EU research and innovation policies as factors of convergence or divergence after the crisis

Kincsö Izsak Slavo Radošević

Science and Public Policy, Volume 44, Issue 2, 1 April 2017, Pages 274–283, https://doi.org/10.1093/scipol/scw063

Abstract

The 2008 global financial and economic crisis has disturbed the evolution of research and innovation (R&I) policies in Europe, and it continues to have significant consequences. This paper reviews the evolution of and changes in R&I policy funding and measures before and in the aftermath of the crisis, and analyses reactions in three, Southern, Central-Eastern, and North-Western European country groups. Based on analysis of the Erawatch-TrendChart Inventory, we show that the crisis-induced three different responses. In North-Western Europe, it induced further support for R&I activities; in Southern Europe, it led to the collapse of national public support and its substitution only to some extent by EU Structural Funds, and in Central-Eastern Europe to an apparently much stronger compensation effect. Overall, these trends suggest that R&I policies have operated as a factor of further divergence between North-West and South, and as a potential factor of convergence between North-West and Central-East.

Keywords: EU crisis; research policies; innovation policies; convergence; divergence

1. Introduction

The 2008 global financial crisis and the ensuing economic and public sovereign debt crisis disturbed the evolution in Europe of both business research and innovation (R&I) and public R&I policies. The crisis had a severe impact on the real economy, resulting in a decreased supply of credit, increased credit standards and cutbacks in firm investments (European Commission, 2014). Finance for innovation started to dry up as a result of more risk-averse behaviour, and this has had an impact on innovation activities. It triggered a shift in many business strategies from long-term competitiveness to short-term survival (OECD, 2009). As a consequence, some of the structural problems in the economy have become more apparent. The crisis has more heavily impacted some countries than others. Southern European countries, such as Greece, Spain or Portugal have had to be bailed out. In Central Europe, in countries such as Hungary and the Czech Republic, the crisis has had a severe impact on the economy (Hebakova et al., 2011), while the economy in Poland has been more resistant (Reichardt, 2011). The crisis led to the protracted decline of GDP in South EU, to a sharp drop in previously high rates of the CEE and stagnant growth in developed EU countries. For example, in 2008-2015 period real GDP in the South fell on average by 1.4% while in CEE and developed EU led to stagnant average growth rates of 0.8% and 0.6% respectively[1].

Seven years since the start of the financial and economic turmoil in Europe, finding the optimal response to the crisis is still pertinent, but this extended period allows reflection on how R&I policies have changed or retained their orientation in the wake of the crisis and how it unfolded in different parts of Europe.

[1] Calculations by authors based on Eurostat data. Groupings exclude Cyprus, Malta and Luxemburg.

The key research question addressed in this paper is whether the crisis has had an impact on the direction of R&I policies, and has changed the emphasis among policy priorities, and, if so, in what direction. First, we would expect that R&I policies as long-term strategies would have remained government priorities. Since research and development (R&D) and innovation are one of the drivers of long-term growth, we would expect economic policies to avoid imposing austerity on R&D systems. Second, we would expect policies in those countries less affected by crisis policies to have suffered less adjustment compared to countries with stronger budgetary pressures. Third, we would expect to see differences in RDI trends over time due not only to the severity of the crisis but also due to anti-cyclical R&I policies wherever they have been applied. It is important to examine whether R&I policies are a factor of divergence or convergence in RDI. Fourth, this is even more important in light of the very slow evolution of national innovation policy mixes between the pre-crisis (2004-2008) and post-crisis (2009-2012) periods (see Izsak et al., 2013). These four factors justify exploring RDI policies and trends in RDI funding in the wake and the aftermath of the crisis.

These research issues will be addressed mainly by analysing the data of the Erawatch-TrendChart Inventory. The Inventory is a unique database of research and innovation policy measures that represent the indispensable basis for analysis of research and innovation policies in the EU. It enables comparative analysis of policy issues across a large number of countries which is usually not possible given the complexity of R&I policies and their contextual differences. Nevertheless, it has to be noted that the Inventory also has its limitations and hence the conclusions of this report are subject to the quality of the primary source.

The paper is structured as follows. Section 2 reviews the literature on R&D and the crisis; Section 3 presents the methodology; Section 4 analyses the changes to public R&I funding;

and Section 5 explores the shifts in the composition of R&I policy measures, comparing the situation before and in the aftermath of the crisis. Section 6 presents the conclusions based on the findings from the quantitative analysis.

2. Research, development and innovation in a period of economic crisis

There is a general understanding that the 2008 economic crisis has negatively affected business innovation and R&D in all countries. The crisis has revealed latent weaknesses in many countries, but provoked fast and adequate responses in some others, resulting in a variety of outcomes (see OECD, 2009). Countries' responses may be pro-cyclical with shrinking government R&D and Innovation (RDI) budgets and slowing Gross Domestic Product (GDP) growth keeping pace with total government expenditures, or anti-cyclical where RDI budgets increase to counteract the decline in GDP.

At a more fundamental level of enquiry, research shows that externalities intrinsic to R&D result in a procyclical response (Barlevy, 2007). The benefits that individual R&D investors derive from their investments increase disproportionately if other investors also invest in R&D. By the same token, in periods of recession, R&D investments fall which leads to weaker spillover benefits for everyone. Consequently, in periods of recession like the one induced by the 2008 global financial crisis, private sector R&D decreases disproportionately, which prolongs the recession and calls for countercyclical R&D subsidies to either the private or government R&D sectors.

There is a small but growing literature analysing the impact of the crisis on R&I policies (see Tsipouri and Reid, 2009; OECD, 2012a). Because of the relatively short time frame,

the lack of data and the complexity involved in separating general trends from shifts that are a direct result of the crisis, there is no consensus on the effects of the crisis on RDI.

The previous literature shows that there is a pro-cyclical relationship between the general economic performance indicators and the variables related to a country's RDI performance. According to the OECD's (2009) analysis of the effects of the economic crisis on innovation activities, in times of crisis, innovative firms tend to scale back their R&D expenditure and investment in risky projects. This shift in behaviour is frequently accompanied by a reduction in patenting activities, new trademark applications, and a drop in venture capital financing. At the microeconomic level, the above observations are supported by Community Innovation Survey (CIS) data (Archibugi et al., 2013), which shows that most companies reduced their R&D efforts in the aftermath of the crisis, with only a small proportion maintaining these activities at the same level.

Filippetti and Archibugi (2011) also show that a large number of firms managed to maintain their investments in innovation while the trends in R&D investment are divergent. The number of enterprises that have been able to continue expanding their R&D has dropped dramatically, and the number that has scaled down their R&D has increased substantially. R&D is an expensive fixed cost activity, and it seems that the crisis has led to the polarization of R&D performing firms - reducing the number of large R&D players and the number of R&D active firms. The geographic spread of these effects shows that the most affected countries are the European 'catching-up countries', especially new member states in Central and Eastern Europe. Also, Veugelers (2014: 2) argues that there be an increasing R&I divide in Europe 'with the stronger countries forging ahead and the weaker countries further cutting their R&I support.'

Kanerva and Hollanders (2009) analysed Innobarometer data for Europe and concluded that firms' innovation expenditure decreased following the crisis. Similarly, Filippeti and

Archibugi (2011) use Innobarometer 2009 firm level data to explore the determinants of and shifts in innovation activities before and immediately after the 2008 crisis. The share of companies showing decreased innovation activity is not evenly distributed across the EU28. The worst affected countries are in Central and Eastern Europe and some parts of Southern Europe while the North-Western European economies (Switzerland, Sweden, Finland, Germany, and Austria) 'will emerge from this crisis with a relatively stronger innovative capacity' (Filippeti and Archibugi, 2011: 189). Makonnen (2013) reaches similar conclusions based on analysis of macro data for 2010. Data on R&D presented in Table 1 partly confirm their findings in the case of EU North-West and South EU, but contradict it in the case of Central-Eastern EU. We ascribe these differences largely to the limited period of the analysis, which covers only the period just before and soon after 2008 while our data extend into the recovery period. The effect of the limited time span is even greater in the study by Archibugi and Filippeti (2011), who conclude that the 2008 crisis will impair convergence in RDI among the EU new member states. However, they ignore EU-South divergence and the compensatory or anti-cyclical effect of Structural Funds on RDI trends in new member states.

3. Methodology

Our analysis is based on the Erawatch-TrendChart Inventory2 (hereafter the Inventory) - a unique depository of R&I policy measures in the EU28, the TrendChart country reports produced between 2006 and 2012, and a selected list of Science and Technology (S&T) indicators. Research and innovation policies are broad-based scientific, technological and innovation-related interventions that address different failures of national innovation systems such as capability, institutional, network or framework failures (Arnold, 2004).

[2] http://erawatch.jrc.ec.europa.eu/

The Inventory tracks a wide range of R&I policy instruments such as collaborative R&D programmes, support for start-ups, number and type (but not value) of tax incentives, Intellectual Property Rights (IPR) measures, and direct support for business RDI. National governments apply a broad mix of policy instruments to support innovation, ranging from fiscal policies and support for research and education via financial measures such as loans, guarantees, subsidies and equity, enhanced linkages between industry and science, innovation consulting services and awareness-raising measures. However, the selection and budgetary weight of these policy instruments and their delivery modes differ across countries. The harmonization of divergent policy measures across numerous countries requires substantial cleaning and revision of the Inventory. Data quality was checked especially the categories of the overall budget, annual budget, classification, a form of funding, and start and end years.[3]

The Inventory defines a policy measure as any instrument that:

- mobilizes resources (financial, human, organizational) through publicly (co-) financed R&I programmes or initiatives; and/or
- funds the generation or diffusion of information and knowledge (studies, roadmaps, dissemination of technology activities, advisory services, public-private partnerships, etc.) to support R&I activities; and/or
- promotes an institutional process (legal acts, regulatory rules) designed explicitly to influence the undertaking of R&I by organizations;
- normally is implemented on an on-going (multi-annual) basis, rather than being a one-off event or a single project.

The key R&I policy measure groups include the following:

3 http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm

1. *Governance & horizontal research and innovation policies*: including support for policy making, policy intelligence, policy advisory services, long-term research agendas, horizontal measures in support of financing, other horizontal policies.

2A. *Research organisations*: covering measures supporting improved excellence, relevance, and management of research in four categories of institutions such as universities, public research organisations, research and technology organisations and research infrastructures.

2B. *R&D cooperation and knowledge transfer*: including funding and training measures for technology transfer offices, research commercialisation structures, measures aimed at improvement in IPR regimes, measures to improve R&D co-operation between public/academic/not-for-profit sector research institutions and enterprises.

2C. *Support for business R&D*: direct state aid measures in support of business research, all forms of direct funding (grants, loans) to enterprises engaged in pre-competitive, industrial research, product development, prototyping.

3. *Human resources development*: including science education, measures to raise the interest of the young in science and technology and enhance the focus of primary and secondary education in science and technology, the relation between teaching and research, stimulation of PhDs, research personnel, career development, skills development and recruitment, awareness creation.

4. *Enterprise support to innovation*: support to sectoral innovation programmes, innovation in services, entrepreneurial innovation, innovation management, and advisory services, organisational innovation including E-Business, new forms of work organization, support to start-ups.

5. *Markets and innovation culture*: measures in support of innovation cultures such as the creation of favourable innovation climate or innovation/design prizes, the establishment of new markets, measures to raise awareness and provide general information on IPR.

To explore the trends in national R&I policies and policy mixes, we review the changes in the composition of the policy measures included in the Inventory. We use two proxies to reflect policy shifts such as the number of policy measures devoted to a certain policy priority, and budget allocated to particular types of policy instrument groups. We analyse funding trends from the onset of the crisis in 2008-2010, and in its aftermath in 2011-2013. We compare the status of the Inventory in two three-year periods - 2006-2008 (status immediately before the crisis), and 2011-2013 (the period following the crisis when the effect of policy adjustments should become evident). We examine trends for three countries in each of three groups (Southern Europe; Central-Eastern Europe; and North-West Europe) whose economies and public sectors have been similarly affected by the crisis.

In Southern Europe among the hardest hit by the crisis are - respectively - Greece, Portugal, and Spain. Countries in Central-Eastern Europe which share similar history by being the former communist countries and which have joined the European Union at the same time - the Czech Republic, Hungary, and Poland. Three countries in North-West Europe that were less badly affected by the crisis and are among the innovation leaders - Denmark, Germany, and Sweden[4]. Countries within each of three groups have their distinctive economic development paths and R&I systems, but also share similar income levels, and the historical commonalities in R&I performance which render them relatively homogeneous groups. Their research and innovation systems are at a similar degree of maturity, they are on the similar economic paths, and represent both larger and smaller

[4] According to the Innovation Union Scoreboard, 2015 available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm

sized economies in each country group. Also, this grouping allows investigation of wider European patterns which would not be possible were we to consider only individual countries.

It should be noted that the Inventory is less complete in certain policy areas such as research infrastructure, human resources, and innovation support infrastructure (innovation agencies, incubators, etc.), where measures are not always linked to a policy programme but are supported by institutional funding. Although the Inventory includes the main policy areas along with some less important policy areas, we consider only the former since we have no indication of the weight or importance of the less important policy areas and their inclusion could distort the analysis. Although we cleaned the Inventory as much as possible, we cannot claim that the figures are an exact expenditure. First, in many cases, they reflect allocations, not real budget spent (which would be nearly impossible to track back). Also, given the near impossibility of collecting the exact figures on budgets which are often composed of different modes of funding like grants, loans, or subsidies they should be considered as indicative of the level of funding based on their relative weights. Nevertheless, this 'cleaned' Inventory is the most comprehensive and reliable source of data on R&I policies in the EU.

4. Research and innovation funding

The impact of the crisis on R&I policies has been analysed by the OECD, and as part of the European Commission's Erawatch and INNO-Policy TrendChart[5] initiatives. The main challenge according to the Annual TrendChart (Acheson et al., 2011) and the OECD (2011) reports is related to preserving the stability of R&I funding in the aftermath of the

5 http://erawatch.jrc.ec.europa.eu/

crisis. Both the OECD and the European Commission argue that innovation is essential to boost productivity and sustainable growth, and have warned against damage to long-term growth and recommend accelerated structural shifts while bearing in mind that the role of innovation might differ in different country groups.

As a response to the crisis, all member states have implemented economic stimulus packages of various sizes and structures (European Parliament, 2009). Although the primary objective has been to restore a functioning financial system and to stimulate aggregate demand in the short term, it is also understood that these packages can "contribute to a sustainable recovery only if the measures taken also strengthen the foundations of long-term sustainable growth" (see the presentation in Hutschenreiter, 2009).[6] So, have these packages managed to sustain investments in R&D across the EU? In a nutshell, the answer is no, not across the board. Outcomes differ across the three EU sub-regions (see Table 1). In the North-Western region (Denmark, Germany and Sweden) and Central-Eastern Europe (Czech R, Hungary, and Poland), both business and government sector expenditures per capita have continued to grow. However, growth in Central-Eastern Europe has been at a much lower level of 8% and 18% of levels for the business and government sectors when compared to North-Western EU respectively. Among the Southern European countries, R&D expenditure has declined in absolute terms in Greece and Spain, increased in Portugal compared to 2007 levels, but decreased compared to 2008 levels. In short, the gap between Central and Eastern EU and North Western EU has been maintained for the public sector, and shows some catch-up in the business enterprise sector, while Southern EU has fallen behind North-Western EU in both respects.

---

6 http://www.vinnova.se/upload/dokument/VINNOVA_gemensam/Kalender/2009/almedalen2009/Gernot%20Hutschenreiter.pdf

Table 1: GERD by business enterprise and government sectors as the source of funding per capita in 2007 and 2012

< >

Given the depth of the EU economic crisis and the policy consensus that R&I should be anti-crisis tools, we would expect that the relative weight of government R&D funding (GOVRD) per capita would increase compared to the business sector. This change in relative weights of financing would demonstrate that anti-cyclical policies are working across all three EU sub-regions. The data in Table 1 and Figure 1 show that a shift towards government funding has taken place in the North-Western countries, but only in the Czech Republic among the other two EU sub-regions. This picture suggests that, at least regarding outcomes, anti-cyclical policies have not been implemented or have not been successful in Southern Europe and partly in Central-Eastern Europe country groups.

Figure 1: Changes in the relative weight of government over business sector R&D funding per capita (percentage points)

< >

The biggest challenge brought by the crisis for many EU member states has been the stability of public funding for R&I. Austerity policies have hit government budgets for RDI hard since they were not considered a priority compared to more urgent socio-economic problems such as high unemployment, social security, and low or negative

growth. These have required prompt responses such as new investments in physical infrastructures.[7]

Initially, R&I were considered as significant catalysts for recovery and growth, especially given the widely accepted idea that the future is about building a knowledge-based economy. Although 2008-2010 period was characterised by countercyclical trend regarding public funding of R&I, this has changed during the subsequent period 2011-2013. Despite a political commitment to the anti-cyclical role of R&I, the budgets for R&D and innovation declined as a result of the severe financial problems in several member states. Figure 2 shows the trends in public R&I budgets in two periods since the start of the crisis: 2008-2010 and 2011-2013. Trends were calculated by comparing the evolution in GBAORD[8] figures complemented by Inventory data for the most recent years.

Figure 2: Trends in national public funding for research and innovation 2008-2009/2010 and 2011-2013

< >

Comparing trends in public R&I funding (based on GBAORD and Inventory funding figures) the negative evolution is striking. Although R&I policies were protected immediately after 2008 up to 2010, maintaining funding levels then became more difficult. In the period 2008-2009/2010, only Greece, Romania, and Latvia suffered a more than 10% decrease in their R&I budgets. However, this had changed in the 2011-2012/2013 period with most of the Southern European countries (Portugal, Spain, Italy), several

[7] A high profile example of this policy orientation is the so-called Juncker plan http://ec.europa.eu/priorities/jobs-growth-investment/plan/index_en.htm

[8] According to Eurostat, Government Budget Appropriations or Outlays for R&D or GBAORD, - is a way of measuring government support for R&D activity. GBAORD includes all appropriations (government spending) on R&D in central (or federal) government budgets'

Central and Eastern EU countries (Bulgaria, Hungary, Latvia, Slovenia), and Netherlands, Ireland, and the UK in Western EU showing a negative trend. Slovenia, although cited as a positive example, has also been affected by the financial crisis and has faced strong pressure on its R&I policies as a result (Bucar, 2011; OECD, 2012b). However, Slovenia has managed to use EU funding to counteract the fall in domestic funding. The fall in GBAORD in the case of Greece, Latvia, Romania and Spain has been especially severe.

The decreasing trends observed in GBAORD figures, in certain cases, are the result of conscious consolidation and effectiveness measures or reallocations. For instance, science-base funding has been ring-fenced in the UK, which should mean stability for the R&I system. On the other hand, overall funding is expected to decrease. Although efforts have been made to stabilize budgets, the science budget was maintained, but in 2010, there was 40% cut to the university budgets (excluding research)(Cunningham et al., 2011), the difference being made up by student fees. The Dutch government has made a shift in the use of its public R&I resources in response to the crisis and has reduced business grants and increased loan-based instruments (Mostert et al., 2012). Alongside funding, the crisis has depleted the capacity of enterprises to apply for new innovation projects, although to differing extents across member states, and has posed problems related to co-financing innovation initiatives, which, in many cases, has led to a smaller number of operations being funded.

It is a positive sign that many countries regard R&I as a means of emerging from the crisis, and many countries made efforts to ‘protect’ R&I budgets from general expenditure cuts in the initial period after the onset of the crisis. In Northern and Western Europe countries such as Austria, Denmark, Estonia, Finland, Germany and Sweden, and even Ireland, Lithuania, and the UK, innovation policy initiatives have been strengthened. For example,

in Austria, funding for R&I shows a minor shift from private to public R&D sources, demonstrating a counter-cyclical R&D expenditure policy in that country (Schuch, 2012). However, some other countries in Central and Eastern Europe, such as Bulgaria, Croatia, Hungary, Latvia, Romania, Slovakia and Slovenia, have turned away from innovation policy and focused on macroeconomic actions and crisis management. For instance, Hungary has been busy trying to mitigate the results of the economic crisis and, in 2010, it suspended several innovation measures and blocked 36.6% of the annual research and technological innovation budget (Havas, 2011). In some countries where Structural Funds were the main source of financing for R&D and innovation policy budgets, overall funding levels have suffered fewer changes. In Slovakia and Slovenia in 2009-2010, for example, there were no cuts to the financial resources for R&D due to on-going Structural Funds measures, although innovation policy was removed from the policy priority list. It should be noted, also, that according to the country reviews in most countries, the budget cuts had a greater effect on direct public R&D expenditures, such as block funding for public research organizations and universities, than competitive R&I programmes.

One consequence of the changes to national public R&I funding is that the importance of other sources has increased. The pressure on government funding has led to a search for more private-public partnerships to implement R&I programmes. Moreover, the emphasis has shifted towards Structural Funds or other EU and international funding as more stable sources of financing (see Figure 2). The real effect is much bigger than the figures based on the numbers of measures suggest since the financial weight of measures supported by Structural Funds is usually much larger than of domestic measures alone.

Figure 3: Sources of co-financing of support measures in EU27 in 2009 and 2013 (as a percentage of the total number of measures)

< >

5. Research and innovation policy measures

To analyse trends in the types of R&I policy measures we have distinguished among three country groups identified according to the severity of the crisis on their economies and according to the level of evolution of their R&I systems.

First, there has been a reduction in the number of R&I policy measures in the aftermath of the crisis (Table 1). This change might reflect a consolidation and reorganization of implementation structures in many EU countries although the number of measures provides only an approximate picture of each country's innovation policy landscape. The Inventory of R&I policy measures shows that there were around 167 fewer innovation policy measures across all EU countries in 2013 compared to 2009, [9] based on Erawatch-TrendChart country correspondent reportings. Regarding the evolution of the number of measures in the selected country groups, we find that comparing the 2006-2008 and 2011-2013 periods, they have declined in the Southern and North-Western EU groups from 92 to 51 and from 118 to 91 respectively and stayed roughly the same in the Central-Eastern EU group going from 90 to 92. However, there are differences within country groups, and there is no general pattern across countries. For instance, the reduction in the number of measures was greater in Spain than in Portugal, and while the number decreased in Hungary, it increased in Poland. Nevertheless, the Inventory shows three broad regional patterns: consolidation in the North-Western group, maintenance of the portfolio of

9 TrendChart inventory: 2009 N=959 and in 2013 N=792

measures in Central and Eastern Europe, and a reduction in the number of R&I policy measures in Southern EU.

Table 2: Number of policy measures across EU countries and sub-regions

< >

Most of the reductions were small-scale support for innovation or pilot initiatives. Some measures continued within the frameworks of larger programmes. The reductions also reflect a consolidation process aimed at making the policy mix more transparent and more accessible for the targeted beneficiaries. For instance, the user-driven innovation programme in Denmark was subsumed into the Business Innovation Fund. The Danish policy support system has been streamlined to improve its effectiveness through a focus on a reduced number of measures with larger budgets (Klitkou, 2012). The crisis may also have caused policy-makers to reflect on the range of policy instruments and delivery mechanisms in a context of tighter public budgets and pressure on national innovation systems, and this might have resulted in a decrease in the number of measures in Southern European countries.

Comparing the budgets devoted to certain policy areas in the three country groups, we find some shifts in emphasis. Figure 3 summarizes the results of the analysis, highlighting the types of policy measures that gained or lost importance between the two periods.

Figure 4: Estimated annual budget per group of R&I policy measures in the period of 2006-2008 (before the crisis) and 2011-2013 (in the aftermath of the crisis) by country groups (budget in thousand euros)

< >

Based on these data, and bearing in mind the limitations of Inventory data already referred to, we can make the following observations:

- In the Southern country group funding for most policy priorities decreased except R&D cooperation and enterprise support for innovation (e.g. innovation in manufacturing, support for innovative start-ups and gazelles, recruitment of skilled people by enterprises). This decrease reflects a shift in emphasis towards business innovation, support for young entrepreneurs, and commercialization of research results. This crisis also prompted measures designed to help researchers and retain highly qualified personnel;
- In the Central-Eastern EU group, the budget amounts allocated to on different priorities remained more or less the same across all groups of R&I support measures although with a slight shift towards enterprise support for innovation (e.g. innovation in manufacturing and support for start-ups and gazelles). However, the amount of the budget devoted to policy measures related to excellence, relevance and management of research in universities, and research infrastructures reduced. The relative stability of R&I funding reflected in the Inventory data is due to the substantial role of Structural Funds which constitute a higher share of GBAORD than in the case of the Southern European countries (see Table 3);
- In the North-Western country group, the R&I budget increased between the period before the crisis to the last period of analysis. The priorities specifically enhanced were horizontal support measures for financing R&D, direct support for business

R&D, support for innovation in manufacturing, support for service innovation and support for risk capital funds. These changes reflect increased support in financing and support for business innovation, which had started before 2008. It reflects long-term policy thinking rather than a response specifically to the crisis. Note that the budget devoted to R&D cooperation decreased in these countries, but this might be due to the cyclical nature of significant R&D programmes which cover specific periods, or to a shift in R&D cooperation towards European funding (FP7, Horizon2020). On the other hand, the budget for direct R&D subsidies has increased. The positive effects of R&D subsidies have been documented for Germany; Brautzsch et al. (2015, p. 623) show that they had a substantial leverage effect so that a subsidized R&D programme resulted in a production, value added and employment effect amounting to at least twice the initial financing. In other words, the R&D programme counteracted the 0.5% decline in GDP in 2009.

Table 3: Share of Structural Funds in total GBAORD

< >

More detailed analysis of the specific types of policy measures based on the Inventory reveals that:

- horizontal measures to support financing decreased in the Southern European country group was stable in Central-Eastern Europe and increased in North-West Europe;
- cluster framework policies received more funding in the Central-Eastern and North/West country groups, but this funding decreased in the Southern country group;
- direct support for business R&D declined in the Southern European country group, stayed stable in Central-Eastern Europe and increased in North-West Europe.
- R&D cooperation measures increased in Southern European countries, stayed stable in Central Europe and decreased in North-West Europe;
- support for human resources development has fallen in Southern Europe, but was stable in Central-Eastern Europe and North-West Europe;
- support for the creation of a context favourable to innovation remained stable in all three country groups.

Overall, the analysis shows that inter-regional patterns dominate: increased funding in North-West EU, decline in the financing in Southern EU and a substitution effect in Central and Eastern EU[10] (see Annex 1).

[10] For further details see Izsák K., Markianidou P., Lukach R., Wastyn A. (2013). *The impact of the crisis on research and innovation policies*. – Study commissioned by DG RTD European Commission.

6. Conclusions

The crisis has had a severe impact on the real economy resulting in tighter credit supply, increased credit standards, and cuts to firm investments. It triggered a shift in many business strategies from long-term competitiveness to short-term survival. However, its impact differed among European countries. Innovation leaders, such as countries in Northern and Western Europe experienced no major shifts in R&D and innovation investments while the Southern-European countries entered a deep recession which has had a severe effect on their R&I systems. The consequences of the crisis on Central-Eastern European countries have been more ambiguous, with some countries benefiting from EU funds and using them as strong anti-cyclical devices, and others are experiencing deep depression and inability to use R&I funding as anti-cyclical devices.

The reduction in public funding has significantly impacted the R&I policy. On the positive side, many of the countries examined here regard R&I as a way out of the crisis and had made real progress in protecting public R&I activities. Although there was a countercyclical trend in 2008-2010 regarding government funding for R&I, maintaining funding levels became difficult after 2011. Securing financing for R&I policies is among the most relevant challenges.

One consequence of the changes in national public R&I funding is the increased importance of other sources. Pressure on public funding has led to more private-public partnerships to implement R&I programmes. Thus, the emphasis has shifted towards Structural Funds or other EU and international financing as more stable sources of finance. The Structural Funds programmes have brought some stability for innovation systems since typically they provide on-going funds.

When we compare the country groups analysed, we observe that the crisis has induced three different responses from three EU regions. This finding contrasts with Makonnen

(2013), Filippeti and Archibugi (2011) and Veugelers (2014) and is the result mainly of the longer time span and scope of analysis which includes both funding trends and actual policy changes. The crisis has worked to reconfigure the relevance of some R&I policy measures, although to different extents in the three country groups. The focus of R&I policies has been sustained in North West and Central and Eastern EU but have lost funding and priority in Southern Europe. In North-Western Europe, this has induced further support for R&I activities. In Southern Europe, it has led to the collapse of national public support and its substitution only to a small extent by EU Structural Funds. In the Central-Eastern country group, this compensation effect has been stronger. Policy mixes have not changed regarding their main composition, but they have been adjusted in North West EU and, to a lesser extent, in the other two EU groupings. This finding contradicts our initial hypothesis that policies do not change in countries less impacted by the crisis. Overall, these trends suggest that R&I policies have operated as a factor of further divergence between EU North-West and EU-South, and as a potential factor of convergence between EU North-West and EU Central-East.

References:

Acheson H., Izsak K., Markianidou P. and Tsipouri L. (2011) *Innovation Policy Trends in the EU and Beyond, an Analytical Report 2011 under a Specific Contract for the Integration of the INNO-Policy TrendChart with ERAWATCH (2011-2012),* European Commission, Brussels

Archibugi D. and A. Filippetti (2011) 'Is the Economic Crisis Impairing Convergence in Innovation Performance across Europe?', *Journal of Common Market Studies*, 49/6: 1153–82.

Archibugi, D., Filippetti, A. and M. Frenz (2013) 'Economic Crisis and Innovation: Is Destruction Prevailing over Accumulation?', Research Policy, 42: 303-14.

Arnold (2004) 'Evaluating research and innovation policy: a systems world needs systems evaluations', *Research Evaluation* 13 (1): 3-17 doi:10.3152/147154404781776509

Barlevy, G. (2007) 'On the Cyclicality of Research and Development', *American Economic Review*, 97/4: 1131-64.

Bucar, M. (2011) INNO-Policy TrendChart Mini country report on Slovenia. European Commission, Brussels

Brautzsch, H. -U., Jutta, G., Loose, B., Udo, L. and Nulsch, N. (2015) 'Can R&D Subsidies Counteract the Economic Crisis? – Macroeconomic Effects in Germany', *Research Policy* 44: 623–33.

Cunningham, P., Sveinsdottir, T., and Gok A. (2011) INNO-Policy TrendChart Mini country report: UK. European Commission, Brussels

European Commission (2014) ECFIN Economic Brief, Financing the real economy, ISSN: 1831-4473, available at http://ec.europa.eu/economy_finance/publications/economic_briefs/2014/eb30_en.htm

European Parliament (2009) Economic Recovery Packages in the EU Member States: Compilation of Briefing Papers, Policy Department Economic and Scientific Policy, Brussels

Filippetti, A., and Archibugi, D. (2011) 'Innovation in Times of Crisis: National Systems of Innovation, Structure, and Demand', *Research Policy*, 40: 179-92.

Havas, A. (2011) Mini country report - Hungary. INNO-Policy TrendChart. European Commission, Brussels.

Hebakova L., Vanzura L., Kostic M. and Pokorny O. (2011) Mini Country Report – the Czech Republic. INNO-Policy TrendChart. European Commission, Brussels.

Izsak, K., Markianidou, P., Lukach, R. and Wastyn, A. (2013) 'The Impact of the Crisis on Research and Innovation Policies', European Commission, Brussels.

Kanerva, M., and Hollanders, H. (2009) *The Impact of the Economic Crisis on Innovation. INNO Metrics Thematic Paper*, European Commission, Brussels.

Klitkou, A. (2012) Country Review: Denmark. INNO-Policy TrendChart. European Commission, Brussels.

Makkonen, T. (2013) 'Government Science and Technology Budgets in Times of Crisis', *Research Policy* 42: 817–22.

Mostert B. and Deuten J. (2012) Country Review Netherlands. INNO-Policy TrendChart. European Commission, Brussels.

Organisation for Economic Cooperation and Development (OECD) (2009) *Policy Responses to the Economic Crisis: Investing in Innovation for Long-Term Growth*. Paris: OECD.

Organisation for Economic Cooperation and Development (OECD) (2012a) "Innovation in the crisis and beyond", in OECD Science, Technology and Industry Outlook 2012. Paris: OECD: 21-57.

Organisation for Economic Cooperation and Development (OECD) (2012b) *OECD Reviews of Innovation Policies: Slovenia 2012,* Paris: OECD.

Reichardt, A. (2011) 'Poland and the Global Economic Crisis: Observations and Reflections in the Public Sector', *Journal of Finance and Management in Public Services*, 10/1: 38-48.

Schuch, K. (2012) Country review Austria. INNO-Policy TrendChart. European Commission, Brussels.

Tsipouri L. and Reid A. (2009) European Innovation Progress Report 2009. INNO-Policy TrendChart. European Commission, Brussels.

Veugelers, R. (2014) 'Undercutting the Future? European Research Spending in Times of Fiscal Consolidation', *Bruegel Policy Contribution*, 6, available at http://bruegel.org/2014/06/undercutting-the-future-european-research-spending-in-times-of-fiscal-consolidation/