

When Regional Innovation Policies Meet Policy Rationales and Evidence: A Plea for Policy Analysis

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Keywords: Catalonia, Basque country, Galicia, Andalusia, regional innovation system, smart specialisation, policy change, regional advantage, policy mixes, policy instruments, regulatory governance, Spain.

JEL: O38, O31, E61

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A Plea for Policy Analysis

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In spite of recent advancements regarding regional innovation policy rationales and evidence, there are few analyses about the actual features of existing regional innovation policies. Nevertheless, a policy analysis perspective is important in order to recognise their distinctive patterns across regions, and to understand how rationales and evidence can be translated into policy-making. To this purpose, this paper develops a framework to study the extent to which regional innovation policies have changed during the past few years. Since the mid-2000s there has been an important development of innovation policy rationales, advocating for more specialisation; likewise, greater data availability at the regional level has allowed more sophisticated assessment of innovation performance. Finally, the crisis since 2008 has had ravaging effects in some regions, with job losses and severe economic sluggishness. Therefore, it is reasonable to expect transforming dynamics in regional innovation policies. Against this backdrop, the paper compares the institutional frameworks and budgetary priorities of four Spanish regions during the period 2001-2014: Catalonia, the Basque country, Galicia, and Andalusia. In so doing, it aims at studying the extent to which regional governments have readily addressed past and new challenges related to their regional innovation system, and if so, how.

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1. Introduction

The widespread view among academics and policy-makers alike is that regional innovation policies must address the problems posed by their specific socio-economic context and not be “one size fits all” responses (Tödting and Trippel 2005). However, for all its usefulness and relevance, most studies of regional innovation performance tend to overlook this. More concretely, they overlook the real life of policies, that is, those that regional governments have been developing over time, and that today form part and parcel of the institutional framework of the regional innovation system. Any exercise that aims at helping regional governments developing strategies to address the problems of their innovation systems logically requires knowing about the actual policies that those governments have already in place. This is the reason why these advanced regional innovation policy rationales need to be complemented by an analysis of actual policies.

Policy analysis takes the regional innovation policies as an object of study on their own right, studying particular ideas inspiring them, as well as the features and dynamics of its policy instruments, initiatives, or overall structure. It is worth noting that policy analysis differs from the normative formulation of rationales, but that both complement each other in at least two important ways because the latter must not take for granted the complexities of regional policy-making, and, perhaps most importantly, because regional innovation policy can be seen as part of an overall regional innovation system. By defining some regulatory and/or governance-based institutions, and by seeking (successfully or unsuccessfully) to transform innovation dynamics and economic performance, relevant policy is intrinsically embedded in the socio-economic functioning of the regional innovation system.

With the purpose of analysing regional innovation policies, this paper studies the extent to which some have changed recently. This is motivated by three relevant macro-trends. The first is the recent advances of regional innovation policy rationales, most of which advocate governments adopting specialised and adaptive innovation policies. As we will review in the next section, rationales like “constructing regional advantages” or, more recently, “smart specialisation” have become widespread among social scientists and policy-makers alike. Likewise, the second trend is the greater availability of data at the regional level, which has allowed for more sophisticated evidence assessment of innovation performance. Finally, the economic crisis that has hit Europe since 2008 has had serious effects in some regions, with job losses and severe economic sluggishness. On the basis of these three large trends, it is reasonable to expect that some regional governments have introduced significant changes in their regional innovation policies.

Against this backdrop, the paper compares the changes in the institutional frameworks and budgetary priorities of four Spanish regions from 2001-2014: Catalonia, the Basque country, Galicia and Andalusia. In so doing, it aims at studying the extent to which regional governments have readily addressed past and new challenges related to the performance of

their regional innovation system, and if so, how. To be sure, this paper does not aim at identifying the explanatory factors behind these regional-level transformations (or lack thereof), but rather studies the extent and nature of these possible transformations.

The paper proceeds as follows. The next section reviews the literature on regional innovation policy analysis, examining different strands. Section 3 showcases some analytical tools for the dimensions of policy analysis in this paper, as it operationalises the study, clarifies the selection criteria of our four case studies, and characterises their innovation system's performance. The next two sections look at the changing patterns of the institutional frameworks (section 4) and budgetary priorities (section 5) of these four regions. The concluding section summarises the findings regarding the extent to which the regional governments have transformed their innovation policies during the period, bringing forward the old and new challenges of these four regions, as characterised in section 3. The paper concludes with a plea for a renewed approach that brings closer scrutiny to policy change (policy analysis) and those of regional innovation systems' performance.

2. Regional Innovation Policy Rationales and Economic Evidence: A look at the Literature

There is a vast literature dealing with innovation policy rationales. According to Lagendijk, one can distinguish between meta-rationales, which are typically assumptions at the highest level of abstraction regarding, for example, market failure, welfare distribution, or system failure; and policy rationales proper, with more concrete guidance towards knowledge production, dissemination, etc. (Lagendijk 2011). Lagendijk also points at the tendency of knowledge-based economy policy rationales to be rather ambiguous and broad, mainly due to the nature of knowledge itself (its tacitness or possible codification), and the complex and indeterminate role of proximity and distance as a competitive advantage (not only based on localized knowledge sources but also to the absorption of external knowledge sources too).

Some critical remarks about the ambiguity of general rationales have also been put forward by Laranja et al., who have addressed this issue from a regional perspective. They stress that general innovation policy rationales have been either developed at the state level or have tended to adopt a rather 'non-spatial' perspective (Laranja, Uyerra et al. 2008), p. 284). Laranja et al. point out how few attempts to make links between specific policy rationales with specific regional innovation patterns have been made. For that reason, "the territorial implications of different economic theories of innovation and technical change remain unclear" (Laranja, Uyerra et al. 2008) p. 284).

During the past decade there has been an increasing effort to fill these deficiencies and to reduce ambiguity in regional-level innovation policy rationales. With this in mind, scholars have started to draw on theoretical developments with geographical and territorial

considerations, like “smart specialisation” and “constructing regional advantage”; or those derived from a growing sophistication of empirical (evidence-based) studies of different patterns of regional innovation performance (Cooke and Tödtling 2000).

Both ‘smart specialisation’ and ‘constructing regional advantage’ are anchored in the evolutionary and institutional innovation systems’ theories, and aim at providing context-based policy rationales that address the needs of the particular territory. As an overall policy rationale, “smart specialisation” has perhaps received the most public attention, as it has been developed within the European Union, and is used in the EU’s regional innovation strategies (RIS³) policy (Kroll, Böke et al. 2016). Put in a nutshell, it basically advocates that “regions – in particular the less advanced and transition regions – need to build capabilities – not only generic capabilities but also capabilities within specific fields, technologies, and sub-systems in order to build competitive advantages in few market niches.” (Foray 2014) p. 492). Smart specialisation is the spontaneous outcome of entrepreneurial discovery, a combination of different knowledge sources, spillovers in the form of entry and agglomeration of firms, and subsequent structural change. However, when this does not take place spontaneously (especially in peripheral regions), policies might seek to foster it (McCann and Ortega-Argilés 2013). This vision forms the backbone of several EU regional policy initiatives, yet it is still somehow discussed by scholars on several grounds, namely, because it tends to disregard the larger variety of possible innovation patterns beyond core-periphery dichotomy, and to overestimate the linkage between knowledge production and its exploitation for growth (Capello and Lenzi 2013).

Another meta-rationale for regional innovation policies is the ‘constructing regional advantage’ approach (Boschma 2014). It is anchored in the tradition of regional knowledge bases (Asheim, Coenen et al. 2007), and puts emphasis on the fact that regions have different industries that differ in their knowledge bases, requiring a more diversified policy design (Isaksen and Nilsson 2013). This is particularly important for peripheral regions, which suffer from institutional and organisational thinness (Martin and Trippl 2014).

Looking at the second large move towards regional innovation policy rationales mentioned above, one of the most significant first movers in using empirical studies into regional rationale identification were Tödtling and Trippl (2005). They took a first step into relating specific features of the regional innovation system with specific policy rationales at the regional level. Avoiding “one size fits all”, they identified three types of overall problems in different regions, namely, peripheral regions with organisational thinness; metropolitan regions with fragmentation of existing capabilities; and old industrial regions with problems of lock-in and lack of knowledge diversity. These regional system problems are the goal for the definition of more tuned and specific regional innovation policies. A more recent study of the OECD moves in the same direction. Past and present experience of OECD regions reveal that regions face three main types of choices, with three corresponding families of strategies: building on current advantages (science push, technology-led, or a mix); supporting socio-economic transformation (reconversion or identification of a new frontier); and catching up (the creation of knowledge-based capabilities) (OECD 2011) p. 78–79). This

broad typology is derived from the OECD categorisation of regions according to major economic and innovation-related data, pointing out problems inherent to the different regional innovation systems. More recently, some authors have developed a new empirically based taxonomy of regional innovation patterns that focus on the different modes of the knowledge-innovation nexus. On this basis, Camagni and Lenzi identified five distinct clusters of regions: European science-based regions, applied science-based regions, smart technological applied regions, smart and creative diversification regions, and imitation innovation regions (Capello and Lenzi 2013).

There is currently a fluid and unfinished process between the development of meta-rationales on the one hand, and the specific policy implications derived from economic taxonomies on the other. This fluidity is reflected in the vibrant scholarly debates surrounding the assumptions from these meta-rationales that search for policy-friendly guidelines that are both theoretically and empirically solid from the perspective of knowledge economics (Boschma 2014).

The rapid development of these rationales for regional innovation policies has not been matched by a similar rapid growth in policy analysis. There might be two reasons for that: first, there are conceptual difficulties associated with the multi-level dimension of policies, such as the cross-national diversity on the role of regions (OECD 2011), the difficult analytical distinction between regional policies from national policies with regional effects, and the complexities of multi-level coordination in the region (Nilsson and Moodysson 2014). Second, there are empirical difficulties dealing with data about policy priorities, goals, institutions, instruments, etc., that are not easily accessible. We will address these issues below. In the meantime, it is worth noting that there are relevant results emanating from the scarce policy analyses. One of the first studies showed the large diversity of policy instruments used and developed by regional governments. In their 2003 study, Asheim et al. identified no fewer than 40 distinct policy instruments in 11 European regions (Asheim, Isaksen et al. 2003). Subsequent studies have gradually provided more sophisticated approaches to the policy mixes of regional innovation policies. From Garofoli and Musyck's initial distinction of seven general sets of policy instruments (Garofoli and Musyck 2003), to the larger pool of 31 policy instruments identified by a later OECD study (OECD 2011).

Likewise, some single-case studies have provided a detailed analysis of individual regional innovation policies. As relevant examples, Eickelpasch and Fritsch have shown that the critical issue is not really the design of regional policy instruments, but their implementation, which tends to transform over time (Eickelpasch and Fritsch 2005). Likewise, some authors have found that regional governments tend to be too generic when designing policy instruments, not customising them enough regarding the specific needs of the region (Martin, Moodysson et al. 2011).

The literature on policy analysis reviewed here provides useful insights about regional innovation policies. However, it leaves unsolved the issue of how to study policy changes in

this area, so that it brings policy analysis closer to studies of regional innovation performance.

3. Operationalising the Study, Selecting and Characterising the Cases

This paper suggests operationalising the study of regional innovation policy change by examining two interrelated issues, namely, the transformations in the institutional dimension of innovation policies, according to regional government organisational priorities; and the shifting budgetary priorities of regional public expenditure on research and innovation.

Regarding the first of these issues, the study will pay special attention to changes of trajectory of existing forms of supporting and organising the performance of research and innovation activities in the region. “Change of trajectory” refers to a deviation from previous organisational forms due to different possible situations, for example, the addition of new and important agencies and other organisational forms, or/and the reduction of existing ones, or/and the gradual modification of the nature and purpose of existing public organisations dedicated to research and innovation; all of them in a way that the regional policy has clearly expressed new priorities and emphasis which are distinct from previously defined patterns.

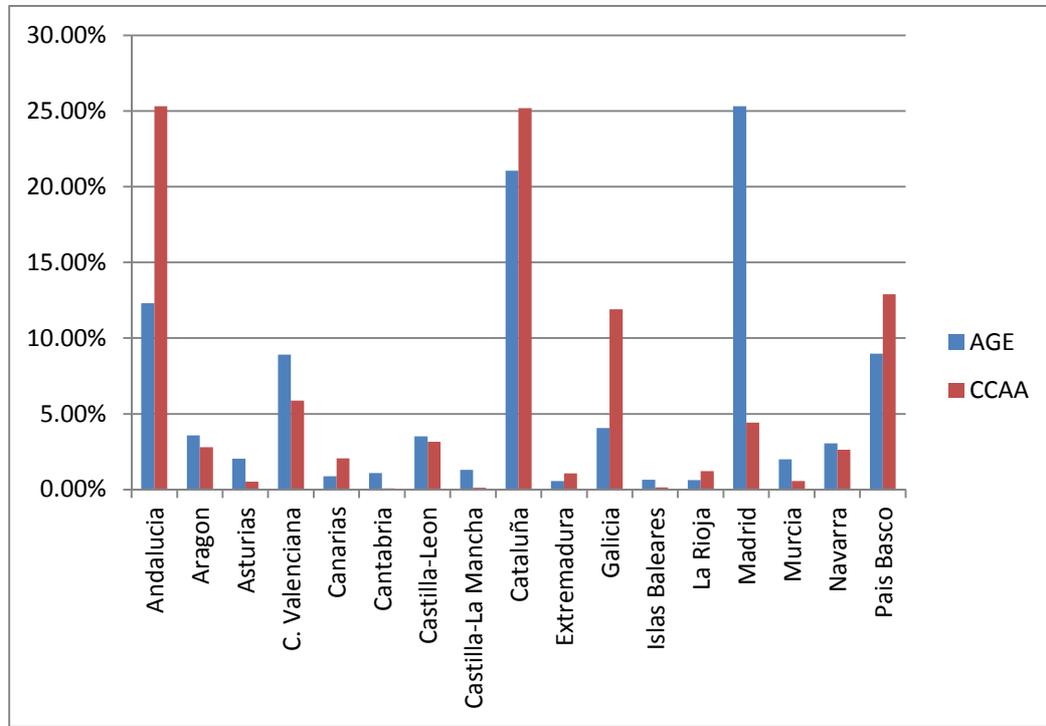
The second of these issues, the study of budgetary priorities, will clarify the transforming dynamics of public expenditure efforts into the different areas of innovation policy at the regional level (universities, private firms, PROs, etc.). Like the previous item, the analytical focus will be primarily on identifying deviations from previous patterns. This second item is particularly important in view of the budgetary constraints that regional governments have experienced since 2008.

As mentioned earlier, our study expects to find significant deviations in the regional innovation policies in Spain due to three parallel trends in the period 2001-2014, namely, the emergence of well-articulated and regional-level innovation policy rationales, the growing number of comparative analysis of cross-regional innovation performance, and the economic crisis since 2008. In order to study this, the paper has chosen four regions in Spain: Catalonia, the Basque country, Galicia, and Andalusia. This situation conforms to a quasi-natural experiment that will allow us to better identify and assess the relevance of dynamics strongly related to the regional-level of innovation policy, as the Spanish national dynamics remains a constant. Furthermore, choosing Spain is particularly relevant, as the country has been hit hard by the economic downturn since 2008, at a time when many national as well as regional governments had devoted considerable efforts to innovation policy.

Cross-regional variations are important in Spain in terms of economic development levels, industrial and services activity, and overall innovation performance. Likewise, the territorial distribution of national Spanish government expenditure and the economic efforts of

regional governments on research and innovation are both quite diverse, as indicated in Figure 1.

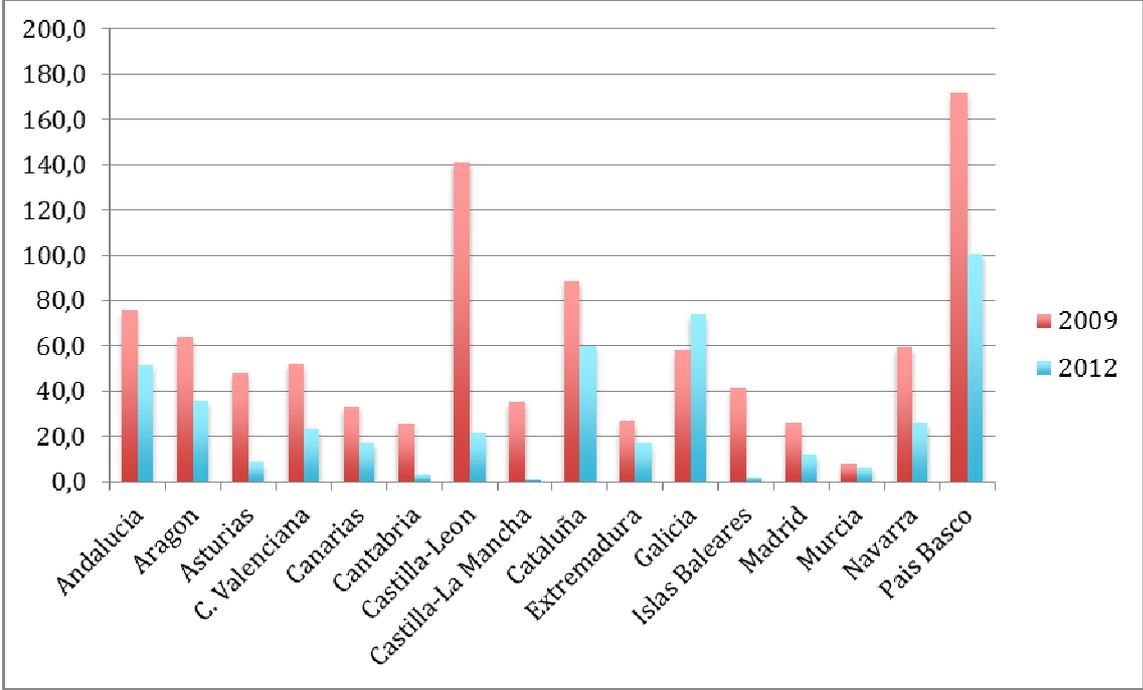
Figure 1. Percentages of R&D expenditure in Spain by regions, funded by Spanish Government (AGE) and by Regional Governments (CCAA), 2012



Source: MEC-FECYT, *Memoria de Actividades de I+D+I*, 2012

Our criteria for selecting Catalonia, the Basque country, Galicia, and Andalusia are based on two interrelated, but distinct accounts. First, these four regions have governments which have been most clearly committed to research and innovation issues among the 17 Spanish regions, having a higher share of their expenditure than the equivalent Spanish government share in the region (see Figure 1). In addition, as can be seen in Figure 2, per capita variations regarding regional governments' expenditures in R&D policies are relatively large. We can appreciate that almost all Spanish regions decreased their expenditures between 2009 and 2012, most quite dramatically (with the exception of Galicia, which introduced some cuts after 2012). While 2009 was a year in which public spending was still expansive, aiming to confront the crisis, 2012 epitomises the strong fiscal adjustment. Thus, avoiding large cuts was a clear signal that R&D and innovation was a policy area of main concern for these four regional governments. Thus, Catalonia, the Basque country, Galicia, and Andalusia are the regions with the highest regional government expenditure on R&D per capita in 2012. Hence, we choose these four regions, as well because they also had strategic plans elaborated before and during the crisis (see next section).

Figure 2: Evolution 2009–2012 of regional governments’ expenditure in R&D (Euros per capita)



Source: MEC-FECYT, *Memoria de Actividades de I+D+I*, 2009 & 2012

Second, our selection aims at studying regions that cover the most substantial variations identified by the literature. Based on Tödting and Trippel’s (2005) typology of regional problems, the four cases constituted a metropolitan region with problems of fragmentation in their capabilities (Catalonia), an old industrial region having lack of knowledge diversity (the Basque country), and two peripheral regions with problems of organisational thinness (Andalusia and Galicia).

After a careful consideration and exploration of different types of data, we will rely on a mix of qualitative and quantitative assessments about the policy strategies of the four regions selected. We aim to observe the variations in their regional innovation policies since 2001 in terms of institutional frameworks and budgetary priorities. In so doing, we will be able to discuss in more detail the expectations placed in the previous section of this paper. Before that, an initial characterisation of our case studies will allow us to identify their most relevant innovation-related challenges.

Among several attempts to identify Spanish regional differences in innovation policies, we should highlight the early study that distinguished between two approaches to innovation policy by regional governments: the academic approach (mainly universities and public research centres), and the business approach (mainly technological centres and innovative

firms) (Sanz-Menéndez and Cruz-Castro 2005). Considering the period 1980-90, these authors found a predominance of the first approach in most regions, with only one case clearly related to the second (the Basque country). In the next section, we examine the extent to which these approaches remained or were transformed in the four case studies from 2001-2014. Moreover, we examine how the (transforming) policy priorities of regional governments are related to the problems and challenges that characterise the patterns of innovation performance in the regional economy.

In order to better understand the socio-economic constraints and the strategic options of regional governments in innovation policy, we need to rely on more refined distinctions of structural patterns in the regional innovation systems. One recent economic study provides a solid basis for that. Based on it, this paper makes an initial characterisation of the problems that the four selected regions are facing. The study is the recent typology of European regions according to three distinct dimensions (Capello and Lenzi 2013). This multi-dimensional approach separates knowledge from innovation, acknowledging that there are different possible patterns and pathways in which these two relate in the knowledge-based economy, thus avoiding the 'one size fits all' pathway. The three dimensions are industrial and high-tech service specialisation (typology I), technological activity and human capital endowment (typology II), and linkages to external sources of knowledge (typology III).

Typology I looks at two sub-dimensions, namely, the regional specialisation in knowledge-intensive sectors and in high-tech manufacturing. Examining the positioning of the four cases reveals some unexpected results. *Vis-à-vis* typology I, Catalonia and the Basque country are considered "advanced manufacturing regions" whereas Galicia and Andalusia are "low-tech regions" (Capello and Caragliu 2013). It is worth noting that no Spanish region is a "technologically advanced region".

Vis-à-vis typology II, among our four cases, only the Basque country is considered a "scientific region", scoring high on both dimensions. Catalonia is a "human capital intensive region", whereas Galicia and Andalusia are "regions with no specialisation in knowledge activities" (Colombelli, Foddi et al. 2013). This is somewhat surprising for Catalonia given its extensive emphasis on scientific knowledge production. As the findings of these authors indicate, Catalonia has significant human capital, but a below-average specialisation in regional technological activity.

Vis-à-vis typology III, which examines the linkages to external sources of knowledge along the axis of low/high formal and informal linkages, the Basque country is a "globalising region" with high formal linkages and low informal linkages, whereas Catalonia, Andalusia, and Galicia are "non-interactive regions", scoring low on both formal and informal linkages (Miguelez, Moreno et al. 2013).

Table 1: Summary characterising the four regions' innovation systems

	Typology I High-tech manufacturing and regional specialisation in knowledge-intensive services	Typology II Human capital endowment and technological activity	Typology III Formal and informal links to external sources of knowledge
Catalonia	<i>Advanced manufacturing region</i> (Above-average specialisation in high-tech manufacturing, and below-average knowledge intensive services)	<i>Human capital intensive region</i> (Above-average quantity of human capital and below-average technological activity)	<i>Non-interactive region</i> (Low formal linkages and low informal linkages)
Basque country	<i>Advanced manufacturing region</i> (Above-average specialisation in high-tech manufacturing, and below-average knowledge intensive services)	<i>Science region</i> (Above-average quantity of human capital and above-average technological activity)	<i>Globalising region</i> (High formal linkages and low informal linkages)
Galicia	<i>Low-tech region</i> (Below-average specialisation in high-tech manufacturing, and below-average knowledge-intensive services)	<i>No specialisation in knowledge activities</i> (Below-average quantity of human capital and below-average technological activity)	<i>Non-interactive region</i> (Low formal linkages and low informal linkages)
Andalusia	<i>Low-tech region</i> (Below-average specialisation in high-tech manufacturing, and below-average knowledge-intensive services)	<i>No specialisation in knowledge activities</i> (Below-average quantity of human capital and below-average knowledge production)	<i>Non-interactive region</i> (Low formal linkages and low informal linkages)

Source: Own elaboration from (Capello and Caragliu 2013, Colombelli, Foddi et al. 2013) and (Miguelez, Moreno et al. 2013)

4. Transforming Regional Innovation Policies - Institutional frameworks

This section and the following one present and discuss the four cases of regional innovation policy in Spain identified above, aiming to explore the regional governments' strategies regarding the transformation of their innovation-related institutional frameworks and changes in their budgetary priorities. It is critical to be reminded that all four selected regions share a committed effort to invest significant amounts of their own regional public resources into the regional innovation system.

Catalan policy priorities during the 1980s and 1990s supported basic research activities in universities, reinforcing an orientation already intense at the Spanish level. However, new priorities emerged in the early 2000s. On the one hand, the Catalan government started to promote separate structures outside universities, namely, public research organisations (PROs), mainly in basic science, while, on the other hand, a few policy instruments were introduced promoting technology and innovation in firms, as well as technology centres (i.e., sectoral cluster programmes). Separate regional governmental ministries, having few contacts among them, led these initiatives. This created what (Bacaria, Borrás et al. 2004) called, "the bipolar structure of the Catalan regional innovation system", that is, two separate policy frameworks, with the latter almost ignoring basic science and academic research, and the former perceiving the business world as very distant.

This bipolar structure has remained quite stable during the last 15 years in Catalonia. On the one side, ACCIO, the Catalan agency for firm competitiveness, supported a network of technology centres and university research groups (TECNIO) and provided some direct assistance to industrial clusters and innovative firms. On the other side, the Catalan ministry in charge of research has been promoting establishing a relevant number of basic science-oriented Public Research Organisations (PROs) separate from universities, and creating their own network (CERCA). These aimed to raise the regional scientific and research performance, aiming primarily at international scientific excellence. Prioritising excellence in science and basic research has continued during more than 15 years of policy-making, while Catalan universities are no longer the leading actors in the public research efforts, and some of their best faculty have moved out to the new PROs.

The advancement of technology and business-oriented innovation policies in Catalonia has never been prioritised as highly as the academic and science excellence development strategy. The Catalan Agency ACCIO has promoted technology centres since the early 2000s, but they were not entirely successful. These centers were meant to run large projects in collaboration with industry (i.e., European research grants), and to establish links with universities, attracting some of their researchers. However, overall, they did not manage to play a nodal role connecting firms' knowledge and technology needs, with research activities. Furthermore, firms have not been the target of any significant R&D&I programmes

by the Catalan government (and Catalan firms rely almost entirely on the support provided by the Spanish technology agency, CEDETI).

Only from 2007-2010 was there a short-lived attempt to shift priorities to a more integrated innovation policy in Catalonia, on the basis of some new policy rationales already visible in its strategic plan for research and innovation in 2005-2008 (OECD 2010), and better delineated in the 2010-2013 plan. During that period, a new regional government merged the Vice Ministry for Research and Universities with the Ministry for Economic Development, uniting for the first time all responsibilities for research and innovation in a single department. However, effective coordination proved difficult, and the new policy priority never truly took off. Consequently, the governmental responsibilities were separated again shortly after; as a result, most of the bipolar policy structure remains unaltered.

Most relevant is that, during the hardest years of the economic crisis' budgetary retrenchments (2011-2014), the new regional government made efforts to keep the Catalan bipolar model unaltered, non-implementing the 2010-2013 plan. On the academic side, while university resources were cut very significantly, basic science PROs kept most of their funding. On the firm-based innovation side, the regional Ministry of Business and Labor experienced a large reduction of the funds available for innovation policy instruments. Only a few innovation programmes survived, and most technological centres were merged. Simultaneously, a few new programmes seeking to foster connections of research centres and universities with firms have started to emerge in the strict context of the European Union's RIS³ policy (Regional Innovation Strategies).

The second case study, the Basque country, has developed a regional innovation policy centred on supporting the business and industrial communities, which was largely a continuation of the policies developed in the 1980s. For most of this period, the Department of Industry has been the leading public body responsible for the design of regional innovation policy, focusing on the modernisation of the economy (implemented by the Basque Agency of Business Development, SPRI) and with significant continuity across different governments (Valdaliso, Magro et al. 2014). The Basque country policy has been predominantly focused on technology and innovation, emphasising business development and firm agglomeration (clusters), which has some common points with the smart specialisation strategy promoted by the EU (Aranguren and Wilson 2013). The development of well-funded technological centres in the 1980s aimed to establish solid links with industry, and direct support to firms engaged in technology and innovation activities have been the two main pillars of the region's innovation policy for more than 30 years.

The Basque innovation system initiated a policy priority shift in the mid-2000s with a new strategic plan (Plan de Ciencia, Tecnología e Innovación, 2007), followed by the introduction of new institutional developments. The overarching Basque Council of Science, Technology and Innovation, established immediately after the launch of the strategic plan in 2007, aims at coordinating all the relevant actors, including universities, government departments

and agencies, key policy-makers, and firm representatives. Hence, this policy change introduced a more systemic perspective, bringing science and research closer to technology and business-driven innovation. Some new implementation agencies were created with this purpose in mind: Ikerbasque, for funding and promoting basic research, and Innobasque, oriented to innovation initiatives and to stimulate connectedness. Moreover, in 2010 the well-established technological centres merged into a single organisation (Tecnalia), to gain more operational capabilities. IK4, which is a network of other technological centres, did not take part in this merger. For that reason, there are today two large technology centres in the region. Moreover, during that period, new hybrid centres were created to support the new strategy, namely, CICs (basic and applied research, dependent on the Industry Department) and BERCs (basic research, dependent on the Education Department).

Previous to that, during the 1980s and 1990s, the research activities of the university of the Basque country (there is only one public university in the region) were not considered relevant for the regional strategy of innovation policy. Thus, research in universities was not strongly sustained by the regional government. In fact, basic science was not a priority for the regional government until late 2008-2009, once the new institutional design had been established. The second 2010 plan on Science, Technology and Innovation continued this line, introducing new strategic goals to support basic research, and to strengthen linkages between science and industry (Navarro, Valdaliso et al. 2013). The view behind that was to expand the knowledge base of industry, to make the knowledge base of the industry broader, generating absorptive capacities in the industrial sector. However, the traditional separation between these two worlds created an institutional path that remains difficult to rectify (OECD 2011), not least due to the scientific weakness of research units in the region. This remains a challenge for Basque regional policy-makers.

Moving to Andalusia, we find a different development path in its regional innovation policy, but the problems are similar to the Catalan case above. Andalusia also initiated its own policy in the 1980s, with a focus on reinforcing universities' research activities; this lasted until 2000 (Romero et al., 2003). In a similar vein to Catalonia until the early 2000s, university and research policies in Andalusia were stronger and better funded than technological and innovation ones, which remained completely separated from each other. In Andalusia, university and research policy was located within a ministry, while technology and innovation policies suffered from institutional instability, with discontinuous implementation (Quesada & Rodriguez Cohard, 2014).

In the early 2000s, a new design for innovation policy was introduced, strongly influenced by European narratives on industry and innovation in the framework of the Lisbon strategy. Technology centres were established to promote development and innovation, while cluster policies were also introduced. This also represented a case of policy transfer within Spanish regions: while the latter were inspired by the Basque country and Valencia initiatives, the former replicated the few initiatives launched in Catalonia during the previous decade. However, fragmentation of innovation policies in the region remained. This new policy

initiative also represented a significant priority shift: while funds for innovation and technological development escalated at that time, funding for universities and research stagnated or decreased.

Aiming to overcome the bipolarity problem, in 2004 a governmental reorganisation merged research, universities, firms and development policies in a single department. The involvement of universities was one of the main goals behind this strategy. The new institutional strategy also involved the launch of a new strategic plan in 2007, including research, development and innovation (Plan Andaluz de Investigación, Desarrollo e Innovación, PAIDI), and the creation of new agencies to strength collaboration between industries and universities. The new institutional design was quite impressive, but it proved to be excessively large and complex (Quesada Vazquez and Rodriguez Cohard 2014). Years after, during the crisis, this design was substantially simplified.

According to region experts, this integrated model is far from functioning effectively. The capacities of the productive system to absorb scientific knowledge and foster innovation remains quite weak, and policies have not devised mechanisms for knowledge transfer mechanisms to SMEs. However, instead of addressing such issues, most Andalusian policy efforts in recent years have prioritised technologically intensive sectors, providing high-tech services to large firms (Quesada & Rodriguez Cohard, 2014).

Taking now our fourth case study, the origin of the regional system of innovation in Galicia was feeble, with few policy initiatives until the 1990s (González López, 2003). The first *Plan Gallego de IDT* in 1999 was primarily concerned with infrastructures and basic research. The second plan (2002-2005) gradually introduced goals to link university and industry (González-López, Dileo et al. 2014). The third *Plan Gallego de I+D+I 2006-2010*, included elements of a new innovation policy rationale, and was particularly strong at creating several new policy instruments towards university-industry relations.

During this period, there was a strong institutional stability regarding the public bodies in charge of the policy. The regional Ministry of Education was responsible for the main strategy focused in supporting research and development in universities. In addition to the goal of improving actual levels of academic personnel—and to improving its productivity—a major focal point for funding was the establishment of a number of large research centres within universities, in particular at the University of Santiago de Compostela, where 26 centres were established. Likewise, a network of technological centres was also established (RECETGA), with each centre devoted to a very specific activity, often in collaboration with local firms. The network aimed to support business development in some economic areas with relevant potential. However, the low levels of private R&D investment, and the absence of high-tech firms, as well as the few policy instruments in this field, undermined the centres' effectiveness (Vence 2010).

The economic crisis coincided with a change in government, and from 2012 the Galician government introduced important changes. The subsequent plan, *Investigación, Innovación*

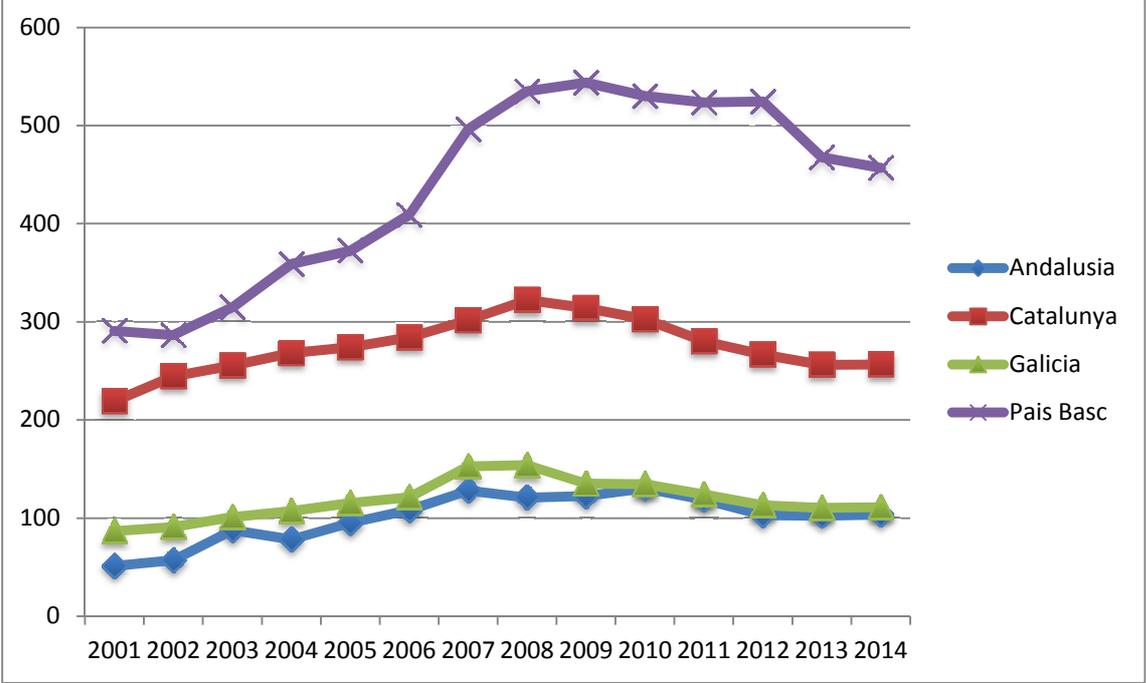
e Crecemento 2011-2015, strengthened the development and innovation programmes. The Galician Innovation Agency was launched in 2012 to promote a more articulated policy. The agency soon assumed a key role in implementing the new regional plan by launching new initiatives, and by discontinuing the instruments introduced during the previous period.

5. Transforming Regional Innovation Policies? Budgetary Priorities.

In this section, we use data from the yearly R&D survey conducted by the National Statistical Office (Instituto Nacional de Estadística, INE) from 2001 to 2014, to examine expenses in our four regional cases, identifying the sources of the funding (who is paying), and the sector performing the R&D activities (who is making the expenditure). These data do not allow us to identify which level of government (EU, national or regional) is the funding source, as they only refer to “public administration”. However, it states whether the sources of funding are public administration, universities, private sector, or foreign. To avoid problems of scale when comparing the four regions, we transformed the data to Euros per capita (and adjusted Euros to inflation, taking 2001 as a base year). We also provided some information about the share of regional expenses, in relation to the total national expenditure, from the same source.

Figure 3 shows the total amount of R&D expenditure in the region by all sources of funding combined. We observe how the economic crisis has been reducing real expenditure in recent years after a peak in 2008 for all regions. It is worth noting that Catalonia and Galicia have suffered large reductions. However, most relevant is the amount of real expenditure among regions. While Andalusia and Galicia had some reduction, but kept an approximately €100 expenditure level per capita during the crisis years (probably with great effort), Catalonia had about €250 per capita expenditure in 2014, descending from €300 before the crisis. Most impressive is the Basque country, with approximately five times more expenditure than Andalusia or Galicia yearly since 2006. The share of Basque country in R&D expenditure with respect to the Spanish total expenditure moved from 9 percent in 2007 to 12 percent in 2012; while Galicia remained about 3 percent, Andalusia about 8 percent, and Catalonia descended from 22 percent to 21 percent. Thus, we observe that the two old industrialised regions have sustained a larger expenditure level than the two less developed regions during the period; in particular, the Basque country has made an extraordinary effort since 2006-07, coinciding with its new strategic development (see previous section).

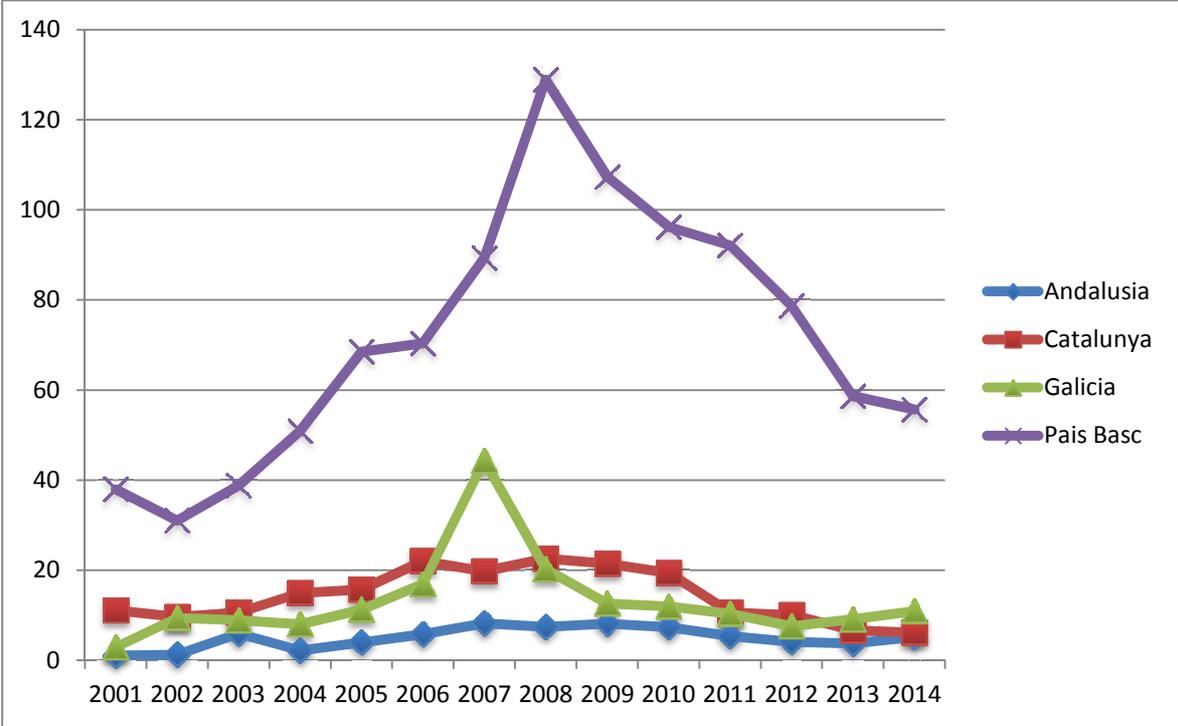
Figure 3: Total R&D expenditure in the region, in Euros (constant price) per capita



Source: Instituto Nacional de Estadística, 2016.

How is this expenditure distributed among main regional actors in innovation policy? Figure 4 shows the evolution of R&D performed by firms, which is funded by public administrations. It is possible to observe the low levels in all regions, except for the Basque country (several times higher, even during the crisis' retrenchments). These data show very clearly the business-oriented nature of the Basque country innovation policy compared to the other regions. Most relevant is the constant descent since 2008 of public R&D funds obtained by firms in Catalonia, considering its industrial tradition (see previous section), while Galicia shows some recent recovery.

Figure 4: R&D performed by firms and funded by public administration (regional and national), in Euros (constant) per capita.

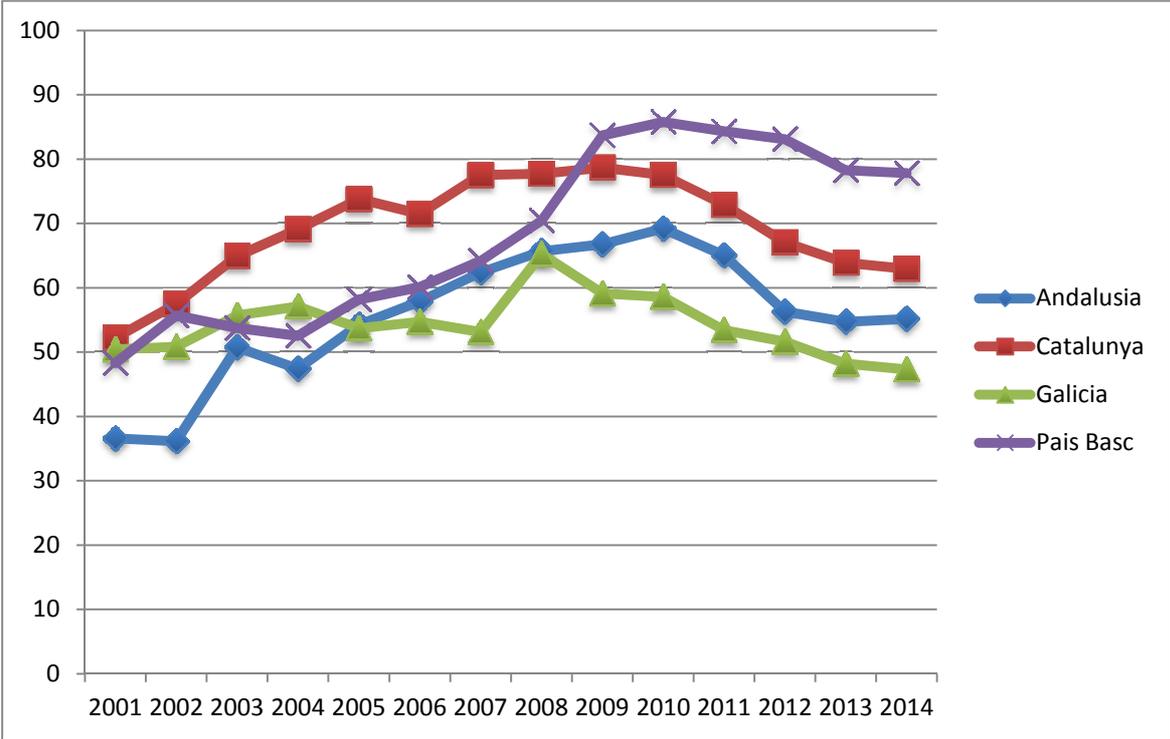


Source: Instituto Nacional de Estadística, 2016.

Figure 5 shows the levels of expenditure in R&D performed by universities. Most of the funding sources are the public administrations (national and regional), while the EU, mainly through its FP6, FP7 and H2020 programmes, funds about 3-5 percent, and another 8-10 percent originates from private sources (firm contracts). What is interesting is the change of regional priorities through the years. If Catalonia was the region with higher expenditure per capita until 2008, and Galicia was very similar to the Basque country levels, readjustments during the crisis period allowed the Basque country to maintain the higher level of R&D performed by universities, while Andalusia is gaining position compared to previous years.

Overall, these changes illustrate the ability of Basque country policy-makers to readjust the policy priorities during an economic crisis. In other words, after their institutional innovations in 2007, and the establishment of new policy rationale as delineated in their strategic planning, the region was able to implement the new priorities in their expenditure distribution, in spite of the difficulties created by the crisis.

Figure 5: R&D performed by universities, all funding sources, in Euros (constant) per capita.



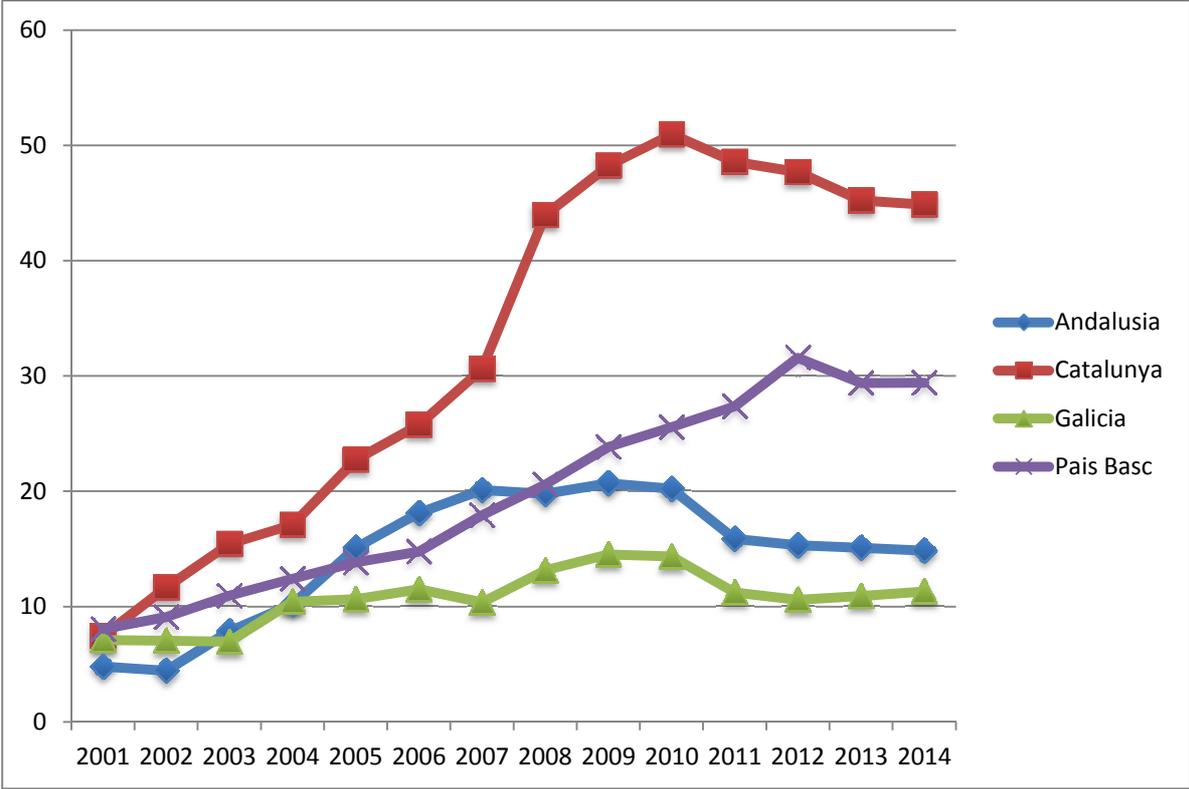
Source: Instituto Nacional de Estadística, 2016.

Figure 6 shows the R&D activities performed by public administration, from all sources of funding, and reflects the activity of all public research centres, either the Spanish Higher Council for Scientific Research (CSIC) (the Spanish PROs system), or the various regional PROs and regional technology centres. Catalonia is the region with the most remarkable shift in tendency from 2006 onwards, increasing five times the funding of these PROs; while the Basque country has expanded its funding as well, but only three times. The other two regions are more stable, although Andalusia also presented some expansion during the same period. These figures reveal the promotion of large basic research centres by regional governments during the 2000s, and the expansion of the national CSIC network. This reflects the significant effort made by Catalan government to consolidate its own network of highly competitive basic science PROs, and the aim of the Basque country to promote basic research more intensively. It is also worth noting in Figure 6 that the budgetary adjustments during the crisis are relatively limited. It is also important to highlight the capacity of some of the regions to attract foreign resources, particularly the Catalan PROs (representing about 30 percent of the Spanish total for this performing sector).

The data reflect the importance of such strategies in Catalonia and the Basque country, as much as this represented in 2014 about 18 percent of total R&D expenditure in Catalonia overall, and only 6 percent in the Basque country. While in the Basque country this reflects a strategy to strengthen basic research, in parallel to a continuous effort to fund and support industrial technology and innovation, addressing the missing link in their innovation system,

in Catalonia this policy priority reflects a different governmental expectation. There is a commitment to fostering excellence in basic research, keeping high levels of funding in highly productive PROs, and disregarding other regional actors if necessary. However, this missed an important opportunity to reduce the persistent bipolarity of the innovation system, disregarding the low levels of R&D performed by firms in the region.

Figure 6: R&D performed by public administration (PROs and public technology centres), all funding sources, in Euros (constant) per capita.



Source: Instituto Nacional de Estadística, 2016.

6. Findings and Conclusions

In the previous sections, we have shown the evolution of the institutional framework and budgetary priorities of the four regional policies during the period 2001-2014. It is now time to examine the extent to which these policies have transformed the regional innovation system, and, if so, whether they have done so in terms of addressing past and new challenges.

Vis-à-vis the Catalan case, the analysis of Colombelli, Foddi et al. (2013) indicated that the innovation system is characterised as a “human capital intensive region” type, but not a “science region” type. This is basically because the region performs below average in terms of specialisation of knowledge production as a whole (that is, the knowledge produced by all

actors in the region, including industry, not just public research by universities or PROs). However, the priority of the Catalan government during most of the period examined was on funding basic research in PROs, most likely in order to overcome the low scientific performance of universities. Yet this has increased significantly the amount of human capital in the academic context, not in the industry or productive sector of the economy. As a result, scientific and research activities in the universities and PROs remained disconnected from other key performing sectors in the innovation system. A policy attempt to address this was delineated in the 2005-2008 strategic plan, but was short lived, being discontinued in 2010 with the budgetary retrenchments from the economic crisis. Paradoxically, in spite of the sustained priority to favor academic excellence by successive Catalan governments, the region continues to perform below average among European regions on firms' formal and informal linkages with international knowledge production sources. Taken together, the Catalan regional innovation policy has introduced some novelties in terms of reinforcing PROs, but has overall not transformed substantially, keeping important gaps and problems in the regional innovation system unresolved.

The Basque country's innovation policy has traditionally had a strong focus on firms and technological development. However, in 2007 the regional government initiated a policy change putting increasing attention to universities and PROs R&D performance, while keeping its traditional pro-firm and technological development policy. Against all odds, the regional government continued with this new policy line in spite of the crisis that initiated shortly after. Apparently, results started to emerge few years later: according to Capello and Lenzi's 2013 analysis, the Basque country is characterised as a "science region" type as it has both high-level quantities of human capital and an above-average specialisation in knowledge activities. Likewise, it is a "globalising region" with high formal linkages to international knowledge production sources, but low informal linkages. The Basque country government made efforts to create a series of institutional developments to remedy the separation between the university/academic communities and the firm/technological sectors. Therefore, this region has truly introduced a policy transformation, addressing the traditional weakness of the innovation system.

Remarkably, the two peripheral regions, Andalusia and Galicia, have made significant institutional and budgetary efforts during the period examined here to advance their innovation strategies. Most relevant is the budgetary dimension: both regions reduced relatively little of their public commitment to R&D expenditures in the midst of the severe budgetary retrenchment in 2012. Likewise, both regions introduced institutional transformations during the 2000s, establishing new agencies to promote closer links between firms and scientific organisations, and introduced new policy instruments in this direction. However, both regions have weak developmental bases, and are considered "low-tech regions" and "regions with no specialisation in knowledge activities", with limited interaction with international sources of knowledge production; in spite of new policy "rationales" introduced, the crisis and its shortcomings probably made a larger shift more difficult. Both regions still continued, as in previous decades, to emphasise supporting

university research activities, but also made specific efforts to create a network of technology centres (Galicia), or to create a cluster policy and to coordinate economic development policies with innovation policies (Andalusia). In 2014, public investment per capita in Galicia in R&D expenditure performed by firms almost doubled that of Catalonia. It is perhaps in these two peripheral regions where the absence of a more integrated multi-level policy between the Spanish and the respective regional governments undermines the regional efforts to redress their innovation systems—a failure with more dramatic effects during economic crisis.

Our findings call for more detailed research about the link between the analytic diagnosis of innovation systems and the difficulties for implementing policy change at the regional level. The advance of new and more sophisticated evidence on innovation systems' performance might not be sufficient for policy-makers' design of relevant initiatives and priority shifting. Misperceptions and policy-organisational weaknesses (like the lack of regional governments' analytical capacity to learn from evidence) might be more common than expected, making successes a very arduous experience (Borrás 2011). Prior to the crisis, the four regions studied were able to formulate clear-cut innovation policy strategies, but not all were able to sustain them during the crisis. They were not equally able to address their structural problems in spite of the budgetary constraints. As reflected by the policy reversal in the Catalan case in 2010, a lack of organisational and analytical capacity facilitated idealistic expectations of replicating world-class scientific environments, without considerations of the specific challenges and problems in the region. Other than the lack of organisational capacity of learning, in all cases there might also be strong clienteles that undermine the implementation efforts, even when the problems of the regional innovation system are clearly identified and the instruments designed.

These preliminary findings call for a renewed approach that integrates policy analysis models and frameworks with studies of regional innovation system performance and evidence, as well as regional innovation policy rationales. Such integration will elicit the challenges and opportunities that regional innovation systems are facing, as well as of the specific policy-related obstacles and weaknesses found in that region, that need to be overcome in order to design more effective innovation policies.

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