ECONSTOR
Make Your Publications Visible.

A Service of

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Cornett, Andreas P.; Sørensen, Nils Karl

Conference Paper

Innovation, income and regional development: An assessment of the importance of differences in regional potentials

56th Congress of the European Regional Science Association: "Cities & Regions: Smart, Sustainable, Inclusive?", 23-26 August 2016, Vienna, Austria

Provided in Cooperation with:
European Regional Science Association (ERSA)

Suggested Citation: Cornett, Andreas P.; Sørensen, Nils Karl (2016) : Innovation, income and regional development: An assessment of the importance of differences in regional potentials, 56th Congress of the European Regional Science Association: "Cities & Regions: Smart, Sustainable, Inclusive?", 23-26 August 2016, Vienna, Austria, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:
https://hdl.handle.net/10419/174617

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

56th Congress of the European Regional Science Association

Andreas P. Cornett & Nils Karl Sørensen**
University of Southern Denmark
E-mail: Cornett@sam.sdu.dk
E-mail: NKS@sam.sdu.dk

Innovation, Income and Regional Development: An assessment of the importance of differences in regional potentials.

Abstract:

The purpose of the current paper is to analyze the impact of regional potentials on the process of growth relative to the level of income. How are different types of regions (e.g. medium sized [city] regions, rural regions, urban regions or metropolitan and high-tech cluster regions) affected by improved performance, and to what extent can differences be explained by ex-ante difference in income? Based on data from the regional innovation scoreboard (RIS) is this issue addressed relative to the income level, previous growth performance and convergence.

The first main part of the paper provides a brief overview of the empirical and conceptual background for the study based on a review of literature.

In Section 3 the innovation performance is related to the process of convergence and divergence. Earlier research has shown that although convergence is present at aggregated European Union level a much more diversified picture is revealed at the disaggregated level. Here it is frequently observed that the more wealthy and central regions move away from the other regions. One of the results is that the economic crisis has reinforced not only intraregional divergence within countries but also the traditional divide between the stronger Northwest European countries and the South and East of Europe. Furthermore the innovation performance of the regions is modelled relative to the income level and the underlying influencing factors are identified. Hereby, we are able to identify strengthens and weaknesses of the innovation structure in different regions. In addition the issues of returns to scale will be considered.

Finally, the paper discusses and evaluates the impact of different types of innovation performance and the level of income on the perspectives of economic growth for different types of regions. A number of scenarios a sketched for the perspectives of the regions depending on endogenous as well as external factor endowment and dynamics.

Keywords: Innovation- regional income differences - economic growth – concentration - convergence & divergence

JEL Classification: R11, R12, R58

* Alsion 2, DK-6400 Sønderborg, Denmark. Phone +45 6550 1211 or 1229. Paper prepared for 56th Congress of the European Regional Science Association August 2016 Vienna, Austria General Theme G_B “Regional growth and development”.

1. Introduction

The purpose of the current paper is to analyze the path dependency of economic development with point of departure in an analysis of the impact of regional potentials on the process of growth and income. The term regional potential does not have an unequivocal meaning, but is usual linked to the traditional linear growth concepts and the concept of new economic growth theory. Since potentials or factor endowment varies between different types of regions, these regions are affected differently. How are diverse types of regions (e.g. medium sized [city] regions, rural regions, urban regions or metropolitan and high-tech cluster regions) affected, and how can they improve their performance in a period of change in the international division of labor. Furthermore the paper aims at to explore to what extent can dissimilarities be explained by ex-ante differences in income and factor endowment? Based on data from the regional innovation scoreboard (RIS) the issue is addressed relative to the income level, previous growth performance and convergence.

The first main part of the paper provides a brief overview of the empirical and conceptual background for the study based on a review of literature.

In Section 3 the innovation performance is related to the process of convergence and divergence. Earlier research has shown that although convergence is present at aggregated European Union level a much more diversified picture is revealed at the disaggregated level. Here it is frequently observed that the more wealthy and central regions move away from the other regions. One of the results is that the economic crisis has reinforced not only intraregional divergence within countries but also the traditional divide between the stronger Northwest European countries and the South and East of Europe. In the remaining part of the section the innovation performance of the regions is modelled relative to the income level and the underlying influencing factors are identified. Hereby, we are able to identify strengthens and weaknesses of the innovation structure in different regions. In addition the issues of returns to scale will be considered.

Finally, the paper discusses and evaluates the impact of various types of innovation performance related to the level of income and the perspectives of economic growth for different types of regions. A number of scenarios a sketched for the perspectives of the regions depending on endogenous as well as external factor endowment and dynamics.

2 The context.

The reason d'être of regional development policy is to overcome the consequences for settlement and welfare caused by the circumstance that some regions perform worse compared to others. This may lead to a (comparative) derogation of the quality of living, and will create unequal conditions within a country or in Europe as a whole. These complex processes vary over time, and are dependent on external as well as internal factors. Path dependency, institutional as well as economic, reinforce this tendency, but differences in regional potentials may become decisive for how the regions can cope with the challenges from the changing international specialization and division of labor, and make the break with old trajectories impossible.

2.1 Theoretical and conceptual framework[1]

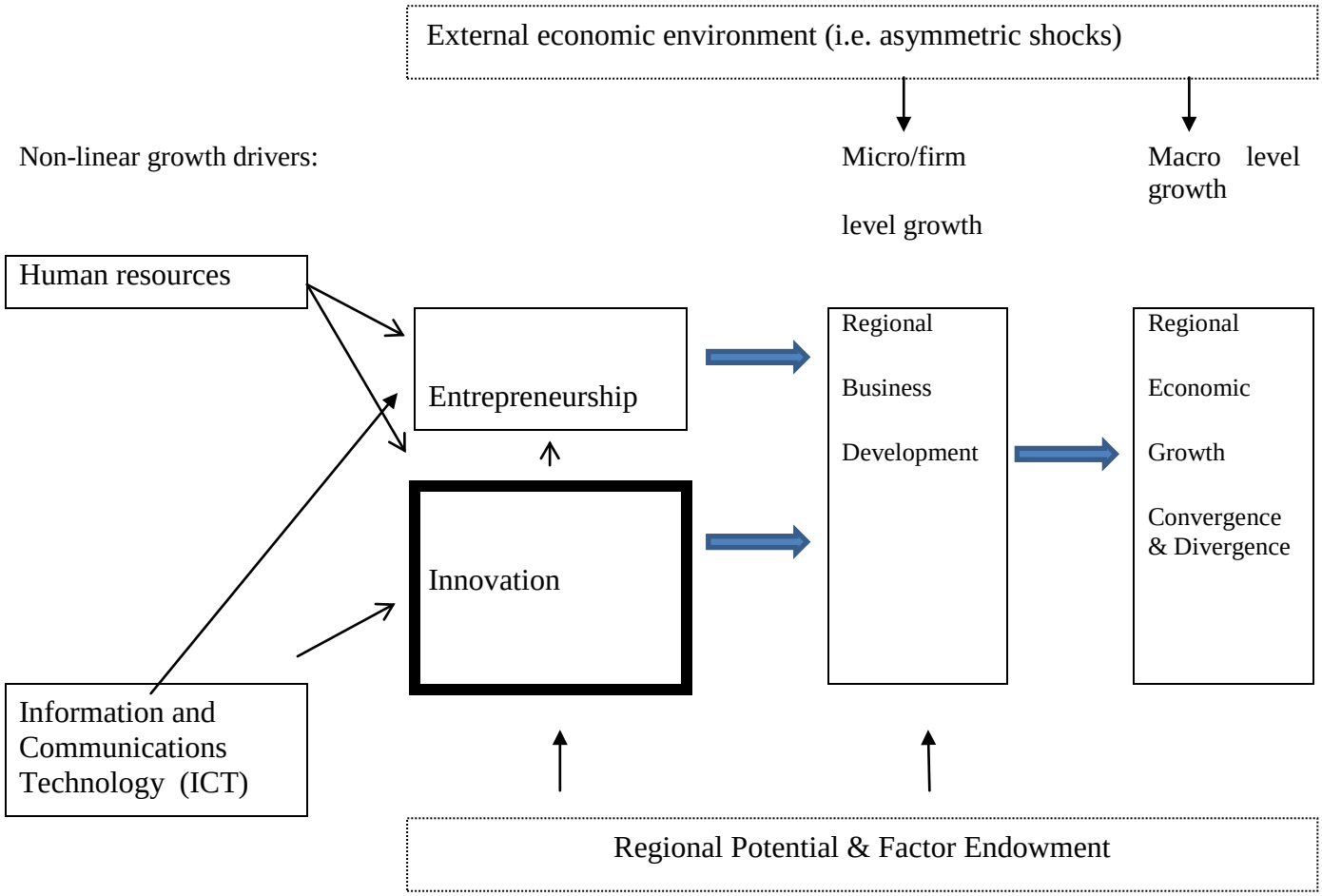
The core essentials of regional development efforts are closely linked to the fact that some regions perform worse compared to others, and that this leads to a (comparative) derogation of the quality of living, and will create unequal conditions within a country or Europe as a whole. These complex processes may vary over time, and are dependent on external as well as internal factors. Traditional economic growth models have their focus on capital and labor as growth drivers. This type of growth has contributed significant to the reduction of international disparities within the EU area for several decades until the beginning of the 21th century. Since the end of the 1990's the pattern has changed, in particular in the mature industrial societies in North Western Europe. More refined concepts of growth and new growth models are operating with a wider range of growth drivers nowadays, and will have increasing importance in future, in particular in a global perspective. These concepts became a significant part of the policy process around the turn of the millennium, most significantly by the OECD (2001) report 'The New Economy: Beyond the Hype'. Central factors like human capital, knowledge and innovation and even intangible factors like entrepreneurial spirit (Audretsch 2006) entered the core of economic and regional development policy. Even the target for entrepreneurial and innovative activities have changed away from traditional job creating sectors in the periphery toward knowledge intensive services and advanced technology.

It has been recognized that some of the mechanisms behind economic growth are endogenous in a certain economic system rather than independent of previous performance (see Romer 1994). Innovation and the capacity to innovate are central factors for economic growth and regional development in this new context. The set-up of the regional and national system of innovation

[1] This section is based on Cornett (2013a).

becomes crucial for the functioning of a modern business environment. Innovation has to be seen as both independent variable (i.e. a growth driver) and as a dependent variable with regard to policies aiming at stimulating innovative behavior in the firm or educational sector. In this perspective, the role of knowledge and innovation is at least twofold. In the short run, innovation and knowledge creation becomes necessary instruments in the process of regional adaptation to industrial change as a response to changes in the competitive environment. In a longer perspective, innovation and knowledge are preconditions for a successful restructuring of the economic base, nationally as well as regionally and locally. As a consequence, attention has been on the role of innovation policy in economic policy in general (i.e. OECD 2001), in particular programs, i.e. the Lisbon Strategy or Euro 2020 strategy (Mancha-Navaro & Garrido-Yserte 2008 & European Commission 2010) as well as on regional development specifically (see Acs & Varga 2002).

Figure 1: From growth driver to regional economic growth



Source: adapted from Cornett (2013a): 32

Contrary to traditional growth theory in New Economic Growth theory (NEC) the non-linear approach emphasizes, the knowledge sector, innovation and entrepreneurship have become the crucial growth-drivers, and have attracted much attention a public policy perspective. Figure 1

above modifies the more common framework (see Cornett & Ingstrup 2010) with special attention on the nature of the mechanisms, the micro and macro aspects of growth, as well as the regional setting (i.e. the regional innovation system). In the current context the main focus is on the linkage between growth drivers and how they influent economic growth and development, direct as well as indirect in various types of regions. In particular the importance of the particular factor endowments for regional growth and balance is assessed in a period of severe economic challenges regional, national as well as international.

In a regional development perspective the contribution to the regional factor endowment, through the creation of a more viable labor market by improving the human capital base is probably the single most important aspects. The local employment and demand effects are often rather limited. Recently the instrument of relocation or geographical spread of public sector agencies again has reached the political agenda in Denmark and the Nordic countries. From an internal public sector perspective efficiency may decline, at least in the short run. In any case it can be questioned to what extent relocation of state agencies will be a solution for the most peripheral parts of the country.

Overall, the factors causing alterations in business and regional development are general and global as well as specific and regional embedded. The drivers of economic development and spatial change in the last 20 years are not linear prolongations of previous trends. They must be analysed in a complex multidimensional framework based on both classical concepts of spatial specialization, theories of agglomeration and new economic growth theory.

2.2 Typology of regions vs. mechanisms of growth

The central issue to be addressed in this section is to analyze and discuss how innovation performance is related to the process of convergence and divergence. Is innovation a driver or the result of convergence and divergence? Previous research has shown that although convergence is present at aggregated European Union level a much more diversified picture is revealed at the disaggregated level. Here it is frequently observed that the more wealthy and central regions move away from the other regions. One of the results is that the economic crisis has reinforced not only intraregional divergence within countries but also the traditional divide between the stronger Northwest European countries and the South and East of Europe (Cornett 2013b). Figure 2 below summarizes expected consequences for different types of regions[1], and provides the classification framework for the assessment in table 4 in section 4 below. This topology will serve as point of departure for a part of the empirical analysis undertaken later in this paper.

[1] For an introduction to the European system of regional classification see Eurostat 2012.

F**igure 2** Classifications of regions according to urbanization and economic development

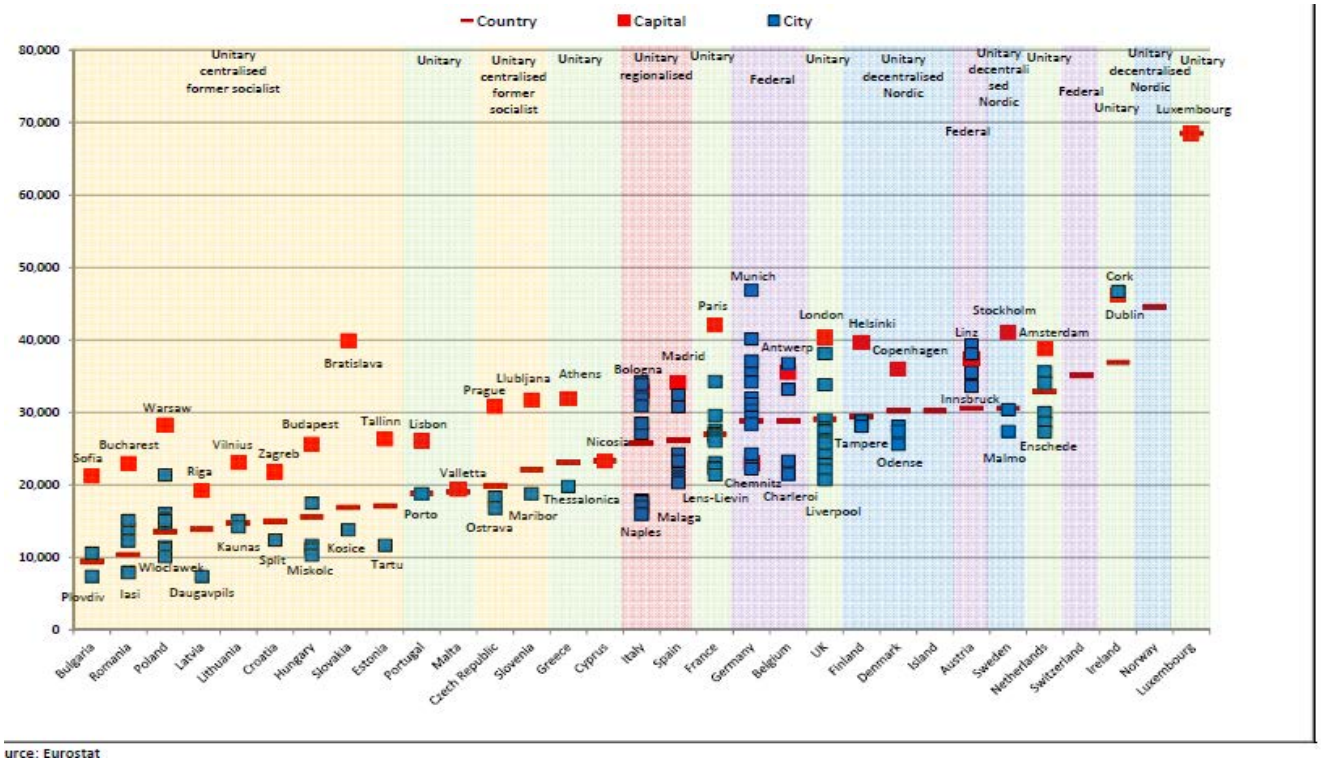
	Center regions -	**Peripheral regions -**
Center regions +	Convergence/status quo	Status quo /Divergence
Peripheral regions +	Status quo / convergence	Status quo

Note: + good/modern factor endowment/high potential - poor/outdated factor endowment/ low potential

2.3 Processes of regional convergence and divergence

After a period of convergence in Europe until the late 1990's the trend toward divergence has reentered the economic landscape in Europe. The overall pattern was interregional convergence (at least measured among nations) and increasing intraregional divergence with increasing disparities between urbanized and metropolitan regions and peripheral or rural areas. Interestingly this trend was common in all EU countries regardless location or economic development[1].

Figure 3: Spread in GDP/cap. (in PPS) in capital and second tier cities 2007



urce: Eurostat

Source: ESPON 2013:14, based on Eurostat

[1] For an assessment before the economic crisis and an evaluation of the policy options see 'Barca Report (2009).

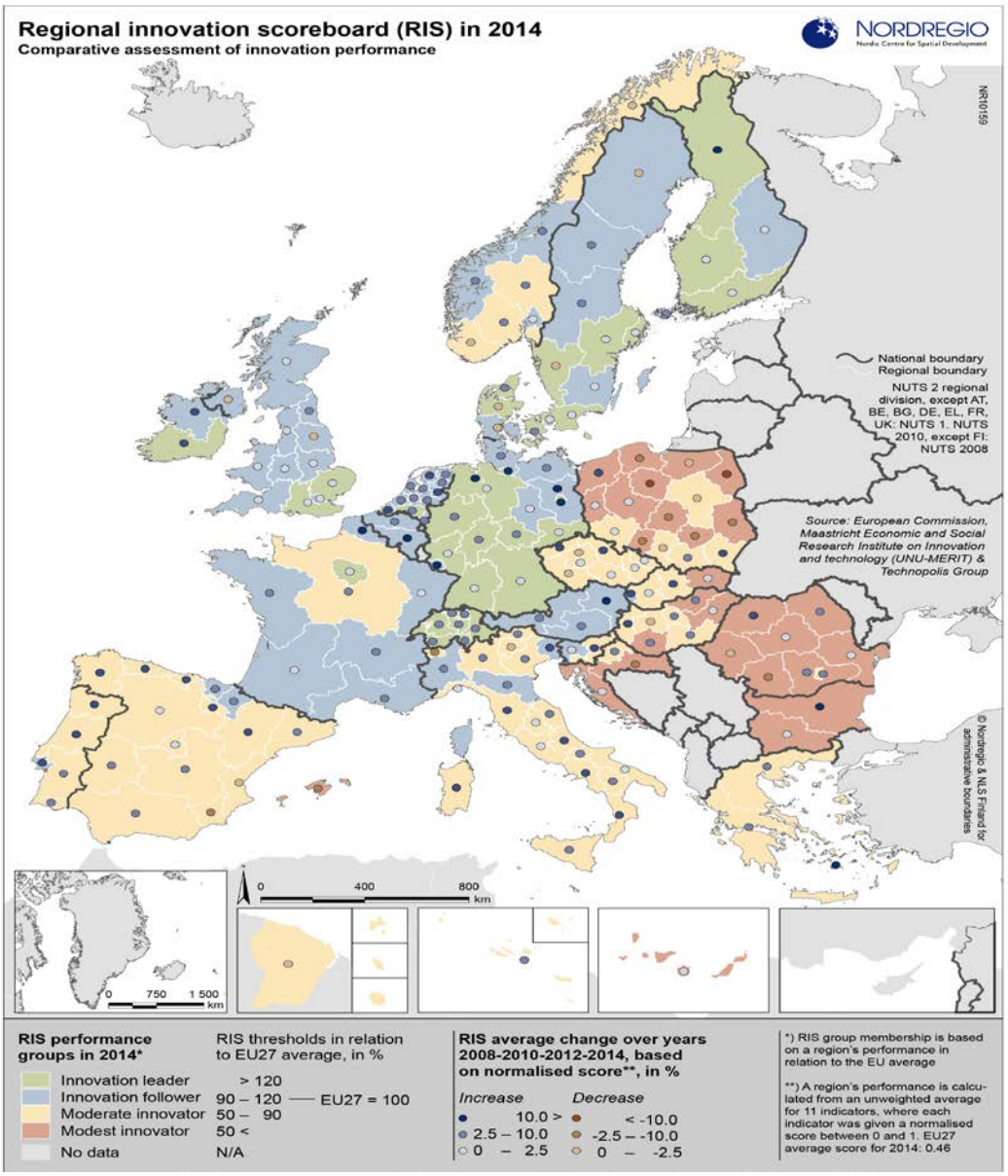
This picture has changed in the aftermath of the economic crisis in that sense that international divergences came back, in particular along the North South divide in Europe due to the consequences of the debt crisis. The internal trend toward deepening the urban rural divide persisted in all countries, see figure 2 above[1] for an illustration of the pre-crisis pattern.

[1] For a detailed overview of the spatial development in the EU with regard to cohesion and divergence see European Commission 2007 & 2014.

3. Innovation performance and growth

This section aims at to introduce to the issue of the innovation performance of the regions based on a model explaining innovation relative to the income level of the regions and to identify the underlying influencing factors. Hereby, we are able to identify strengthens and weaknesses of the innovation structure in different regions. In addition the issues of returns to scale will be considered. Figure 4 below provides a first impression of the significance of innovation performance as a regional potential for the generation of income and wealth.

Figure 4 Innovation and regional growth



Source: Nordregio 2016a: 85

The next sections will shed some light on the growth performance of the different regions depending on their overall classification (leaders, followers, moderate or modest innovators, and in case the changes in classification). More specifically it will be investigated how innovation relevant factor endowment and path dependency can explain the pattern and performance of economic growth.

3.1 Innovation as regional growth driver: Evidence for different types of regions

In this section we analyze the impact of innovation performance as a driver of the Gross Domestic Product (GDP). In order to achieve this task a very simple approach is adopted. For a region *i* the GDP can be stated as:

$$GDP_i = f(Z_i) \qquad i = 1, \dots, n$$

Here *n* is the total number of regions. *Z* is a matrix of innovation performance drivers, and it is further assumed that $f' > 0$. This could be interpreted as a simple production function approach.

The framework is applied on a data set compiled from the *Regional Innovation Scoreboard* (RIS) published by the European Union; see European Commission (2012, 2014a). The present data set reports statistics for the following European Union members primarily collected at the NUTS two level: Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Hungary, the Netherlands, Austria, Poland, Portugal, Rumania, Slovenia, Slovakia, Finland, Sweden, the United Kingdom and Croatia. In addition, statistics can be found for Norway. In total there are 23 countries with a total of 183 regions. Statistics has been compiled for the years 2007, 2009, 2011 and 2013[1]. The impact of the years has been analyzed by use of dummy variable for the years 2009, 2011 and 2013. On this basis a data panel of 732 observations can be established. Further, data on the GDP by region has been compiled from Eurostat[2].

For the analysis, the GDP per capita is used. The Regional Innovation Scoreboard (RIS) variables are normalized shares and ranges between 0 and 1. Data are divided into a total of a total of 13 "growth drivers". These variables constitute the description of the Z matrix. The variables are summarized in Table 1. Table 2 reports results of four simple OLS regressions on a non–transformed linear model. So no logarithmic transformations etc. have been undertaken. The results focus on the impact of innovation of super clusters and city dummies respectively. The

[1] Future work will also consider the updates for 2015 published in the summer of 2016.

[2] Cornett & Sørensen (2012a) used a data set on innovation performance based on Innometrics (2006). They used innovation statistics from 2004 to analyze the influence of innovation on convergence. The present analysis is a little different because the economies have been in recession for most of the period. As demonstrated in Cornett & Sørensen (2014) the rate of convergence by region decreased from 2.63 percent before the recession to 1.60 percent in the period 2008 to 2012.
Future work intends to combine the Innometrics Statistics and the RIS statistics into a single consistent database covering detailed by region the innovation performance from the millennium and forward. This long time period will enable us to consider the issue of regional convergence in a set up robust relative to the recession from 2008 to 2012.

classification with regard to super clusters follows the classification given in Center for Strategy and Competitiveness, CSC (2011) whereas the classification into cities follows the classification in Cornett & Sørensen (2012a).

Table 1: Regional Innovation Scoreboard Variables

Variable	***Measurement and rationale for inclusion***
POP with tertiary education	Population with tertiary Education. Number of persons in age class with some form of post-secondary education age group 25–64. *Included as a general indicator of the labour supply of advanced skills.*
PUB R&D expenditure	R&D expenditure in the public and higher education sector. *Induced as an overall driver of technological development.*
BUS R&D expenditure	R&D expenditure in the business sector. *Included as an indicator of formal creation of new knowledge within firms.*
Non R&D innovation exp	Non R&D innovation expenditure. *This variable measures investment in equipment and machinery and the acquisition of patents and licenses.*
SME's innovative in house	*Measures the degree to which the SME's has introduced any new or significantly improved products or production processes, have innovated in-house.*
Innovative SME's collaboration	Innovative SME's collaboration with others. *Measures the degree to which SME's are involved in innovation co-operation. Complex innovations often depend on the ability to draw on diverse sources of information and knowledge, or to collaborate on the development of innovation.*
Pub-private co-publications[1]	Number of public-private co-publications (PPC's) This indicator captures the public-private research linkages and active collaboration between the public and the private sector
EPO patents	EPO patens applications. *The capacity of firms to develop new products will determine their competitive advantage. This is approximated by number of patent applications at the European Patent Office.*
Technological innovator	SME's introducing product or process innovations. *New products are the key to innovation in manufacturing activities. Higher shares of technological innovators should reflect a higher level of innovation activities.*
Marketing innovator	SME's introducing marketing or organizational innovations. *Many firms, in particular in the service sectors, innovate through non–technological forms of innovation.*
Employ in med or high tech	Employment in knowledge intensive activities. *The sectors of medicine and high technology use frequently a highly educated and trained workforce.*
Sales new markets	Sales to new to market, and new to firm innovations *Measures the turnover of new or significantly improved products.*

Note: 1) Not available for 2013.

Source: Own complication from European Commission (2012, 2014b).

3.2 The significance of Super Clusters and Cities

All innovation scoreboard variables are positive as expected. In general, the power of the models as expressed by the adjusted R^2 and the standard error are satisfactory.

Table 2: Innovation Drivers of GDP by Regions, Clusters and Cities

	Full data set			**Super Clusters**			**City Dummies**			**Super Clusters and City Dummies**		
	Coefficients	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***
Intercept	2507	1733		9078	3461	***	-5610	3798		8101	4922	
POP with tertiary Education	23817	2155	***	19138	2993	***	31347	4293	***	21433	4891	***
PUB R&D expenditure	982	2089		11019	3575	***	7289	4490		25796	5402	***
BUS R&D expenditure	9071	2535	***	16717	4056	***	7695	5714		3568	7419	
NON R&D Innovation exp	16764	2527	***	24622	5030	***	8888	5050	*	22257	6705	***
SME innovating in house	13980	3023	***	12891	4023	***	13106	5305	**	8104	5751	
Innovative SME's collaboration	511	2203		6020	3237	*	4695	4566		5057	5374	
Pub-private co-publications	22012	2638	***	38189	5644	***	31200	6373	***	50430	8596	***
EPO patents	2879	2969		5976	4817		743	6121		21140	8664	**
Technological innovator	2461	3501		6746	4868		1296	6559		11350	7399	
Marketing innovator	9300	2869	***	19523	4495	***	13458	5271	**	27642	6149	***
Employ in med or high tech	9712	2064	***	12695	3556	***	10701	4145	**	15742	5725	***
Sales new markets	4662	2020	***	277	3319		4388	4078		3609	5204	
Year dummy 2009	-2504	802	***	-4180	1283	***	-2951	1524	*	-4850	1828	***
Year dummy 2011	2	808		-81	1269		-735	1549		65	1911	
Year dummy 2013	-1489	1001		-3779	1715	**	-1180	1906		-5366	2577	**
Multiple R		0.83			0.87			0.87			0.90	
R Square		0.68			0.76			0.75			0.80	
Adjusted R Square		0.68			0.74			0.74			0.77	
Standard Error		7542			5851			7727			6324	
Observations		732			188			216			104	
Total of Regions		183			47			54			26	

*Note: *** is strong significance at the 1 % level, ** is significance at the 5 % level, * is weak significance at the 10 % level.*
Source: Calculations based on GDP statistics from EUROSTAT and European Innovation Scoreboard, various volumes.

In all cases the variable population with tertiary educations is positively significant and large. So a qualified labor supply is of importance for the generating a high GDP. This is especially tur in the cities. The coefficient of the regression with the super clusters is smaller than for the overall regression. The variables NON R&D innovation expenditure, Public-private co-publications, SME's introducing marketing or organizational innovations and employment in medicine and high technological firms are all also significant for in all the regressions. Finally, the variable NON R&D Innovation expenditure is significant across all categories. These three variables are then the general contributors of innovation behavior to the formation of GDP.

Turning to the process of research and development (R&D), then different patterns are observed. Public R&D is having impact on GDP in the super clusters and also super clusters and large cities. The observed findings are consistent with the analysis undertaken in Cornett & Sørensen (2012a). Here it was also found that the presence of EPO patents has strong influence on economic growth and the process of convergence. This was especially true for the regions with high income. In the present analysis this variable does not perform very well in order to explain the level of GDP. An explanation of the different results could be either the definition of the variables or presence of multicollinearity.

With regard to time effects then the time dummy for year 2009 is negatively significant and for the super cluster and including the cities this is also true for year 2013. The time effects are in general weaker than expected taking the strong nature of the world-wide slowdown of the economy since 2008 into account.

In order to dig deeper into the regional pattern of innovation and growth reported in Figure 3 in the previous section Table 3 provides in depth insight into some of the main drivers. The regions divided into the four classifications given namely the *Innovation Leaders, Innovation Followers, Moderate Innovators* and the *Modest Innovators*. The division into groups has been obtained from European Commission (2014b) and Nordregio (2016). This classification is an update of the classification given in Cornett & Sørensen (2012a). Again the share of the population with tertiary education is the variable that is of general significance. The highest values are obtained with regard to the innovation leaders and for the Modest Innovators. These two groups are rather different. Also the Pub-private co-publications are significant across all groups, and take the highest for the Moderate and Modest Innovators. The public and private expenditure on R&D follows a rather diversified pattern. For the innovation leaders and the modest innovators the public expenditure on R&D is significant whereas the business expenditure on R&D is significant for the innovation followers and moderate innovators. The explanation of this pattern could be due to differences in development policy. As in the first set of regressions results, the EPO patents perform poor.

Table 3: Innovation Drivers of GDP by Regions, Leaders and Followers

	Innovation Leaders			**Innovation Followers**			**Moderate Innovators**			**Modest Innovators**		
	Coefficients	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***
Intercept	5597	6995		-258	5422		-935	3646		-6094	3704	
POP with tertiary Education	42232	8048	***	15320	3490	***	24837	3987	***	34360	6293	***
PUB R&D expenditure	18666	4821	***	2625	3173		-11	4033		11849	6482	*
BUS R&D expenditure	8489	5283		11649	4393	***	17038	5142	***	737	7720	
NON R&D Innovation exp	17538	9125	*	6172	6716		17590	4351	***	12951	4657	***
SME innovating in house	10404	6157	*	12050	4807	**	13758	7337	*	8037	12133	
Innovative SME's collaboration	10844	6173	*	8663	3744	**	4826	4405		1167	7210	
Pub-private co-publications	11451	6108	*	11816	4653	**	27018	5130	***	23398	6602	***
EPO patents	8916	6533		6350	7037		34521	6501	***	8775	9312	
Technological innovator	265	7058		2386	5391		4235	7809		34425	13885	**
Marketing innovator	12841	6947	*	8253	5114		7892	5145		520	7839	
Employment in med or high tech	19027	6456	***	19961	4502	***	2803	3320		3780	5835	
Sales new markets	2880	6039		7134	4522		9128	3079	***	739	4816	
Year dummy 2009	-6621	1874	***	-3752	1377	***	-409	1332		-973	1898	
Year dummy 2011	-2780	2005		-860	1429		517	1331		-1434	1940	
Year dummy 2013	-3981	3141		-209	1926		2810	1775		-1408	2454	
Multiple R		0.81			0.64			0.75			0.84	
R Square		0.65			0.41			0.56			0.70	
Adjusted R Square		0.59			0.36			0.54			0.67	
Standard Error		5923			6666			7139			8132	
Observations		104			204			260			160	
Total of Regions		26			51			65			40	

*Note: *** is strong significance at the 1 % level, ** is significance at the 5 % level, * is weak significance at the 10 % level.*
Source: Calculations based on GDP statistics from EUROSTAT and European Innovation Scoreboard, various volumes.

Table 4: Innovation Drivers of GDP by Regional Urbanization and Development

	FP: Strong absorbers - cities			**FP: Strong absorbers - no cities**			**SF: low users - cities**			**SF: low users - no cities**		
	Coefficients	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***	***Coefficients***	***Error***	***Sig***
Intercept	12825	9024		10543	5198	**	-6457	3283	*	8892	2154	***
POP with tertiary Education	18852	7882	**	2598	4545		10158	4230	**	12355	2864	***
PUB R&D expenditure	12844	8042		7035	3028	**	556	4457		1627	2938	
BUS R&D expenditure	8391	9633		3212	5445		18722	5324	***	14065	3385	***
NON R&D Innovation exp	13578	9878		25399	5963	***	5106	4183		21945	3224	***
SME innovating in house	14278	7506	**	19713	6298	***	4567	4737		21314	3640	***
Innovative SME collaboration	8039	7779		6884	5127		4020	3946		1430	2434	
Pub-private co-publications	33561	10646	***	2408	4908		26084	6448	***	8189	3312	**
EPO patents	1205	13557		8769	7375		19662	5217	***	10204	4497	**
Technological innovator	18014	10127	*	2664	9189		27	5417		2305	4004	
Marketing innovator	21430	8920	**	15829	7378	**	21331	4546	***	9914	3523	***
Employ in med or high tech	5504	10354		8693	5262		13260	3094	***	8571	2769	***
Sales new markets	7664	6785		1620	6954		4060	3634		356	2332	
Year dummy 2009	3371	2579		-3383	1637	**	-2335	1144	**	-1814	950	*
Year dummy 2011	561	2727		2272	1813		775	1155		1133	956	
Year dummy 2013	742	3687		-262	2129		2069	1505		-1864	1201	
Multiple R		0.72			0.84			0.94			0.84	
R Square		0.52			0.71			0.89			0.71	
Adjusted R Square		0.40			0.61			0.87			0.70	
Standard Error		7625			3926			3897			5501	
Observations		76			60			104			288	
Total of Regions		19			15			26			72	

*Note: Sig is significance. *** is strong significance at the 1 % level, ** is significance at the 5 % level, * is weak significance at the 10 % level.*
Source: Calculations based on GDP statistics from EUROSTAT and European Innovation Scoreboard, various volumes.

The performance of the regions can also be split up into the period considered. The growth rate in the Regional Innovation Scoreboard can be calculated. For 2007 to 2013 the growth rate for the Innovation Leaders can be calculated to equal 1.3 percent; for the Innovation Followers it equals 3.9 percent; for the Moderate Innovators it equal 1.8 percent, and finally for the Modest Innovators the growth rate equals -2.2 percent.

This is an interesting result the negative growth rate of the Modest Innovators underlines the increase in the diversity of the regions in Europe. This issue was also addressed with regard to the process of convergence in Cornett & Sørensen (2014).

3.3 Innovation performance and location

The final issue to be addressed in this section is to analyze how innovation performance is related to the location of a given region. Here it is frequently observed that the more wealthy and central regions move away from the other regions see for example Cornett & Sørensen (2008). One of the results is that the economic crisis has reinforced not only intraregional divergence within countries but also the traditional divide between the stronger Northwest European countries and the South and East of Europe. It is evident that the two variables are related: Strong factor endowments are found in the urban located regions whereas the weak factor endowments are found in the peripheral regions.

Table 4 reports the findings for the resulting OLS regressions on the regional GDP per capita. The two most interesting cases relative to the evidence put forward in Table 5 is found in the first and the last regression. For the FG strong absorbers – cities much fewer variables are significant than for the SF low users – no cities.

Table 5: Classification of regions according to use/absorption of funding and urbanization

	Urban located region	Peripheral located region	Total
"Strong factor endowment" High regional potential NEG / (FG Strong absorber)	19	15	34
"Weak factor endowment" Low regional potential NEG / (SF low users)	26	72	98
Total	45	87	132

In both cases the population share with tertiary education, SME's innovating in house, public-private co-publications and marketing innovator variables are significant. For the SF low users the

BUS R&D expenditure, NON R&D Innovation expenditure, EPO patents and employment in medicine and high tech industries are also significant. Consequently, the contribution from innovation to GDP is much diversified for the SF low users – no cites. Relative to funding this implies more open options and possibilities.

To address this issue the regions has been divided on hand by the use/absorption of EU funding and on the other hand by location as expressed by the city classification. The resulting cross-tabulation is found in Table 5. Notice that the total of regions does not sum up to 183 because not all regions have been considered for funding.

4. Conclusion and Perspectives

The purpose of the current project was to contribute to the understanding of the drivers behind regional economic development and income creation. A central issue is to estimate the impact of regional potentials on this process and to contribute to the development of instruments to cope with the problem, to overcome path dependency in lagging regions. The main focus in this contribution is on the innovations as drivers of GDP growth and income generation. The conceptual point of departure is in New Economic Growth theory.

Overall, the results points toward a quite diversified picture, but in general the population with tertiary education serves as a good indicator along with the variables public-private co-publications and the 'NON R&D Innovation' expenditure i.e. investments in equipment and machinery and the acquisition of patents.

These variables stress the importance of three drivers for the generation of income namely the presence of a well-educated labor force; the dynamics of the corporation between the private and the public sector, and finally the importance of the right equipment and the acquisition of patents. With regard to the type of R&D expenditure – business versus public, the picture is quite diversified, and no overall pattern can be observed. Contrary to what was found in Cornett & Sørensen (2012a) the presence of EPO patents has very limited influence on the level of GDP. An explanation of the this result could be that the EPO variable referees to new patents whereas the acquisition of the existing patents in the well-established process of production embodied in the variable NON R&D innovation expenditure is of higher importance. Overall these results point toward a conclusion that a path dependency characterized by negative downward spiral in lagging regions will extremely difficult to overcome since the most important drivers identified are in increasingly short supply in these regions.

The material presented allows a classification into four categories innovation performers namely the Innovation Leaders, Innovation Followers, Moderate Innovators and Modest Innovators. Comparing the Innovation Leaders with the Modest Innovators it is evident that the number of significant variables is much higher for the former than for the latter. Consequently, the Modest Innovators has fewer innovation parameters. The innovation growth for the Modest Innovators has also been negative over the considered period. This is in line with the decrease in GDP for the same group of regions studies in Cornett & Sørensen (2014). The best innovation performance over the period is observed for the group of Innovative Followers. With an innovation growth rate equal to 3.9 percent this group is catching-up on the group of Innovation Leaders that experienced a growth rate equal to 1.2 percent.

Regions with strong factor endowments are primarily urban whereas regions with weak factor endowments are primarily peripheral. For the strong endowment regions located in the cities there are fewer innovation drivers than with regard to the peripheral regions with weak factor endowments.

Our preliminary results points at least toward three areas to extend our analysis: first of all the application of the NEG concept could be extended, at least with the inclusion of entrepreneurial skills, see figure 1 as a second activator of regional potentials. Secondly the concept of regional factor endowments and potential needs specification and clarification how potentials can be activated. Last but not least a detailed specification and understanding of the linkages between economic growth, path-dependency and different categories of regions is needed.

References

Acs, Z. J. & Varga, A. (2002): Geography, Endogenous Growth, and Innovation in *International Regional Science Review* 25, 1, 2002: 132-148.

Audresch, D.B. (2006): "The Knowledge Spillover Theory of Entrepreneurship and Spatial Cluster" pp. 177-188 in Iréne Johansson (ed,), *Innovations and Entrepreneurship in Functional Regions*. Papers presented the 8th Uddevalla Symposium & the 8th McGill International Entrepreneurship Conference Uddelvalla, Sweden 15-17 September, 2005. Research reports 2006:01 University West, Trollhättan; Sweden.

"Barca Report" (2009): "AN AGENDA FOR A REFORMED COHESION POLICY A place-based approach to meeting European Union challenges and expectations Independent Report prepared at the request of Danuta Hübner, Commissioner for Regional Policy by Fabrizio Barca.

Available at http://www.europarl.europa.eu/meetdocs/2009_2014/documents/regi/dv/barca_report_/barca_report_en.pdf

Center for Strategy and Competitiveness, CSC (2011): "Strong Clusters in Innovative Regions". Stockholm School of Economics. European Commission Entreprise and Industry.

Cornett, A. P. (2013a): "Conceptualization of clusters as a tool in local and regional business development" pp. 30-45 in Brown, K., J. Burgess, M. Festing, & S.Royer (2013), *Resources and Competitive Advantage in Clusters*, Rainer Hampp Verlag, München/Germany.

Cornett, A.P. (2013b): "Stimulating innovative entrepreneurship, knowledge creation and firm growth as a regional *Special session on 'Entrepreneurship and the Economic Crisis'*, Kansas City, MI, June 13-15, 2013.

Cornett, A.P. & M. B, Ingstrup (2010): Cluster Development as an Instrument of Regional Business development Policy: Concepts and Danish Reality, 43-61in Brown, Kerry, John Burgess, Marion Festing & Susanne Royer (Eds.), *Value Adding Webs and Clusters - Concepts and Cases*, Rainer Hampp Verlag München, Mering, Germany, 2010.

Cornett, A.P. & N. K. Sørensen (2014): "Regional GDP Convergence in the European Regions in the light of the Economic Recession". In: Peter Linde (editor): Symposium i anvendt statistik 2014. Københavns Universitet, Danmarks Statistik, page 111−117.

Cornett, A.P. & N. K. Sørensen (2012a): "Innovation and regional disparities – a survey of regional growth drivers and economic performance" pp. 81-108 in Charlie Karlsson et al. (2012), *Innovation, Technology and Knowledge*, Routledge , Abingdon (UK) & New York (NY).

Cornett, A.P. & N. K. Sørensen (2012b): "Determinants of Convergence and Disparities in Europe: Innovation, Entrepreneurship and the Processes of Clustering". Paper for the special session ' SS- Knowledge, Innovation and regional Growth', 52th Congress of the European Regional Science Association, "Regions in Motion – Breaking the Path" Bratislava, Slovakia August 21 – 25. (Published in ERSA - proceedings of 52th Congress of the European Regional Science Association, Bratislava Slovakia).

Cornett, A.P., & Sørensen, N.K. (2008): "International vs. Intra-national Convergence in Europe – an Assessment of Causes and Evidence", pp. 35-56 in *Investigaciones Regionales* No. 13, Otoño 2008, Asociación Española de Ciencia Regional, Madrid.

Danmarks Statistik, Regional accounts, København.

ESPON (2013): "SGPTD Second Tier Cities and Territorial Development in Europe: Performance. Policies and Prospects" Applied Research 2013/1/11, Final Report Version 30/06/2012. (http://www.espon.eu/export/sites/default/Documents/Projects/AppliedResearch/SGPTD/SGPTD_Final_Report_-_Final_Version_27.09.12.pdf) (accessed 26-6-2014).

European Commission (2014a):"Investment for jobs and growth Promoting development and good governance in EU regions and cities", Sixth report on economic, social and territorial cohesion Brüssel 2014. (available at http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion6/index_en.cfm accessed October 8, 2014)

European Commission (2014b): "Regional Innovation Scoreboard 2014" Luxembourg 2014. (available at www.europa.eu).

European Commission (2012): "Regional Innovation Scoreboard 2012" Luxembourg 2012. (available at www.europa.eu).

European Commission (2010a): "Communication from the Commission Europe 2020 – Strategy for smart, sustainable and inclusive growth" Brussels 3.3.3010 COM(2010) 2020.

(http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf, accessed June 11, 2010).

European Commission (2010b): "Europe 2020: Commission proposes new economic strategy in Europe". **IP/10/225** Brussels, 3rd March 2010. (http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/225&format=HTML&aged=0&language=EN&guiLanguage=en,).

European Commission (2007): "Growing Regions, growing Europe, Fourth report on economic and social cohesion" PowerPoint Presentation.(http://ec.europa.eu/regional_policy/sources/docoffic/official/reports/cohesion4/index_en.htm, accessed June 2010).

Eurostat (2016): "Regio Data" Luxembourg. (www.europa.eu).

Eurostat (2012): "Focus on territorial typologies" pp.192-201 in *Eurostat regional yearbook 2012*, Luxembourg (available at http://ec.europa.eu/eurostat/documents/3217494/5735193/KS-HA-12-001-14-EN.PDF/7cb7d907-e19c-4d9e-8cf8-3262233460c0?version=1.0 accessed 22.1.2016).

Innometrics (2011): "European Innovation Scoreboard 2011", Maastricht Economic Research Institute on Innovation and Technology (MERIT) and the Joint Research Centre (Institute for the Protection and Security of the Citizen) of the European Commission (http://www.proinno-europe.eu/metrics).

Innometrics (2006): "European Innovation Scoreboard 2006", Maastricht Economic Research Institute on Innovation and Technology (MERIT) and the Joint Research Centre (Institute for the Protection and Security of the Citizen) of the European Commission (http://www.proinno-europe.eu/metrics).

Mancha-Navarro, T and R. Rubén Garrido-Yserte (2008): "Regional policy in the European Union: The cohesion-competitiveness dilemma", pp.47-66 in *Regional Science Policy & Practice* Volume1, Number 1, 2008.

Nordregio (2016a): "State of the Nordic Region 2016", *Nordregio Report 2016:1* Stockholm, Sweden.

Nordregio (2016b): "Maps" available at http://www.nordregio.se/en/Maps--Graphs/ (18.5.2016)

OECD (2001): 'The New Economy: Beyond the Hype the OECD growth report', Paris 2001.

Romer, P.M. (1994): "The Origins of Endogenous Growth", pp. 3-22 in *Journal of Economic Perspectives* 8 (1), 1994.