The Innovation Paradox in Southern Europe. Unexpected Performance During the Economic Crisis

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Abstract

The international crisis has exerted a strong impact on the National Innovation Systems (NIS) of three Southern European economies: Italy, Portugal and Spain. These countries represent interesting cases for analysing responses to the crisis because they show a sort of innovation 'paradox': despite the weakness of their institutional systems and the defensive policies developed by governments, some of their companies have nevertheless been able to innovate even during the hardest years of the recession. In order to shed light on this 'paradox', three matters are taken into account: the distinctive features of the Southern European National Innovation Systems, the behaviours of governments and companies; and the 'generative dynamics' and the 'creative processes' that have taken place during the crisis.

Keywords

National Innovation Systems; Economic Innovation; Southern Europe; Moderate Innovators; Mediterranean Economies; Innovative Companies.

The international crisis that began in 2007-2008 and the subsequent financial difficulties that it brought about have produced negative effects of a general kind on European economies, imposing particular strains on the Southern European ones. While the analyses of observers have focused on the consequences of, and responses to, the crisis, the impact on National Innovation Systems has still not been the subject of much study. However, one issue which deserves close attention is the effects that the sharp fall in demand and the policies of austerity have produced on the actions of governments and private companies in fostering innovation[1]. A crucial aspect to investigate in this particular context is the kind of anti-conjunctural policies adopted in Southern European countries, distinguishing between proactive measures (with a growing investment of resources in training and research and a policy mix of innovation support) and activities of a more defensive nature (with a contraction of resources invested in innovation). In other words, it is important to understand if, and with what results, these countries have exploited the crisis to embark on a strategy to ensure long-term growth and to stimulate their economies.

The article deals specifically with three Southern European countries: Italy, Portugal and Spain (hereafter SE3). These countries have long been

considered Moderate Innovators, and they still achieve modest innovative performances (European Commission 2016). However, during the crisis, in all the three economies both the percentage of companies introducing product or process innovations and the share of sales related to newly introduced products have been similar or even superior to the averages of the EU countries. These unexpected results make the SE3 an interesting case for analysing responses to the crisis: in fact, they represent a sort of 'South European Paradox' because SE3 companies have been able to introduce some kind of innovation despite the weaknesses of the National Innovation Systems and the adverse economic conjuncture. The article aims to shed light on this paradox and proceeds as follows. In the next section, we will introduce the topic, addressing it in a frame typical of a comparative political economy analysis. The third section is devoted to the presentation of SE3 National Innovation Systems (henceforth NIS), paying attention to some key features characterising these countries and affecting their capacity for innovation. The fourth section presents responses to the economic crisis as regards both measures adopted by governments and strategies pursued by private companies. There, and also in the conclusions, we provide some explanations of the 'South European Paradox', drawing attention to the 'generative dynamics' and the 'creative processes' that have occurred during the crisis.

Economic crisis and innovation in Italy, Portugal and Spain

The impact of the international crisis on the innovation performances of European economies has only recently become a matter for reflection. Several international organizations have carried out macro-level analyses, using pooled data and publishing regular reports that monitor the performance and trends of NIS (European Commission 2011, 2012, 2013a, 2013b, 2014a, 2015, 2016; OECD 2002, 2004, 2006, 2008, 2010, 2012). Works of a more academic kind, however, have predominantly adopted a more micro-level approach focused on analyses of the behaviour of companies in different economic sectors and territorial contexts (Kuznetsov & Simachev 2010; Antonioli et al. 2011; Filippetti & Archibugi 2011; Archibugi & Filippetti 2012; Paunov 2012; Archibugi, Filippetti & Frenz 2013). Overall, these studies have addressed the question of the impact of the crisis on the innovative capacity of the various national economies and drawn some general conclusions: a) government policies have basically followed a countercyclical path (they have not, in other words, reduced resources during the crisis); b) the crisis has had a differentiated impact on national economies, productive sectors, and the various types of company.

Despite these studies, however, we still know little about what has happened in the NIS of Southern Europe. But, what are NIS? The use of this concept is relatively recent in the field of Innovation Studies (Freeman 1987; Dosi *et al.* 1988; Lundvall 1992; Nelson 1993). It was introduced in the 1980s and refers to 'all important economic, social, political, organizational, institutional and other

factors that influence the development, diffusion and use of innovation' (Edquist 1997, 14). Despite substantial differences, certain basic features are common to studies using this concept (see Ramella 2016). First, the idea that knowledge and learning processes are key drivers of development. Second, the abandonment of a strictly economistic view of innovation, with the realisation that: (a) innovation requires the contribution of a plurality of actors, both economic and otherwise (companies, universities, governments, etc.); (b) *institutions* play an important role in shaping the context in which these actors operate. Third, the recognition that these processes are embedded in networks of relationships between people and organisations (Edquist 2005; Ramella 2016).

This article analyses SE3 innovative performance amid the current crisis by starting from the idea that Italy, Portugal and Spain share a number of characteristics that define a specific type of NIS. As will be seen, the most salient feature is their weakness: as shown by the data of the European Innovation Scoreboard (European Commission 2016), all these countries are included in the 'Moderate Innovators' group, with performances below the EU average. A second distinctive feature concerns their productive structure and the institutional architecture that sustains it: these three countries are all under-specialised in high-tech sectors and have a high endowment of small and medium-sized enterprises. They also display low investment in research, a limited propensity to patent, and a number of critical issues in the regulation of economic activities.

If we observe the behaviour of companies, however, a less dismal situation becomes apparent. In fact, as regards the percentage of innovative small and medium-sized enterprises (SMEs) and sales related to new products, the three countries perform in a manner similar to, or even better than, the European average. This data thus highlight a kind of paradox: SE3 companies have been able to create innovation despite the constraints – both structural and conjunctural – that characterise their national systems and the lack of resources invested in R&D. This article therefore aims to shed light on this paradox by analysing: 1) the specific characteristics of the three NIS; 2) the behaviour of companies during the international crisis; 3) the 'generative dynamics' and the 'creative processes' that have taken place during the crisis, with particular attention paid to the Italian situation (i.e. to the main Southern European manufacturing economy), which will provide the fulcrum for our final considerations.

The article follows a pattern typical of comparative political economy. As well known, the debate on varieties of capitalism (Hancke 2009; Burroni 2016) has underlined the link between systems of regulation and regimes of innovation. Hall and Soskice (2001), for example, outlined two ideal-typical models of contemporary capitalism. On the one hand, coordinated market economies, which are associated with a *regime of incremental innovation* and a specialisation in productive sectors with a relatively slow rate of technological

change (slow-tech): for example, the mechanical engineering industry, transport, and durable consumer goods. On the other hand, liberal market economies, which are associated with a *regime of radical innovation* and a specialisation in sectors that feature rapid technological change (fast-tech) – such as biotechnology, semi-conductors, information – or in activities that require ongoing innovation, such as entertainment and advertising.

From our point of view, the debate on varieties of capitalism and in particular on SE3 – often described as 'mixed market economies' (Molina and Rhodes 2007) and related to the category of 'Mediterranean capitalism' (Amable 2003; Sapir 2005; Burroni 2016) – can be enriched by reflection on the characteristics of their NIS (Ramella 2016). SE3 economies, in fact, also have their own regimes of innovation which take some features of the incremental version to extremes. Their NIS, however, are not simply weaker variants of those of coordinated economies; rather, they have their own distinctive characteristics. As we shall see in the following section, Italy, Portugal and Spain possess a unique mix based on the one hand on a lack of collective goods and resources for innovation and, on the other, on greater state involvement and weak relations between actors in the system. Moreover, as we shall argue in the third section, these features have produced perverse effects in their economies, they have: a) reduced competitiveness and innovative potential; b) made those economies more vulnerable during the international crisis, due to retrenchment in the public sector. However, in the business sector, the crisis has also triggered 'generative dynamics' that can stimulate a rethinking of the competitive strategies that have been followed in recent decades.

Methods and data

This section briefly outlines the methods and data that will be discussed in those that follow. As said above, the focus is on Italy, Portugal and Spain, i.e. the three main Southern EU economies. Another important country, namely Greece, has been omitted from the analysis, since the sovereign debt crisis in that country was of such magnitude as to make the economic and political dynamics that followed entirely idiosyncratic.

In what follows, we propose an analysis of SE3 NIS and their performances that takes different types of secondary sources into consideration. A first crucial source is the European Innovation Scoreboard, an annual study promoted by the European Commission since 2001: its purpose is to provide an overview on economic innovation and a comparative analysis of the EU NIS by processing primary data from Eurostat, OECD and the United Nations. The innovative performances of individual countries are classified and compared using an indicator – the Summary Innovation Index – that sums up the scores on 25 indicators relating to three different aspects: the relevant inputs to the innovation process (*Enablers*); innovative strategies at a company level (*Firm activities*); innovation outputs (*Outputs*) (European Commission 2015).

In the next sections, we will also introduce some secondary data from the World Bank: in this case, we consider indicators related to 'governance' and 'doing business'. These are two dimensions of key importance for understanding the quality of regulatory capacity and the system's efficiency in a given institutional context. Here, a certain level of both is assumed to be the precondition for realizing a country's full innovative and economic potential. A third relevant source is the Community Innovation Survey (CIS), conducted every two years (since 2004) by Eurostat and the statistical offices of EU countries. It gathers information on innovation processes in European industry and service companies with at least 10 employees. The survey is by sample for companies with 10 to 249 employees and by census for those with at least 250 employees. It will help us to reconstruct the behaviour of firms during the crisis.

In the fourth section, we will take into account other data provided by the statistical office of the European Union (Eurostat) in order to show the effects of the crisis on national policies and private companies. Further data from the Italian Central Statistical Institute (Istat) will be presented when we focus on the case of Italy.

National Innovation Systems in Southern Europe

Besides certain differences, the NIS of SE3 share a number of features that – compared to other European countries – define a specific 'Southern Europe model'. These features can be reconstructed by referring to evidence provided by the European Innovation Scoreboard. Confirming the picture that emerged in previous versions, the most recent report classifies SE3 as *Moderate Innovators*, in that a number of indicators rank their innovative performances significantly below the EU average (Innovation Index equal to 0.52). In this classification, Italy (0.43) is placed seventeenth, Portugal (0.42) eighteenth, and Spain (0.36) twentieth (European Commission 2016). The scores lie a long way behind those achieved by the historical quartet of *Innovation Leader* countries – Sweden (0.70), Denmark (0.70), Finland (0.65) and Germany (0.63) – which can represent benchmarks useful for determining the critical issues and weaknesses of the three cases that we examine most closely[2].

It should also be considered that, although the classification is periodically updated, repositioning is usually infrequent. A diachronic reading of all the 28 EU member states shows a situation virtually unchanged in recent years. However, this evidence is not the outcome of a widespread and generalised condition of stasis; rather, it is the combinatorial effect of a variety of situations: in fact, although the negative consequences of the economic crisis have affected all EU countries, from the point of view of innovation some have been able to improve their score while others have remained unchanged or even worsened.

All this has taken place in a general framework (referring to the period 2008-2015) in which most of the worst-performing countries have been able to grow even beyond the average, in contrast to the Leaders – with the exception of

Denmark – which have a mild negative trend (Finland) or continue to advance but at a slower pace (Sweden, Germany). The result is an intermittent and discontinuous process of convergence among the performances of the various EU countries which was already apparent before 2011. This first convergence was followed by a setback in 2012. It resumed between 2013 and 2014, and then halted again in 2015. At present, the catching-up process already apparent in the past seems to be underway, although its development is taking place in a more varied and contradictory panorama (European Commission 2014a, 2015, 2016).

Bearing these background trends in mind, we now go more deeply into the reasons for the low innovative performances of the SE3. Through the use of several indicators, we will first illustrate the weak aspects of their NIS, and then focus on the institutional architecture and the lack of regulatory capacity in these countries.

The Weakness of Southern European NIS

As mentioned above, a main feature shared by Italy, Portugal and Spain is above all the weakness of their NIS. Their scores are below the European average on at least three fronts: i) investments in qualified human capital and ongoing training; ii) the financial resources allocated to research and development activities; iii) inter-organisational partnerships that foster innovation through cooperative learning processes that promote the circulation and exchange of knowledge.

With regard to the first point, although with some differences among the individual countries, there emerges a negative spread with reference to investment in training: a backwardness found at all levels but which becomes even more pronounced in higher education. A general reading shows that the ratios to GDP of public spending on education is below the EU average (5.3 per cent) both for Italy (4.3 per cent) and for Spain (4.2 per cent), while Portugal (5.3 per cent) is in line with the general European level. For tertiary education, however, all the values fall below the European average (1.3 per cent): Italy 0.8 per cent, Spain 1.0 per cent, and Portugal 0.9 per cent (referring to 2013 Eurostat data). If we then focus on those who complete university education and those who complete their doctoral degree, the situation looks even gloomier, especially when compared to that of the Leader countries (Table 1). It should be remembered that, compared to an EU average of 38.5 per cent of young people between 25 and 34 with a university degree, Italy (24.9 per cent) and Portugal (31.3 per cent) – Spain (41.1 per cent) is the exception here – seem to be in serious difficulties (2015 Eurostat data).

Table 1. National Innovation Systems in Italy, Portugal and Spain, compared to four Innovation Leader countries (EU28 = 100)

	Population completed tertiary	New doctorate graduates	R&D expenditure public sector	R&D expenditure business	Venture capital investments	Innovative SMEs collaborating	Public-private co-publications
Italy	65	83	75	55	35	47	53
Portugal	81	171	92	45	110	66	21
Spain	107	95	81	50	68	59	48
Germany	83	152	126	150	78	112	157
Finland	118	158	139	165	169	138	206
Denmark	121	176	150	150	94	167	424
Sweden	130	158	144	163	129	123	318

Source: our elaborations on Eurostat data - European Innovation Scoreboard 2016 (European Commission, 2016)

A second weakness relates to innovation funding. Even considering the expenditure on R&D relative to GDP, the position of the SE3 is well below the EU average (2.0 per cent): in this ranking, Portugal (1.3 per cent), Italy (1.3 per cent) and Spain (1.2 per cent) are very close together in terms of values (2015 Eurostat data). The public sector unquestionably spends very little on R&D compared to the EU average, but if we look at company behaviour and compare the situation with that of the Leader countries, the gap is even more pronounced (Table 1). Added to these deficiencies is the decidedly more modest role of private finance specialised in innovation. Not only is the impact of venture capital funds on GDP significantly lower than the EU average, but the trend is also a negative one: in the period 2007-2014 their amount – in absolute terms – fell by about 75 per cent in Italy and 67 per cent in Spain. Even though in Portugal it actually grew by 20 per cent, in 2014 it still stood at only one third of the Italian and a quarter of the Spanish total (2007 to 2014 Eurostat data).

A third element of weakness concerns the relational dynamics that link companies to a plurality of actors and institutions – not only those in the economic field – that collaborate in innovation processes. Companies are increasingly less able to bear the costs and risks of innovative projects on their own, especially in times of crisis, so that partnerships with other companies, universities and research centres have become essential. In this regard, the last two indicators presented in Table 1 once again provide evidence of a significant backwardness in all the three countries: the first indicator refers to the percentage of small and medium-sized innovative companies that have initiated cooperation with other external actors, while the second one refers to the publications resulting from the collaboration between public and private entities. More generally, the partnership problem emerges most clearly on considering the data of the Community Innovation Survey concerning the relations between innovative companies and strategic actors such as universities and research and training institutions. On this front, too, the performance of Southern Europe countries is worse than the European average

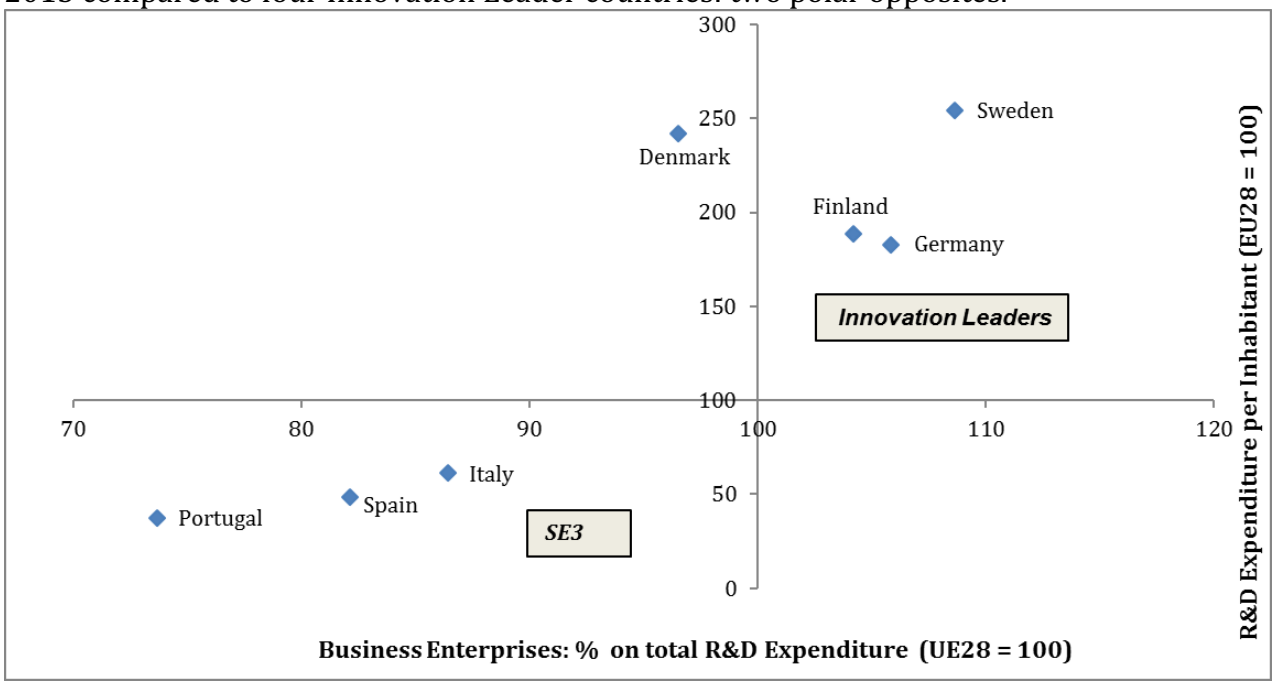
(13.2 per cent), with Spain (10.9 per cent) and Portugal (9.2 per cent), however, performing a little better than Italy (7.0 per cent) (CIS 2014).

Institutional Architectures Compared

A further point to note is the specific institutional architecture that characterises the SE3. Given that our reflections on the NIS follow an integrated approach, attention must be paid to the components of the system and to the relationships that they have with one another (Lundvall 1992; Nelson 1993; Edquist 1997, 2005). As well known, innovative dynamism is facilitated by cooperation among a variety of actors who possess complementary resources (Ramella 2016). Accordingly, it is appropriate to consider the innovative capacity of individual countries as a phenomenon associated not only with the structural characteristics of their economies, but also with the quality of the regulatory and institutional frameworks within which the actors operate. Innovative performance thus evolves in a way that is partially path-dependent, since it is influenced by the institutional architecture of the NIS.

From this perspective, there is a clear polarisation between the situation in the three SE3 and that of the Innovation Leaders. The latter display a model that can be called 'highly integrated'. As shown in Graph 1, these are NIS a) with high levels of per capita expenditure in R&D and b) which are 'firm-centred'. In fact, the contribution made by the companies, compared to the total investment in R&D, is above the European average, and this in a context in which public funds for research and training are already very substantial. This model is also characterized by a considerable degree of integration, since the various actors participating in innovative processes have relations at various levels, showing a high propensity for inter-organisational collaboration (Fagerberg, 2016; Gherardini 2015; Fagerberg & Fosaas 2014; Hedin et al. 2008). This is combined with a regime of innovation that is more science-based, given the importance that the sectors of high and medium-high technology have in the productive structures of the Leader countries.

Graph 1. The architecture of the National Innovation Systems in Italy, Portugal and Spain in 2015 compared to four Innovation Leader countries: two polar opposites.



Source: our elaborations on 2015 Eurostat data.

In marked contrast to the Leader countries, Italy, Portugal and Spain NIS are 'weakly integrated', with private enterprise playing a far less important role. These low levels of investment are connected to the high fragmentation of the productive structure and, in part, to the significantly familial nature of small and medium enterprises in SE3 (Burroni 2016). It is therefore a more 'public-centred' type of system, even though, as already said, the public institutions themselves spend comparatively less both on R&D and on the training of human capital. In addition, the architecture of the model appears less textured (Cis 2012; Gherardini 2015; Nunes et al. 2013). Partnerships between actors are more sporadic and are often structured around short-range relationships. In some of these countries, in fact, the territorial dimension is extremely important for the social construction of innovation. In contexts of this kind, the use of new technologies is combined with flexible and localised production systems based on *learning by doing* (Bellandi 1989). The innovation regime is therefore *empirically-oriented*: that is, it does not rely on codified knowledge and formalized R&D activity.

With reference once again to the institutional context, it should also be stressed that all SE3 display critical issues in terms of capacity for regulation. The indicators developed by the World Bank relating to dimensions of governance and 'doing business' highlight significant problems in the quality and efficiency of the institutional context (World Bank 2014, 2015). In particular, the four dimensions of governance – 'Government Effectiveness', 'Regulatory Quality', 'Rule of Law' and 'Control of Corruption' – give an idea of the competitive disadvantage of the three countries in comparison to the

situation of the innovation Leaders. And the same goes for the 'doing business' index, which makes it possible to evaluate the distance of Italy, Portugal and Spain from the efficiency 'frontier' – in other words, from those benchmark countries which in various fields offer the best possible conditions for 'doing business'[3].

The low quality of the institutional context and public regulation finds immediate confirmation in the obstacles encountered by companies in carrying out their activities. A survey conducted in 2014 by Eurobarometer on 12,000 companies shows that over three-quarters of them in Southern Europe countries report difficulties in marketing their innovations – difficulties related to the costs or the complexity of the regulations and standards required. Italy ranks first in this negative European classification (with 81 per cent of companies complaining of problems), Portugal second (with 80 per cent), and Spain third (with 77 per cent). By way of comparison, in the Leader countries only 46 per cent of companies report the same difficulties (European Commission 2014b, p. 68).

The Effects of the Crisis

What impact has the economic crisis had on Southern Europe countries? The immediate answer is that the fall in domestic and international demand and the austerity policies imposed by the European Union have exerted a braking action. They have interrupted a path of growth and catching-up that in some countries, such as Spain, had in previous years been particularly intense. While indisputably true in certain respects, this response – focused as it is only on external shocks –provides a partial picture of the transformations that took place in SE3.

That said, however, let us begin with the elements that confirm such an exogenous and exclusively disruptive reading of the crisis, and consider the data provided by Eurostat[4]. On the economic front, the first point to note is the significant slowdown in GDP. In the seven years prior to the international crisis (2000-2007), the SE3 economies grew overall by 15 per cent in real terms; a figure in line with the European average and higher than that of the innovation Leader countries. Over the next seven years (2007-2014), however, GDP fell by 7 per cent, while the rest of Europe registered a slight increase. In per capita terms, the retrenchment of the three Southern Europe economies is even more obvious: if the per capita GDP of the EU is given a value of 100, in 2000 the SE3 had a value of 99[5]. In 2014, this fell to 83. The most striking decline was recorded by Italy, which went from a value of 120 to one of 98, with a reduction of as many as 22 percentage points.

Decline in investment also confirms a substantial contraction of the Southern Europe economies. While in the previous seven years (2000-2007) the accumulation of fixed capital grew in real terms at a rate higher (+27 per cent)

than the European average (+21 per cent) and that of the Leader countries (+8 per cent), in the crisis years (2007-2014) the retrenchment shows a far more substantial result: -32 per cent as against the EU average of -12 per cent and the +2 per cent of the Leader countries. All this resulted in a dramatic reduction in employment. In the pre-crisis period, employment had grown in SE3 much more than the European average (+17.3 per cent vs. +6.9 per cent), especially thanks to the extraordinary performance of Spain (+33.3 per cent). In the following period, however, this trend underwent a sharp reversal (-9.3 per cent vs -1.5 per cent), especially in the case of Spain (-15.8 per cent) and in the manufacturing sector (SE3 -17.2 per cent), as was the case in almost all EU countries (-11.9 per cent)[6].

The impact of the crisis on innovation systems and the defensive policies implemented by governments was equally significant. In short, anticipating what we will say later, the result that emerges is that SE3 governments did not carry out any counter-cyclical action, unlike the Leader countries. In terms of both resources invested in education and policies in support of research and innovation, the public sector's contribution suffered major cutbacks. The slowdown in education spending is evident. While in the pre-crisis period such spending grew at a slightly faster rate than the EU average, in the following period the opposite occurred. The annual rate of increase – calculated at purchasing power parity – fell from 4.2 per cent a year to an extremely modest 0.7 per cent. In the Leader countries, on the other hand, a slight increase was registered, from 3.9 to 4.1 per cent.

Table 2. Average annual growth rate of spending on R&D in some EU Countries, 2000-2015 (val. %).

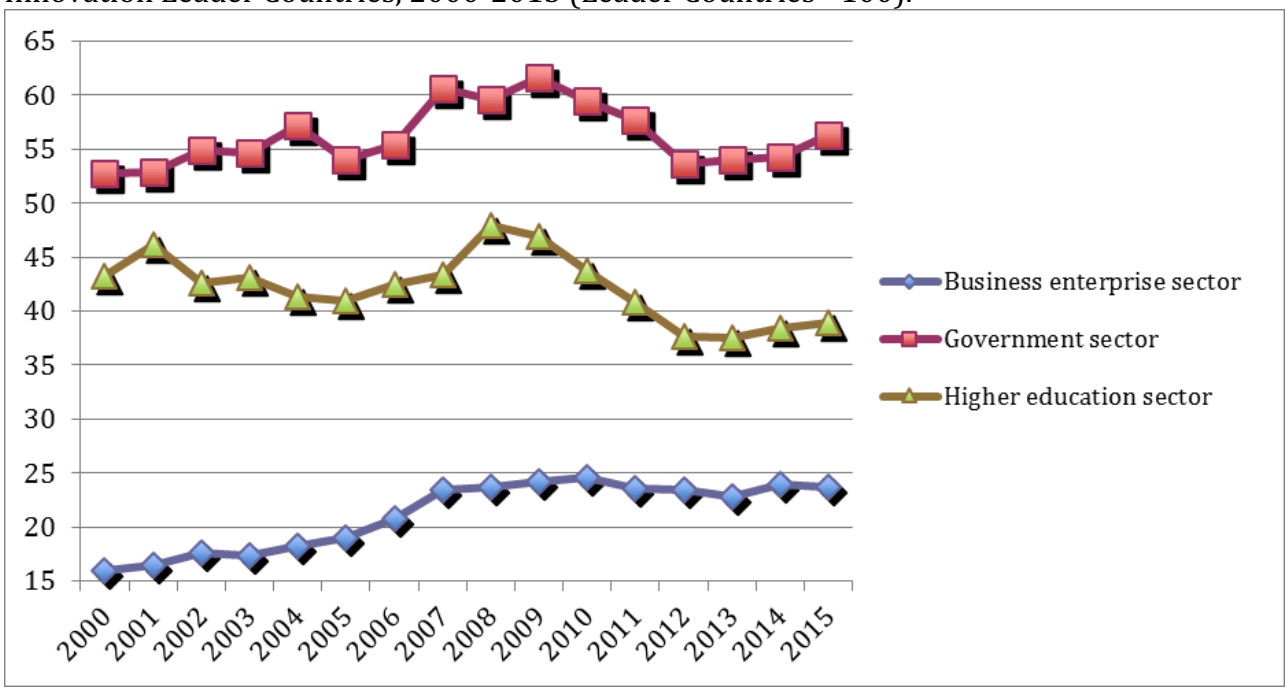
	Public sector		Business sector		All sectors	
	2007-2014	2000-2007	2007-2014	2000-2007	2007-2014	2000-2007
European Union (28)	2,3	2,9	2,4	2,6	2,3	2,7
Innovation Leaders	4,2	2,1	1,9	1,7	2,6	1,8
SE3 (Southern Europe)	0,6	3,7	0,6	6,4	0,5	5,4

Source: Eurostat data; unit: Million Purchasing Power Standard (PPS) at 2005 prices.
Note: public sector spending includes that which Eurostat includes in the two categories of "Government" and "Higher Education". This is a proxy value, given that not all spending on R&D in the education sector is from public sources.

The same divergence is observed in public spending on research (Table 2). Even though a slowdown is also visible in the field of commercial companies, what is most striking is the specular action carried out by public institutions (government and higher education). While in the SE3 a clear fall in spending on

R&D is registered – with the exception of the first two years of crisis (2008-2009) – in the Leader countries, the reverse happens: the average annual growth rate doubled compared to the previous period, performing a clear counter-cyclical function. In terms of per capita expenditure, therefore, the gap between the first and second increased primarily in the public sector (Graph 2). Although much larger, in the business sector the spread remained broadly unchanged, while in government and university fields there was an increase of up to 6 percentage points. The overall effect was a clear setback in the catching-up process that had been underway before the crisis[7].

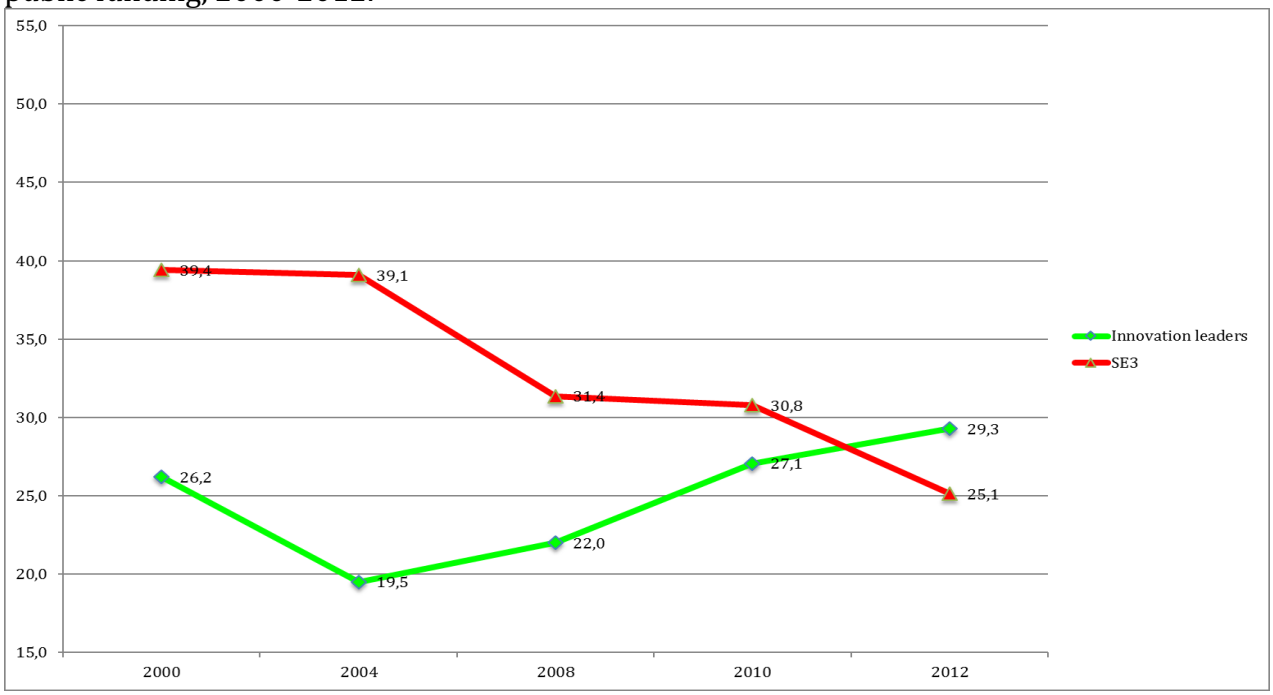
Graph 2. Comparison of per capita spending on R&D in Southern European Countries with Innovation Leader Countries, 2000-2015 (Leader Countries= 100).



Source: Eurostat data; unit: Purchasing Power Standard (PPS) per inhabitant at constant 2005 prices.

Public intervention methods also changed. Over the past 20 years, the policy mix adopted by the Southern Europe countries has been focused on direct support to companies (European Commission 2013b). In the first half of the last decade, the proportion of business expenditure on R&D covered by government subsidies was considerably higher than the EU average, and actually three times that of the Leader countries. In the manufacturing sector, nearly 40 per cent of innovative companies received some public funding; twice the percentage in the most advanced countries (Graph 3). This pattern has changed during the crisis. In Southern Europe, direct support to companies has declined, while the opposite has occurred in the Leader countries. In the latter, the percentage of expenditure deriving from public support has not changed significantly, but the number of companies benefiting from some sort of funding has increased until it has overtaken the number of companies in SE3[8].

Graph 3. Percentage of innovative manufacturing companies that have received some form of public funding, 2000-2012.



Source: CIS data (2000; 2004; 2006; 2008; 2012).

These initial data evidence the highly negative impact of the crisis on Southern Europe's NIS. However, looking at company behaviour produces a picture that is somewhat less bleak. CIS surveys, for example, reveal that the percentage of innovative manufacturing companies was largely in line with the EU average[9]. Furthermore – and this is the datum that we want to highlight – this percentage increased in all size categories, especially in the first years of the crisis: meanwhile, the opposite occurred in other EU countries (Table 3).

This pattern is confirmed by the results of the 2014 Eurobarometer survey (European Commission 2014b). Italy is in first place and Portugal in third in terms of the number of companies that, between 2011 and 2013, introduced at least one product innovation, with percentage values (49 and 48) well above the EU average (37 per cent) and that of the innovation Leader countries (35 per cent). Something of an anomaly therefore emerges. Despite all the problems mentioned above, and the weakness of their NIS, the Southern European companies have been able to innovate even during the international economic crisis. How can this 'South European Paradox' be explained?

Table 3. Percentage of innovative manufacturing firms by size, 2006-2012-2014.

	10--49 employees			50--249 employees			250 employees and more			Total		
	2014	2012	2006	2014	2012	2006	2014	2012	2006	2014	2012	2006
European Union (28)	35.2	35.3	35.5	56.6	55.4	56.4	74.9	73.7	75.2	41.2	40.7	41.9
Innovation leaders	-	55.2	60.1	-	71.5	74.7	-	86.2	90.3	58.6	60.8	66.9
SE3	33.1	35.9	33.5	61.6	63.2	58.8	85.2	83.7	79.3	38.1	40.4	37.7

Source: CIS data (2006; 2012; 2014).
Note: in the 2006 survey the EU average refers to 27 countries.

To provide an answer, we must first look at the production system. In the SE3 economies, manufacturing employment is predominantly concentrated in SMEs and medium-low technology sectors, which account for over 70 per cent of employment. This sub-specialization in high-tech sectors is confirmed by a glance at exports, of which the share of high technology accounts for about half the EU figure. A first explanatory hypothesis therefore ensues from the typical development pattern of these countries, which is associated with a system of incremental innovation. In a system of this kind, the operative logic is very different from radical regimes – and also those that are incremental but more science-based – because the production sectors in which enterprises operate are less exposed to the 'scientification' process of technology (Carlsson & Stankiewicz 1991, 112).

The innovation methods of the Italian industrial districts illustrate this different operative logic well. Such districts feature a *widespread innovative capacity* (Marshall 1920; Bellandi 1989) mostly based on forms of learning from experience that exploit the practical knowledge acquired by the manufacturers (learning by doing) and users (learning by using) or arising from their relationships (learning by interacting). This 'distributed knowledge' makes incremental improvements to products and production processes possible, thus continuously refining the district's overall innovative capacity. In light of these considerations, it is therefore not surprising that Southern Europe companies have been able to innovate despite the above-highlighted shortcomings in their NIS. On the one hand, in fact, these innovative regimes are less dependent on the quality of education and research; on the other hand, regional and local systems are able to off-set – albeit to a limited extent – the shortcomings of national regulations.

Although this helps partly to explain the 'South European Paradox', this line of reasoning is actually incomplete and – potentially – misleading. Not only because the quality of the scientific-technological infrastructure and of the training system also influences the competitiveness of medium-low technology

sectors, but above all because it yields a static picture of the situation: a 'snapshot' that is not able to account for the *generative dynamics* that developed during the crisis, even in countries that suffered a serious retrenchment in their economies. In those years, in fact, it was above all the traditional model of development in the Southern Europe countries that came under challenge, as is clearly shown by employment trends. Between 2008 and 2014, in the medium-low and low technology manufacturing sectors, the decline in employment was 20.2 per cent, compared to 9.0 per cent in medium-high and high technology. Yet, the same pattern emerges from an analysis of the company mortality rate.

The explanation that we would like to put forward, therefore, integrates with the previous one (the model of specialization), drawing attention, along Schumpeterian lines, to the 'creative processes' that take place during periods of crisis. On the one hand, there are processes of *creative destruction*, which emphasise the disappearance and replacement of less efficient companies, and on the other, processes of *creative accumulation*, which focus on intensification of competitive efforts by existing companies. There is substantial evidence that both of these processes co-existed during the crisis, and that this also occurred in other European countries (for example, in the case of Great Britain: see Archibugi & Filippetti 2012; Archibugi, Filippetti & Frenz 2013).

Let us first look at *creative destruction*: the replacement of old companies that can no longer compete with new ones. As might be expected, during the crisis this company replacement syndrome reached reasonably high levels. In the manufacturing sector, the mortality rate was around 7.0 per cent per year, with the disappearance – between 2008 and 2014 – of 352,000 companies. New companies, however, sprang up even during the hardest years of the recession, albeit at a slower pace. In the SE3, the average rate was 5.2 per cent per year: below the EU average (6.8 per cent) but slightly higher than that of the Leader countries (4.7 per cent). Many innovative start-ups also came into existence. To take only the Italian case, it is worth noting that in the space of only a few years, as a result of a law enacted in 2012, around 3,700 innovative start-ups were registered in the special section of the Company Register, the majority operating in knowledge-intensive services (information technology, research, etc.), high-tech production and mechanical engineering. More generally, it has been calculated that in the medium and high technology sectors around 15,000 new companies were founded (InfoCamere 2015; Cerved 2014).

Turning to the matter of *creative accumulation*, first to be noted is an increase in heterogeneity in companies' performances. To take the example of Italy once again, the analyses conducted by the Central Statistical Institute emphasise a widening of the productivity gap compared to the main EU countries, but also the high variety in performance of Italian companies, connected to their disparate aptitudes for innovation (Istat 2010, ch. 2; Istat 2015, pp. 97*ff* and 116*ff*). Looking at the SE3 as a whole, the data seem to suggest that some companies intensified their innovative efforts, adopting a pro-active attitude in

the face of crisis. And this was also due to the dramatic nature of the crisis itself. Hence, it is conceivable that, in the face of a reduction in domestic demand and policies of austerity, the 'battle for survival' was perceived as a more radical challenge in these countries. This is also shown by the drastic reduction in the number of companies in comparison to what happened in other countries: in the manufacturing sector, between 2008 and 2014, active enterprises were reduced by 17.0 per cent, while in the UE by 3.3 per cent.

One indicator of this pro-active attitude can be found in the increasing resources allocated to R&D by manufacturing enterprises in the years of the crisis. In fact, between 2007 and 2014, the nominal increase in the SE3 was not very different from the EU average: 18.2 per cent vs. 19.2 per cent. In addition, it should be considered that the figures were affected by the particularly poor performance of Spain (+7.4 per cent) compared to Portugal (+18.1 per cent) and, especially Italy (+32.8 per cent). The latter did even better than the Leader countries (+24.1 per cent). If we also take into account the reduction in the number of active companies, what catches the eye is the growth of the 'research intensity' underway in the Southern European manufacturing sectors. Taking as 100 the resources invested in R&D in 2008 by each manufacturing company, in 2014 this rose to 133 in the SE3, in contrast to a figure of 126 in the Leader countries and a EU average of 121. The gap is still formidable today, and yet these data suggest a selection process that seems to have raised – at least for certain companies – the quality of competitive strategies. A panel survey carried out on more than 400 Italian companies with European patents in the high and medium-high technology sectors supports this hypothesis. The research was carried out on the same companies in two different periods, covering their performance over a six-year period (from 2007 to 2012) and indicates good performances, even during the crisis, especially by companies that continued to invest resources in research, innovation and staff training (Ramella 2017).

In the light of these data, therefore, the 'South European Paradox' can be explained in two ways, neither of which is an alternative to the other. On the one hand, it can be explained by the reduction in the number of the least efficient firms; on the other, by the arrival of new innovative companies, and an increase in the competitive efforts of those already in existence. A slight confirmation of the 'dynamic and creative' character of the crisis, especially in the private sector, is provided by the European ranking of the 5,000 companies with the highest growth during the three-year period 2011-13: in the top 100, one third consists of companies from the SE3. Italy in particular stands out, occupying second place (after France) for the number of companies included in the list of 5,000: 768, in fact (three of them in the top 10), equivalent to 15 per cent of the total[10].

So far, we have dealt with the Southern Europe countries by regarding them as a whole, but we should not let this obscure the diversity in their economies, especially in terms of size and productive specialisations. Italy, for example, has a greater industrial endowment: those employed in the manufacturing

industries are, in absolute terms, about twice as many as those in Spain and more than five times those in Portugal. Italy also enjoys a substantial presence in the medium-high and high technology sectors, with employment figures not far from the EU average (in 2015 33.3 per cent vs. 37.2 per cent). Spain and, especially, Portugal, however, are more specialised in low-tech sectors. Differences also exist in terms of reaction to the crisis. In this respect, it should be noted that, as regards the corporate sector, the trajectory followed by Spain is slightly divergent. In the years before the crisis, growth in investment and employment proceeded at a much faster pace in Spain than in the other two countries, and the same was true for the contraction registered over the following years, including the area of innovation.

There are two further points that should be briefly mentioned before conclusions are reached, and they refer to all SE3. The first concerns the strong emphasis placed by many analysts on exogenous shocks – on the international crisis, in other words – to explain the difficulties with which Southern Europe economies are struggling today. While this is certainly a very real aspect, it is an interpretation that is likely to obscure the fact that the growth paths of the SEC3 had begun to diverge from those of the more advanced economies well before the explosion of the international crisis, as is clearly shown by the per capita GDP trend over the past 15 years. This was due to low labour productivity rates: between 2000 and 2007, hourly productivity in the SE3 always fell below the EU average, with an average annual increase that was fairly modest (0.7 per cent vs. 1.6 per cent). This datum indicates a development strategy based on a 'low road to competitiveness', centred on flexibilisation of the labour market and reduction of costs, rather than on research, advanced training and the creation of collective goods for innovation.

The second point concerns the costs of this strategy, with respect to the weakening of the productive and innovative capacity of the SE3 economies. This point finds clear confirmation when the most technologically advanced sectors are considered, using Southern Europe's most industrialized country as an example. As is well-known, Italy is the second largest manufacturing country in the European Union. Perhaps less well-known is that this fact also applies to medium-high and high technology sectors. On grouping these productive sectors together, it turns out that, in 2014, Italy was first in EU in terms of number of companies, second in terms of volume of employment, and third in terms of turnover (calculations based on Eurostat data). This indicates an extremely respectable productive potential that, however, does not seem able to translate into an equivalent capacity for innovation, as the data regarding patenting clearly highlight. In general, Italian patenting intensity is fairly low, standing at around two-thirds of the EU average (69.7 patents per million inhabitants vs. 112.0), but it is the country's performance in high-tech sectors that is, in fact, far from satisfactory, where it manages to reach only a third of the EU average (5.0

vs. 15.8 in 2013)[11]. The gap, in other words, increases precisely in the areas where NIS deficiencies have a stronger and more negative impact.

Conclusions

The impact of the crisis on NIS is a little-explored issue that we have begun to address with this work by focusing on the situation of Italy, Portugal and Spain. We have looked at the behaviour of governments and companies in order to inquire into the anti-conjunctural strategy undertaken on both sides. Our analysis has made use of indications deriving from the literature on the varieties of capitalism, from which we know that a link exists between the system of regulation and the regime of innovation: incremental innovation is found in coordinated market economies, and radical innovation in liberal market economies. Italy, Portugal and Spain present the typical features of the first model – with an under-specialisation in high-tech sectors – but they are also characterised by other elements that we thought useful to emphasise: a lack of collective goods and input for innovation; under-investment in the training of highly-skilled human capital; a predominant role played by the State with respect to private actors in relation to R&D activities; and a less than substantial articulation of relations and cooperation between the actors participating in innovative processes. These reasons also explain why SE3 are poor performers from the standpoint of innovation and display obvious weaknesses when compared to the more advanced situation in Europe.

From the point of view of institutional architecture, there is a clear polarisation between SE3 and the European Innovation Leaders. The latter have 'highly integrated' NIS. Their levels of per capita expenditure on R&D are higher than the EU average. They are *firm-centred* thanks to substantial investment by private companies, display a good level of collaboration among actors, and have a more *science-based* innovation regime. The NIS of the SE3, by contrast, are 'weakly integrated' and characterised by a per capita expenditure on R&D that is lower than the EU average. They are *public-centred* in orientation (although public expenditure is still lower than that of the Leaders countries), with weaker interconnections between actors and a tendentially *empirical-oriented* model, where development is nourished by forms of learning based on experience.

With the lag of Italy, Portugal and Spain highlighted in these areas – and also in terms of quality of governance and in conditions of 'doing business' – we then focused on the actual behaviour of Southern European companies. This revealed, with an especial focus on the Italian case, a picture that was less gloomy: some of these companies, in fact, despite the weakness of their NIS and the economic downturn, were still capable of producing innovation. The percentage of innovative companies in the SE3 – with the exception of Spain – is in line with the EU average and even increased during the crisis years. We therefore provided some possible explanations for this apparent 'South European Paradox'.

The crisis has certainly had a negative impact on the economies of the SE3 and on their NIS. The governments were unable to carry out counter-cyclical actions, as they were able to do in Leader countries: indeed, the public sector underwent a major retrenchment in terms of investments and policies supporting research and innovation. This meant that the gap between these two groups of countries regarding the use of public resources for R&D – a gap that in the pre-crisis period was growing smaller – once again began to increase (for companies, on the other hand, the situation remained roughly unchanged). The intervention methods of national governments also changed, and in opposite directions. In the SE3 the crisis brought about a huge reduction in a model of intervention that focused on direct transfers to companies. The opposite occurred amongst the Leader countries, which instead significantly expanded the number of companies able to benefit from some form of public support (to a level exceeding that of the SE3).

That being said, how can the 'South European Paradox' be explained? Productive structure is one of the first responses that can be brought into play. Manufacturing employment in the SE3 is predominantly concentrated in SMEs and low-tech sectors. Since this model is associated with a system of incremental innovation, which is less dependent on education systems and research, this might explain why Southern Europe companies are still able to innovate despite the weaknesses of their respective NIS. However, this explanation does not make it possible to grasp the generative dynamics that developed during the crisis. We therefore integrated the previous hypotheses by taking two processes into consideration: *creative destruction* and *creative accumulation*. These, we believe, are of help in explaining this apparent paradox. The first process developed through a reduction in the number of less efficient firms and the arrival of new companies; the second, through the intensification of competitive and innovative efforts on the part of certain existing companies, which adopted a pro-active attitude when faced with the 'battle for survival' imposed by the crisis. More generally, while the unfavourable gap between the SE3 and other EU countries is still present, today there seems to be a higher variability in company performance and propensity to innovation.

To summarise, the 'South European Paradox' shows two sides of the same coin. On the one hand, in fact, the weaknesses in the SE3 NIS have reduced the resistance to the crisis of many enterprises and lowered the economic and innovative potential of these economies. On the other hand, the harshness of crisis in the SE3 has also triggered more positive and 'creative' processes, inducing the more resilient and dynamic enterprises to multiply their innovative efforts.

Before concluding, we would also like to put forward one last brief consideration on the role of the crisis in relation to the NIS in Italy, Portugal and Spain: should it be seen only as a constraint or also as an opportunity? Government policies that have prevailed so far – also taking into account the

constraints imposed by the EU – have focused on the reduction of public expenditure rather than on research funding, advanced training and the endowment of public goods for innovation. This 'low road to competitiveness', however, is likely to produce a further weakening of the SE3 economies. Italy, for example, the second manufacturing country in Europe, displays a productive potential that is unable to generate a corresponding capacity for innovation. In this regard, the crisis could have represented an appropriate moment for a strategic rethinking of development policies, as occurred during the 1990s in South Korea and Finland, when the governments of those countries took advantage of a period of economic crisis to increase and review the logic of investments in training, R&D, technological infrastructure and other collective goods (OECD 2009). To date, however, the Southern Europe countries have not been able to meet the challenge posed by the crisis by interpreting it as an opportunity to solve the structural problems of their NIS and to promote policies for innovation and long-term growth.

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[1] That of 'innovation' is a broad concept which in this paper is declined in an economic sociology perspective. Given the complexity of the innovation process and the variations among different types of innovation (see Ramella 2016), it may be useful here to refer to the rather wide definition adopted by the Oslo Manual, which inspired the investigation carried out in the context of the EU: 'An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations'(OECD/European Communities 2005, p. 46).

[2] In this article, as benchmarks for the analysis of the three SE3, we will consider the four countries - Sweden, Denmark, Finland, Germany - that have confirmed themselves as Innovation Leaders over the years, thus excluding cases like the Netherlands, which has been upgraded to the Leaders group only recently in 2016, as well as the UK, which has been classified a Leader only in the past.

[3] The annual 'Worldwide Governance Indicators' reports present a number of indicators related to governance, and take the economies of a total of 215 states into account. The 'Doing Business 2015' report, on the other hand, provides a comparative overview of the economies of 189 countries involving the structures and practices of regulations that foster/hinder the start-up of economic activities (World Bank 2014, 2015).

[4] All the data commented on in this section - except when otherwise specified - come from the following Eurostat databases: http://ec.europa.eu/eurostat/data/database and http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database.

[5] Unless otherwise indicated, our comparison is between the seven years preceding the crisis and the next seven ones: 2000-2007 and 2007-2014.

[6] Between 2008 and 2014, Spain recorded a sharp decline in real estate activities (-17.7 per cent vs. EU +7.8 per cent), construction (-59.7 per cent vs -20.9 per cent EU) and mining extraction (- 40.0 per cent vs -9.2 EU), which were hit by the real estate bubble (for a detailed reconstruction of the effect of the crisis on Spain, see OECD 2014a; Royo 2008, 2013; Bosco & Varney 2012; Hamann 2013; Molina & Godino 2013; as regards Portugal, OECD 2014b).

[7] It cannot be described, however, as a 'back-to-zero' situation: in 2000 for every 100 Euros spent per capita on research in Innovation Leader countries, 24.9 Euros were spent in the SE3; in 2007 this amount had risen to 31.5, falling back to 28.3 in 2014 (source: Eurostat).

[8] Referring to the CIS 2014 survey, the absence of data for Denmark does not make a comparison possible.

[9] To render the data between the various Community Innovation Surveys comparable, companies were considered innovative if they introduced process or product innovations in the three-year period of research. There are very significant variations among the SE3: in Italy, innovative manufacturing companies accounted for 45.9 per cent, in Portugal for 39.8 per cent, and in Spain the figure went down to 28.5 per cent.

[10] In the last three years (2015-17) the average number of the SE3 companies appearing in the ranking of the top 5,000 has amounted to 944, that is, approximately 19 per cent of the total. The ranking was compiled by the US magazine Inc. (http://www.inc.com/inc5000eu).
[11] To provide a more concrete idea of this gap, suffice to say that while the employees in high-tech activities (manufacturing + services) in Germany are a little more than double those in Italy, the volume of patenting is over 5 times higher.