Fiscal Design and the Location of Economic Activity

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by

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Abstract

In the process of economic integration regional production structures are about to change. Several studies analysed already trends of regional specialization in the European Union and attempted to figure out determinants of observed changes. In this context, so far date the role of the public sector and especially the impact of different fiscal designs as determinants of the change in production structures have been left aside. Advantages and shortcomings of decentralized government organization have been largely discussed theoretically within the last decades. Several empirical studies attempted to examine the impact of decentralization on national performance, e.g. economic growth and fiscal stability. This paper aims at linking these two subjects and analyzes the empirical relationship between regional specialization and fiscal decentralization for a panel of 13 Member States of the European Union, controlling for regional and other institutional determinants. The analysis shows that rather autonomous regions tend to diverse their production structure in order to insure against adverse supply shocks.

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1. Introduction

Since the initial work of Tiebout (1956) and Oates (1972) there has been a wide interest in the optimal division of providing public services between different government levels in economic literature and political practice. Especially for countries in transition and developing countries the decision for centralizing or decentralizing governmental tasks in order to promote economic and social development is an important question. Also in developed countries changes in the vertical structure of governments can be observed in the last decades (OECD 2002). Although there is evidence for increasing decentralization in a majority of OECD countries, a unique pattern to one or the other structure does not seem to occur (Stegarescu 2004).

At the same time increasing integration, particularly the creation of the Single Market in the European Union facilitating the movement of labour and capital lead to reflections on changing production structures in countries and regions. Here the fear of over-specialised regions not able to cope with asymmetric shocks may emerge. But the analysis of direction and determinants of regional specialization is still an open debate in the theoretical and empirical literature. Additionally, the possible role of the public sector in influencing process of spatially changing production structures becomes more and more a crucial part in this discussion (Baldwin et al. (2003), Brakman et al. (2002), Brülhart und Trionfetti (2004)).

This paper aims at linking these two topics in asking if the autonomy of a region in deciding about revenue and expenditure may influence its level of specialization and thus its potential capacity of shock absorption. The analysis is organised as follows: section two summarizes recent theoretical and empirical work on decentralization and specialization and offers some hypotheses for the empirical analysis in section three. Results are presented in section four and the paper ends with a conclusion and prospects for futures research.

2. Theoretical and empirical insides

In the following background theoretical and empirical considerations will be explored in order to work out testable hypotheses for the above mentioned research question.

Before starting to investigate the effects of decentralization on economic performance and determinants of specialization, it is important to figure out if the public sector is able to shape the production structure. In the theoretical and empirical literature there exist different positions. While results of the proponents will be discussed in 2.1, opponents as Davis and Weinstein (2002, 2004) and Brakman et al. (2004) point out in their empirical analysis that even large temporary shocks as Allied bombing of Japanese and German cities in World War II did not have an effect on the growth path of these cities and, more important, it has not even changed the urban industrial structure of Japanese cities. The implications for the effectiveness of regional policy are far reaching, since following Davies and Weinstein (2004) policy makers may not be able to choose between multiple equilibria and select with temporary interventions the one which is convenient for long-term regional development. However, Allied bombing could not destroy the social and transport infrastructure and the specific human capital which may have served as an important basis for reconstruction.[1] In the case of the West-German cities the federal government aimed at rebuilding cities to their pre-war levels and provided specific grants to cities and private persons in order to stimulate re-construction of houses and buildings (Brakman et al. 2004). These arguments may thus limit the rather pessimistic view on policy actions and effects of changing institutions.

2.1 Decentralization and economic performance

A large debate on advantages and weaknesses of decentralization and thus their impact on economic performance has already taken place in economics and political science[2]. The following table summarizes shortly the main pro and contra arguments:

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[1] This argument was mainly forwarded in the comments of F. Robert-Nicoud and the authors admit that point to a certain degree in their paper.

[2] For a comprehensive survey see e.g. Thießen (2001: 2-8).

Table 1:   Arguments supporting and challenging the effects of fiscal decentralization

Pro	Contra
+ *diversification hypothesis*: increased efficiency due to better information on residents' needs + *leviathan restraint hypothesis*: intense competition between local governments reduce the size of governments + *productivity enhancement hypothesis*: incentives for political and product innovations ("laboratory federalism") as well as a better quality of public services due to autonomy and accountability of the local government + *specialization of functions*: efficiency gains may arise through specialization of representatives dealing with very specific activities + *high per capita income* fixed costs of maintaining a decentralized system may only be affordable at a higher stage of economic development + *high degree of urbanization*: economies of scale are more likely to occur at lower government level if the population is concentrated	− *inequities and the need for a centralized redistribution policy* − *macroeconomic stabilization*: counter-cyclical actions and co-ordination of local governments are difficult to manage − presence of *inter-jurisdictional spillovers* − exploiting *economies of scale* in production of public goods and administration − *quality of governments*: central governments may attract higher qualified people, lobbying and corruption activities may be less controlled on the local level − *small size of the country/population*: preferences can be assumed to be rather homogenous[3] − *scarcity of good local taxes* meaning taxes and fees relying on the benefits received principle represent only a minor share of total taxes levied − *low per capita income level*: see Pro − *low degree of urbanization*: see Pro

Source: Thießen (2003), OECD (2002), Feld and Dede (2005), own compilation.

Given this range of possible positive and negative effects of fiscal decentralization, empirical testing was needed. Empirical studies testing the impact of fiscal decentralization on economic performance measured as economic growth, capital formation and total factor productivity growth in cross country studies as well as analysis of single countries come to very diverse results[4]. This fact might be mainly due to different measures of decentralization since the commonly used one provided by the IMF's Government Finance Statistics (GFS) – subnational share of total government expenditure or subnational share of total government revenue – does not capture the fiscal autonomy the subnational unit possess to decide about expenditure (including different grant schemes) and revenue (taxes, tax bases, fees etc.) (Ebel

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[3]   However, this rule does not seem to be supported by clear real world experience regarding the heterogeneity of small countries like Belgium or Switzerland (Stegarescu 2004: 6).

[4]   For a recent survey see Feld and Dede (2005: 9-12).

and Yilmaz 2002). In order to include these missing aspects, the OECD started to create new measures of fiscal decentralization (OECD 1999) for 18 OECD countries. Stegarescu (2004) extends this data set to 23 countries and covers the period between 1970 to 2001. Further details will be given in the Data section since these data will be used in the empirical analysis.

2.2   Determinants of regional specialization

The theoretical literature provides very different explanations for the emergence of regional specialization. Following traditional trade theory comparative advantages will mainly lead to specialization of regions which open their borders. In neoclassical theories political institutions are not at all taken into account, regional policy activities would only disturb the market forces leading to an equilibrium. "New theories" allowing for imperfect competition and economies of scale provide a rich set of possible explanations leading to specialization / agglomeration but also to dispersed and multiple equilibria. Especially recent theoretical models of the New Econonomic Geography (NEG) in the tradition of Krugman (1991) try to analyse the role of public sector interventions in shaping the spatial production structure and influencing break and sustain points. Up to now the analysis focuses mainly on the impact of policy instruments as taxes and tax competition (Anderson and Forslid 2003, Baldwin and Krugman 2004), government spending (Brakman et al. 2002, Brülhart and Trionfetti 2004) and specific regional policy measures as infrastructure or subsidies (Baldwin et al. 2003).

Regarding taxes and tax competition the models demonstrate that in the course of integration with an emerging centre-periphery structure, production factors in the core will benefit from an agglomeration rent which can be taxed by the region without loosing the mobile production factors. Extending this model by government expenditure and thus taking the relations of taxes and spending into account, Brakman et al. (2002) can show that increasing public spending from a production point of view stimulates agglomeration since the location becomes more attractive for production factors operating under economies of scale. Moreover, governments are able to change the equilibrium i.e. from agglomerating to spreading forces, depending on the relative size, direction or efficiency of public good production and distribution. Brülhart and Trionfetti (2004) regard public procurement from the demand side and show theoretically and empirically that a region with a large home-biased public procurement will specialize in that high demanded good produced in a monopolistically competitive sector ("pull effect"). The emergence of the so called "spread effect" is a second result of home-biased public procurement meaning that due to public spending agglomeration forces may be offset. Theoretical results of the impact of public

infrastructure investment on the production structure depends on the presence of localized spillovers and the policy objectives since here the trade-off between equity and efficiency becomes predominant (Baldwin et al. 2003). In their empirical study Combes and Lafourcade (2001) confirm the positive relationship of decreasing transportation cost on regional specialization and concentration for French regions.

Empirical studies focussing on policy activities and specialization are very scarce for the time being, but there are also only few econometric studies providing insides of the specialization process as such. Stirböck (2004) identifies several determinants of regional specialization in capital investment and employment coming from different theories as neoclassical trade theory, polarisation theory and NEG. Another approach has been chosen by Kalemli-Ozcan, Sorensen and Yosha (2003) who focus on the positive impact of risk sharing on specialization patterns.

Theoretical and empirical work on determinants of specialization, especially the role of public activities and institutions, is still at the beginning. As far as the author knows there are no studies of regional specialization taking the fiscal design of the nation state encompassing the regions into account.

2.3.   Hypotheses

In the following hypotheses for the empirical analysis coming from the theoretical and empirical considerations above will be summarized.

(i) Decentralization

The measures of decentralization capture revenue and expenditure autonomy. Since higher specialization is in general related to a higher exposure of economic risk, autonomous regions may try to insure against possible shocks by diversifying the local production structure. On the other hand, if there is a mechanism of the central government to regulate these risks with a redistribution schemes among regions, local levels need not to cover the risk themselves and may rather focus on the attraction of specific industries in order to have possible tax revenue from agglomeration rents. Another possible explanation for a positive relationship between decentralization and specialization may be deducted from the NEG models mentioned above. Since local governments would take advantage from greater autonomy to provide specific public goods, they may be able to attract mobile production factors which could promote a process of agglomeration and intensifying specialization. Following Brakman et al. (2002) this may only be possible if the public sector works efficiently. As shown by Baldwin and

Krugman (2002) the subnational unit benefits from these developments by levying taxes on agglomeration rents.

(ii) New Economic Geography

The NEG models point to several determinants of location decisions which should be considered. Market size, population density and the location of a region seem to be important factors – while core regions would rather attract industrial sectors and market services (industries with economies of scale), the periphery may specialize in economic activities which rely heavily on factor endowments (agricultural territory, touristic services etc.) or which have to be provided by the public sector (health, education etc.). The intuition behind market size and population density go into the same direction as monopolistically competitive sectors prefer the location near large markets with a diversified labour market. Considering the last argument from the perspective of mobile workers, they also may want to insure against shocks and will chose a location with a diversified production structure.

(iii) Other influencing variables

In order to capture effects of business cycle, unemployment rates have to be included in the empirical analysis since the magnitude of the decentralization measure may also be influenced by economic fluctuations. The attractiveness of a region may also depend on research activities and thus patents as indicator for research intensity should be taken in.

3.   Empirical analysis

3.1   Data

In the following the two important indicators of interest – the specialization and decentralization indicators – and their data sources will be described. All other data are provided in the appendix.

In order to analyse the described determinants of specialization we use a panel of 13 EU Member States at NUTS2-level (and thus 200 regions)[5]. The NUTS2 regions are defined by administrative conditions and might not measure economic regions. This problem refers to the well known "modifiable area unit problem" MAUP (Brülhart and Traeger, 2004). Figuring out economic regions is often an arbitrary task and depends on the analysed variables and sectors. Advantage of administrative units is data availability and especially the NUTS2-level

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[5]   NUTS refers to Nomenclature of Statistical Territorial Units (NUTS) and is a hierarchical classification of regions in a Member State where higher numbers indicate a smaller administrative unit (Eurostat 1999).

can be considered when focussing on regional policy implications or on regional structural programmes.

The analysis is based on several data sources. This is first due to the fact that none of the possible sources was able to provide a complete data set and consequently several gaps had to be filled.[6] However, the starting point was the regional data base (REGIO) of Eurostat[7].

The basic economic variables for constructing the degree of regional specialization in production structure is annual gross value added and employment. As far as possible the data set is compiled according to the European System of National Accounts ESA95 including 17 sectors following NACE Rev. 1[8] including agriculture, manufacturing as well as market and non-market services.[9] The rather short time period of investigation (1995-2001) is due to the introduction of the new European System of National Accounts (ESA) in 1995 where the sectoral disaggregation changed fundamentally.

As the data for fishing (sector B) is for most regions not separately available, we took the aggregate figure for agriculture and fishing (A + B). Consequently, two sub-sectors (A + B as well as mining and quarrying (C)) are included for the *primary sector*. The breakdown into branches of the *secondary sector* is rather limited in ESA95 as only three sub-sectors are available (i. e. manufacturing (D), electricity, gas, water supply (E) and construction (F)). On the other hand, ESA95 reflects the increased importance of services. The breakdown of the tertiary sector into ten branches, (i. e. G to P[10]) including retail services, tourism, financial intermediation and real estate as well as public services, is now more detailed than it was before when the data were based on ESA79.[11] The author is conscious of the limitation of this rather broad sectoral breakdown as it can be questioned if the statistical classification is fine enough as it might hide heterogeneous developments in specific sub-sectors or cannot show economic dependence of some regions on specific sub-sectors. This is the more the case here since for example manufacturing is not disaggregated. However, this data set allows for a more comprehensive overview of the overall economic activity instead of focussing on manufacturing representing on average only 27% of production in the incumbent EU Member States contrasting to 70% for services. Moreover, despite their though increasing in fact still limited tradability, services are more and more part of international production chains as

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[6]   The regional data set of Cambridge Econometrics offers most of the data that would be needed for this study in one set. However, to the author it was not transparent enough how data that is not available at the corresponding statistical office was estimated.
[7]   For the made adjustments see table A2 in the appendix.
[8]   Nomenclature des activités économiques dans les Communautés Européennes.
[9]   See table A1 in the appendix.
[10] Since no data are available for sector Q (exterritorial organisations) it has been left out of the analysis.
[11] For a list of the NACE sectors see table A1 in the appendix.

becomes clear e.g. by foreign direct investment (FDI) data. Services account on a world wide scale for 60% of FDI inward stocks as well as two thirds of inward flows (UNCTAD 2004). Consequently, to limit an analysis of specialisation to manufacturing as frequently done, leaves aside the main part of local and also international economic transactions.

In relation to employment data, the use of GVA encompasses several advantages: differences in labour productivity within and between regions have to be accounted for, employment definitions still vary from country to country, flexible employment schemes which become increasingly important make comparisons difficult and employment data are compared to GVA in a more direct way influenced by public policy as labour protection laws etc. (Aiginger and Leitner 2002: 12). However, GVA data have also disadvantages like the need to convert them into one currency. Possible misalignments of exchange rates are one major disadvantage of operating with GVA data (Brülhart and Traeger 2004: 11).[12]

In empirical literature various indicators are used for analysing sectoral specialisation of regions and regional concentration of sectors. All indicators have their advantages and shortcomings.[13] In order to obtain results that can easily be compared to other studies and compared between each other, one indicator has here been applied that is most commonly utilised. Due to the latter, in the following it is not necessary to include an in-depth discussion and description.

Specialisation in relative terms should reveal how much the production structure in one *region* differs from the average of a given set of regions. For this analysis of relative regional specialisation the *dissimilarity index D* has been used. This indicator is one of the most commonly applied indicators for regional specialisation, reused e.g. by Krugman (1991):

$$(1) \qquad D_j = \frac{100}{2} \sum_{i=1}^{I} \left| x_{ij} - x_{i\bar{j}} \right|$$

For each branch i in a region j the absolute values of the differences of sectoral shares in GVA between region j and the average of all regions of the nation state[14] ($x_{i\bar{j}}$) are added up. In contrast to *Krugman* we divide the result by 2 and multiply it by 100 so the index will take the value zero when no specialisation can be observed, i. e. the production structure does not differ from the average of all regions included, and it will take the value 100 if full specialisation exists.

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[12] Due to data problems the dissimilarity has only been computed with GVA data. The comparison with employment data is left for future research.
[13] For surveys see for example Amiti (1997), Krieger-Boden (1999), WIFO (1999), Bode et al. (2004), Brülhart and Traeger (2004), Combes and Overman (2004).
[14] This is the reason why one-region-countries as Luxembourg and Denmark had to be left out in this analysis.

The dissimilarity index offers the advantage that it is in comparison to others easily interpretable. It also has been applied already in several other empirical studies so that the results can be compared to findings of other empirical studies. Moreover, outliers do not influence the values as much as it is the case for other indicators.

As already stated in section 2.1., a dataset compiled by Stegarescu (2004) is the basis of the decentralization indicators. He distinguishes between tax revenue decentralization and revenue decentralization including non-tax revenue[15] (e.g. user fees, capital revenue etc.). Following his argumentation, measures of fiscal autonomy has to take into account "legislative competencies to determine tax base and tax rate, the attribution of the tax receipts, and tax administration"(Stegarescu 2004: 5). The OECD scheme of tax autonomy (OECD 1999) has been used to provide a classification of taxes (Table 2). While local government has total or significant control over its taxes regarding the cases a)-c) and d.1)-d.2) it only has very limited or no tax autonomy.

Table 2:   Classification of sub-national taxes sorted by decreasing order of control

a)	sub-central government (SCG) sets tax rate and tax base
b)	SCG sets tax rate only
c)	SCG sets tax base only
d)	tax sharing arrangements
d.1)	SCG determines revenue-split
d.2)	revenue-split can only be changed with consent of SCG
d.3)	revenue-split fixed in legislation, may unilaterally be changed by central government
d.4)	revenue-split determined by central government as part of the annual budget process
e)	central government sets rate and base of SCG tax.

Source: OECD (1999: 11).

Three indicators capture three different degrees of tax revenue decentralization adding up the above classified taxes and weighted by the tax revenue of general government (GG):

$$D\_tax1 = \frac{SCG\ a)\ to\ c)}{GG\ total\ tax\ revenue}$$

$$D\_tax2 = \frac{SCG\ a)\ to\ c)\ +\ d.1)\ to\ d.2)}{GG\ total\ tax\ revenue}$$

$$D\_tax3 = \frac{SCG\ a)\ to\ e)}{GG\ total\ tax\ revenue}$$

Data and indicators are used on a yearly basis and are analysed for the time period 1995 – 2001.

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[15]   Due to data problems, this second measure has been left out of the analysis.

3.2   Investigation approach

Following the working hypotheses derived in section 2.3 the empirical investigation tries to figure out if fiscal decentralization may be one determinant of regional production specialization taking into account other possible factors influencing the regional production structure.

The analysis is carried out using generalised least square (GLS) in order to control for potential heteroscedasticity. These results will be compared with a pooled cross-section time series model and with a country fixed effects model. While pooled regressions exhibit mostly the problem of unobserved heterogeneity and thus a bias in the estimators, fixed effects models account for all time-invariant unobserved or not-quantifiable country specific factors. Herewith the problem of time-constant heterogeneity can be solved. However, difficulties with latter techniques arise if time invariant effects play a role[16] or if the assumption of strict exogeneity is violated.

Formally the basic equation takes the following form:

$$D_j = \quad b_0 + b_1 Dtax_j + b_2 Transf_j + b_3 Efficiency_j + b_4 RGDP_j + b_5 Density_j + b_6 PerInd_j$$
$$b_7 Patents_j + b_8 Unemp_j + \text{country dummies} + \text{capital dummy} + \varepsilon_{ij}$$

D_j represents the dissimilarity index D as described above in region j[17]. $Dtax_j$ indicate the tax decentralization variable in region i. Since changes in institutions (here the federal structure) do not lead to an immediate reaction of sectoral change, the variable has been included with a three years lead. One has to note that this variable has been computed on a national basis. Considering the derived hypotheses it is not ultimately clear in which direction the decentralization variable will influence the specialization patterns of a region. In order to capture the intranational insuring aspect, the variable *Transf_j* standing for transfers to sub-national units from other levels of Government (% of total sub-national revenues and grants) has been included in the analysis. If this variable shows a positive sign, one could infer that these transfers are used as insurance against economic risk rising with production specialization.

As Brakman et al. (2004) demonstrate, the capacity of regions influencing agglomeration tendencies hinges on the efficiency of the public sector. Unfortunately there are no efficiency indicators available at the regional level thus we use the Bertelsmann Success Index (*Efficiency_j*) (Bertelsmann Stiftung 2004) indicating the performance of the national economy.

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[16] In this analysis the theoretically important impact of the peripherality index has to be taken out with country fixed effects models.

[17] As pooled data are used, the time index has been taken out of the specification.

Determinants coming from the NEG models are considered in the variables $RGDP_j$, $Density_j$ and $Perind_j$. Regional gross domestic product (RGDP) measured as GDP per capita as an indicator of demand capacity, population density and the peripherality index representing market access of a region can be used a indicators for the attractiveness of a region for mobile firms and workers. The same also applies for the regional research intensity captured by the variable $Patents_j$.

In order to control for business cycle fluctuations, we included the regional unemployment rate $Unemp_j$.

Country and capital dummies have been added to the analysis to control for effects on the country and capital level.

The robustness of the results will be checked by using a distinct variable for the efficiency indicator - the Bertelsmann Activity Index[18] - and by applying different concepts of decentralization. Firstly this can be done by looking at the expenditure side of decentralization. Expenditure decentralization (*ExpDez*) is measured by subnational expenditure in percent of total expenditure. As Stegarescu (2004: 7) points out the analysis of revenue decentralization may also be broadened by including mostly all sources of public revenue and not only taxes such as user charges, operational surplus or capital revenue. Thus the variables drev_1, drev_2, drev_3[19] are analysed.

4.   Results

In table 3 first results for the pooled OLS and GLS estimations are presented. The overall performance of the estimation is relatively well with explaining 30 and 25 percent respectively of changing specialization patterns in this short time period.

The negative sign of all three decentralization variables show that tax autonomy might be linked with decreasing regional specialization although the coefficients of the POLS estimates are not significant[20]. However, when transfers are considered the insurance function of autonomy disappears and regions tend to be more specialized the higher the transfer share is[21].

The effect of efficiency (Suc) seems to be not very important since the coefficients are very low and not significant. Regarding the NEG variables, regional GDP per capita is positively related to specialization for both estimation techniques and independently from the

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[18]   This index focuses on factors describing the sources of performance differences between countries.

[19]   The three variables represent in descending order the autonomy of regional public revenue building.

[20]   This effect is very likely as has already been stated above.

[21]   This effect is reversed (but not significantly) in the GLS III where the region has less autonomy on taxes and tax bases.

autonomous degree of tax revenue. This supports the hypothesis that regions with attractive markets might be more specialised and/or might have better insurance possibilities against adverse shocks and thus take specialization advantages. While population density seems to encourage slightly a specialised production structure, the peripherality index shows that regions in the core are rather less specializes relative to peripheral regions. Also regions with a higher research intensity seem to be less specialized. The latter effect may be due to the data structure, since research intensive sectors are swallowed by the aggregated sector structure. The capital dummy variable has the expected positive sign (the capital effect of administration), but is surprisingly not significant.

Table 3: **Influence of fiscal variables and regional indicators on specialization patterns, Pooled OLS and GLS estimations**

D_j	POLS1	POLS2	POLS3	GLS I	GLS II	GLS III
Dtax_1	-0.055 (0.52)			-0.522 (2.62)**		
Dtax_2		-0.087 (0.60)			-1.322 (4.11)**	
Dtax_3			-0.082 (0.58)			-0.934 (3.58)**
Transfers	0.021 (0.49)	0.020 (0.46)	-0.000 (0.01)	0.010 (1.00)	0.004 (0.44)	-0.025 (1.67)
Suc	-0.037 (0.82)	-0.046 (0.94)	-0.044 (0.92)	0.005 (0.48)	-0.003 (0.32)	0.000 (0.05)
RGDP	0.264 (7.54)**	0.264 (7.51)**	0.264 (7.50)**	0.049 (2.71)**	0.041 (2.29)*	0.042 (2.30)*
Density	0.001 (3.94)**	0.001 (3.95)**	0.001 (3.95)**	0.001 (2.64)**	0.001 (2.71)**	0.001 (2.68)**
Unemp	0.358 (1.69)	0.361 (1.70)	0.358 (1.69)	0.041 (0.29)	0.088 (0.61)	0.001 (0.01)
PerInd	-0.789 (10.07)**	-0.789 (10.07)**	-0.789 (10.06)**	-0.844 (4.78)**	-0.842 (4.77)**	-0.827 (4.69)**
Patents	-0.189 (9.11)**	-0.189 (9.10)**	-0.189 (9.11)**	-0.045 (2.54)*	-0.043 (2.45)*	-0.053 (3.01)**
dum_capital	0.849 (1.16)	0.848 (1.16)	0.853 (1.17)	1.104 (0.65)	1.083 (0.64)	1.215 (0.72)
Constant	19.191 (4.27)**	20.114 (4.06)**	20.968 (3.58)**	19.728 (7.97)**	21.880 (8.55)**	23.191 (8.48)**
No. of observations	1112	1112	1112	1112	1112	1112
R^2 (overall) Prob. Chi^{2}[22]	0.30	0.30	0.30	0.26 0.0000	0.26 0.0000	0.26 0.0000

Absolute value of t / z statistics in parentheses, * significant at 5%; ** significant at 1%

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[22] The probability of the Chi²-test gives the joint significance of all coefficients.

The estimation results of the fixed effect model shown in table 4 are rather discouraging since only 2 to 3 percent of the model can be explained by the used variables. Thus a strong sign that further factors should be included in the analysis. However, the interesting coefficients of decentralization indicators show significant negative signs emphasizing the possible influence of public sector autonomy on production structures. Comparing the coefficients with the POLS and GLS results, the signs of the density coefficients have changed but are not significant.

Table 4: **Influence of fiscal variables and regional indicators on specialization patterns, fixed effect estimations**

Dj	FE 1	FE 2	FE 3
Dtax_1	-0.055 (2.34)*		
Dtax_2		-0.121 (3.77)**	
Dtax_3			-0.108 (3.42)**
Transfers	0.014 (1.39)	0.011 (1.07)	-0.016 (1.18)
Suc	0.008 (0.80)	-0.004 (0.36)	-0.001 (0.07)
RDGP	0.044 (2.37)*	0.041 (2.20)*	0.039 (2.11)*
Density	-0.004 (1.54)	-0.003 (1.48)	-0.003 (1.46)
Unemp	0.030 (0.20)	0.095 (0.63)	0.037 (0.25)
Patents	-0.032 (1.73)	-0.027 (1.45)	-0.034 (1.84)
Constant	11.937 (8.17)**	15.257 (8.59)**	16.271 (7.97)**
No. of observations	1112	1112	1112
R² overall	0.02	0.03	0.03

Absolute value of z statistics in parentheses* significant at 5%; ** significant at 1%

Extending the analysis of public revenue decentralisation by including also non-tax revenues the results remain quite stable. As is shown in tables A5 – A8 the decentralization variable (tax revenue or whole revenue) is mostly significantly negative[23]. Considering expenditure decentralization, the results suggest a positive relationship between decentralization and specialization. Thus, one might infer that if a region has a relatively high expenditure rate compared to the national level, it attracts specific sectors resulting in a higher specialised

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[23] The estimations in POLS VII – IX are an exception but the coefficients are not significant.

production structure. The significantly positive sign of the transfer in a further analysis shows the possible source of this positive effect – national transfer schemes could provide an insurance against adverse shocks and regional expenditure policy might influence location decisions of firms. However, one has to be very careful with these proposals since the expenditure variable does not reflect the regional autonomy on spending, it only covers the level of subnational expenditure. Thus, further analysis should be based on differentiated indicators.

5.   Conclusions

Summing up this short empirical exercise on influences of different vertical government structures on specialization pattern we could show that the organization of government levels has a certain impact on the regional production structure by using a panel of 13 EU Member States in the period 1995 – 2001. The results presented so far are very preliminary and should, at this stage, regarded with caution. However, it is surprising how well the negative relationship between tax decentralization and specialization seems to be. Scope for future research will be on several aspects.

The variable for expenditure decentralization does not capture regional expenditure autonomy and should be refined, since this measure could give more insides on the impact of public activities on shaping the economic landscape. It would also be interesting to see which sectors are mainly attracted by more or less autonomous regions, thus sectoral indicators should be included in the analysis. Also the measure of public efficiency lacks generality and can only be seen as a rough proxy. It would be very helpful for the analysis to have an index on regional government performance.

The regarded time span is very short for the moment and the small variation in the data could be overcome with a longer time period. The new Member States of the European Union would be another interesting field of research since production structure and public organization have been changing in the last years. Up to now data problems make an in-depth analysis difficult.

However, this first attempt gives already encouraging results for future research on this subject.

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Appendix

Data sources and description

Gross value added

- at basic prices

- Eurostat Database REGIO

Table A1: Sectors included according to NACE Rev. 1

	Sector
A_B	Agriculture, hunting, forestry and fishing
C	Mining and quarrying
D	Manufacturing
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	Hotels and restaurants
I	Transport, storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defence; compulsory social security
M	Education
N	Health and social work
O	Other community, social, personal service activities
P	Private households with employed persons

Table A2: Data adjustments

General rules		• Due to data problems, some regions had to be excluded or sub-regions to be taken together as one region as explained in table A2. • Negative values or zero values have been replaced by a value equal to 1 pro-mille of the reported value for the corresponding region. • Missing values in a region in the first or last year were calculated using the corresponding growth rate in the next higher regional aggregate for which data was available. • Missing values in the middle of the time span were calculated using linear interpolation. • After all adjustments, new sums were calculated before calculating regional or sectoral shares.
Germany	F, I, J	Breakdown of NUTS1 into NUTS2 according to sector specific regional employment shares. Source for employment shares: Bode et al. (2004)
	C, E, G, H	Result of (C + D + E + F) – (D – F) on NUTS 2 level, i.e. (C + E) was split up between these two sectors according to the corresponding shares of the single sectors C and E on NUTS1 level. Similar approach for G and H.
	D	Source: Federal Statistical Office Germany
	K	Result of (J + K) - J
	L, M, N, O, P	Due to a lack of better possibilities (L + M + N + O + P) on NUTS2 level had to be split up according to the sectoral shares in those EU15 countries where those data are available
Greece		In 2001 regional breakdown from NUTS1 into NUTS2 according to regional shares in 2000 of the corresponding sector.
United Kingdom	All sectors	Source: Office for National Statistics (ONS), United Kingdom. In 2001 regional breakdown from NUTS1 into NUTS2 according to regional shares in 2000 of the corresponding sector.
	P	Source: Office for National Statistics (ONS), United Kingdom. Regional breakdown from NUTS1 into NUTS2 according to regional shares in all other sectors in the corresponding year.

Regional Gross Domestic Product, Population Density, Patents, Unemployment
- Eurostat Database REGIO

Peripherality Index
This measure has been taken from Schürmann and Talaat (2000). This is an index of the potential or gravity-model type where market size / potential and distances in terms of accessibility are taken into account. High (low) values of the peripherality index indicate a central (peripheral) position of the related region.

Decentralization indicators Dtax_1, Dtax_2, Dtax_3, Drev_1, Drev_2, Drev_3
- for methodology and sources see Stegarescu (2004).

Expenditure Decentralization ExpDez
- Sub-national Expenditures (% of total expenditures)
- IMF's Government Finance Statistics (GFS)

- downloadable from the official website of the Worldbank: Decentralization and Subnational

Regional Economics: http://www1.worldbank.org/publicsector/decentralization/fiscalindicators.htm

Transfers

- Transfers to sub-national from other levels of Government (% of total sub-national revenues and grants)

- IMF's Government Finance Statistics (GFS)

- downloadable from the official website of the Worldbank: Decentralization and Subnational

Regional Economics: http://www1.worldbank.org/publicsector/decentralization/fiscalindicators.htm

Efficiency

- Success Index (*Suc*) of the Bertelsmann Stiftung

Being the core measure for the International Employment and Growth Ranking of the Bertelsmann

Stiftung it contains variables of labour market performance and economic growth. Values range from

0 to 120 with higher values indicating better performance.

- Activity Index (*Act*) of the Bertelsmann Stiftung

This measure focus on 12 indicators of three areas of activity: "labour market, government and

economy, economy and labour and management" and takes values from 0 to 120 where higher values

indicate a better performance.

Both measure are only available on a national basis.

- for a summary and the methodological background see:

http://www.bertelsmann-stiftung.de/de/4303_8886.jsp

Table. A3:   Regional disaggregation

Member State	NUTS-level	No. of Regions	Member State	NUTS-level	No. of Regions
Austria (AT)	2	9	Italy (IT)[24]	2	20
Belgium (BE)	2	11	Netherlands (NL)	2	12
Finland (FI)	2	5	Portugal (PT)[25]	2	5
France[26] (FR)	2	22	Spain (ES)[27]	2	16
Germany (DE)[28]	2	40	Sweden (SE)	2	8
Greece (GR)	2	13	United Kingdom	2	37
Ireland (IE)	2	2			

As data are not yet sufficiently available for ITd1 (Provincia Autonoma Bolzano-Bozen) and ITd2 (Provincia Autonoma Trento) separately, we have taken them as 1 region by subtracting ITd3, ITd4 and ITd5 from ITd.

[25] PT20 (Região Autónoma dos Açores) and PT30 (Região Autónoma da Madeira) have been excluded.

[26] Overseas departments have been excluded.

[27] ES63 (Ciudad Autónoma de Ceuta) and ES64 (Ciudad Autónoma de Melilla) as well as ES70 (Canarias) have been excluded.

The new division of DE40 (Brandenburg) has not been taken into account due to several missing data for the subregions.

Table A4:   Descriptive Statistics of the specialization and decentralization indicators

Variable		Mean	Std. Dev.	Min	Max	Observations	
Dtax_1	overall	10.76693	10.16804	.166	47.559	N =	1400
	between		10.06519	.1997143	45.15629	n =	200
	within		1.586065	6.038784	17.01578	T =	7
Dtax_2	overall	21.79792	18.50848	.166	50.343	N =	1400
	between		18.51624	.1997143	49.10986	n =	200
	within		1.087814	17.76363	25.88435	T =	7
Dtax 3	overall	22.76117	17.96666	1.823	50.343	N =	1400
	between		17.94503	2.050714	49.10986	n =	200
	within		1.468898	18.72688	29.48431	T =	7
Drev 1	overall	16.69176	8.915629	4.988	42.875	N =	1011
	between		8.248219	5.595714	40.22329	n =	187
	within		1.259603	14.06616	23.46316	T-bar =	5.40642
Drev 2	overall	24.20761	16.03906	4.988	50.102	N =	1011
	between		16.53243	5.595714	49.514	n =	187
	within		.9693243	21.98044	27.39621	T-bar =	5.40642
Drev 3	overall	25.38106	15.22976	7.051	50.102	N =	1011
	between		15.64868	9.833333	49.514	n =	187
	within		1.671269	22.01586	32.10421	T-bar =	5.40642
ExpDez	overall	26.94306	9.225294	10.74	41.86	N =	1067
	between		9.073458	11.04167	40.24333	n =	187
	within		.9991016	24.23972	29.48305	T-bar =	5.70588
Transf	overall	45.75556	20.06248	14.54	78.6	N =	1112
	between		19.48264	18.72286	77.712	n =	187
	within		3.158878	35.28156	54.45127	T-bar =	5.94652
Act	overall	83.13571	7.72028	65	98	N =	1400
	between		7.216743	71	93.14286	n =	200
	within		2.782933	71.70714	89.85	T =	7
Suc	overall	82.31071	9.696754	66	110	N =	1400
	between		9.091197	71	102.4286	n =	200
	within		3.425149	72.88214	91.88214	T =	7
RGDP	overall	19.51962	6.804136	6.138614	67.91367	N =	1400
	between		6.375828	7.954968	50.55679	n =	200
	within		2.41235	2.503411	36.8765	T =	7
Density	overall	385.292	899.1545	3.3	8789.6	N =	1400
	between		900.9942	3.357143	8542.271	n =	200
	within		13.03477	185.6203	632.6203	T =	7
PerInd	overall	95.4704	66.57292	1.42	218.87	N =	1400
	between		66.71614	1.42	218.87	n =	200
	within		0	95.4704	95.4704	T =	7
Patents	overall	236.1224	407.0841	0	3545.18	N =	1400
	between		394.2009	0	2912.346	n =	200
	within		104.8308	-790.6562	1230.754	T =	7
Unemp	overall	9.673143	5.531125	0	33.3	N =	1400
	between		5.274064	2.514286	27.95714	n =	200
	within		1.702025	3.616	16.416	T =	7

Table A5: Robustness Tests, tax revenue decentralization, POLS and GLS

D_j	POLS IV	POLS V	POLS3 VI	GLS IV	GLS V	GLS VI
Dtax_1	-0.07 (0.63)			-0.066 (3.04)**		
Dtax_2		-0.117 (0.77)			-0.142 (4.75)**	
Dtax_3			-0.084 (0.8)			-0.099 (4.93)**
ExpDez	0.022 (0.14)	-0.007 (0.04)	0.04 (0.25)	0.067 (2.12)*	0.035 (1.08)	0.087 (2.76)**
Act	-0.004 (0.08)	-0.01 (0.17)	-0.01 (0.17)	0.000 (0.01)	-0.009 (0.74)	-0.004 (0.32)
RGDP	0.134 (3.59)**	0.133 (3.54)**	0.135 (3.60)**	0.017 (1.08)	0.01 (0.69)	0.013 (0.89)
Density	0.001 (5.37)**	0.001 (5.38)**	0.001 (5.37)**	0.001 (2.75)**	0.001 (2.79)**	0.001 (2.75)**
Unemp	0.072 (2.04)*	0.073 (2.05)*	0.071 (2.01)*	0.039 (1.68)	0.048 (2.09)*	0.03 (1.33)
PerInd	-0.044 (10.11)**	-0.044 (10.10)**	-0.044 (10.12)**	-0.044 (4.51)**	-0.044 (4.51)**	-0.045 (4.57)**
Patents	(0.001) (2.71)**	-0.001 (2.69)**	-0.001 (2.68)**	0.001 (2.49)*	0.001 (2.75)**	0.001 (3.16)**
dum_capital	0.073 (0.09)	0.076 (0.1)	0.069 (0.09)	0.227 (0.13)	0.209 (0.12)	0.188 (0.1)
Constant	15.132 (3.10)**	16.134 (3.13)**	15.922 (3.16)**	15.963 (6.63)**	17.24 (7.12)**	16.88 (6.99)**
No. of observations	1067	1067	1067	1067	1067	1067
R^2 (overall) Prob. Chi²[29]	0.32	0.32	0.32	0.19 0.0000	0.20 0.0000	0.20 0.0000

Absolute value of z statistics in parentheses* significant at 5%; ** significant at 1%

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[29] The probability of the Chi²-test gives the joint significance of all coefficients.

Table A6: Robustness Tests, tax revenue decentralization, fixed effects

Dj	FE IV	FE V	FE VI
Dtax_1	-0.065		
	(2.99)**		
Dtax_2		-0.142	
		(4.75)**	
Dtax_3			-0.101
			(5.03)**
ExpDez	0.067	0.035	0.087
	(2.11)*	(1.08)	(2.76)**
Act	0.003	-0.006	0.000
	(0.25)	(0.48)	(0.04)
RGDP	0.018	0.012	0.015
	(1.15)	(0.77)	(0.97)
Density	-0.003	-0.003	-0.003
	(1.41)	(1.41)	(1.52)
Unemp	0.037	0.047	0.028
	(1.55)	(1.97)*	(1.21)
Patents	0.001	0.001	0.001
	(2.91)**	(3.18)**	(3.62)**
Constant	10.749	15.027	12.433
	(7.78)**	(8.76)**	(8.69)**
No. of observations	1067	1067	1067
R² overall	0.03	0.04	0.05

Absolute value of t statistics in parentheses* significant at 5%; ** significant at 1%

Table A7: Robustness Test, public revenue decentralization, fixed effects

Dj	FE VII	FE VIII	FE IX
Drev_1	-0.036		
	(1.56)		
Drev_2		-0.071	
		(2.28)*	
Drev_3			-0.085
			(2.59)**
Transfers	0.014	0.01	-0.011
	(1.49)	(1.08)	(0.75)
Suc	-0.008	-0.01	-0.009
	(0.75)	(0.95)	(0.82)
RGDP	0.031	0.025	0.022
	(1.9)	(1.51)	(1.31)
Density	-0.003	-0.003	-0.003
	(1.61)	(1.54)	(1.48)
Unemp	0.004	0.017	-0.004
	(0.03)	(0.13)	(0.03)
Patents	0.001	0.004	-0.001
	(0.07)	(0.18)	(0.04)
Constant	13.06	14.547	15.999
	(9.55)**	(9.07)**	(8.41)**
No. of observations	1067	1067	1067
R² overall	0.03	0.04	0.05

Absolute value of t statistics in parentheses* significant at 5%; ** significant at 1%

Table A8: Robustness Tests, public revenue decentralization, POLS and GLS

D_j	POLS VII	POLS VIII	POLS IX	GLS VII	GLS VIII	GLS IX
Drev_1	0.039			-0.036		
	(0.32)			(1.55)		
Drev_2		0.075			-0.071	
		(0.46)			(2.24)*	
Drev_3			0.063			-0.088
			(0.37)			(2.67)**
Transfers	0.025	0.029	0.041	0.011	0.007	-0.015
	(0.54)	(0.6)	(0.57)	(1.17)	(0.77)	(1.02)
Suc	-0.049	-0.046	-0.047	-0.009	-0.011	-0.01
	(0.86)	(0.8)	(0.82)	(0.85)	(1.05)	(0.92)
RGDP	0.283	0.285	0.284	0.036	0.031	0.027
	(7.32)**	(7.31)**	(7.27)**	(2.29)*	(1.91)	(1.67)
Density	0.001	0.001	0.001	0.001	0.001	0.001
	(3.27)**	(3.25)**	(3.25)**	(2.50)*	(2.54)*	(2.57)*
Unemp	0.223	0.219	0.223	0.008	0.02	0.004
	(1.00)	(0.98)	(1.00)	(0.06)	(0.16)	(0.03)
PerInd	-0.696	-0.697	-0.697	-0.897	-0.897	-0.889
	(8.25)**	(8.26)**	(8.25)**	(4.99)**	(4.99)**	(4.95)**
Patents	-0.244	-0.244	-0.244	-0.024	-0.021	-0.025
	(10.13)**	(10.14)**	(10.13)**	(1.23)	(1.12)	(1.32)
dum_capital	1.362	1.358	1.356	1.069	1.059	1.105
	(1.79)	(1.78)	(1.78)	(0.62)	(0.61)	(0.64)
Constant	19.82	19.22	18.732	20.803	21.299	22.444
	(3.50)**	(3.25)**	(2.77)**	(8.35)**	(8.50)**	(8.72)**
No. of observations	987	987	987	987	987	987
R² (overall)	0.31	0.31	0.31	0.20	0.20	0.20
Prob. Chi²[30]				0.0000	0.0000	0.0000

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[30] The probability of the Chi²-test gives the joint significance of all coefficients.