decentralisation Index, one can assume that decentralisation, amongst other factors, has a significantly positive influence on the dynamics of the performance of a country's economy.

As in the case of the level regression, the results using only the quantitative or only the qualitative elements of decentralisation are very similar. Interestingly enough that the biggest differences can be stated for the decentralisation variable itself: The parameter value of the qualitative decentralisation variable is about three times as big as the quantitative one. This clearly stresses that decentralisation is not just a financial matter.

[8] Assuming that δ<0 this term can be interpreted as an error correction term. Omitting such a lagged level term can lead to a systematic bias of the estimated parameter values of β and γ.

[9] We also tested for a quadratic term in the level equation. However, it was insignificant and did not add to the explanation o0f GDP per capita.

**Table 5: Results of the regression analyses for the country sample: Decentralisation and GDP growth**

| Dependent variable: GDP growth (average growth rate 2001 to 2006) | **Total** | **Quantitative Decentralisation** | **Qualitative Decentralisa-tion** |
|---|---|---|---|
| Constant | 0.07373 *** | 0.08925 *** | 0.05851 ** |
| **Decentralisation** | **0.00196 ** ** | **0.00122 ** ** | **0.00283 ** ** |
| Decentralisation^2 | **-2.03E-05** ** | **-1.11E-05 * ** | **-3.24E-05** ** |
| Regulation of product markets | -0.02506 *** | -0.02514 *** | -0.02485 *** |
| Shanghai-Index points per capita | 7.29E-06 * | 7.80E-06 * | 6.98E-06 * |
| Share of tertiary educated [a)] | 0.00103 | 0.00110 | 0.00089 |
| GDP per capita 2001 | -0.00312 *** | -0.00322 *** | -0.00298 *** |
| R-squared | 0.75134 *** | 0.73772 *** | 0.76155 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

[a)] in natural sciences

Source: BAKBASEL

The estimated parameters in these growth equations are much smaller than for the level equations in the previous chapter. This is due to the fact that the mean of the left-hand variable is now about 2.5% (per annum) instead of about 25 thousand US-Dollars (which is a multiple of 1000).

The results for all three equations are statistically very sound and have a high explanatory power. Only the human capital variable does not show significant albeit positive parameter estimates. Altogether we can conclude that decentralisation - amongst other factors - has a significantly positive influence on the performance of a country's economy. The negative quadratic term indicates the existence of an optimum value of decentralisation.

In table 6 the regional sample is used to explain the dynamics of GDP over the period from 2001 to 2006. The results show that the dynamics can be explained by company and manpower taxation: The higher the tax burden the stronger the negative impact on economic growth. The quality of the universities measured by the Shanghai index per capita provides significant empirical explanation for the dynamics of a region's economy.

Besides the change in the regions' industry structure has additional explanatory power for economic performance. This aspect is measured by the difference in the structural effect (from a shift-share analysis) between the averages of the periods 1996-2001 and 2001-2006. Although this difference measures changes from slow growth industries to high growth industries, the estimates contribute less to the explanation of GDP growth than e.g. taxation or decentralisation. Again, the parameter δ which controls for level effects is negative which indicates cohesion also on the regional level (not necessarily for all lagging regions, but at least on average).

Once more all three dimensions of decentralisation (total, quantitative and qualitative) have a highly significant positive influence on regional economic performance. The qualitative aspects of decentralisation seem to have a bigger impact on growth than the quantitative aspects. And here, too, the negative signs of the squared decentralisation indicators point to the existence of an optimal degree of decentralisation.

**Table 6: Results of the regression analyses for the regional sample: Decentralisation and GDP growth**

| Dependent variable: GDP growth (average growth rate 2001 to 2006) | **Total** | **Quantitative Decentralisation** | **Qualitative Decentralisation** |
|---|---|---|---|
| Constant | 0.02741 ** | 0.04414 *** | 0.00678 |
| **Decentralisation** | **0.00182 *** ** | **0.00102 *** ** | **0.00272 *** ** |
| Decentralisation^2 | **-2.12E-05*** ** | **-1.18E-05*** ** | **-3.21E-05*** ** |
| Company Taxation | -0.06013 *** | -0.07479 *** | -0.06056 *** |
| Manpower Taxation [a)] | -0.04430 *** | -0.03283 ** | -0.03820 ** |
| Shanghai-Index points per capita | 0.22562 *** | 0.22846 *** | 0.22159 *** |
| Change in Industry structure [b)] | 0.18793 * | 0.19695 * | 0.22349 ** |
| GDP per capita 2001 | -0.00036 ** | -0.00037 ** | -0.00033 * |
| R-squared | 0.19560 *** | 0.16938 *** | 0.22481 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

[a)] with an net income > 100.000€ per year

[b)] structural effect derived from a shift-share analysis

Source: BAKBASEL

Also with the regional data set, the results for all three equations are statistically very sound and have a high explanatory power: Decentralisation – amongst other factors – has a significantly positive influence on the performance of a country's economy.

We now turn to the question which competences or policy fields are of special relevance for economic growth of regions? Table 7 summarizes the results of 96 regressions: for 48 different aspects of decentralisation and two data sets. The table only contains the estimated values of the two γ parameters of each equation together with the information on its statistical significance (as above). As the left-hand variable is a growth rate in both data sets, the parameter values for the two sets are of the same magnitude. The interesting result is that, despite the fact that the 48 different decentralisation variables cover various different aspects of decentralisation, almost all parameters have the expected sign ($\gamma_1>0$, $\gamma_2<0$), many of them in a significant manner. This is especially true for the country sample where none of the "wrong" signs is statistically significant. Though, it should be noted that outside the set of the aggregated indices (shown in the first nine lines) not many parameters are significant. All the more interesting that "D5: infrastructure" is an exception: the more decentralised infrastructure decisions are the higher economic growth. The same applies for recreation and culture. Quality of living seems to be a relevant issue for the regions.

In the regional sample many parameter estimates are statistically significant. Some of them have the "wrong" sign. But many more have the expected sign. This holds particularly for the set of aggregated indices (shown in the first nine lines). The same is true for other items already identified to be relevant such as the independence of the regional government, the qualitative aspects of financial competences and quantitative financial indicators.

Decision competences in the field of infrastructure and of recreation and culture prove again relevant. Focussing on the asterisks we can conclude that decision making competences (D1 to D9) are more relevant for economic growth than implementation competences (and duties) (I1 to I10). In this data set financial decentralisation variables are at least as relevant as qualitative competences of the regions.

**Table 7: Estimators of the Decentralisation variables for GDP growth**

| Dec-Indicator | 33 conglomerates | | 234 regions | |
|---|---|---|---|---|
| | DEC | $DEC^2$ | DEC | $DEC^2$ |
| Decentralisation Index | 0.00196** | -0.00002** | 0.00182*** | -0.00002*** |
| Qualitative Indicators | 0.00283** | -0.00003** | 0.00272*** | -0.00003*** |
| Quantitative Indicators | 0.00122** | -0.00001* | 0.00102*** | -0.00001*** |
| Administrative decentralisation | 0.00102* | -0.00001* | -0.00009 | 0.00000 |
| Functional decentralisation | 0.00229*** | -0.00003*** | 0.00188*** | -0.00003*** |
| Political decentralisation | 0.00111* | -0.00001* | 0.00108*** | -0.00001*** |
| Vertical decentralisation | 0.00189 | -0.00002 | 0.00206*** | -0.00003*** |
| Deciding decentralisation | 0.00205** | -0.00002** | 0.00145*** | -0.00002*** |
| Financial decentralisation | 0.00172** | -0.00002* | 0.00202*** | -0.00002*** |
| EU | 0.00024 | 0.00000 | 0.00087*** | -0.00001*** |
| Employees | 0.00051 | 0.00000 | 0.00029 | 0.00000 |
| D1 Economic policy | 0.00018 | 0.00000 | -0.00014 | 0.00000 |
| D2 Social policy | 0.00025 | 0.00000 | -0.00051** | 0.00001* |
| D3 Healthcare | -0.00014 | 0.00000 | -0.00020 | 0.00000 |
| D4 Education & Research | 0.00027 | 0.00000 | -0.00005 | 0.00000 |
| D5 Infrastructure | 0.00143*** | -0.00002*** | 0.00147*** | -0.00002*** |
| D6 Public order & safety | 0.00007 | 0.00000 | 0.00043*** | -0.00001** |
| D7 Environment & energy | 0.00072* | -0.00001 | 0.00021 | 0.00000 |
| D8 Recreation & Culture | 0.00132*** | -0.00001*** | 0.00062*** | -0.00001** |
| D9 Migration & integration | 0.00023 | -0.00001 | -0.0003** | 0.00000 |
| Total **d**ecision making power | 0.00173*** | -0.00003** | 0.00153*** | -0.00002*** |
| I1 Economic policy | 0.00046 | 0.00000 | 0.00072** | -0.00001*** |
| I2 Social policy | -0.00003 | 0.00000 | -0.00049*** | 0.00001*** |
| I3 Healthcare | 0.00056* | 0.00000 | -0.00002 | 0.00000 |
| I4 Education & Research | 0.00074* | -0.00001 | 0.00074** | -0.00001*** |
| I5 Infrastructure | 0.00076 | -0.00001* | -0.00021 | 0.00000 |
| I6 Public order & safety | 0.00020 | 0.00000 | 0.00006 | 0.00000 |
| I7 Environment & energy | -0.00006 | 0.00000 | -0.00011 | 0.00000 |
| I8 Recreation & Culture | 0.00263** | -0.00002* | 0.00058 | 0.00000 |
| I9 Migration & integration | 0.00020 | 0.00000 | 0.00013 | 0.00000 |
| I10 EU policy | 0.00041 | 0.00000 | 0.00032*** | -0.00000*** |
| Total **i**mplementing power | 0.00138 | -0.00001 | 0.0009** | -0.00001** |
| Territorial | 0.00016 | 0.00000 | 0.00003 | 0.00000 |
| National parliament | 0.00021 | 0.00000 | 0.00029* | -0.00001** |
| Political interrelation | 0.00151* | -0.00001* | 0.00096* | -0.00001* |
| Regional constitution | -0.00628 | 0.00006 | -0.02506 | 0.00025 |
| Regional government | 0.00017 | 0.00000 | 0.00078*** | -0.00001*** |
| Political power distribution | 0.00009 | 0.00000 | -0.00020 | 0.00000 |
| Incentives | 0.00002 | 0.00000 | -0.00047** | 0.00001** |
| Taxation power | -0.00009 | 0.00000 | -0.00001 | 0.00000 |
| Debts (balance) | 0.00012 | 0.00000 | -0.00034** | 0.00000*** |
| Qualitative finance | 0.00078 | -0.00001 | 0.00449*** | -0.00005*** |
| Revenues | 0.00099 | -0.00001 | 0.00274*** | -0.00003*** |
| Expenditures | 0.00101 | -0.00001 | 0.00216*** | -0.00002*** |
| Public consumption & invest. | 0.00049 | -0.00001 | 0.00137*** | -0.00001*** |
| Financial balance | 0.00082** | -0.00001** | 0.00045*** | -0.00001*** |
| Financial perequation | 0.00026 | 0.00000 | -0.00018 | 0.00000 |
| Quantitative finance | 0.00129 | -0.00001 | 0.00253*** | -0.00003*** |

Source: BAKBASEL

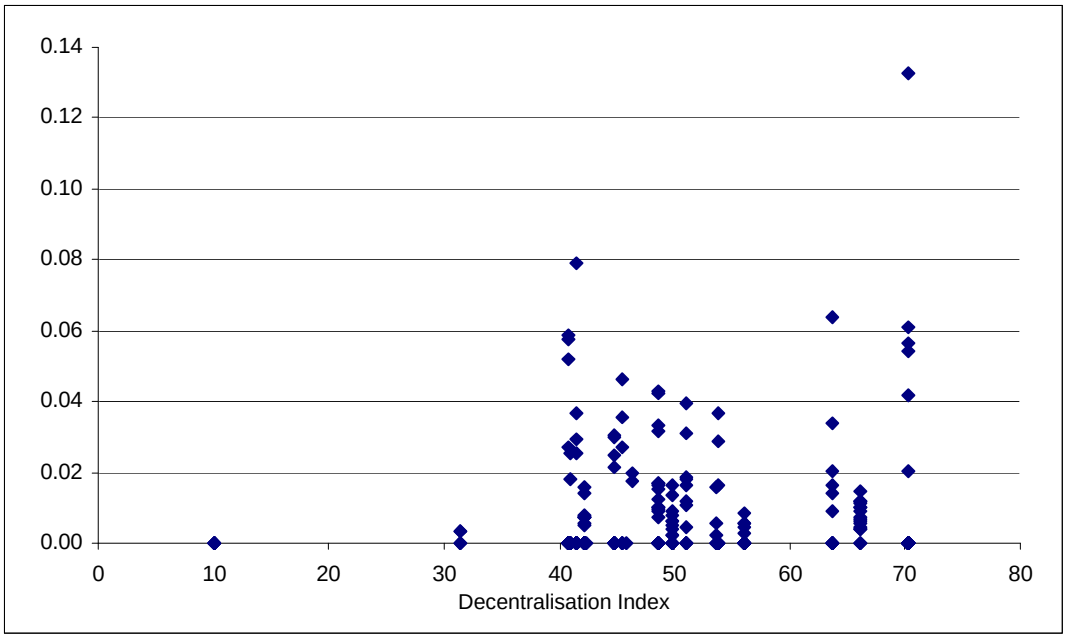
## 5.3 Decentralisation and Innovation

In this chapter the relation between decentralisation (Decentralisation Index) and innovation is analysed. As innovation is a concept and not a measure we will use three different measures as indicators for the innovation capacities of a region: (1) the number of patents, (2) the score in the Academic Ranking of World Universities by the Shanghai Jiao Tong University, (3) the number of academic publications.

The analysis in this chapter is restricted to the regional data set since the data for patents and publications are not available in the same form for all countries in the country sample.

Representative for the three indicator variables, the simple correlation diagram of figure 8 gives a first impression of the data and the relation between decentralisation and the Shanghai criterion.

**Figure 8: Decentralisation and Shanghai points per capita**




The Shanghai Index is gauged to the best university in the world (Harvard) with 100 points. The top 500 universities are rated accordingly relative to Harvard. Universities outside the top 500 have zero points. The best European university is Cambridge (ranked 4th) with a score of 70. Rank 100 (e.g. Strasbourg or Rome) has 24 points, rank 500 (e.g. Tromsø or Loughborough) has about 9 points. The

vertical axe of the above diagram indicates the number of Shanghai points per thousand inhabitants (Shanghai density, in 2006).

As all regions of a conglomerate have the same value of the Decentralisation Index, the Shanghai data take the form of columns. Switzerland is to the very right (with the highest decentralisation score of 70). The eight universities listed in the Shanghai ranking are located in six different cantons. Thus we see six dots above the zero line. The remaining 20 cantons are together in the one dot on the zero line. The top position is Basel (the canton of Basel-Stadt) with 26 Shanghai points and a population of less than 200'000. Zürich, albeit with 72 Shanghai points number 5 in Europe[10], has only half the Shanghai density of Basel because of a population of over a million. Thus the Shanghai density depends on the delimitation of the regions.[11] At the same time this narrow delimitation of e.g. Basel results in many other (small) regions without any Shanghai points (on the zero line). For the regression analysis there will be no systematic bias.

In the following we present the results for patents, Shanghai scores and publications (each per capita, sample of 234 regions) for the following regression:

$$\text{Innovation} = \alpha + \beta * X + \gamma * Z + \delta * (\text{GDP per capita (2001-2006)}) + \varepsilon$$

Apart from various location factors we also use the average level of GDP per capita in the period 2001 to 2006 as a control variable (to control for pure wealth effects). As before, our main focus lies on the parameter $\delta$ which measures the impact of decentralisation on the three innovation indicators.

The results are a little bit more complex than in the previous chapters. Research and development are not spread evenly over space, nor are they correlated in the same way with economic activities. On the one hand, some regions are specialised in academic research (e.g. university cities and capital cities) and produce a large number of academic publications. Other regions are more specialised in manufacturing and thus more interested in directly usable research output for which the number of patents is a good indicator (e.g. in investment goods, chemicals or

[10] The European cities with the highest Shanghai scores are Paris, London, Stockholm, Cambridge and Zürich. Looking at regions in the definition of the ARE, also the German Bundesländer Nordrhein-Westfahlen, Baden-Württemberg and Bayern rank high (between London and Stockholm).

[11] Using a generous definition of regions, the top position in Europe as for Shanghai density would go to Switzerland, using a narrow definition of regions, Cambridge would rank first.

pharmaceuticals). Regions good at academic output are not necessarily good at practical research results – and vice versa.

On the other hand research activities exhibit a certain degree of economies of scale. In other words: for many types of research domains (especially in natural and engineering sciences) there are high fixed costs for doing research. You either need a considerably large group of specialists or complicated and expensive equipment and materials. Such research activities are not divisible at will; a certain minimum size is required, but this minimum size is expensive. Once the research team and the equipment are available, further research activities and output become easier.[12] A certain concentration of research is therefore reasonable.

Clusters follow a similar logic leading to the same result. To be able to profit from positive spillovers you need a certain minimum size of people (and institutes and/or companies) interested in specific issues (themes, technologies etc). This cluster effect leads to both specialisation (banking at one spot, biotechnology or automotives in another) and concentration (many researchers at one spot).

**Table 8: Decentralisation and the number of patents per capita**

| Dependent variable: Patents per capita (average 2000-2004) | **Total** | **Quantitative Decentralisation** | **Qualitative Decentralisation** |
|---|---|---|---|
| Constant | -0.00716 | -0.01035 | 0.00897 |
| **Decentralisation** | **0.00111 ***** | **0.00084 ***** | **0.00086 ***** |
| Shanghai-Index points per capita | -0.72910 *** | -0.78049 *** | -0.70696 *** |
| Publications per capita | 0.01792 *** | 0.01834 *** | 0.01785 *** |
| Company taxation | -0.20891 *** | -0.18667 *** | -0.22529 *** |
| Continental accessibility | 0.00024 *** | 0.00034 *** | 0.00026 *** |
| GDP per capita (2001-2006) | 0.00049 | 0.00040 | 0.00054 |
| R-squared | 0.47423 *** | 0.48555 *** | 0.43906 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

Source: BAKBASEL

[12] Diminishing marginal returns from research activities become relevant only later. In other words: The hypothesis is that the (marginal) costs of the first unit of research output are very high. The cheapest unit (regarding marginal costs) is the second unit. Subsequent units are e little costlier up to the point where marginal costs exceed marginal returns and research is stopped.

The regression results for patents show the specialisation pattern of regions: The negative sign of the Shanghai variable measuring the quality of universities supports the hypothesis that regions tend to specialise either in academia (theoretical or basic research in universities) or in practical research (industry related patents). Publications enter with a positive sign, probably because research leading to patents often also results in a publication.

The remaining variables are straightforward: High taxation of companies is a negative incentive to start activities and can drive existing companies to disinvest. Physical accessibility contributes to good research results because researchers are mobile and need access to the international research community. The level of GDP per capita (albeit not significant) controls for pure wealth effects. All other variables are highly significant.

This holds also true for the decentralisation variable: The more decentralised the higher the patent density. Regions in decentralised countries seem to be better suited to facilitate and support regional research. Note that qualitative and quantitative decentralisation have about the same size of impact on patent density. This is likely to be connected to the relevance of financial resources. The statistical quality of the estimations is good.

**Table 9: Decentralisation and Shanghai-Index points per capita**

| Dependent variable: Shanghai-Index per capita, 2006 | **Total** | **Quantitative Decentralisation** | **Qualitative Decentralisation** |
|---|---|---|---|
| Constant | -0.01454 *** | -0.01649 *** | -0.01228 ** |
| **Decentralisation** | **0.00012 *** | **0.00013 **** | **5.92E-05** |
| Patents per capita | -0.10494 *** | -0.10961 *** | -0.09468 *** |
| Publications per capita | 0.00802 *** | 0.00806 *** | 0.00789 *** |
| Industry structure [a)] | 0.10502* | 0.10764 ** | 0.10353 * |
| Company Taxation | -0.02523 * | -0.02123 | -0.02418 * |
| GDP per capita (2001-2006) | 0.00077 *** | 0.00076 *** | 0.00079 *** |
| R-squared | 0.56045 *** | 0.56591 *** | 0.55639 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

[a)] structural effect derived from a shift-share analysis

Source: BAKBASEL

A similar pattern can be found in the regression results for the quality of universities measured by the number of Shanghai points per capita. The “trade off” between academic and industry related research leads to a negative sign of the patent variable in the Shanghai equation (the same effect as above). This supports the hypothesis of specialisation of regions. The number of publications correlates of course positively to the quality of universities.

Company taxation is again negative, however with a much lower significance than in the (industry related) patent equation. A strong industry structure also supports the quality of universities. Though, one should bear in mind that causality might run the other way: good universities can also support economic development especially in growth industries. The level of GDP per capita controls for pure wealth effects. The significantly positive parameter stresses the relevance of money for good universities.

The effect of decentralisation is much lower for good universities than for patents. The sign is still positive but less significant indicating that the concentration effect due to economies of scale becomes more important but is still less relevant than the specialisation effect. Moreover, the impact of quantitative decentralisation is much higher than that of qualitative decentralisation. This result is hardly surprising as good universities are very costly.

**Table 10: Decentralisation and the number of publications per capita**

| Dependent variable: Publications per capita (average 2003-2006) | **Total** | **Quantitative Decentralisation** | **Qualitative Decentralisation** |
|---|---|---|---|
| Constant | -0.20033 | -0.14495 | -0.40387 |
| **Decentralisation** | **-0.01464 ***** | **-0.01125 ***** | **-0.01116 **** |
| Shanghai-Index points per capita | 37.50301 *** | 38.09201 *** | 37.20276 *** |
| Patents per capita | 11.23106 *** | 11.04951 *** | 10.59056 *** |
| Company Taxation | 3.25107 *** | 2.78043 *** | 3.33813 *** |
| GDP per capita (2001-2006) | 0.00456 | 0.00340 | 0.00436 |
| R-squared | 0.52283 *** | 0.52321 *** | 0.51537 *** |

*, **, *** respectively means statistical significance on the 10, 5, 1 percent error level.

Source: BAKBASEL

As for the results for publication density, they are distinctly different to the previous results. Shanghai and patent densities contribute positively to the density of publications in refereed scientific journals. GDP per capita (to control for wealth effects) has a positive sign but is not significant.

In the case of publications, the concentration effect (due to economies of scale) dominates the specialisation effect and also possible effects from diminishing marginal returns from research activities. This interpretation is supported by the negative sign of the decentralisation variable: As centralised states tend to centralise (i.e. concentrate in a few regions) their research budget, decentralisation leads to less efficient production of scientific articles. Moreover, publications are public goods and produce substantial spatial spillovers favouring centralised solutions.

Which competences or policy fields are of special relevance for the innovation potential of the regions? Table 11 summarizes the results of 144 regressions: for 48 different aspects of decentralisation and three data sets. However, they do not say much: As can be expected from the three tables above, most parameters are positively significant in the patent equation, most parameters are positive but only few significant in the Shanghai equation and most parameters are negatively significant in the publications equation. The only noteworthy aspect is the high relevance of financial decentralisation in the publication equation. The number of publications rises (ceteris paribus) with decreasing financial decentralisation.

The findings of this chapter can be summarised as follows: In research and development there are some economic effects leading to a specialisation of the regions, others leading to a concentration of research in only a few regions. The empirical analysis shows that industry related or applied research (measured by the number of patents) is dominated by the specialisation effect, which favours decentralisation. Academic or basic research (measured by the number of publications in refereed journals) is dominated by the concentration effect, which favours a central organisation of the competences within a country.

**Table 11: Estimators of the decentralisation variables for innovation**

| Dec-Indicator | Patents | Shanghai | Publications |
|---|---|---|---|
| Decentralisation Index | 0.00111*** | 0.00012* | -0.01464*** |
| Qualitative Indicators | 0.00084*** | 0.00013** | -0.01125*** |
| Quantitative Indicators | 0.00086*** | 0.00006 | -0.01116** |
| Administrative decentralisation | 0.00050*** | 0.00010** | -0.00703** |
| Functional decentralisation | 0.00090*** | 0.00004 | -0.00826* |
| Political decentralisation | 0.00064*** | 0.00006 | -0.00950*** |
| Vertical decentralisation | 0.00084*** | 0.00000 | -0.00238 |
| Deciding decentralisation | 0.00095*** | 0.00010 | -0.01212*** |
| Financial decentralisation | 0.00118*** | 0.00014* | -0.01617*** |
| EU | -0.00030*** | -0.00002 | 0.00121 |
| Employees | 0.00055*** | 0.00011*** | -0.00707*** |
| D1 Economic policy | 0.00024* | 0.00005 | -0.00273 |
| D2 Social policy | 0.00032** | -0.00004 | 0.00272 |
| D3 Healthcare | 0.00034*** | 0.00006* | -0.00400* |
| D4 Education & Research | 0.00053*** | 0.00007* | -0.00835*** |
| D5 Infrastructure | -0.00012 | 0.00000 | -0.00044 |
| D6 Public order & safety | 0.00025*** | -0.00001 | -0.00170 |
| D7 Environment & energy | -0.00015 | 0.00000 | -0.00345 |
| D8 Recreation & Culture | 0.00001 | 0.00003 | -0.00240 |
| D9 Migration & integration | 0.00054*** | 0.00004 | -0.00629** |
| Total **d**ecision making power | 0.00060*** | 0.00007 | -0.00868** |
| I1 Economic policy | 0.00007 | -0.00004 | 0.00236 |
| I2 Social policy | 0.00022*** | -0.00006** | 0.00241 |
| I3 Healthcare | 0.00018*** | 0.00000 | -0.00056 |
| I4 Education & Research | 0.00029*** | 0.00000 | -0.00293 |
| I5 Infrastructure | -0.00006 | -0.00007* | 0.00048 |
| I6 Public order & safety | 0.00035*** | 0.00002 | -0.00042 |
| I7 Environment & energy | 0.00016* | -0.00004 | -0.00089 |
| I8 Recreation & Culture | 0.00037*** | 0.00001 | 0.00004 |
| I9 Migration & integration | 0.00017*** | 0.00002 | -0.00099 |
| I10 EU policy | -0.00017** | -0.00002 | -0.00170 |
| Total **i**mplementing power | 0.00040*** | -0.00006 | -0.00118 |
| Territorial | 0.00051*** | -0.00002 | -0.00008 |
| National parliament | 0.00001 | 0.00000 | -0.00287 |
| Political interrelation | 0.00077*** | 0.00009 | -0.01196*** |
| Regional constitution | 0.00017*** | 0.00001 | -0.00142 |
| Regional government | 0.00030*** | 0.00003 | -0.00404* |
| Political power distribution | 0.00045*** | 0.00004 | -0.00480* |
| Incentives | -0.00030*** | -0.00001 | -0.00128 |
| Taxation power | 0.00060*** | 0.00005 | -0.00764*** |
| Debts (balance) | 0.00006 | 0.00003 | -0.00078 |
| Qualitative finance | 0.00044* | 0.00007 | -0.00986** |
| Revenues | 0.00092*** | 0.00009 | -0.01002** |
| Expenditures | 0.00089*** | 0.00011** | -0.01111*** |
| Public consumption & invest. | 0.00062*** | 0.00005 | -0.00687* |
| Financial balance | 0.00054*** | 0.00006** | -0.00784*** |
| Financial perequation | -0.00050*** | 0.00001 | 0.00324 |
| Quantitative finance | 0.00107*** | 0.00013* | -0.01343*** |

Source: BAKBASEL

## 5.4 Optimal Degree of Decentralisation

In this chapter we deal with the question whether there is an optimal degree of decentralisation and whether this optimum can be derived from the data. Theoretically there should be an internal optimum of the degree of decentralisation: Economies of scale favour more centralised organisation of a nation state; heterogeneous preferences (over space) and spatial externalities (spillovers), however, are in favour of a more decentralised organisation. Assuming decreasing marginal returns from all these effects (which economists usually do) results in concave functions of economic performance with respect to the degree of decentralisation (see chapter 3). Aggregating the three effects, there will be an internal optimum of the degree of decentralisation (DEC, between 0 and 100%). The sign of the derivative of economic performance (GDP and gGDP) with respect to DEC is not unambiguous: for small values of DEC it should be positive, but for large values of DEC it should be negative. All in all, performance is a concave function of the degree of decentralisation (DEC). This can be modelled using a quadratic form (where X are the control variables):

$$\text{Performance} = \alpha + \beta * X + \gamma_1 * DEC + \gamma_2 * DEC^2$$

Concavity requires $\gamma_1 > 0$ and $\gamma_2 < 0$; $\beta$ is a parameter vector for the various control variables. The subsequent table displays the relevant part of the results from the equation above, using the same two data sets, either GDP per capita (GDP/POP) or real GDP growth (g(GDP)) as left hand variable (LHV), and also the same control variables as before (in chapter 5.2 and 5.3). As a starting point we estimate the above equation restricting the quadratic term to be zero ($\gamma_2 = 0$):

**Table 12: Linear relationship: $Y = \alpha + \beta * X + \gamma_1 * DEC$**

| LHV | **Sample** | **$\gamma_1$** | **$R^2$** |
|---|---|---|---|
| GDP/POP | 33 conglomerates | 0.24662 *** | 0.74 |
| g(GDP) | 33 conglomerates | 0.00021 | 0.70 |
| GDP/POP | 234 regions | 0.09459 *** | 0.52 |
| g(GDP) | 234 regions | -0.00021 ** | 0.11 |

Source: BAKBASEL

Allowing $\gamma_2$ to deviate from zero we get the results in the following table. From the estimated parameter values it is possible to compute at which value of DEC there is the maximal effect (the unconditional maximum) on performance[13].

**Table 13: Unconditional optimum: $Y = \alpha + \beta*X + \gamma_1*DEC + \gamma_2*DEC^2$**

| LHV | Sample | $\gamma_1$ | $\gamma_2$ | Optimum |
|---|---|---|---|---|
| GDP/POP | 33 conglomerates | 0.15415 | 0.00104 | 100% |
| g(GDP) | 33 conglomerates | 0.00195 ** | -0.00002 ** | 48% |
| GDP/POP | 234 regions | 0.26166 * | -0.00172 | 76% |
| g(GDP) | 234 regions | 0.00182 *** | -0.00002 *** | 43% |

Source: BAKBASEL

The empirical results are ambiguous. In the two level equations (GDP/POP), the quadratic term is not significant. In the smaller sample, the sign of the quadratic term is even wrong. As a consequence, there is no finite maximum and the optimum in the table is given as 100%. In the other three cases, the negative quadratic term yields an internal optimum. Note that the standard deviations are relatively large: an optimum value of e.g. 50 percent is within less than one standard deviation of all four equations. Given this low estimation power, we should not derive any political recommendations for specific countries.

It should be noted that it is possible that the majority of the countries in our sample are in the positive slope section resulting in almost a linear positive relation between DEC and performance. However, the results indicate that there is an internal optimum.

The above relation implies that the optimal degree of decentralisation is the same for all countries. Of course this should be questioned. Theoretical considerations lead to two different aspects of optimality:

(1) From the theory chapter we know that heterogeneous preferences over space favour decentralisation. Assuming that large countries are in general more heterogeneous than small countries, we can use the size of a country (in square kilometres) as a proxy variable for heterogeneity: The bigger a country the more hetero-

[13] We set the first derivative of the performance equation to zero and solve this equation with respect to DEC: $Y = \alpha + \beta*X + \gamma_1*DEC + \gamma_2*DEC^2$ , $\partial Y/\partial DEC = \gamma_1 + 2*\gamma_2*DEC = 0$ => $DEC = -\gamma_1 / 2*\gamma_2$

geneous the preferences and the higher the optimal degree of decentralisation.

(2) We also know from the theory chapter that spatial spillover effects favour centralisation. Assuming that small regions in general both produce and are affected by more spillovers than large regions (at least in relative terms), we can use the (average) size of the regions in a country as a proxy variable for the relevance of spatial spillovers: The bigger the regions the lower the relevance of spillovers and the higher the optimal degree of decentralisation. (2a)

Given the size of a country we may alternatively look at the number of regions per country: The higher the number of regions (elements on the regional tier) the higher the relevance of spillovers and the lower the optimal degree of decentralisation. (2b)

How can these effects be modelled for the econometric estimations? Adding these variables as additional linear terms would only affect the value of the function but not the position of the optimum value.[14] In order to reach the desired horizontal shift of the curve we have to combine the quadratic term with the additional variables. The regression equation changes as follows

(1) $\text{Performance} = \alpha + \beta * X + \gamma_1 * DEC + \gamma_2 * DEC^2/KM$

(2a) $\text{Performance} = \alpha + \beta * X + \gamma_1 * DEC + \gamma_2 * DEC^2/KMREG$

(2b) $\text{Performance} = \alpha + \beta * X + \gamma_1 * DEC + \gamma_2 * DEC^2 * ANZ$

The quadratic DEC-term is divided in (1) by the area of the first tier (nation state: KM) and in (2a) by the average area of the second tier (regions: KMREG). Since $\gamma_2$ is assumed to be negative the derivative with respect to the area will be positive: A bigger area shifts the concave curve to the right. In (2b) the quadratic term is multiplied by the number of regions of a country (ANZ). Since $\gamma_2$ is assumed to be negative the derivative with respect to ANZ will be negative: A bigger number of elements in the regional tier shifts the concave curve to the left.

Calculating the first derivative of performance with regard to DEC now depends on

[14] In more technical terms: adding further variables as linear terms would shift the concave curve vertically but not horizontally, thus leaving the optimal value of DEC unaffected

the value of the additional argument in the quadratic term.[15] Thus, the optimum value is conditional. We need an assumption for the size of the variable KM to compute at which value of DEC there is the maximal effect (the conditional maximum) on performance. For the three equations under debate we use roughly averages for the large Western European countries (D, F, I, E). Table 14 shows the estimation results of equation (1).

**Table 14: Conditional optimum: $Y = \alpha + \beta*X + \gamma_1*DEC + \gamma_2*DEC^2/KM$**

| LHV | Sample | $\gamma_1$ | $\gamma_2$ | Optimum |
|---|---|---|---|---|
| GDP/POP | 33 conglomerates | 0.26359 *** | -0.02065 | 100% |
| g(GDP) | 33 conglomerates | 0.00017 | 0.03868 | 100% |
| GDP/POP | 234 regions | 0.11095 *** | -7.00045 | 100% |
| g(GDP) | 234 regions | 0.00013 | -0.13747 *** | 100% |

Optimum evaluated at 400'000 $km^2$ per country

Source: BAKBASEL

With one exception all parameter estimates show the expected sign. However, the parameter estimates of the quadratic term are too small to bend the curve back towards the zero line. As a consequence, there is no internal optimum when evaluated at 400'000 $km^2$, which is why the optimum is set to 100 percent. For small countries (below 15'000 $km^2$), however, there is an internal optimum.

The following table shows the estimation results of equation (2a).

**Table 15: Conditional optimum: $Y = \alpha + \beta*X + \gamma_1*DEC + \gamma_2*DEC^2/KMREG$**

| LHV | Sample | $\gamma_1$ | $\gamma_2$ | Optimum |
|---|---|---|---|---|
| GDP/POP | 33 conglomerates | 0.25112 *** | -0.32428 | 100% |
| g(GDP) | 33 conglomerates | 0.00017 | 0.00240 | 100% |
| GDP/POP | 234 regions | 0.11200 ** | -0.36199 | 100% |
| g(GDP) | 234 regions | 0.00026 ** | -0.01144 *** | 100% |

Optimum evaluated at an average of 20'000 $km^2$ per region

Source: BAKBASEL

[15] From $Y = \alpha + \beta*X + \gamma_1*DEC + \gamma_2*DEC^2/KM$ e.g., we get the first derivative $\partial Y/\partial DEC = \gamma_1 + 2*\gamma_2*DEC/KM = 0$ and the optimum at $DEC = -\gamma_1*KM / 2*\gamma_2$

The pattern is very similar: Again most parameter estimates show the expected sign with too small values of the quadratic terms. Thus the maximum values (evaluated at 20'000 $km^2$ per region) are outside the data range of 0 to 100 percent which is why the optimum is set to 100 percent. For small regions (below 600 $km^2$), however, there is an internal optimum.

Table 16 shows the estimation results of equation (2b).

**Table 16: Conditional optimum: $Y = \alpha + \beta*X + \gamma_1*DEC + \gamma_2*DEC^2*ANZ$**

| LHV | Sample | $\gamma_1$ | $\gamma_2$ | Optimum |
|---|---|---|---|---|
| GDP/POP | 33 conglomerates | 0.23210 *** | 6.72E-06 | 100% |
| g(GDP) | 33 conglomerates | 0.00029 | -6.48E-08 | 100% |
| GDP/POP | 234 regions | 0.09827 *** | -1.99E-06 | 100% |
| g(GDP) | 234 regions | -0.00018 * | 2.16E-08 | 0% |

Optimum evaluated at 20 regions per country

Source: BAKBASEL

The results of the first three lines are similar to the previous two tables leading to optimum values of 100 percent. The last equation exhibits wrong signs for both parameters leading to an optimum below the relevant data range which is why the optimum is set to 0 percent.

Bearing in mind that the statistical power of these estimates is not very high, we should not draw political conclusions from this chapter. What we can state is that there seems to be an optimum level of decentralisation primarily regarding GDP growth. For the GDP per capita equation, the quadratic term of decentralisation does not improve the explanation of the left-hand variable. Also, the modification of the quadratic term to allow for conditional optima does not yield additional insights. These results, although not adding much value, do not put the general impact of decentralisation on economic performance into question.

## 5.5 Technical Summary

In chapter 5 we have investigated the empirical relation between decentralisation and economic performance. Decentralisation is measured by the Decentralisation Index and various parts of it measuring different aspects of decentralisation. Performance is measured both by GDP per capita and GDP growth.

Using the tool of multiple cross section regression analysis it can be assumed that decentralisation, amongst other factors, has a significantly positive influence both on the level and the dynamics of economic performance of countries and regions. From a statistical point of view, the regression results are meaningful and significant. Thus it is worthwhile to interpret the results from an economic viewpoint: The higher (ceteris paribus) the value of the decentralisation indicator, the higher the value of economic performance.

Regarding innovation, the picture is more complex. Decentralisation favours industry related or applied research and development (measured by the number of patents). Academic or basic research (measured by the number of scientific publications) tends to profit from a more centralised system. As for the quality of universities (measured by the Shanghai Index) the empirical evidence slightly favours a decentralised system of government.

Finally we investigated the question whether there is an optimal degree of decentralisation which, for theoretical reasons, should exist. The empirical results seem to support this view. For most specifications, the quadratic term which is needed for a finite optimum is not strong enough to result in an internal optimum. In the few cases with an internal optimum, the variance of the parameter estimates is too big to draw conclusions about the “true” value of the optimum.

All in all, decentralisation has clearly a positive impact on the economic performance of regions.

# 6 Conclusions

The project “From Subsidiarity to Success: The Impact of Decentralisation on Economic Growth” consists of three parts:

- Descriptive Analysis: Concept of how to measure decentralisation, data gathering (using an extended survey and secondary sources), construction of an index family catching various aspects of decentralisation, description of the results (for the main indices and for the countries covered)

- Statistical Analysis: Theoretical considerations why decentralisation should affect economic performance of regions (transmission channels), application of multiple cross section regression analysis using a variety of control variables, interpretation of the empirical results

- Communication: Targeted dissemination of the results

The present paper is the technical report for the second part.

The findings of this project suggest that the application of the subsidiarity principle is a key to economic success**.** This holds true in the short term (direct effect on GDP) as well as in the long term (via education and research).

The empirical analysis has unveiled the following aspects as most relevant for the economic regions:

- more influence of the regions on the national level
- more independence of the regions from the national level
- more financial competences and resources for the regions
- more competences in (1) recreation and culture, (2) infrastructure, (3) education and research, (4) health care.

Generally, regions with more competences develop better than others, and countries with a higher degree of decentralisation are economically more successful than centrally governed countries.

# 7 Annex: Data Sources

In this annex we briefly describe the data and their sources.

**Table A1: Sources and content of the quantitative decentralisation database**

| Quantitative Variables | Sources* |
|---|---|
| **Employees** | |
| Number of employees in the public sector | ILO, Public Sector Employment, 2002-2005 |
| Remuneration of employees in the public sector | IMF Yearbook 2006, compensation of employees |
| **Revenue** | |
| Tax revenue | IMF Yearbook 2006 |
| Social contribution revenue | IMF Yearbook 2006, a) |
| Grants (funds granted from other public bodies) | IMF Yearbook 2006, a) |
| Amount of fees (for sold goods and services) | OECD, non-tax revenues and grants, 2002-2005 |
| Other revenue (residual) | IMF Yearbook 2006, a) |
| **Expenditure for…** | |
| General public services | IMF Yearbook 2006, a), b) |
| Defense | IMF Yearbook 2006, a), b) |
| Public order and safety | IMF Yearbook 2006, a), b) |
| Economic affairs | IMF Yearbook 2006, a), b) |
| Environmental protection | IMF Yearbook 2006, a), b) |
| Housing and community | IMF Yearbook 2006, a), b) |
| Health | IMF Yearbook 2006, a), b) |
| Recreation, culture, religion | IMF Yearbook 2006, a), b) |
| Education | IMF Yearbook 2006, a), b) |
| Social protection | IMF Yearbook 2006, a), b) |
| Total expenditure | IMF Yearbook 2006 |
| **Public consumption** | |
| Public consumption | Eurostat, Annual Government Finance Statistics, 2005 |
| Public investment | Eurostat, Annual Government Finance Statistics, 2004-2005 |
| **Financial Balance** | |
| Financial assets | IMF Yearbook 2006; Eurostat, Financial Accounts, 2004-2006 |
| Financial debts | IMF Yearbook 2006; Eurostat, Financial Accounts, 2003-2006 |
| **Financial Perequation** | |
| Transfers between national, regional and sub-regional tiers | Eurostat, Annual Government Finance Statistics, 2005 |

*missing data on the regional tier completed by national statistics and/or estimated by BAK
a) U.S. Census Bureau, State & Local Government Finances 2004-2006
b) Eurostat, Annual Government Finance Statistics 2003-2004

**Table A2: Sources and content of the regression database**

| Variable | Data set | Source* |
|---|---|---|
| Gross Domestic Produduct (GDP) | 33 | BAK, OECD |
| | 234 | BAK |
| Population | 33 | BAK, OECD |
| | 234 | BAK |
| Patents granted | 234 | BAK, Thomson |
| Patents in high tech sciences | 33 | Eurostat, BAK |
| Publications in scientific journals | 234 | BAK, Thomson |
| Shanghai index scores | 33 | Shanghai |
| | 234 | |
| Share of tertiary education | 234 | BAK |
| Share of tertiary education in natural sciences | 33 | Eurostat, BAK |
| Regulation of product markets | 33 | OECD |
| | 234 | |
| Regulation of labour markets | 33 | OECD |
| | 234 | |
| Taxation of companies | 33 | BAK, ZEW, KPMG |
| | 234 | BAK, ZEW |
| Taxation of manpower | 33 | BAK, ZEW, OECD |
| | 234 | BAK, ZEW |
| Accessibility within Europe | 234 | BAK, IVT |
| Capital city (dummy) | 234 | BAK |
| Industry structure | 234 | BAK |
| Decentralisation | 33 | BAK, AER |
| | 234 | BAK, AER |

* Missing data on the regional tier completed by national statistics and/or estimated by BAK. The decentralisation data for mainland Portugal are set for each indicator to the respective minimum of all other conglomerates (because the regions are only administrative units).

| Source | Description |
|---|---|
| AER | Assembly of European Regions, (part one) |
| BAK | BAK Basel Economics (International Benchmarking Database) |
| Eurostat | Statistical Office of the European Commission |
| IVT | Institut für Verkehr und Transport at the Federal Institute of Technology (ETHZ) |
| KPMG | KPMG Corporate and Indirect Tax Rate Survey |
| OECD | Organisation for Economic Cooperation and Development |
| Shanghai | Shanghai Jiao Tong University |
| Thomson | Thomson Scientific |
| ZEW | Zentrum für Europäische Wirtschaftsforschung, Mannheim |

## Table A3: Conglomerates

| No | Conglomerate | content | abbreviation |
|---|---|---|---|
| 1 | Schweiz/Suisse/Svizzera | 26 Kantone/cantons/cantoni | CH |
| 2 | Deutschland | 16 Bundesländer | D |
| 3 | Belgique | 3 regio's/régions | BEL |
| 4 | España | 17 comunidades autónomas | E |
| 5 | Österreich | 9 Bundesländer | A |
| 6 | Italia (Friuli Venezia Giulia) | 5 regioni statuto speciale (Valle d'Aosta, Friuli-Venezia Giulia, Sardegna, Sicilia, Trentino-Alto Adige) | I-F |
| 7 | Italia (Lombardia) | 15 regioni | I-L |
| 8 | Nederland | 12 provincies | NL |
| 9 | Česká republika | 14 kraj | CZ |
| 10 | United Kingdom | 75 English regions (counties, unitary authorities) | UK |
| 11 | Polska | 16 województwo | PL |
| 12 | Sverige (Västra Götaland) | 2 län (Västra Götaland, Skane) | S-VG |
| 13 | Sverige (Västernorrland) | 19 län | S-VN |
| 14 | Suomi (Etelä-Pohjanmaa) | 19 maakunta | FIN-EP |
| 15 | Suomi (Aland) | 1 maakunta | FIN-A |
| 16 | Magyarország | 20 megyék | H |
| 17 | România | 42 judete | RO |
| 18 | Portugal (Norte) | 5 regiões | PT-N |
| 19 | Portugal (Madeira) | 2 regiões autónomas (Azores, Madeira) | PT-M |
| 20 | France | 26 régions | F |
| 21 | Danmark | 5 regioner | DK |
| 22 | Ireland | 26 counties | IRL |
| 23 | Norge | 19 fylker | NO |
| 24 | Hrvatska | 21 zupanija | HR |
| 25 | Slovenská Republika | 8 kraje | SK |
| 26 | Lietuva | 10 apskritys | LT |
| 27 | Latvija | 26 rajoni | LV |
| 28 | Ellás | 54 nomos | GR |
| 29 | Eesti | 15 maakond | EST |
| 30 | Bălgarija | 28 oblasti | BG |
| 31 | United States of America | 50 states | US |
| 32 | Canada | 13 provinces/territories | CA |
| 33 | New Zealand | 17 regions | NZ |

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