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Abstract

The EU's cohesion policy should now be confluent with the goals of the Lisbon strategy by promoting growth and employment. In this context, the promotion of a concept called regional innovation system has recently become important in the EU for guaranteeing long-term regional economic growth. This paper attempts to explain the determinants of the varying degrees of innovation promotion by the EU from one region to another. Since regional-policy strategies should have been subject to a new orientation towards more innovation promotion, we are particularly interested in whether the EU's co-financing policy of innovation projects changed for the 2007-2013 program period compared with the 2000-2006 period. According to our empirical analysis, which controls for various determinants of innovation promotion, there has been no significant change in the EU's regional policy strategy in general. We confirm this result when focusing on less-developed Objective 1 regions, where we would have expected the new policy strategy to show up more pronounced in particular.

JEL-Code: O180, O310, O520, R110, R580.

Keywords: Lisbon Agenda, regional innovation network, EU cohesion policy.

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1. Introduction

According to Schumpeter (1934), the basic innovation carried out by firms provides the basis for long-term economic growth. The application of this idea in the empirical regional science also suggests that regional growth is stimulated by the existence of numerous innovative industries and/or industries in the rapid-growth phase of the product life-cycle, and is retarded by the strong presence of old, declining industries. Moreover, the incidence of introducing new technology tends to be lower in those regions that are already economically disadvantaged (Grossman and Helpman, 1991). The Regional Innovation Performance Index, which testifies how spatially concentrated innovation activities are in 208 EU regions, suggests that innovative performance and economic development are closely linked in the EU regions (Hollanders, 2006; Fragerberg and Srholec, 2007). In this context, the promotion of regional innovation system has recently become one of the important EU policy measures for guaranteeing the sustainable economic growth of a region: "generation, dissemination and use of knowledge [are] critical to the way in which businesses operate and grow. Facilitating access to finance and markets, promoting business support services, reinforcing links between enterprises and the scientific base, equipping people with the right skills through education and training, encouraging the take-up of new technologies and increasing investment in R&D are all key to improving the business environment and stimulating innovation [as well as economic growth and job creation in the lagging EU regions]" (European Commission, 2004, p. 114).

Unlike the linear innovation-commercialization process which starts with basic scientific research leading to the creation of a new product and its market introduction, chain-linked network characteristics have become crucial for innovation and growth prospects of regions (Cooke and Memedovic, 2003; Musyck and Reid, 2007). More precisely, innovation is seen as an evolutionary, systemic process resulting from various associational interactions among many actors in a given region (Puttnam, 1993; Nelson, 1993; Karlsson, 1995; Cooke 2001). A regional network usually comprises (i) horizontal and vertical relations among firms, (ii) firms' contacts with universities and other research institutions, as well as with technology centers, and (iii) government agencies (promotion), interest groups (commercial, technical and information support) and lending bodies (the provision

of venture capital). Theoretical development of such a regional innovation system is based on the traditional concept of agglomeration economies and associated positive external effects (Glaeser, *et al*. 1992; Mills and McDonald, 1992), and expanded further by integrating the logic of intangible social capital and its effects on regional growth. In short, regional innovation systems can be characterized as "places where close inter-firm communications, socio-cultural structures and institutional environment may stimulate socially and territorially embedded collective learning and continuous innovation" (Asheim and Isaksen, 2002, p. 83).

On the other hand, the knowledge-generation in regional innovation systems has also shortcomings: First, stable, long-lasting networks are assessed as prerequisites for innovation success, which could, however, impede the creation of new products due to the so-called path dependence ('lock-in-effects' shown in Fritsch, 2001; Cooke and Memedovic, 2003).[1] Second, in a spatial sense, the 'closure'-aspect of the regional innovation process is emphasized, while a global exploitation of new opportunities appears to be crucial for the success of regional innovation system at the same time (Amin and Thrift, 1994). Third, industrial clusters are usually defined by their local communities (Heidenreich, 2003), yet their performance is largely based on competition between firms in co-operation (Piore and Sabel, 1984).

The activation and utilization of endogenous innovation potentials for regional development has been a major challenge for an innovation and technology-oriented regional policy. According to Koschatzky and Gundrum (1997), public (regional) technology and innovation promotion can ideally have three major tasks:

- activation of potential regional resources for development and application of new technology,
- creation of a region-specific inter-linkage (i.e. the regional innovation network) that comprises all the relevant actors in industry, science and policy, and

[1] Innovation and technological development in a region is path-dependent in the sense that a further step in their process is based on knowledge previously acquired or generated in the same region. "On the other hand, previous investments, competence, habits and qualifications are devalued by innovations. The benefits of innovations and the risks of omitted innovations, therefore, always have to be balanced against the costs of successful innovations and the benefits of omitted innovations" (Heidenreich, 2003, p. 502).

- integration of regional networks into supra-regional technology co-operation systems (see also Camagni, 1999; Courchene, 1995; Wolfe, 2002).[2]

Apart from the general critics on the policy intervention that disturbs free market mechanism and allocation efficiency, and generates a culture of dependence, there are also some controversies on the extent to which the regional R&D promotion measures, which are aimed at supporting the new establishment of innovative firms and research institutions in economically less-developed areas, reduces the existing disparities among regions. The effects of regional co-operation depend on the concrete needs and the availability of partners that match these demands. Therefore, increasing the number of co-operative relationships (or the share of partners) within a region as well as supporting the formalization of local clusters alone cannot always be recommended as the best possible strategy (Grabher and Stark, 1997). As already mentioned above, the regional innovation system tends to be path-dependent. Due to this reason, if a region is dominated by declining industries or agricultural production, radical government intervention may be required to modernize its economic structure (Braczyk and Heidenreich, 1998; Turpin and Garrett-Jones, 2002).

More importantly, compared to the case with growth poles (i.e. the case with large city regions), innovation-oriented regional policy measures designed to stimulate the rapid establishment of regional technology networks (incl. the establishment of new innovative SMEs[3]) in less-developed (peripheral rural) areas have remained less successful, because

[2] Maurseth and Verspagen (2002), and Hoekman *et al*. (2009) additionally highlight that in the EU the volume of patenting in a region is greatly stimulated not only by the indigenous science-base and the funding of research, but also by the region's proximity to other regions with strong scientific performance. Furthermore, they argue that researchers collaborate most with each other in research-intensive regions, but cross-border links tend to be far better established between researchers located in capital and other large city regions. These facts suggest that the three (regional, national and international) levels of innovation system do not function independently from each other, but mutually rely on each others strengths and specific system qualities in order to productively interact (Fromfold-Eisebith, 2007).

[3] Apart from the fact that SMEs suffer particularly from rapid technological development processes and the consequent organizational changes, it is generally assumed that the strong 'locational dependency' of small firms leads to the 'bounded vision' including a lack of awareness of innovation possibilities caused by limited resource and knowledge bases and expertise, etc. (Wiig and Wood, 1997; Nauwelaers and Wintjes, 2000; Belussi, 2001). However, Pavitt, Robson and Townsend (1987) suggest that small firms have also been able to introduce new products over time. Moreover, Rothwell (1986) emphasizes that SMEs are important agents in the technology diffusion in that they take innovations made elsewhere and present them in various forms in a way that meets customers' needs. In many cases they are fast adopters of new technologies. Therefore, small and innovative firms are often seen as a potentially powerful force

in many cases they lack a sufficient mass of know-how, skills, finance, socio-cultural and institutional infrastructure, and a certain degree of entrepreneurial tradition, which cannot easily be generated by public intervention within a short period of time (Amin and Thrift, 1994; Sternberg, 1995; Grotz and Braun, 1997; Cooke and Morgan, 1998). However, growth poles in Europe have also benefited from (national and regional) innovation promotion measures.

In the Treaty of Establishing the European Community, economic and social cohesion is defined in terms of reducing regional disparities in the level of development, usually measured by GDP per capita (relative to the EU average) in purchasing power parities. As a timely response to the slow economic growth in the EU, the Lisbon Agenda agreed by EU leaders at the Lisbon summit in March 2000 aims at making the EU a more competitive and dynamic knowledge-based economy, which would be achieved by economic reforms and growth-enhancing investments. In this context, cohesion policy should now be confluent with the goals of the Lisbon strategy by promoting growth and employment. In part, this political idea has been generated since there has been less clear consensus on the impact of 'past' EU cohesion policy on economic growth of EU regions and convergence in the EU (Leonardi, 2006). Consequently, compared to the previous EU financial supports from Structural Funds which used to be concentrated on infrastructure and human capital development, the Lisbon strategy's stress on the knowledge economy raised new policy orientations for the EU cohesion policy. In particular, the role of regional innovation system is seen as a kind of self-help and learning tool that is expected to trigger local, self-sustained growth dynamics, especially targeted at peripheral regions, which would, in turn, help these less-favoured regions to catch up with core regions (De Bruijn and Lagendijk, 2005).

However, the integration of the Lisbon strategy in the EU regional policy has created some tensions between competitiveness aims and cohesion aspirations. According to

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in local economic change (Wynarczyk, Thwaites and Wynarczyk, 1997). However, there are also some disputes surrounding the technology promotion of SMEs as a long-term strategy for solving regional economic problems. Leaving aside the high insolvency rates among SMEs, large firm size is generally acknowledged as a prerequisite for technological change and economic progress (Gray, 1992). Large internationally-active companies have a greater ability to provide capital, information and experts. They can also spread the innovation risks over a number of R&D projects.

Lawton-Smith (2003), the twin goals of increasing competitiveness in the global economy and economic and social convergence are contradictory and inherently comprise different policy options: the former is generally about 'winners and losers', while the other is about 'redistribution'. First of all, there is a trade-off between growth and cohesion, as different core and periphery growth trends tend to increase regional disparities at low levels of development. Secondly, while cohesion policy primarily aims at enabling low performing regions to catch up the core regions in the EU, the promotion of competitiveness triggered by the Lisbon Agenda seems to strengthen the competitiveness of the best performing regions. Furthermore, cohesion policy has been primarily bottom-up in the design and implementation of policy since 1989, and has had a regional dimension and a multi-level governance structure to accommodate it. In contrast, the Lisbon Agenda was imposed top-down on EU members with targets that are more macro- than micro-economic, and has therefore an overriding national dimension and clearly violates the subsidiarity principle[4] (see also De Propris, 2007).

As already mentioned above, EU's cohesion policy should now be confluent with the goals of the Lisbon strategy by promoting growth and employment. In this context, the promotion of regional innovation system has recently become important in the EU for guaranteeing the long-term regional economic growth. This paper attempts to explain the determinants of the varying degrees of innovation promotion by the EU from one region to another. Since regional-policy strategies should have been subject to a new orientation towards more innovation promotion, we are particularly interested in whether the EU's co-financing policy of innovation projects changed for the 2007-2013 program period compared with the 2000-2006 period.

Our empirical investigation gives rise to four main results. First, after conditioning on a number of aspects determining innovation promotion, we cannot confirm any increase in the degree of innovation promotion in the second program period 2007 to 2013 (where the new policy strategy should show up) compared with the first program period

[4] According to the well-known subsidiarity principle, efficiency in the allocation of financial resources is best achieved by assigning responsibility for each type of expenditure to the level of government that most closely represents the beneficiaries of provided public goods and services. In other words, the expenditure assignments involve decisions as to which level of government should be predominantly responsible for the formulation, financing and administration of policy activities and related follow-ups.

from 2000 to 2006. Second, when focusing on less-developed regions, innovation promotion for 2007-2013 has not been increased in Objective 1 regions – which obtain a significantly higher level of innovation promotion overall, though – compared with the earlier program period 2000-2006. These first two findings are central and demonstrate that there has not been a considerable realignment of the EU's policy towards more innovation funding. Third, the analysis of the innovation-spending-to-total-spending ratio shows that core regions with advanced economic performance obtain a relatively higher share of innovation spending. Forth, the analysis of the level of innovation spending shows that more financing is provided to less-developed regions, which is in line with the basic policy goals of the EU's cohesion policy.

The paper is structured as follows. Section 2 provides an overview on innovation promotion in the context of the EU cohesion policy and also includes a case study, comparing innovation promotion in different EU cohesion policy program years. Section 3 presents the data used for the analysis exploring the determinants of innovation spending. In Section 4, we provide some concluding remarks.

2. Innovation Promotion in the Context of EU Cohesion Policy

2.1. An Overview

The policy priority of promoting the regional innovation system has been reflected for the first time in the cohesion policy program for the period 2007-2013 addressed to the EU27. According to the overall EU financial budget, the main fields of investment and their relative shares of funding are classified into: (a) knowledge and innovation: almost 83 billion euros (24% of total 347 billion euros) are spend on research centers and infrastructure, technology transfer and innovation in firms, and the development and diffusion of information and communication technologies; (b) transport: about 76 billion euros (22%) have been allocated to improving the accessibility of regions, supporting trans-European networks, and investing in environmentally sustainable transport facilities in urban areas in particular; (c) environmental protection and risk prevention: investments of around 51 billion euros (19%) finance water and waste-

treatment infrastructures, decontamination of land in order to prepare it for new economic use, and protection against environmental risks; and (d) human resources: around 76 billion euros (22%) are spend on education, training, employment and social inclusion schemes. Other interventions concern the promotion of entrepreneurship, energy networks and efficiency, urban and rural regeneration, tourism, culture and strengthening the institutional capacity of public administrations (Table 1).

Compared to the cohesion policy budget for the 2000-2006 period, with a total amount of 234 billion euros, Table 1 indicates that: (a) the financial share for promoting less-favorable EU regions increased from 75% to 82% in the course of EU expansion from 15 to 27 countries; (b) infrastructure support has also gained importance and has been increased from 32% to 37%; (c) yet the share for promoting education and training has been reduced remarkably from 31% to 22%; and (d) a movement of financial priority took place from the promotion of firms' production and cooperation activities including also establishment and innovation (EU budget 2000-2006) to knowledge-innovation (EU budget 2007-2013).

Table 1: EU Budget for Cohesion Policy

	EU budget 2000-2006 EU15 (+ EU10 later)	EU budget 2007-2013 EU27
Total amount	234 billion € (100%)	347 billion € (100%)
Promotion of Objective 1 (or Cohesion) region	175 billion € (75%)	283 billion € (82%)
Infrastructure (mainly transport & environment)	76 billion € (32%)	127 billion € (37%)
Firms' production & cooperation activities (incl. also establishment & innovation)	73 billion € (31%)	
Human resources	73 billion € (31%)	76 billion € (22%)
Knowledge-innovation		*83 billion € (24%)*
Cross-border cooperation & others	12 billion € (5%)	61 billion € (18%)

Source: European Commission (2008).

Let us now look at the EU cohesion policy operational programs officially adopted by the European Commission at the beginning of the budget years. For such programs, the total cost of regional programs and the respective EU contribution are reported on the

NUTS 2 level.[5] These programs were prepared by each EU member state and present the weights of financial priorities (e.g. infrastructure, innovation, human capital, environment, etc.) set by the national and regional authorities for the corresponding budget period. We are interested in the share of innovation promotion grants that are directly addressed to respective regions as well as the respective level of innovation promotion. We calculate the former variable as the national and EU sum of innovation support divided by total cost of the regional program for an eligible region.[6] The data is available on a NUTS 2 level for the EU program periods 2000-2006 and 2007-2013, respectively.

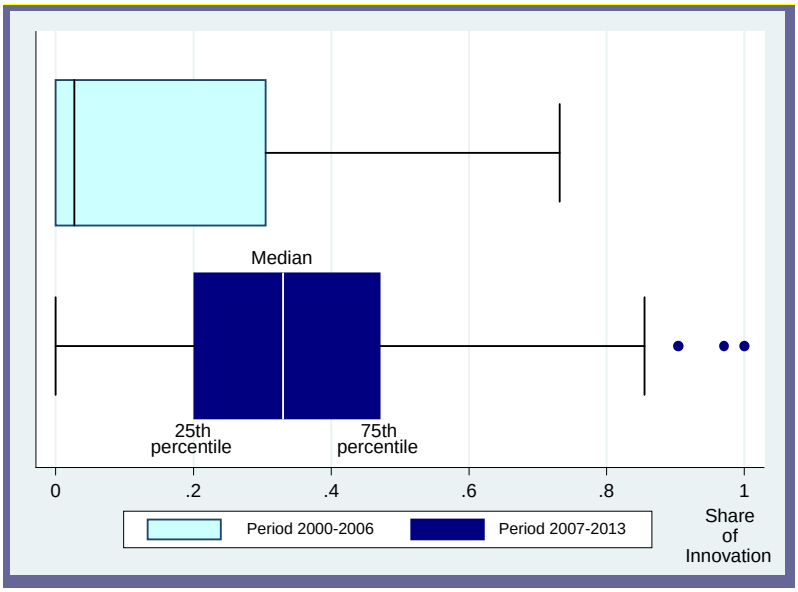
Figure 1 graphically highlights the difference between the two aforementioned program periods. It shows simple box plots where the upper one refers to the share of innovation spending to total spending of the 2000-2006 period and the lower box plot to that of the 2007-2013 period. According to Figure 1, the average share of EU innovation promotion for the 2007-2013 period is higher by a factor of 2.35 compared to the previous program period (0.372 *vs.* 0.158).

Since the Lisbon Agenda particularly aimed at promoting economic growth of Objective 1 regions in order to trigger their catching-up process, it appears to be interesting to display box plots for such regions separately. While innovation promotion was rather irrelevant in these type of regions during the 2000-2006 EU regional program, it has become more important in the latter program period. Figure 2 clearly demonstrates that the Objective 1 regions caught up in comparison to the regions not classified as Objective 1. Indeed, while it seems that the EU support shares for innovation activities in the EU regions have generally gone up, they particularly increased for the Objective 1 regions. Note that we will test in Section 3.2 whether this descriptive fact still holds in a multivariate analysis.

[5] See http://ec.europa.eu/regional_policy/country/prordn/index_en.cfm. There are also national, multi-regional as well as cross-border regional cooperation programs which are financially supported by the EU. Yet, for such programs, the distribution of project costs from one region to another is unclear.

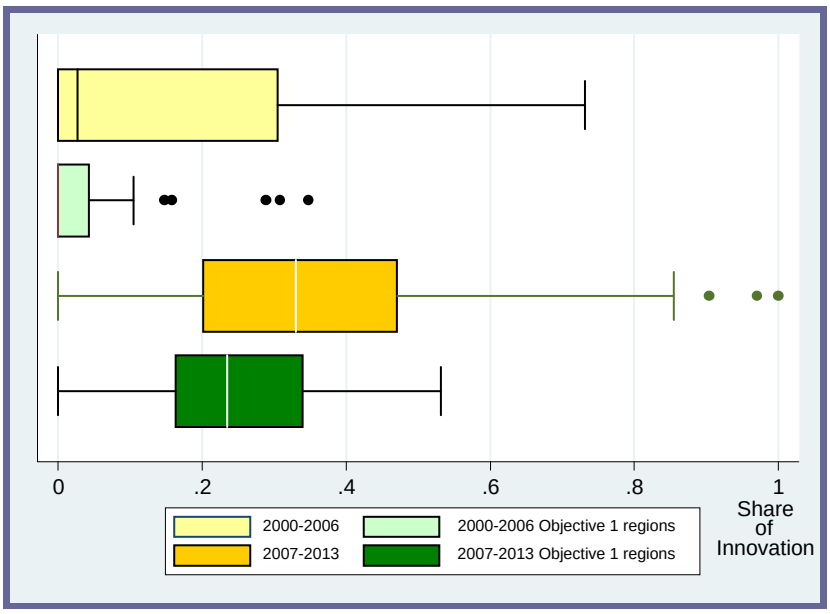
[6] The EU only provides money for the regional projects if national authorities also chip in. Such a 'matching co-finance principle' aims at ensuring the complementary relationship between the fund providers in the context of the EU cohesion policy (Nam and Wamser, 2010).

Figure 1: Dispersion of the Share of Innovation Spending for EU Regions in Different Budget Periods



Notes: Share of Innovation is measured as the amount of innovation promotion to a region divided by the total amount of contributions to a region.

Figure 2: Dispersion of the Share of Innovation Spending for EU Regions in Different Budget Periods (distinguishing Objective 1 Regions from other Regions)



Notes: Share of Innovation is measured as the amount of innovation promotion to a region divided by the total amount of contributions to a region.

2.2. Case Study: Comparison of Innovation Promotion in Spanish Regions in Different EU Cohesion Policy Program Years

The innovation promotion scheme implemented in the EU cohesion policy framework can be classified into the three categories: (a) financial support for firm's innovation activities, (b) promotion of public R&D capacity expansion (universities and technology centers), and (c) support for projects aimed at the creation and (better) establishment of regional innovation system (i.e. cluster formation, networking and knowledge transfers).

In the following, taking the Spanish regions as an example, the change of the innovation policy practice is investigated between the EU program years 2000-2006 and 2007-2013 to highlight the significance of the Lisbon agenda for the cohesion policy in the EU regions. For the budget period 2000-2006, Table 2 shows that firms' innovation activity was rarely promoted by the EU cohesion policy in the Spanish Objective 1 regions (except Valencia and Cantabria), while the same activity was financially supported in most advanced regions like Basque Country, Catalonia, Navarre, Aragon, etc. In contrast, the expansion of public R&D capacity was generally promoted by the cohesion policy in most Spanish regions (except a few Objective 1 regions like Ceuta, Malilla and Cantabria), in part in the context of the enhancement of infrastructure. The promotion of system-oriented, cluster formation, networking and knowledge transfers was popular only in the non-Objective 1 regions, while such a promotion did not exist at all in most less-favored Spanish regions in the 2000-2006 program period.

Compared to that of the former period, the 2007-2013 cohesion policy program delivers a quite different picture. First of all, regardless of the level economic development, innovation and R&D activities are financially promoted in all Spanish regions. In particular, SMEs are major beneficiaries in most Objective 1 regions (except Murcia, Asturias, Ceuta and Cantabria). For most Spanish regions, the enhancement of public R&D capacity has continuously been playing an important role in the context of the EU cohesion policy, while an intensive promotion of cluster, networking and knowledge transfer has also become apparent in most Objective 1 regions (Table 2).

In addition, one should also pay attention to the changes of innovation promotion as a %-share of the total public (national and EU) contributions made in the EU cohesion policy framework (see columns 5 and 9, Table 2). The following observations can be made: Firstly, in all the investigated Spanish regions the share of innovation promotion has rapidly grown from the former to the latter program period. Yet the extent of its increase has been much greater in the non-Objective 1 regions. Consequently, compared to that of the Objective 1 regions, the share of innovation promotion has remained generally much higher in the advanced regions during the two program periods. In other words, compared to the case in the less-favored regions, the innovation promotion has been more strongly intensified in the rich regions in the program period 2007-2013. These findings violate the basic idea of the new EU cohesion policy, which particularly aims at stimulating the catching-up process of the less-favored regions through the activation of innovation potential and the creation of a well-functioning innovation system in these regions. Furthermore, significant differences in the share of innovation promotion exist even within the group of the Objective 1 regions, which has also become more apparent for the program period 2007-2013. For example, the promotion share widely ranges from 16.3% (Canary Islands) to 41.0% (Valencia) and 79.8% (Cantabria). Hence, a more thorough investigation on the determinants of the share of innovation promotion appears to be necessary in order to explain its regional differences and examine whether objective and practice of the innovation-oriented EU cohesion policy are consistent.

Table 2: Innovation Promotion in Spanish Regions in the Context of EU Cohesion Policy

Region	Budget year 2000-2006				Budget year 2007-2013			
	Firm-oriented promotion	System-oriented promotion		Innovation promotion as a %-share of total public contributions***	Firm-oriented promotion	System-oriented promotion		Innovation promotion as a %-share of total public contributions***
		Expansion of public R&D capacity	Promotion of cluster, networking and knowledge transfer			Expansion of public R&D capacity	Promotion of cluster, networking and knowledge transfer	
Castile-La Mancha*		x		1.9	x**	x	x	25.7
Canary Islands*		x		4.2	x**	x	x	16.3
Castilla y Léon*		x		2.7	x**	x	x	36.3
Extremadura*		x		4.4	x**	x	x	23.5
Murcia*		x		3.4	x	x		30.8
Asturias*		x		2.2	x	x		35.2
Ceuta*				0.0	x		x	16.9
Melilla*				0.0	x**	x	x	20.3
La Rioja	x	x	x	26.7	x**		x	80.0
Andalusia*		x		3.0	x**	x	x	27.2
Valencia*	x	x	x	9.3	x**			41.0
Galicia*		x		14.7	x**	x	x	24.7
Basque Country	x	x	x	32.7	x		x	72.0
Catalonia	x	x	x	29.5	x	x	x	51.6
Navarre	x	x	x	42.1	x	x	x	90.4
Aragon	x	x	x	33.9	x**	x	x	81.0
Balearic Islands	x	x	x	26.9	x	x	x	56.2
Madrid		x	x	36.9	x**	x	x	61.7
Cantabria*	x		x	6.6	x	x	x	79.8

Notes: * = Objective 1 regions defined in the framework of the EU Regional Development Programs 2000-2006; ** = Mainly SME-specific promotion; *** = EU contribution + national contribution
Source: European Commission

3. Empirical Analysis

3.1. Data and Descriptive Statistics

In this section, we aim at taking a closer look at the determinants of innovation promotion (in shares and levels) to test whether the descriptive pattern found in the isolated inspection above also shows up in a multivariate analysis. For this purpose, we use various explanatory variables. These variables are measured at the level of the regional entities and are taken from different sources (see Table A1 in the Appendix for further information on data sources), including a study of the European Parliament (see European Parliament, 2007), the EU Regio database, and the European Regional Innovation Scoreboard (see Hollanders, 2006).

Against the background of the goals of the Lisbon agenda, innovation is particularly important in case of regions lagging in economic development. Hence, whether a region is already an innovative region or not should be an important aspect. We take this into account by using the variable *RIS*. This variable is measured such that a high score on the Regional Innovation Scoreboard (*RIS*) is associated with an enhanced performance in terms of innovation. The composite indicator comprises various aspects as, for example, business and public R&D expenditures, employment in high-tech manufacturing and service sector, as well as patent statistics. *A priori*, we would expect a more intensive innovation promotion in the context of the EU cohesion policy in those regions with a lower *RIS* value.

A standard measure applied by the EU to classify regions according to economic development is the regional *GDP per capita* (expressed in terms of PPS). If regions consistently pursue the goals of the Lisbon agenda, regions with low GDP per capita should, ceteris paribus, spend a higher share of their national and EU funds on innovation projects in order to achieve the economic catching-up. Moreover, we would also expect that a higher absolute level of innovation promotion is provided to less-developed regions.

Further variables of interest are measures that proxy for features of the local labour market. As one assumption of the new EU cohesion policy is that especially spending on innovation leads to growth and job creation, it intends to support regions with structural difficulties. Potentially relevant labor-market variables are the *Unemployment ratio* and the *Long-term unemployment* ratio. The variable for the long-term unemployed refers to the long-term-unemployment-to-total-employment ratio. A high ratio implies that the region is suffering from a serious structural problem. Such a structural weakness, in turn, belongs to the typical economic characteristics of lagging regions in the EU. As a consequence, if long-term unemployment is high, a region should more strongly focus on projects that promote innovation in order to overcome such economic difficulties as soon as possible. A similar argument can also be made in case of the unemployment ratio, which we expect to also positively relate to the share of innovation promotion as well as the level of innovation spending. Another appropriate variable that may proxy for labor-market aspects is the share of service sector employees, i.e. employment in the *Service* sector relative to total employment. A high share of employment in the service sector indicates that some structural change (‘deindustrialization’) has already taken place in a region. For this reason, the service variable is expected to exert a negative effect on innovation promotion.

We further control for the total local *Population* and the *Land area* to control for size effects, as well as for the *Population density* to capture differences of spillover effects in urban vs. rural regions. In general, densely populated urban areas are better equipped with the innovation system and more successful in terms of innovation. Moreover, we condition on a variable that may proxy for the level of development of a region in terms of R&D and education infrastructure. *University accessibility* is the share of the regional population that lives within 1-hour car driving time from the next university. Besides, the variable *GDP accessibility* is an indicator of the size of market areas for suppliers of high-order business services, which varies according to the degree of regional attractiveness as a modern high-tech location. Thus, if the regional policy consequently follows the rule that less-developed regions should be particularly stimulated by providing grants for innovation projects, a higher GDP accessibility is expected to

negatively relate to innovation promotion. Table 2 provides descriptive statistics for all variables used in our empirical analysis.

Table 3: Descriptive Statistics

Variable	Mean	Standard Dev.	Minimum	Maximum
Share of innovation spending	0.282	0.239	0	0.970
Level of innovation spending	666.299	981.347	6	6,531
2007	0.569	0.496	0	1
Objective 1 region	0.186	0.390	0	1
RIS	0.595	0.297	0.070	1.600
Ln(GDP per capita)	9.922	0.357	8.713	11.052
Unemployment ratio	0.090	0.046	0.025	0.280
Long-term unemployment	0.402	0.134	0.13	0.679
Employment in Service	0.663	0.089	0.448	0.887
Ln(Land area)	9.435	1.211	5.081	11.941
Ln(Population)	7.337	0.873	4.800	9.357
Ln(Population density)	4.800	1.251	1.194	8.747
University accessibility	0.704	0.230	0	1
GDP accessibility	0.966	0.967	0.022	6.363

Notes: 204 observations. If time-varying information is available, variable values refer to the years 1999 and 2006, respectively, depending on the program period. See Table A1 for more details on variable sources and definitions. *Level of innovation spending* is the amount of total innovation spending provided to a region (measured in 1,000,000 euro). *Share of innovation spending* is spending on innovation relative to total spending. *RIS* is an indicator that comprises the overall innovation performance of a region. *Objective 1 region* is a dummy variable taking value 1 if a region is classified as Objective 1 region, and 0 otherwise. *GDP per capita* refers to the regional GDP per capita in PPS. *Unemployment ratio* is the unemployment rate. *Long-term unemployment* is the long-term-unemployment-to-total-unemployment ratio. *Service* is the ratio of employment in the service sector to total employment. *Land area* is the land area of the region measured in square kilometers. *Population* refers to the total population of a region. *Population density* is the regional population density measured as inhabitant per square kilometer. *University accessibility* is defined as the share of the regional population living within 1-hour car driving time from next university. *GDP accessibility* is an indicator of the size of market areas for suppliers of high-level business services.

3.2. Results

Table 4 shows pooled regression results for the 2000-2006 and the 2007-2013 program periods. In this first regression analysis, we investigate the determinants of the share of innovation spending. Since the EU regions are supposed to increase their share of innovation spending in the 2007-2013 period, in column I, we first include the dummy variable *2007*, which takes value 1 if an observation refers to the period 2007-2013, and 0 otherwise. As expected from Figures 1 and 2 (and also from the descriptive analysis of the Spanish regions), we find that the EU regions place more emphasis on innovation with respect to their funding activities. The estimated coefficient in column I suggests that the EU has increased the share of innovation spending provided to regions by 21%

compared with the 2000 to 2006 period. Note, however, that this simple bivariate regression neglects other determinants which may have affected the EU's decision process. Since, according to the knowledge-orientation of the Lisbon strategy, we would expect that the increased focus on innovation is particularly pronounced for the Objective 1 regions, we further include the interaction term *2007*Objective 1 Region* and a dummy variable indicating *Objective 1 Regions* in column II.

Table 4: Regression Results – Share of Innovation Spending

	I	II	III	IV
2007	0.210***	0.208***	0.302***	0.112
	[0.049]	[0.063]	[0.040]	[0.083]
Objective 1 region		-0.138**	-0.107***	-0.084**
		[0.052]	[0.035]	[0.035]
2007*Objective 1 region		0.030	0.027	0.013
		[0.061]	[0.057]	[0.066]
RIS			0.227***	-0.070
			[0.063]	[0.077]
Ln(GDP per capita)				0.178**
				[0.073]
Unemployment ratio				0.080
				[0.430]
Long-term unemployment				-0.625***
				[0.174]
Employment in Service				-0.120
				[0.325]
Ln(Land area)				1.368*
				[0.785]
Ln(Population)				-1.363*
				[0.773]
Ln(Population density)				1.365*
				[0.782]
University accessibility				0.147**
				[0.056]
GDP accessibility				-0.005
				[0.014]
Observations	204	204	204	204
R-squared	0.191	0.230	0.269	0.455

Notes: Pooled OLS estimation, including an intercept (not reported). Dependent variable: share of innovation spending. Robust standard errors (clustered by country) in brackets. If available, all control variables refer to 1999 and 2006 values (see Table A1 for further definitions of control variables).
* significant at 10%; ** significant at 5%; *** significant at 1%.

While this specification shows that the share of innovation spending is significantly lower in Objective 1 regions, the coefficient for the interaction term is insignificant,

suggesting that there has not been a redistribution of innovation funds towards Objective 1 regions as of the recent program period. This is surprising since, for the earlier EU cohesion program 2000-2006, innovation promotion was not a priority policy issue, but instead regions were to pay their attention to infrastructure and education projects.

In order to investigate further aspects that might have an impact on the share of innovation promotion, the specification in column III includes the indicator RIS, capturing the innovation potential in a region as one major determinant of the share of innovation. If the primary goal of the EU cohesion policy was redistribution, we would expect a negative impact of RIS, because regions with already advanced innovation performance tend to require lesser funds for innovation projects relative to other projects promoted in the context of the EU cohesion policy. The estimated coefficient, however, points at a positive relationship. But, when adding 9 more control variables in specification IV, RIS becomes insignificant. Column IV shows that some additionally added variables are significantly related to the share of innovation. First, a higher regional *GDP per capita* increases the share of innovation promotion. Hence, as there appears to be comparatively greater need for innovation spending in less-developed regions, this finding seems to contradict the EU's policy goals of promoting growth by supporting innovative projects particularly in less-favored regions. Furthermore, a higher share of *long-term unemployment* is associated with a lower share of innovation spending and a higher degree of *university accessibility* is associated with more innovation promotion relative to total promotion. These two findings support the hypothesis that regions which are already economically advanced obtain a relatively higher share of innovation. This clearly violates the *a priori* expectation that the need for the innovation promotion tends to be particularly large in regions where long-term unemployment is high and the accessibility to university is poor. Finally, the findings for *university accessibility* and *population density* suggest that core regions are particularly supported.

However, most importantly, the analysis presented in Table 4 (column IV) shows that, when conditioning on a number of determinants capturing various characteristics of a

region, the share of innovation for the 2007 program period has not been increased for the average region and, besides, it has not been increased for the average (less-developed) Objective 1 region. In this sense, investigations relying on simple correlations as Figures 1 and 2, as well as columns I to III, may be misleading.

Of course, while considering variation in many determinants, the EU may have pursued a constant share of innovation spending across regions and over the two program periods, but, at the same time, may have provided more funds in absolute values. For this reason, we use the same regression framework to investigate the level of innovation spending, rather than the share, to learn more about the EU's financing policy. One obvious result from the analysis shown in Table 5 is that the level of innovation financing is, as expected, higher in *Objective 1 regions*. If the EU's regional policy particularly aimed at supporting innovation projects in these regions during the second (2007-2013) program period, we would expect that the interaction term *2007*Objective 1 region* shows a positive coefficient. In fact, though not statistically significant, we estimate a negative relationship. This is rather surprising, because it implies that there has been no major shift in the funding strategy, which confirms findings from Table 4. The same is true for the dummy variable *2007* indicating that, ceteris paribus, the 2007-2013 program does not differ from the 2000-2006 program with respect to the level of innovation spending. Concerning other determinants, specification IV shows that more financing is provided to less-developed regions, i.e. the variables *RIS*, *Ln(GDP per capita)* and *GDP accessibility* are negatively related to the total funds provided for innovation projects. Although this is in line with the basic policy goals of the EU's cohesion policy, the main conclusion from the regression analysis in Table 5 is that, ceteris paribus, there has not been a considerable realignment of the EU's policy towards more innovation funding.

Table 5: Regression Results – Level of Innovation Spending

	I	II	III	IV
2007	85.539	136.641	-186.877	-95.356
	[132.473]	[122.907]	[113.883]	[155.408]
Objective 1 region		1,531.129***	1,425.329***	1,163.800***
		[487.088]	[442.751]	[262.214]
2007*Objective 1 region		-472.571	-463.642	-368.395
		[372.257]	[326.640]	[295.780]
RIS			-781.826***	-576.792*
			[232.248]	[297.465]
Ln(GDP per capita)				-670.515**
				[274.928]
Unemployment ratio				-1,210.380
				[2,629.004]
Long-term unemployment				620.006
				[905.594]
Employment in Service				801.575
				[965.487]
Ln(Land area)				3,330.340
				[2,501.691]
Ln(Population)				-2,898.776
				[2,489.096]
Ln(Population density)				3,446.099
				[2,494.188]
University accessibility				-373.814
				[259.777]
GDP accessibility				-162.213***
				[37.980]
Observations	204	204	204	204
R-squared	0.002	0.257	0.284	0.536

Notes: Pooled OLS estimation, including an intercept (not reported). Dependent variable: level of innovation spending. Robust standard errors (clustered by country) in brackets. If available, all control variables refer to 1999 and 2006 values (see Table A1 for further definitions of control variables).
* significant at 10%; ** significant at 5%; *** significant at 1%.

4. Conclusion

The integration of the Lisbon strategy in the EU cohesion policy has created some tensions between competitiveness aims and cohesion aspirations. The twin objectives of enhancing competitiveness in the global context and economic and social convergence among European regions are contradictory and inherently comprise different policy options. The so-called innovation trap tends to occur when making relevant EU policy intervention, which results from the apparent contradiction between the comparatively greater need to spend on innovation in lagging regions and their relatively lower

capacity to absorb public funds earmarked for the promotion of innovation and to invest in innovation-related activities, compared to more advanced regions.

This study questions the consistency between the cohesion policy objectives and its practice. Empirical findings of the study show that there has not been a significant change in the financing practice. We would have expected such a change according to the new orientation of the EU's cohesion policy, which is supposed to place more emphasis on innovation-related promotion. While less-developed regions obtain higher absolute amounts of innovation funds, innovation spending (as a share of total spending as well as in absolute values) has not been increased for the program period 2007-2013 compared with the earlier period 2000-2006. Since we would expect that more funds have been allocated to Objective 1 regions – to increase the long-term prospects to benefit from innovation there – we also investigate whether the later program period features more innovation promotion in these regions. In fact, after conditioning on various other determinants, we find that the extent of innovation spending, measured as the share of innovation spending as well as the level of innovation spending, has not changed significantly for Objective 1 regions.

To conclusively evaluate our finding of no significant change in the EU's regional policy strategy, the aimed-at new orientation of the EU cohesion policy raises a number of basic questions which need to be addressed first: (a) Is it possible for a region with limited expertise in knowledge creation to take full advantage of new knowledge?; (b) Is it sufficient to use dissemination and technology transfer instruments to upgrade the regions with limited capabilities for indigenous knowledge creation?; (c) Are there arguments for investment in innovation network system in less-favored regions to repair structural imbalances in innovation potential? (see also Musyck and Reid, 2007). Innovation takes time and many innovation efforts remain in vain. In addition, we are now just at the beginning of a new cohesion policy era. The best one can expect in the short run appears to be the increased and better targeted provision of financial resources for more EU lagging regions which help them to enhance their absorptive capacities of knowledge – the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends – at least to keep up with developments

elsewhere (see also De Bruijn and Lagendijk, 2005). To evaluate whether EU cohesion policy has successfully improved the absorptive capacity of knowledge in the less-favored regions remains an important task for future research.

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Table A1: Variable Description and Data Sources

Variable	*Description*	*Database*
Share of Innovation Spending	Innovation supporting funds provided by the national government and the EU relative to total expenditures for the respective budget period	EU Regional program 2000-2006, 2007-2013
Level of Innovation Spending	Innovation supporting funds provided by the national government and the EU	EU Regional program 2000-2006, 2007-2013
RIS (Regional Innovation Scoreboard) 2006*	A re-scaled synthetic indicator showing the overall innovation performance of regions in the EU	Hollanders (2006)
GDP per capita	Regional GDP per capita (in PPS); yearly data 1999-2006	EU Regio database
Unemployment ratio	Unemployment rate 1999-2006	EU Regio database
Long-term unemployment	Long-term unemployment in 2005 as share of total unemployed persons	EU Regio database
Employment in Service	Employment in service sector relative to total employment in 2005	EU Regio database
Land area	Land area in square kilometer	EU Regio database
Population	Total population of a region	EU Regio database
Population density	Regional population density measured as inhabitant per square kilometer (1999-2006)	EU Regio database
University accessibility	Share of regional population living within 1 hour car driving time from next university	Study of the European Parliament (2007)
GDP accessibility**	An indicator of the size of market areas for suppliers of high-level business services, standardized at EU27+2***	Study of the European Parliament (2007)

Notes: * The RIS 2006 is calculated based on a set of seven determinants, capturing human resource and knowledge creation indicators from different statistical sources such as labor force survey, R&D statistics and patent statistics. These seven determinants include: (1) human resources in science and technology – core (% of population in 2004), (2) participation in life-long learning (% of 25–64 years age class in 2004), (3) employment in medium-high and high-tech manufacturing (% of total workforce in 2004), (4) employment in high-tech services (% of total employment in 2004), (5) public R&D expenditures (total R&D expenditures – business expenditures on R&D) (% of GDP in 2002), (6) business expenditures on R&D (% of GDP in 2002), and (7) The European Patent Office (EPO) patent applications (per million population in 2002).

** Potential accessibility is measured based on the assumption that the attraction of a destination increases with size, and declines with distance, travel time or cost. Destination size is usually represented by GDP or population. In other words, the potential accessibility is a construct of two functions, the *activity function* representing the activities or opportunities to be reached and the *impedance function* representing the effort, time, distance or cost needed to reach them. For potential accessibility the two functions are combined multiplicatively.

*** Switzerland and Norway.