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University Policy Needs To Beef Up For Europe To Be More Innovative

Jo Ritzen, Gabriele Marconi, Simone Sasso
in collaboration with
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Second EEU Report on the State of University Policy for Progress in Europe

Technical Report

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Jo Ritzen*, Gabriele Marconi**, Simone Sasso***
in collaboration with Cecile Hoareau

* UNU-MERIT, Maastricht University, email: jo.ritzen@empowereu.org
** Maastricht University, email: g.marconi@maastrichtuniversity.nl
*** UNU-MERIT, Maastricht University, email: sasso@merit.unu.edu

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Preface of the EEU Board

This report is produced by the Foundation Empower European Universities with the support of many other organisations and individuals. This foundation emerged from a debate within a group composed out of former ministers of (higher) education internationally renowned higher education experts in 2010.[1] They felt the need to track how European higher education policies help universities face the challenges of quickly changing societies which are dependent on innovation to cater for future well-being. These analyses might help Governments to learn from European experience in devising university policies (the term "universities" is used interchangeably with "higher education" in this report).

In the first (2012) report we presented a way of summarising a country's policy, in terms of legislation which determines the organisation strength of the university and in terms of funding, into factors. We looked at the relations between policy and performance in 32 European countries. This policy report is the second on the State of University Policy for Progress in Europe, following on the first, published in 2012 (see: www.empowereu.org).

This second is also the last report of EEU which will cease to exist with the appearance of this report. The mission of the Foundation has not been completed, but can be served by the individuals who have actively taken part in the work of the foundation, with a special role for Maastricht University which has housed the Foundation at UNU-MERIT/School of Governance.

We deeply appreciate the substantive support to the EEU work by the Netherlands Organisation for Scientific Research (NWO), Educational Testing Service, UNU-MERIT at Maastricht University, Aarhus University, Central European University, RAND Corporation Europe as well as the support of many student assistants and volunteer students from Maastricht University.

The Board,

Jo Ritzen, Chair

Lady Tessa Blackstone, Secretary

Balint Mayar, Treasurer

Eduardo Grilo, Member

Christian Bode, Member

[1] A summary of this debate is presented in Marconi (2011).

Chapter 1

Introduction

1.1. Why this report?

The EU wants to become more innovative. Europe even wants to be the most innovative region in the world. The EU Heads of State formulated in Lisbon in 2000 that the EU should by 2010, "*become the most competitive and dynamic knowledge based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion"*. Europe was supposed to be the most innovative continent, mostly by means of ensuring sufficient investments in public and in private research. As an afterthought there was the realisation that human capital was important as well (…).

More innovation may be the 'vibrant' alternative to the present policies which might be considered as 'muddling through' after the successive economic downturns in Europe (Ritzen and Zimmermann, 2013).

Our analysis focuses on the role which university graduates and university research play in innovation (defined as the increase in labour productivity) and the institutional setting (university policy) which brings about the kind of graduates and the kind of research which makes a difference for innovation.

In many respects this EEU reports link up to the notion of the 'third generation' of innovation policy (European Commission and Louis Lengrand & Associés, 2002): "The 1st generation of innovation policy was based on the idea of a linear process for the development of innovations. This process begins with laboratory science and moves through successive stages till the new knowledge is built into commercial applications that diffuse in the economic system. The emphasis of policy was on fostering critical directions of scientific and technological advance, and enhancing the flow of knowledge down along the innovation chain. 2nd generation policy recognises the complexity of the innovation system, with many feedback loops between the different 2stages" of the process as outlined in the first generation model. It also gives more recognition to the generation and diffusion of innovations within what have become known as 'innovation systems' (national, regional, per sector, etc.). Policy seeks to enhance two-way communication across different points in the innovation 'chain', and to improve innovation systems in ways that can better inform decisions about research, commercialisation, technology adoption and implementation, etc. "The third generation of policy would emphasise the benefits of co-coordinating actions in policy areas, and making innovation – and innovation-friendly policies – one of the core principles of this."

European universities have a central role to play through their research and teaching in furthering the level of economic innovation, leading to higher productivity and higher

economic growth, through such coordinated action. Indeed, we believe that innovation (read: labour productivity) could benefit substantially from coordinated policies between economic ministries and education ministries, both on the national as on the regional level.

European universities seem to be still struggling with their massification, i.e. the expansion needed to accommodate substantial enrolment rates to university education. Massification has been the response both to social demand as well as the needs of the labour market for better qualified workers. In the late 1960s the needs of the new students, originating from lower socio-economic home backgrounds with no university experience in their families, were different from those of the pre-war elite students. A fast changing labour market, driven by globalisation, by ICT and its potential for more and more mechanisation and robotisation, by new concepts of organisation and management led to a long wave of policy reforms, originally with a speed of one per 10-20 years but speeding up in the 1990s to one every four to five years (Ritzen, 2010).

Public university policy has been constantly in the process of finding its way to tune universities in the process of massification towards the 'best' performance in education and in research, as seen from the needs of the globalising societies. These needs are here caught in the term: 'innovation'. Individual European states strive to improve their performance on indicators of innovation such as used in the Innovation Index[2].

European research is widely recognised as an important investment in innovation. The former Chair of the European Commission, Barroso said (on July 15th 2014) that the EU needed to invest 300 billion euro in innovation. He clearly referred to research only, without mentioning (or perhaps realising) the overwhelming role of well-trained graduates in promoting innovation.

Of course, universities are not the only source of innovation. Other education levels are also important. Research in non-university institutes, including those of the private sector, is important as well. Equally relevant are the conditions for new firms to emerge and to consolidate, summarised by composite indicators such as the 'ease of doing business'[3] and credit facilities for starters.

European universities traditionally rely heavily on public funding both for education and for research. It is understood that public funding for education combined with student grant and loan facilities – in full or in part – is necessary to guarantee equity in access. The massification of higher education has put substantial strain on the funds per student. The economic crisis of the 2008 and beyond has increased that pressure.

In the late part of the 20th and the early part of the 21st century, European societies became painfully aware that their top institutes of higher education had fallen behind those in the US. Substantial migration of good staff and students to the US took place. When

[2] http://www.globalinnovationindex.org/
[3] http://data.worldbank.org/indicator/IC.BUS.EASE.XQ

international rankings became available, this pain was made visible by the relatively poor performance of top European universities (Ritzen, 2010).

Several observers feel that the models of higher education which prevailed in the second half of the twentieth century are 'broken'[4]. They feel that higher education institutions should adjust by providing 'knowledge on demand'. New technologies have entered the stage of higher education. Yet the likelihood that the MOOCs are a serious threat to existing higher education provision is small: ICT supported learning will become more and more part of traditional institutions through blended learning. At the same time, the mismatch between the quiet revolution in skills requirements on the labour market and the traditional provision of learning at universities may better fit the term 'broken'.

European Union member states have expressed their dedication to strengthen European innovation and the so-called 'Europe of Knowledge', including universities, in their Europe 2020 strategy. But what does this mean, and what are ways to strengthen innovation? So far there has been no effective answer in terms of Government policy on universities. Individual universities seem to take this role seriously, but they are moving in different (and sometimes not compatible) directions.

This second report builds further on this with two objectives.

The first objective is to understand the evolution of higher education policies, and more particularly available resources between 2008 and 2010, and higher education performance over the period 2010-2013 in the broader context of economic innovation. Employers' satisfaction with graduates is included as a measure for education performance.

The second objective is to apply our accounting model for the contribution of higher education policies through university performance to economic innovation (as developed in the first report) to the landscape of higher education policies as it emerged in recent years. In the first edition of the State of University Policy for Progress in Europe we have developed a measure for the quality of university policy in a country. We consider the changes in the quality scores for the 32 European countries, due to the addition of two new variables to the 2012 report and the changes in these scores from the 2012 analysis to the present 2014 edition. Hence, this report seeks to answer the following questions:

- How have higher education policies and performances evolved across European countries, in policy and university performance indicators? Have higher education systems converged or diverged?
- Has the relationship between policy and innovation remained stable across time, according to our quantitative model?
- What seem to be essential recommendations for university policy to be better linked to social and economic innovation?

[4] Barber et al. (2013); Creative destruction: reinventing the university. (2014, June 28). *The Economist*.

1.2. Approach

Our approach is both quantitative as qualitative. The quantitative is based on the data from public sources. The qualitative part is derived from correspondents in all of the 32 countries. Correspondents replied to a questionnaire assessing the recent changes in university policies and the position of universities with respect to innovation.

1.3. Chapter content

- Chapter 2 illustrates the way we have looked at university policy: through the lens of our indicators of performance of universities (e.g. graduation rate, or research output) in European countries. We also find measures of economic innovation, so that finally our gage for the quality of higher education policy is a score derived from the relation between policy and innovation. This method was first developed in the EEU 2012 report, leading to a ranking of countries by the quality of their university policies and is elaborated in Marconi (2014)
- Chapter 3 shows the development of the main variables on policy, performance and innovation in the 32 countries, with comparable data for 2012 and 2014
- Chapter 4 presents the qualitative changes since 2012 in terms of policies. This part relies on the reports of correspondents based in each of 32 European countries
- Chapter 5 then shows how these changes between the 2012 and this report have affected the standing of countries in terms of their quality of university policy. This standing is measured by computing non-arbitrary weights
- Chapter 6 closes the report by presenting our conclusions

Chapter 2

Gauging the quality of university policy through the lens of innovation

2.1. What is good policy?

'Good policy' in this report is considered from the point of view of the relationship between policy and the functioning or performance of universities (in terms of education and research), and subsequently of the relationship between universities' research and education and a country's economic innovation. University policy is – as in the earlier report – observed in 32 European countries[5].

We try to compare the policies of 32 European countries first by introducing a way of measuring policy. We distinguish two characteristics in university policies: the legislative environment and the funding. Funding itself has three different components: public funding, private funding and that part of public funding that is spent on financial aid to students (student loans and grants). The legislative environment is typified by the term: 'autonomy', the degrees of freedom for universities to achieve goals in education and research, mostly with a mission set by Government (in public education) or by the Founders (for private universities).

Our lens is the degree to which these policies relate to 'innovation'. Innovation is measured in this report by two indicators: labour productivity and the proportion of the workforce employed in innovative activities. This is quite a tall order: looking at university policy through the lens of innovation. In simple terms, what we mean is that we compare the levels of innovation in different countries and see whether countries with high levels are also similar in terms of university policies. These similarities may be there by accident, but may be also the result of systematic differences between countries in university performance. The connecting factor between university policy and innovation in a country is the 'performance' of universities in that country, in terms of research and education. Research performance and education performance are both measured on the country level.

We look at the statistical relation for the 32 countries between, on the one hand, university performance and the level of innovation and, on the other hand, university policy and the level of performance. The underlying idea is that **good higher education policies are those sets of regulations whose impact through university performance on economic innovation is substantial**. There are substantial differences in university policies between the 32 European countries observed. There are also huge differences in university performance and in the level of innovation in these countries. We use these differences to identify 'good policies', as a means to contribute to the body of evidence from which country policy development could learn.

[5] The countries are all EU countries, plus Iceland, Norway, Switzerland and Turkey.

The accounting model for policy, performance and innovation in the 32 countries through which we identify 'good policies' is explained in more detail in section 2.2. The subsequent section 2.3 gives the theoretical backing for this accounting framework from the existing literature. Section 2.4 presents an elaboration of the framework on the basis of the variables chosen to measure policy, performance and innovation.

2.2. University policy, university performance and innovation: the EEU accounting framework

We are aware from many studies of the macro relations between the performance of universities (in terms of research and of education) and 'innovation' (productivity/growth) (see section 2.3). In addition, we know that policy (i.e., the legislative framework and the funding available for higher education) is relevant and makes a difference in the performance of universities. We build upon these two notions, and combine these two relationships (performance-innovation; policy-performance) to provide a measure of the predicted level of innovation in a country, given its policy.

Our aim is to get an impression of the 'quality' of university policy in the 32 European countries selected. We assess the quality of a university policy in a country from the relationship between university policies and economic output using an accounting framework. Our framework assesses this relationship using two steps:

University Policy (t,i) → University performance (t+2,i) → Economic output (t+2,i)

In other words we look at the impact of the policies of country (i) in year (t) on university performance and economic outputs two years later (t+2). This is a highly simplified accounting framework. University policy has a much longer-run impact while also university performance (in terms of the number and quality of the graduates as well as the proceeds of research (in the form of new and deepened insights) may have a longer lasting impact on the economy. In Chapter 5, we will discuss the relationships described in the previous figure for two different time points, t=2008 (which we call the 2012 analysis, from the year in which we first carried it out) and t=2010 (which we label 2014 analysis, as we first ran the analysis with these data in 2014).

2.2.1. Measuring university policy, university performance and economic output

We believe that universities will increase their performance if they are 'empowered'. Empowerment expresses the room provided by national policies (in the form of sufficient resources and an appropriate regulatory environment) to tailor their contribution to the need of the economy. We concentrate on public policies for universities, bearing in mind that in Europe many systems of higher education rely by and large on publicly funded universities with a minor role for private universities less reliant on public funding. Some of our indicators refer to higher education at large, including amongst others polytechnics, university of applied sciences, hochschulen and private higher education.

Higher education policies do not affect innovation directly. Instead, they lead to performance/outputs, which then may lead to greater economic innovation. We assume that the relationships between education policy, performance and economic innovation are linear (it is an accounting framework). We limit the use of this model to a descriptive relationship between education policy and economic innovation. The relations that we find reflect accounting relations and cannot be considered to be causal relationships.

We abstain here from the extensive potential of other drivers of innovation in the university-innovation nexus. These drivers may be as varied as the existence of linkages to facilitate diffusion (such as university-innovation relationships), the overall regulatory framework, the existence of accumulated knowledge, the research and development landscape, factors specific to a particular market or product such as the level of demand and cost structure, the type of government, social infrastructures, the existence of property rights, government consumption, international openness, inflation or the ease of doing business, etc. (Hall and Jones, 1999; Barro, 2001; European Commission and OECD, 2005; Goldin and Katz, 2008; Archibugi et al.,2013). We also abstain from what is defined in the macroeconomic literature as 'vintage approach', well realising that the impact of new generations or vintages of graduates on productivity is the result of the addition to the stock of graduates.

The term innovation has several meanings. We define an innovative economy as one driven by the implementation of new or significantly improved products, processes, new marketing or organisational methods in business practices, workplace organisation or external relations (adapted from European Commission and OECD, 2005). We proxy innovation by productivity per hour worked and by employment in knowledge-intensive activities. In other studies measures such as patents and intellectual property rights are often used to proxy innovation. However, patents are a short-term output of research activities. Productivity is the outcome that patents seek to achieve.

The relationship between (higher) education and labour productivity is complex, especially when considering the influence of technology and physical capital. Technological progress itself does not 'come from heaven', but is the result of new vintages of human or physical capital with higher productivity levels (Solow, 1956; Swan, 1956; Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1995 and Aghion and Howitt, 1998). At the same time, the changes in the productivity levels of new vintages of physical capital could be the result of the involvement of knowledge workers in the production process. This is the reason why we also use employment in knowledge intensive activities as a proxy for the innovation in a country because we assume that innovative economies have a broader knowledge intensive industry than other economies.

Much of the relation between education and innovation runs through the way in which graduates take risks either as entrepreneurs or within firms as entrepreneurs (OECD, 2013). In the absence of data on the entrepreneurial skills of graduates we leave this outside our analysis. We have also abstracted from the availability of venture capital investments as a

percentage of GDP. This is viewed as an important accommodating condition for the foundation and expansion of industries generating a large amount of value added per employee. In particular the difference between the US in young leading industries ('yollies') is often linked by researchers to the greater availability of venture capital in the US (Gill and Raser, 2012).

A third factor from which we abstract is business regulation. The World Bank documents annually the regulatory conditions under which firms operate for different countries and finds that they have a substantial impact on employment and productivity (World Bank, 2014).

The ultimate objective of economic innovation is to achieve economic growth. Educational attainment has typically been used to measure the contribution of education to economic growth (Goldin and Katz, 2008). Yet, Borghans et al. (2001: 375) showed that equal investments in education can lead to different quantities of skills; that skills may not always be used due to labour market mismatches; and that education might be a signalling mechanism more than a source of skills supply. Indeed, differentiators of higher education, such as the length of study, type of program and the university that graduates choose influence the likelihood to be employed and to be productive (Støren and Aamodt, 2010).

Therefore gaining a better understanding of how higher education can foster economic innovation through education requires an analysis of the skills acquired by graduates. Yet, the supply of skills needs to be matched with labour market demand. The match between educational level and job level, and balances/imbalances in the demand and supply of graduates on the labour market influences productivity (Hartog, 2000; Vershaest and Van der Velden, 2012). Being in a job where skills are underutilised poses a limit on the utilisation of skills and the worker's productivity. Conversely, working in a job above one's own level in effect increases this 'productivity ceiling', allowing workers to be more productive than they would be when working at their own level. Allen and Van der Velden (2001) find that 15% of all graduates experience a high or very high degree of underutilisation. They distinguish between educational mismatch (representing the use of formal qualifications) and skills mismatch (which relates to the skills actually used). Educational mismatches influence wage; while skill mismatches, in contrast with educational mismatch, explain differences in job satisfaction and the quit intentions of graduates (the intensity of job-search while on a job).

In other words: the accounting relationship between on the one hand education policy and on the other innovation at the national level will be no more than a very rough relation.

2.3. Universities are fundamental for economic growth

2.3.1. Macro relations well established between research and innovation

University research is an important source of research in the country. Research in a country is funded by the private sector (which may carry this out in their own laboratories or contract it out, like to university laboratories) and by the public sector. The 32 European

countries observed spend the majority of their public research funding in universities, although some countries like Germany and France are heavily engaged in public research through separate public research facilities outside universities.

Research as a whole has been shown to be beneficial to innovation, while innovation contributes between two-thirds and four-fifths of economic growth in developed countries. In other words, about 85% of productivity growth in advanced economies is driven by innovation. Innovation is driven by research in the appropriate 'eco-system'. An overview of the large literature on R&D and economic growth is found in Hall et al. (2010). A review of the econometric literature on measuring the returns to R&D shows that the private returns to R&D are strongly positive and somewhat higher than those for ordinary capital, while the social returns are even higher, although variable and imprecisely measured in many cases.

It is a substantial leap from these general findings to our accounting framework in which we specify university research and its quality to bear a relation to economic innovation.

2.3.2. University education and economic growth

The era of the 1990s has been an eye opener for many observers in European countries. They witnessed a tremendous increase in the number of graduates. Many observers had warned that this would lead to 'overeducation': graduates would replace workers with less education, so that they would work below their skill level, causing the return to their education would decrease. They believed that 'education' was outrunning 'technology' in the race between education and technology (as coined by Nobel Prize winner Jan Tinbergen, 1975). Technology was a force from the outside which was more or less at a steady pace, constantly leading to more automation. The steady rise in the technological level calls for a steady increase in workers with more education. The jolt in the supply of graduates in the 1990s caused concern of 'overeducation' on the part of many observers.

The eye opener was that actually the jolt in graduates did not lead to underemployment of graduates, but caused the pace of technological change to increase (Acemoglu, 2002). For economic scientists this was not unexpected: the accumulation of knowledge through education can increase labour productivity, innovation and growth, in the same way as happens with physical capital. This occurs through the change in the quantity and quality of new vintages of human capital (Kim, 1998; Van Zon and Antonietti, 2004; Hanushek and Woessman, 2012).

And this brings the quality angle into education. The quality of graduates of different levels of education has – for a long time – been outside the public discussion, because no measurements were available. The level of human capital in a country was then simply approximated by the number of years of education in the labour force. If human capital was measured this way then no statistical relation between human capital and productivity in a country could be found (Pritchett, 2001). However, when a quality factor was introduced, results were more encouraging (Hanushek and Woesmann, 2012).

Human capital (more and better educated workers) does not affect innovation uniformly. Vandenbussche et al. (2006) argued that a more educated workforce does not only facilitate the creation of new technologies, but also increases the country's capacity to adopt technologies already developed elsewhere. Moreover, technological change seems to be an upward spiral: it increases the demand for expert thinking and complex communication ('non-routine work'), acquired through higher education (Levy and Murnane, 2005), which in turn contribute to technological change.

The contribution of (higher) education occurs through the provision of quality education rather than merely a quantitative expansion, as Hanushek and Woessman (2012) have shown using internationally comparable assessments; and as Asteriou and Agiomirgianakis (2001) similarly demonstrated for Greece. Yet precise data with measurements of the actual skills of graduates are (very) scarce. Often researchers fall back on data from PISA (Project International Student Achievement – which provide information on cognitive skills of 15-years old) or employers' or employees' surveys (which, however, provide only subjective information).

In our accounting framework we have included the employment rate of young graduates (relative to the overall employment rate in the same age category) as a proxy variable for the quality of graduates. This is a huge leap, as the relative level of employment might also be affected by the social security provisions, or employment protection legislation, or the specific circumstances of a country at a certain point in time (the crisis in Greece).

2.3.3 Public policy and the quality and quantity of graduates

Public policies play an important role in enhancing the outputs and quality of higher education, through the legislative framework imposed on universities as well as through funding. Acemoglu et al. (2006) and Aghion et al. (2007) find that investments in research-related education are likely to pay off for areas which specialise in innovation and are close to the world's technological frontier. Aghion et al. (2009a, b), along the pathways of Volkwein (1986) and Volkwein and Malik (1997), investigated the impact of the legislative framework (through the governance of universities) on research output using the number of patents and the position of the university in international research rankings as university performance indicators. They found that university autonomy (as an expression of the legislative framework) and competition were positively correlated with university outputs across the US and Europe. They also found a positive relationship between funding shocks and patent production when public universities are more autonomous and more competitive. This relation between autonomy and funding, on the one hand, and policy and university performance in research, on the other hand, was expanded by Hoareau et al. (2012) to 'education performance': to what extend can one find statistical relations between policy, university performance in a country and the level of innovation.

2.4. Indicators for university policy, university performance and innovation

Our framework for analysing the impact of innovation policies on economic innovation relies on a set of – in total – eighteen statistical indicators, divided over three groups:

2.4.1. Indicators of economic innovation

Employment in Knowledge Intensive Activities (KIA) as % of total employment. Innovative societies are likely to exhibit both higher labour productivity as well as a higher percentage of employees in Knowledge Intensive Activities[3]. Labour productivity – GDP per capita per hour worked – strongly relates to employment in Knowledge Intensive Activities. Moreover, North-Western European countries, like Norway, Luxembourg, Sweden, the UK, the Netherlands, and Iceland, appear to be the most innovative across Europe in terms of KIAs.

Labour productivity per hour worked, calculated as real output (deflated GDP measured in chain-linked volumes, reference year 2005) per unit of labour input (measured by the total number of hours worked).

2.4.2. Indicators of university performance

Education performance (6 indicators):

- Mobility: inward mobile students (i.e., students who live in the country because of their education) as a percentage of student population in the host country
- Enrolment rate: Students (ISCED 5-6) - as a percentage of total population
- Graduation rate: graduates in ISCED 5 and 6 / total enrolled students
- Graduate employment ratio: employment rate for individuals ages 25-34 who attained education at the ISCED 5-6 level relative to overall employment rate in the same age category
- New entrants: entrants to the first stage of tertiary education (programmes that are theoretically based/research preparatory or giving access to professions with high skills requirements – level 5A), any age as a percentage of total population
- Employers satisfaction: employers satisfaction with graduates skills (see Appendix D for more details)

Research performance (4 indicators):

- Ranking performance: number of universities in the top 500 (ARWU-Shanghai ranking) per 1000 inhabitants
- Top publications: scientific publications within the 10% most cited scientific publications worldwide as a percentage of total scientific publications of a country
- Public-private research cooperation: public private co-publications per 1000 inhabitants
- ERC grants: European Research Council starting investigators grant won per call year per 1000 inhabitants

2.4.3. Indicators of university policy

Policy indicators include both measures of the governance of universities as of the financial resources available to higher education institutions or students, through public or private expenditures and through student financial aid. Expenditures are expressed as a percentage of GDP per capita.

The measures of the legislative framework which determines the governance are captured in the term 'autonomy'. Autonomy is understood very differently across European countries because of differences in culture and history. For example, in Germany and France, autonomy is traditionally connected with the specific notion of 'academic freedom', namely that professors of the universities (the Senate) – once they are appointed – choose their own leadership and decide themselves on the design of the degree programs and the research subjects and content, within location, staffing and funding arrangements decided by the Government. In the UK and the Netherlands, in contrast, autonomy is considered to be the ability of institutions to function independently from the Government (in terms of raising and managing their own funds etc. and in terms of the freedom to choose the subject and content of education and research), while the concept of academic freedom is no longer a matter of the interpretation of the Senate, but for the appointed leadership of the university.

There are also differences between countries in terms of the autonomy to attract students. In some countries the number of places that the Government will finance in a university is decided by the Government. In other countries a university can enrol (with Government funding) all students who apply and are admitted. Studies which are subject to a 'numerus fixus' imposed by Government are an exception.

To capture different notions of autonomy, we use three concepts, namely organisational, policy and financial autonomy.

Organisational autonomy measures the extent to which a university is allowed to decide on its own organisational structures, its own internal authority, responsibility and accountability structures, as well as its institutional leadership. Organisational autonomy includes the notion of a supervisory board for the university which appoints the top leadership of the university (the president, board or rector), where the top leadership appoint the deans and the professors.

Policy autonomy includes the ability of universities to create academic communities through the selection of staff and students and to determine their teaching and research programs (in other words, it includes staffing and academic autonomy).

Financial autonomy is related to a university's ability to attract income from additional funding sources, to be able to decide on the internal allocation of funds, to build reserves and to borrow funds on the capital market. University systems in which Governments allocate funds by line items, where unused funding has to be returned at the end of the

year, or where universities cannot borrow money or develop alternative funding sources are considered not to be financially autonomous.

A shift in the degree of autonomy does not automatically lead to a reduction in Government control. For example, the retreat of a priori command and control system in some continental countries (such as having the Government laying down the national-wide curricula) towards more posteriori quality control mechanisms (based on an a posteriori evaluation of programs), may imply a displacement of the relative role of the Government rather than a retreat.

Autonomy may also be experienced differently at different levels within the university. Musselin (2004) shows for French institutions that more university autonomy from the Government may well imply that the university leadership decides on a strategy which limits the freedom of academics more than in the situation of more Government control. Van Vught and Neave (1991) give a description of the changing role of the relationship between universities and the Government as a move away from state control to state supervision.

The Center for Higher Education Policy Studies (CHEPS), INCHER and NIFU-STEPS (2008) have assessed these dimensions of autonomy through a questionnaire sent to and answered by national experts and through interviews with relevant stakeholders. They coded the extent to which autonomy has been achieved in organisational, policy and financial autonomy on an ordinal scale from 1 (low) to 5 (high) (for organisational autonomy) and 1 (low) to 3 (high) for policy and financial autonomy. The scores only reflect a comparative picture at the national level. They ignore possible differences on the regional, federal or institutional level within a country. They indicators also do not capture differences that may exist in levels of autonomy across degree courses, for example in the selectivity of undergraduate versus postgraduate degrees.

Our first indicator for funding is public annual expenditure per student for all services related to higher education relative to GDP per capita. The services include core services such as teachers; school buildings, teaching materials and school administration. They also include ancillary services. Measuring the full-cost of higher education institutions is a challenge in several European countries, because of the different funding streams related to a university for research or for education (Estermann and Kanep, 2008). Note that we have decided to use a variable which reflects 'effort' in a country by relating the absolute amounts to GDP per capita.

Our second funding indicator is private expenditures on higher education (students' tuition fees and other private expenditures) per student, relative to GDP per capita.

The third indicator related to funding in the country is the amount transferred to households and private entities in the form of student financial aid, as a percentage of total public expenditure on higher education. One might hypothesise that countries which are able to generate the broadest access to higher education would also be the most able in increasing human capital-led innovation. A way to improve access is to invest in financial aid

schemes, such as grants, scholarships and loans. Extra child allowances and extra tax deductions are also used in Europe as instruments to support parents with children in university. Student grants and more recently loan schemes (in some cases the latter have been replacing the former) have been implemented in all European countries. There is considerable political debate (Johnstone and Marcucci, 2010) on the impact of loans on students' behaviour and on the distribution of the risk of non-completion, or the borrowers' inability to pay back in case of loans. Some scholars argue in favour of grants over loans for students from low income backgrounds with the rationale that debt aversion is correlated with social background, even though it appears that the introduction of student loan schemes did not affect negatively the number of applications from students from a varied backgrounds, if one controls for their grade after high school (Babb et al., 2004). However, that does not yet undercut the argument in favour of more aid to students from poor backgrounds, as they might not have had the same chances to develop their ability. As will be discussed later (chapter 4) financial aid for university students continues to spark a lot of political debate in Europe.

One should bear in mind that other variables, like the availability of state-funded places might also affect equality of opportunity (besides financial aid), to promote access. For example, the reduction of the number of state-funded places in Hungary between 2000 and 2012 from roughly 60,000 to 35,000 (plus 15,000 places with 50% funding) could well have had a (substantial) impact on the composition of the student force by parental background with the likelihood that inequity will be increasing[5].

Subsidies in the form of grants loans and scholarships show a large variation in Europe, ranking from around 50.9% of public expenditure for tertiary education in Cyprus to merely 1.5% in Poland[6]. The UK has by far the largest public loan scheme, to compensate for the highest tuition fees in Europe. The UK ranks high in terms of the availability of facilities, but the trend is towards (slightly) less availability of loans and grants. The same holds true for the Netherlands.

In summary: the following indicators for policy are assessed:

- Organisational autonomy: ordered categorical variable representing the extent to which a university is allowed to decide on its own organisational structures, their own internal authority, responsibility and accountability structures, as well as their institutional leadership
- Financial autonomy: ordered categorical variable representing the university's ability to attract income from additional funding sources, to be able to decide on the internal allocation of funds, to build reserves and to borrow funds on the capital market
- Policy autonomy: ordered categorical variable representing the ability of public universities to constitute their own academic community in terms of student and staff selection and to determine their teaching and research programmes

- Public expenditures: Expenditure per student as a percentage of GDP per capita. Public expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities)
- Financial aid: financial aid to university students as % of total public expenditure on education, level of education (ISCED 5-6)
- Private expenditures: private expenditure per university student as a percentage of GDP per capita.

Appendix A provides an overview of the data sources. Note that some of these indicators correspond to those of the 2012 EEU report (www.empowereu.org). Some have been added (like private expenditures and employer satisfaction). A few others indicators have been replaced to improve comparability across time. For our measures of autonomy and of employer satisfaction there are no available time series. Hence, when conducting the analysis for different years, we keep these variables constant.

Although we tried to choose indicators on which data were available for all the countries and years covered by our analysis, in some cases this was not possible and some data were missing. We imputed these data points by using data for other years or from different sources, or using some proxy variables. More details are provided in Appendix A.

2.4.4. Control Variables.

In our previous report, we did not include control variables in the quantitative analysis. The reason was that most potential control variables (e.g., general attitudes towards innovation in the population) are endogenous to the higher education policy-university performance-economic innovation relationship that is at the core of that study. As a result, including such control variables could have biased our estimation of the effect of higher education policies downwards. This would have been particularly problematic given our small sample, which already makes it difficult to generate accurate estimates, but it is a general problem for macroeconomic studies of the relationship between education and aggregate outcomes (as noted, for example, by Krueger and Lindahl, 2001). For this edition of the report, we decided to include at least those variables that could affect innovation, but are exogenous to the higher education policy-university performance-economic innovation relationship. As a result, we included the following four indicators:

- Total population in the country
- Total number of higher education institutions in the country
- Old dependency ratio (population 60 and over to population 20 to 59 years)
- Young-age dependency ratio (population aged 0-19 to population 20-59 years)

The first two indicators could affect innovation if the national innovation systems are not perfectly integrated, and there are scale effects to innovation activities. Increasing returns to scale in innovation are suggested in modern macroeconomic frameworks such as Romer (1990). From an 'algebraic' point of view, total population appears as the denominator in

many of our variables, so that we preferred to include it as a control variable. Population structure may affect innovation if, for example, older workers are more conservative towards new technologies.

Chapter 3 (originally drafted by Cecile Hoareau)

Changes 2012-2014 in university policy, university performance and innovation

3.1. Data on policy, performance and economic innovation

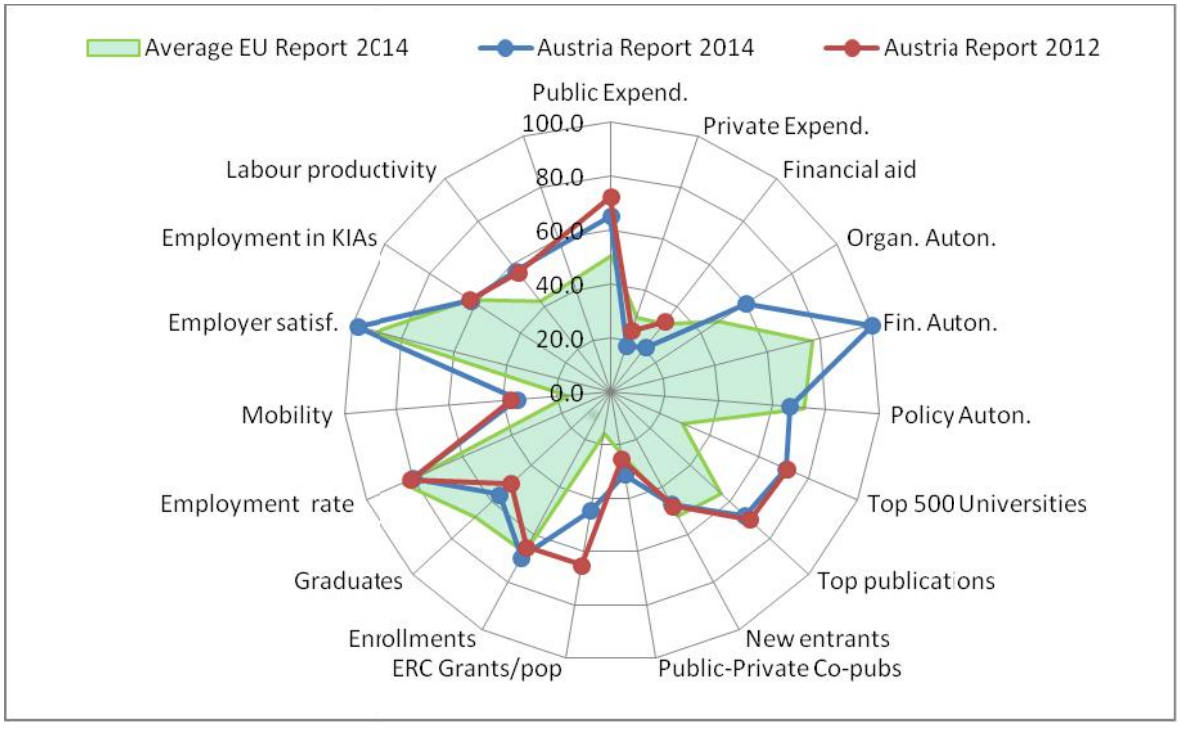
This chapter discusses quantitative trends in the three elements which we scrutinise:

- Policy
- Performance (both in education and in research)
- Economic innovation

The quantitative trends were derived from the data sources in Appendix A.

3.2. Quantitative trends

The quantitative trends (over the relatively short periods 2008-2010, for the policy variables, and 2010-2012, for the indicators relating to higher education performance and innovation) are summarised for each country in the spider diagrams in Appendix B. An example is Figure 1: the spider diagram for Austria. For each country the spider diagram shows its position versus the other European countries. The blue line refers to 2014.



3.2.1. Policy: autonomy

An important policy instrument to steer universities' decisions is the legislative framework in which universities operate, often called 'autonomy'. The 2012 edition used a European survey conducted in 2008 by the Centre for Higher Education Policy Studies (CHEPS) to

measure the degree of university autonomy in the 32 countries investigated. This survey has – unfortunately – not been repeated. There is a later survey conducted by the European University Association in 2010, however with substantially different questions. As a result the autonomy measures of the CHEPS and the EEU survey are not entirely comparable (Golabi, 2013) and we will use the CHEPS measures both for the 2012 and for the 2014 analysis.

The values for the three subsets of university autonomy, namely organisational autonomy, financial autonomy and policy autonomy (for the definition: see Appendix A), provided by the Centre for Higher Education Policy Studies are summarised in the Appendix C. Appendix C shows that the three variables representing organisational, financial and policy autonomy are not closely related to each other. A higher education system may have a high level of organisational autonomy, with less financial and policy autonomy, as is the case for Germany for example. In addition, Appendix C shows that university autonomy may not necessarily be a function of the level of expenditures allocated to the higher education system. This can be illustrated by the position of Croatia, which public expenditures on higher education were below the median of our sample in 2010, yet scores very high on autonomy.

3.2.2. Policy: funding

Public expenditure per student as a percentage of GDP per capita has slightly increased between 2008 and 2010 for the median observation in our sample of 32 European countries as Appendix B shows. Public expenditure increased in general for the group of countries above the median value of the base period, although this is only due to one outlier with a large expenditure increase (Malta). The average for the same variable has remained stable for countries below the median (although it increased for new member states Estonia, Slovenia, Poland, Slovakia and Lithuania as well as Portugal and the UK[6]). Malta has had the highest increase in public expenditure as a percentage of GDP per capita, despite an increase in enrolment which in many countries is accompanied by a 'watering down' of expenditures.

The median of financial aid to students relative to total public expenditures on tertiary education has slightly decreased in the 32 European countries between 2008 and 2010, passing from 14.2% to 13.9% of the total. Financial aid increased on average for countries below the median from 6.4% to 9%, whereas it increased for countries above the median. Financial aid decreased in Norway and Austria; but increased in Estonia, and Poland. One can imagine that financial aid decreases in high income countries as larger parts of the population are able to cover the living costs of students themselves.

Private expenditure per student as a percentage of GDP per capita has slightly increased, at the median, across European countries, from 6.2% to 6.5%, with the largest increase in the UK due to the increase in tuition fees.

[6] The UK had a broad reform of its financing system in 2010. This is not yet captured in the data of 2010.

3.2.3. Education performance

European countries seem to be somewhat converging in enrolment, although the changes are not substantial. Countries which were below the median in the base period increased their enrolments (as a share of total population) by 0.05% on average, whereas no change is observed for countries above the median. Enrolment numbers have increased in the Netherlands, Switzerland, Germany, Malta, Luxembourg, Belgium and Spain for example; but decreased in Romania, Latvia, Slovenia, and Slovakia.

There are several background factors potentially leading to higher enrolments: demographics, increased access to higher education, or because of delaying graduation during an economic downturn as unemployment looms. The latter would be reflected in low graduation rates. Enrolment numbers may increase when a country is becoming more attractive for foreign students. This would be visible through an increase in the number of inbound mobile (international) students. The median European country has become slightly more attractive to mobile students, as the share of mobile students over total enrolments increased by 0.1%. The Netherlands has seen the largest increase (+3%), although on average the increase in mobile students has been stronger in countries with a level which is below the median.

The number of new entrants has decreased in the majority of European countries, particularly in countries which were above the median value during the base period. This decrease was particularly visible in Portugal and Romania. Conversely, countries which were below the median have had a less drastic reduction in the number of new entrants. Some of these countries, including Denmark and Germany, saw an increase in the number of new entrants.

The tendency towards convergence is also observed for graduation rates. Typically countries below the median value in the base period have had a higher increase in graduation rates than countries for which the graduation rate was above the median. The increase in graduation rate was particularly noticeable for Italy (which increased from 10.8 to 19.9%), the Netherlands and Portugal. Government policy has been for a long time focused in many countries on the increase in the graduation rate and the decrease in the length of the study period. Graduation rates have decreased the most in Romania and Turkey (Luxembourg also displays a large increase, but its value for 2010 has been imputed, so it is less reliable).

The increase in the median graduation rate in Europe does not necessarily translate in a successful transition to the labour market, as the relative employment rate of graduates has very slightly decreased between 2010 and 2012, passing from 1.11 to 1.10 (a value larger than one means that young graduates are more likely to be employed than non-graduates). Countries with the strongest decrease in the relative graduate employment rate are Estonia, Lithuania, and Iceland.

3.2.4. Education performance: employer's satisfaction with graduates

Survey results are the main tools available to compare skills across Europe. Appendix D provides an overview of employer satisfaction with graduate skills. This survey shows that the highest levels of satisfaction with skills (greater than or equal to 95%) occurred in Northern European countries: Austria, Denmark, Finland, Germany, Norway and Sweden. The highest proportion of employers who are dissatisfied with graduate skills (less than 85% satisfaction) is found in new EU member states, namely in the Bulgaria, Czech Republic, Estonia, Lithuania, Slovakia and Slovenia.

3.2.5. Research performance

The number of European universities in the top 500 has very slightly decreased in the ARWU Academic Ranking of World Class Universities (also called the 'Shanghai' or 'Jiao Tong' Ranking)[7]. Portugal is the only European country with a substantial change between 2011 and 2013 (increasing the number of its universities among the top 500 by two, while the Netherlands has one university fewer in 2013).

The connection between academia and the external environment (measured as the number of public private co-publications) has improved in the large majority of European countries (with Finland, Greece, and Turkey as exceptions). The number of European Research Council Starting Investigator Grants has decreased for the large majority of countries between 2011 and 2013 (the only exceptions are Croatia, Cyprus, Portugal and Turkey), probably because of an overall reduction in the number of projects per capita that receive funding. This reduction has been especially marked for countries which have traditionally been recipients of a large number of Starting Investigator Grants (above the median of the base period).

3.2.6. Innovation

Innovation, as measured by the proportion of workers employed in innovative activities and by labour productivity, increased slightly. The median of the first variable increased from 34.5% to 35.5% between 2009 and 2012, whereas the median of the second variable increased from 29.1€ per hour to 29.7€. The average increase in labour productivity for countries above the median has been very similar to the average increase for countries below the median. In contrast, the rise in the average proportion of workers employed in innovative activities has been much stronger for countries below the median than for countries above the median.

3.3 Summary of quantitative changes

The quantitative development on universities and innovation in the 32 European countries shows some signs of convergence across Europe. The percentage of public expenditure on education dedicated to financial aid are overall slightly converging. There is also a tendency towards convergence in education performance. The rate of change in enrolment, new entrants, and graduation and mobility rates was higher for countries which were below the

[7] See: http://www.shanghairanking.com/

median for the base period than for those above the median. This did not apply to graduate employment, where the change was similar for countries above and below the median.

In terms of research performance, there has been an increase in research outputs, like the number of co-publications between the private and public research sector. The number of world class universities has very slightly declined. The number of wins of the highly prestigious ERC Starting Grant has clearly decreased in the countries which were traditionally the main winners, showing signs of convergence also in research performance.

Innovation has slightly increased in our sample of countries. There is no strong evidence of convergence, although the increase in the average proportion of workers employed in innovative activities has been mostly due to a rise in the bottom quartile of the distribution.

Chapter 4 (originally drafted by Cecile Hoareau)

Qualitative assessments of policy changes

4.1 Correspondents reflections

The qualitative assessment on policy changes was given by correspondents in each of the 32 countries. Correspondents responded to a questionnaire over the summer 2013, and further updates were gathered in May 2014. Most of these correspondents were the same ones involved in the 2012 report. The list of correspondents is presented in Appendix E. Each of them is a reputed, independent expert in higher education, and particularly in the higher education system of the country from which he/she correspond. Our considerations on the quantitative changes are included in the country reports (Appendix B).

4.2 Types of policy changes

Correspondents first reflected on the types of policy changes. Their qualitative observations were grouped in eight different categories. The details on these changes are reported in the country report in Appendix F. The label (column in Appendix F): 'system' includes reforms of the funding allocation schemes, or of the quality assurance system. The column 'student contribution' includes changes in tuition fees and financial aid to students. The column 'autonomy' includes regulatory changes in the relationship between universities and Government. 'Enrolment' includes changes in student recruitment or in the number of student places. 'Graduation' covers measures aiming to influence student graduation rates; 'employment' includes measures to facilitate the transition of university to employment. 'Mobility' covers measures related to inward and outward student mobility. 'Research' covers policy changes related to the research output of universities.

Private contributions to higher education in combination with student aid are dominant in the political discussions on higher education: in 17 of the 32 European countries such policy reforms took place. In some countries, tuition fees were abandoned (like in Estonia, Germany and Turkey), but in others the student contribution was increased (in Ireland). Bulgaria and Hungary reformed their student loan systems. In the UK a debate has started regarding the real costs of the subsidised student loan scheme, after the relatively sizeable increase in tuition fees combined with a social student loan scheme. In Finland, a Governmental proposal is aimed at allowing universities to charge tuition fees for international students.

Changes in the overall higher education system were the second highest reported (in 11 countries). For example in Portugal and Latvia the introduction of formula- and performance-based funding are discussed by the Government. In Italy, the Government aims at improving the quality of teaching through a self-assessment tool. In Slovakia, university programmes are becoming accredited through a peer group of university teachers

(rather than a single person). In Turkey, the Government continued an expansion policy aimed at increasing the number of universities.

Only 2 countries dealt with the autonomy of universities. The Romanian Government adopted a plan to guarantee university autonomy in combination with public liability. In Slovakia, universities were given the (policy) autonomy to set up their own courses, in combination with an accreditation system (as most other European countries have).

Eight countries showed changes in their enrolment policies. The majority of these policies were meant to increase enrolments. This is the case in Malta, the UK, Romania, Cyprus and Finland. For example, the Finance Minister in the UK announced a lift in the student enrolment cap, which will allow universities to recruit as many students as they feel appropriate. Policies to restrict enrolments were in place in Sweden and Denmark.

Attempts to improve graduation rates are taking place in Austria, the Netherlands, Iceland and Denmark. One of the ways to improve graduation rates occurs through providing a higher level of support from the university to students in order to increase 'study choice checks'. The purpose of this check is to test the match between the students' interests, expectations, motivations etc. and the course of studies.

Policies aiming to tackle graduate employment were reported in Austria, Finland, Lithuania and Slovenia. In Finland, the Youth Guarantee, which came into force from the start of 2013, ensures that everyone aged between 25 and 30 obtains a study place, a place in on-the-job training or a rehabilitation three months after becoming unemployed . The Youth Guarantee is expected to increase enrolment and graduate employment rates.

Several Governments aimed at increasing inward student mobility, including Slovenia, the Czech Republic and Denmark. The Governments of Cyprus and Norway aimed to increase outward mobility, while the Hungarian Government aimed to limit such mobility. Finally, the Flemish government in Belgium has approved the action plan on mobility *Brains on the move* to promote student mobility both from and to Flemish universities which may be able to increase the presence of international students in the upcoming months.

Only two correspondents reported policy reforms in terms of research. The Netherlands Organisation for Scientific Research was reined in by requiring for part of its budget researchers to work jointly with industry in top-sectors of the economy. In France, the previous Government invested large financial and public efforts to enhance investment in R&D, to support excellent research units, and to facilitate networking between innovative teams (e.g. *Laboratoires d'excellence*) between 2008 and 2013.

The above shows the following:

- There is considerable concern about equality in access to higher education. European countries care about access.
- The dominant line of thought seems to be that equality of opportunity is safeguarded by low or non-existent tuition fees, against a smaller group of countries

which believes that funding requires private contributions to be sufficient for quality education, while equality of opportunity is safeguarded by social student loans and grants.

- The volatility in the policy position within countries on student contributions is remarkable. The countries which decreased student contributions had increased them in the recent past, while the countries which have raised them have decreased them in the recent past.
- Very few countries seem to be concerned (when looking at policy changes) about the factors which raise the contribution of universities to innovation.
- Some countries seem to have allowed for an increase in enrolment by decreasing per student expenditures. However, others seem to have deliberately increased expenditures per student while expanding enrolment. Decreases in enrolment generally led to higher per student expenditures (except for Cyprus and Latvia).

4.3 Correspondents' assessment on the impact of policy changes on innovation

Correspondents not only observed policy changes, they also gave their assessment of the directions of change in their country on the three major fields in which universities are placed:

- Policy
- Performance
- Output/innovation

Table 4.1 summarises these assessment. Correspondents were asked to report whether policy changes since 2012 had contributed positively or negatively to university performance. These changes may not entirely match the statistical trends observed in chapter 3, because they may not have occurred in the same period in time, or because they may require some time before appearing as having an effect in national statistics.

In terms of innovation: Poland is the only country for which the correspondent is optimistic on improvements in innovation (even though the spider-diagram in Appendix B does not show such a strong reason for optimism). Most country correspondents were neutral. Croatia, Cyprus, Hungary and Latvia were pessimistic.

Correspondents' perceptions appear tied to their countries' economic situation. Overall, correspondents from Cyprus, Hungary, Iceland, Ireland, Portugal, Slovenia and Spain have been the most consistently pessimistic regarding the evolution of their higher education policies between the 2012 and 2014.

Public expenditures per student were viewed with continued optimism in Denmark, Estonia or Sweden; while correspondents of six countries were becoming increasingly concerned: Finland, Germany, Hungary, Poland, Romania and Turkey. Correspondents from Estonia,

Finland and Poland have also grown increasingly concerned by financial aid levels; while correspondents from Romania, the UK or the Netherlands were becoming fairly optimistic.

Research performance was seen in a more optimistic light in the UK and Latvia, and in a more negative light in Cyprus, Hungary, Greece, and Poland. Educational outputs were the object of more concerns in Denmark, Lithuania and Turkey.

Overall correspondents do not see many changes which might spur universities to contribute better to innovation.

Table 4.1: Correspondents assessments on policy and innovation changes

	Policy													Performance										Output		
	Autonomy			Public expenditure				Private expenditure			Student financial aid			Research				Education						Innovation		
	2013	2012		2013	Research 2012	Education 2012		2013	2012		2013	2012		2013	Productivity 2012	Attractiveness 2012		Grad. Empl. 2013	Graduation rates 2013	Employer satisfaction 2013	Education 2012			2013	2012	
Austria																										
Belgium (Fl)																										
Bulgaria							+										-									
Croatia			-														=					=			-
Cyprus			=				=						=				-					=			-
Czech Rep.																										
Denmark			=				=															-				
Estonia			=				=						-									=			-
Finland			+				-						-												-
France																										
Germany			-				-						=													
Greece							=										-									

Hungary			=				=						=				-					=			=
Iceland																									
Ireland			=				=						=												
Italy																									
Latvia			-				=										+								
Lithuania			+				=										=					-			
Luxembourg																									
Malta																									
Netherlands							+						+												
Norway																									
Poland			-				=						-				-					=			=
Portugal			=				=						=												
Romania							-																		
Slovakia																									
Slovenia							=						=												
Spain			-				=						=				=					-			=
Sweden			=				+						=				-								

Switzerland																										
Turkey			=				-						=				=					-				
UK			+				=										+									

Note on colour code

Red cell: indicates that correspondents are more pessimistic.

Green cell: indicates that correspondents are optimistic.

Yellow cell: indicates that correspondents are relatively neutral.

White cell: missing data.

Chapter 5

The quality of university policy 2012 and 2014

5. 1 Can we say anything about the quality of public policy?

In section 2 we gave briefly the background for our way of comparing the quality of university policy in 32 European countries, by considering the relation between on the one hand Government university policy and on the other hand the level of innovation. In this section, we present the results of this analysis, applied to the data that we had available in 2012 and to the data that available in 2014. This leads to two comparable numerical exercises, referred to as '2012 analysis' and '2014 analysis' in this report.[8] The analysis takes place in a two stage process by first considering the relation between Government policy and university performance in education and research and in a second step by considering the relation between university performance and innovation.

The relations of these two steps are assessed statistically, using the data on the 32 countries which were discussed in chapter 3. The advantage of this approach is that it allows for non-arbitrary weights in assessing the quality. This is an improvement above existing ranking methods as used for example in the Universitas21, Shanghai or Academic Ranking of World Universities (ARWU), and the Times Higher education Supplement rankings. In those rankings arbitrary weights are attributed to different 'performance factors' of universities. We were able to derive statistical weights because we use a 'lens': the level of innovation in the country. All other rankings assign weights to selected indicators based on a normative judgment of what the assessors believe is important, without making clear what the criterion for importance is. Webster (2001) earlier dismissed the relevance of such normative judgment, by making a thorough statistical analysis of the US News and World report rankings of colleges and universities (USNWR ranking). He used a principal component analysis to reveal some flaws in the US News & World report rankings of colleges and universities, showing that the most significant ranking criterion should be the average SAT score of enrolled students and not (as the US News & World report uses) academic reputation. Webster also found high multi-collinearity between the indicators of the USNWR ranking. Another analysis showing how problematic the arbitrary assigning of weights can be is that by Saisana et al. (2011), who find that the inferences made by rankings for institutions and countries are not robust to changes in the weighing system.

The drawback of our method is that due to the limited number of observations (32) and the large number of variables the statistical coefficients will be quite 'rough': often they will not be statistically significant on a high level. This drawback is somewhat reduced by combining the variables which statistically explain the level of innovation into factors. These factors are

[8] The computations have been performed with the free software R. The codes developed to carry out the analysis are available at www.empowereu.org.

again determined with statistics through factor analysis. In this approach those variables which are closely related are grouped into one factor which often can be given an intuitive interpretation.

Moreover we realise that most of the quantifications of the qualitative variables (like autonomy, or like employers' satisfaction with graduates) are 'fuzzy', i.e. not very precise. In sensitivity analyses we shall see (section 5.4) how this may impact the assessments of the quality of university policy by omitting variables for the scoring of the quality of university policy.

The factors in policy are related to those in university performance as if policy 'drives' university performance in a linear fashion. Here we find coefficients for the 'impact' (i.e. the relationship, not necessarily of a causal nature) of university policy on university performance.

Subsequently university performance factors are related to the factor derived from our two indicators for innovation. The coefficients of the association between innovation and performance factors are estimated by OLS. By through-multiplication we then find the weights of the different policy factors on innovation. These weights then indicate how the different policy elements predict innovation based on the experiences of the 32 countries. Note that, as illustrated by Marconi (2014), this two-stage process implicitly relies on a perfect mediation model, whereby the policy factors are assumed not to be related to the innovation factor conditional on the performance factor. We tested this restriction in both the analyses that we present in this report. We find that this restriction holds for the 2014 analysis, but not for the 2012 analysis.[9]

By multiplying these weights with the values for the respective policy variables for each of the 32 countries we find a measure for the quality of university policy in that country. This measure, which is equal to the predicted value of the innovation factor in each country given the observed policy variables, is presented for 2012 in section 5.2 and for 2014 in section 5.3. Let us repeat: it is a rough measure because of the methodological problems implicit in working with a small sample and with noisy measures. In section 5.4 we present a sensitivity analysis for different configurations of the variables to be included, by showing the effects of excluding the private expenditures on universities (and just adding them up to public expenditures) and by excluding employers' satisfaction with graduates.

5.2 The quality of university policy 2012 revisited

In our earlier report (Hoareau et al. 2012) we presented a comparison of the 32 European countries in terms of their quality of university policy. Here we revisit this ranking because new data have become available and because we have expanded the statistical exercise. The

[9] This test is carried out by regressing the innovation factor on the performance factors, the policy factors and the factors extracted from the control variables. In both cases, the performance factors are jointly significant in this regression at the 1% confidence level. The policy factors are not significant in the 2014 analysis (p-value=0.58), indicating that the restriction holds. However, they are significant for the 2012 analysis (p-value=0.045).

new available data are, on one side, those on employer satisfaction of graduates and, on the other side, those on private expenditures for universities (see chapter 3). In gauging the statistical impact of university policy on innovation, four control variables are introduced: two representing the size of the country, and two the composition of the population. Note that the year 2012 is the year of publication. The variables were mostly measured in 2008 (policy) or 2010 (performance and innovation).

5.2.1. Relationship between policy, performance and economic output

Policy: The factor analysis uncovers an interesting correlation structure among the policy indicators.

Countries in Europe with a substantial organisational autonomy also have substantial financial autonomy. However: policy autonomy bears no relation to organisational autonomy and is only weakly related to financial autonomy.

When countries have high public expenditures per student, they also have substantial financial aid. Private expenditures are weakly and negatively related to public expenditures (consistent with the findings of Ritzen, 2010, p. 144: for every additional Euro in private expenditures, public expenditures tend to decrease by only 0.25 cents).

Performance: Several of the performance measures are strongly correlated with each other as well. Interestingly some of the interrelationships between our indicators run across the research-education dividing line. Countries which do better in research also tend to show a higher employer satisfaction with graduates. Perhaps this is an indication of the impact of good research on the graduate quality.

Innovation: The two indicators of innovation are very strongly correlated.

5.2.2. Factors: policy, performance and innovation

Factor analysis allows us to reduce the number of variables in each subset based on the understanding of the relationships between indicators. For that purpose we need to choose an algorithm to compute the factors, and a rule to decide which factors to retain. To be consistent with our previous report, we compute the factors through what is often called 'principal factor component analysis', i.e. we run a principal component analysis and then we standardise the resulting components (which become our factors). In addition, by using the so-called Kaiser rule (Guttman, 1954) for selecting the factors to include in the analysis, both for 2012 and the 2014 analysis[10]. This means that we retain for our analysis only those factors with an eigenvalue higher than one[11]. In this way we reduce the dimensionality of

[10] The eigenvalue for the factor that is labelled as 'Policy autonomy' in the 2012 analysis was 0.98. We decided to retain this factor despite its eigenvalue is slightly smaller than 1, for the sake of comparability with the results from our previous report and from the 2014 analysis.

[11] We follow our previous report also in the choice of the method used to carry out the factor analysis, as we use principal component analysis to derive the factors, and we standardise the resulting components/factors. To rotate the factors, we use varimax, as it is commonly used in the applied literature (e.g. Braun et al., 2013). This represents a change from our previous report (Hoareau et al., 2012), where we used oblique rotation. As

our dataset from 18 variables to 8 factors. In Appendix 2 an overview of the factors and their loadings for 2012 is presented.

Policy: The factor analysis leads to three factors which – according to their loadings coefficients – can be termed (see Appendix G, Table G-1):

- Public funding, loaded by per student expenditures in relation to GDP per capita and student financial aid,
- Organisational autonomy and private expenditures, with a large (positive) loading on organisational autonomy (and, to a lesser extent, on financial autonomy) and a large (negative) loading on private expenditures,
- Policy autonomy, loaded by policy autonomy and – to a lesser extent – by private expenditures.

Performance: also here three factors emerge (see Appendix G, Table G-2):

- Research performance with high loadings from research performance, yet also with a substantial loading from employer satisfaction,
- Enrolments and mobility, with a large (positive) loading on the enrolment rate and on new entrants and a large (negative) loading on student mobility,
- Graduation rate.

The factor extracted from the innovation variables is strongly associated with both the variables used as an indicator: labour productivity and employment in knowledge intensive industries with factor loadings of 0.94 (out of 1, representing perfect correlation between the factor and the indicator).

Four indicators representing country size and population structure were added as control variables. The four variables employed turn out to load into two factors, which can be interpreted as country size and the relative size of the older population. Country size loads heavily on total population and on total number of higher education institutions (0.95 and 0.96, respectively), whereas population structure loads on the old age and on the young age dependency ratio (with loads equal to 0.87 and -0.88, respectively).

5.2.3. Relating policy to performance factors

We are now interested in the relations between the policy factors and the performance factors. These are presented in Appendix G, Table G-3. These tables report a number of interesting findings:

- Research performance is positively and significantly related to public expenditure, but also to the factor representing organisational autonomy and private expenditures. The latter result is difficult to interpret, as it may reflect a positive correlation between organisational autonomy and research performance, or a negative correlation between private expenditures and research performance

discussed in Marconi (2014), the type of rotation used is irrelevant for the computation of the variable weights and of the final ranking of countries, given our methodology.

- Enrolments are positively, but not significantly related to the factor representing organisational autonomy and private expenditures
- Graduation rates are negatively related to organisational autonomy and private expenditures (this result is significant only at the 10% level), as well as to public expenditures and financial aid (not significant)
- Policy autonomy is positively related to all three performance factors, but the coefficients are not significant
- The variables controlling for the size of the country and the composition of the population are not significant.

5.2.4. Relating innovation to performance

And how is innovation related to the performance variables? This relationship can be expressed by a simple formula:

Innovation 2010 = 0.68 Research performance 2010 – 0.49 Enrolment & mobility 2010 + 0.04 Graduation rates 2010

The coefficients for research performance and for size are statistically significant at a 1% confidence level (with t- values of 6.25 and -4.47 respectively), while the third coefficient is not significant (t-value -0.35). We omit here the control variables as they turned out not to be significant and not to be relevant for the computation of the scores presented in section 5.2.6.

5.2.5. Policy weights for innovation

The formula presented above for the relation between innovation and performance together with the results from the regressions presented in Appendix G, allow us to determine the direct relationship between the factor representing innovation and the policy factors. As we did in our previous report, we use these weights and the policy factor scores to compute our measure for the 'impact' of policy on innovation according to the following formula:

Innovation 2010 = 0.40 Public funding 2008 – 0.08 Private expenditures & organisational autonomy + 0.04 Policy autonomy

Note again that the autonomy variables are 'fuzzy', as they represent quantifications of qualitative and subjective judgements of experts. They could be substantially affected by errors in measurement. Hence we expect their coefficients to be biased towards 0, so that they do not play a prominent role in the computation of the scores.

We use our measure for the 'impact' of policy on innovation as a score for ranking the countries according to their policies. Using the previous formula and the loading coefficients, the country score can be computed as a weighted average of the values taken by the policy variables. As these weights are statistics which are produced on the basis of the data, it is also possible to derive their standard errors by bootstrapping (Marconi, 2014). The formula

for computing the score can be expressed as (standard errors of the weights are reported inside the brackets):

Innovation (score) = 0.18 (0.10) * public expenditures + 0.07 (0.11) * private expenditures + 0.20 (0.09) * financial aid + 0.07 (0.11) * organisational autonomy + 0.07 (0.10) * financial autonomy + 0.07 (0.11) * policy autonomy

This formula makes it clear that our measure of 'impact' of policy on innovation depends largely on two variables, public expenditures and financial aid. These are also the only variables whose weight is large, compared to its standard error[12].

5.2.6. Country scores

The rank of each country in the assessment derived from our 2012 analysis is presented in Table 5.1, together with the country score and the difference between this ranking and the ranking that we computed in our previous report (Hoareau et al., 2012). The names of five countries (Malta, Romania, Turkey, Greece and Luxembourg) are written in brackets. These are the countries for which data on at least two, out of the six policy variables, were missing and had to be imputed (see Appendix A for more details on missing data and imputation). In general, the ranking presented in Table 5.1 is not very different from the ranking of Hoareau et al. (2012), although the difference is large for a few countries, such as Malta, Germany, the Czech Republic and Spain. Note that a negative value indicates that a country **improved** its relative score or decreased its rank, i.e. gained a position in the rank order. As the two rankings differ both in terms of variables included and the weights used to compute the ranking, it is difficult to say what exactly is causing these sharp changes in the position of a few individual countries.

Table 5.1 shows two countries with excellent policies, according to our composite indicator: Cyprus and Norway. Both countries were in 2008 high in per student public spending, in student aid as well as in autonomy. Cyprus is a special case as these policies date from before the financial crisis in Cyprus. A second group of the Netherlands, the UK, Denmark, Sweden, and Austria is doing well, but could do better as Cyprus and Norway show. A third group is that of Italy, Croatia, Belgium, Ireland, Iceland, Finland and Slovenia (all with a positive, above-average score). The fourth group contains all the other countries. It is a mixture of all of the newly accessed countries to the EU and some of the older EU countries, like France and Spain. This group also includes some non-EU countries, such as Switzerland and Turkey.

[12] The weights for the funding variables are approximately two times larger than their standard errors, which may be interpreted as statistical significance. However, since our correlational analysis focuses on the relationship between factors, and not on the relationship between variables, we are not interested in which variable weights are significant in a statistical sense. However, it is important to compare the weights to their standard errors as computed by bootstrapping, as this gives an idea of their sensitivity to using different samples of countries.

Table 5.1 Quality score of university policy 2012 (policy of 2008)

Rank	Country	Score	Difference from Hoareau et al. (2012)
1	Cyprus	1.04	-1
2	Norway	0.97	1
3	Netherlands	0.55	-1
4	United Kingdom	0.49	1
5	Denmark	0.42	-1
6	Sweden	0.33	1
7	Austria	0.32	-3
8	Italy	0.14	-4
9	Croatia	0.11	1
10	Belgium	0.1	1
11	Ireland	0.07	-2
12	Iceland	0.04	1
13	Finland	0.03	-2
14	Slovenia	0.01	0
15	(Malta)	-0.06	-7
16	Portugal	-0.08	-1
17	Germany	-0.1	10
18	Switzerland	-0.11	-3
19	Estonia	-0.12	0
20	France	-0.2	0
21	Bulgaria	-0.21	-3
22	Czech Republic	-0.22	-8
23	Spain	-0.23	7
24	Hungary	-0.24	6
25	(Romania)	-0.28	-2
26	(Turkey)	-0.29	-2
27	Slovakia	-0.33	-2
28	Lithuania	-0.38	5
29	Poland	-0.4	4
30	Latvia	-0.42	4
31	(Greece)	-0.43	-1
32	(Luxembourg)	-0.51	1

5.3 What changed between 2012 and 2014 in the quality of university policy?

The development over time of each country's policy measures are presented in Appendix B. In the policy area, these developments have been analysed only for the funding variables, as there are no new and comparable data available for the autonomy measures. For the same reason, in the performance area, the measure on employers' satisfaction is the same for 2012 and 2014. The 2014 analysis uses 2012 data on innovation and research and education performance. The data on funding policy are of the year 2010 and those on autonomy of 2008.

5.3.1. Policy and performance factors

The factor loadings for the three policy factors are similar, for certain aspects, to those computed for the 2012 analysis, although there are also substantial differences. But there are also some substantial differences, as shown in Appendix H, Table H-1 (in comparison to Table H-1). The public funding factor is the most stable, even though the load of this factor on policy autonomy is larger in 2014 than in 2012, and the contrary is true for private expenditures. The second policy factor in the 2014 analysis is substantially correlated with all three measures of autonomy, and especially with organisational and financial autonomy. We label this factor 'autonomy' in the context of the 2014 analysis. The third factor represents private expenditures, as its correlation with this indicator is equal to 0.93.

The factor loadings for the performance are very similar for the 2012 and 2014 analysis, as well the correlation between the innovation factor and the two innovation indicators. The factor loadings for the performance variables can be seen in Appendix H.

5.3.2. Relating policy to performance

The coefficients of the relations between the three performance factors and the three policy factors are presented in Appendix H, Table H-3. They show a similar pattern as the results of the 2012 analysis, although there are also substantial differences): public funding is important for research performance; private funding is negatively related to enrolments and mobility (although this is only significant at a 10% confidence level); autonomy is positively related to each performance factor (but never significant). Autonomy is positively related to university performance and enrolments and mobility, although these relationships are not significant. As it is the case in the 2012 analysis, our control variables are not significantly related to university performance.

5.3.3. Relating innovation to performance

Given the relatively similar factor loadings obtained for 2012 and 2014, it is not surprising that the estimated relationship between innovation related and performance is very similar for 2012 and 2014. In the context of the 2014 analysis, the formula for computing the predicted value of innovation (excluding the control factors, which besides being not significant are exogenous and cannot be changed easily by policy makers) is:

Innovation 2012= 0.69 Research performance 2012 - 0.39 Enrolments & mobility 2012 - 0.09 Graduation rates 2012

The coefficients for research performance and for enrolments are again statistically highly significant at a 1% confidence value (with t- values of 5.84 and -3.24 respectively), while the third coefficient is not significant (t-value -0.76).

5.3.4. Policy weights for innovation

In this way we now can say with the 'impact' of policy on performance that

Innovation 2012 = 0.38 * Public expenditures & aid 2010 + 0.06 * Autonomy 2008 – 0.02 * Private expenditures

The autonomy variables are the same as in the 2012 analyses. We called them 'fuzzy' as they consist of quantifications of qualitative and subjective judgements of experts. Since these measures are likely to contain substantial error in measurement, we did not expect them to play an important role in the analysis. Differently than in the 2012 analysis, private expenditures are now clearly represented by a distinct factor. However, this factor does not seem to be related to economic innovation.

These regressions show a similar pattern of relationships as that of the 2012 analysis, namely research and graduation rates/graduate employment are more strongly related to economic innovation than enrolments and that the resources allocated to higher education systems are robustly associated to their performance. Education performance (in the crude way it has been measured) hardly matters. The enrolments factor is even negatively correlated to innovation.

In the same way as in Section 5.2.5, we re-write the above formula for 'innovation score 2012' in terms of policy:

Score = 0.22 (0.12) * public expenditures – 0.02 (0.11) * private expenditures + 0.18 (0.10) * financial aid + 0.02 (0.11) * organisational autonomy + 0.01 (0.09) * financial autonomy + 0.11 (0.10) * policy autonomy

This formula shows the close similarity between the way in which the score for a country is computed for the 2012 and the 2014 analysis. The two most important variables in the determination of the score are public expenditures and financial aid. These are also the only variables which weight is high, compared to the standard error. Private expenditures are assigned a negative weight, although these variables are not very influential in the determination of the score as their weights are about ten times lower (in absolute value) than the weights of public expenditures and financial aid.

Table 5.2 Country score 2014 and change to 2012

Rank, 2014 analysis	Country	Score, 2014 analysis	Difference from 2012 analysis	Difference from 2012 analysis, constant weights
1	Norway	0.81	-1	0
2	Malta	0.66	-13	-4
3	Cyprus	0.64	2	0
4	(Denmark)	0.6	-1	-1
5	Sweden	0.5	-1	-2
6	Netherlands	0.39	3	2
7	Finland	0.3	-6	-3
8	United Kingdom	0.28	4	6
9	Iceland	0.19	-3	0
10	Austria	0.09	3	-1
11	Belgium	0.06	1	-2
12	Italy	0.01	4	4
13	Slovenia	0	-1	-1
14	Ireland	0	3	2
15	Estonia	-0.02	-4	0
16	Portugal	-0.05	0	0
17	Switzerland	-0.06	-1	-2
18	Poland	-0.14	-11	-3
19	Croatia	-0.14	10	1
20	Germany	-0.16	3	3
21	(Turkey)	-0.19	-5	-6
22	France	-0.21	2	2
23	Slovakia	-0.23	-4	-1
24	Czech Republic	-0.26	2	-2
25	(Greece)	-0.27	-6	-4
26	Lithuania	-0.32	-2	-2
27	Hungary	-0.33	3	4
28	Spain	-0.35	5	6
29	Romania	-0.4	4	-3
30	Latvia	-0.44	0	0
31	Bulgaria	-0.46	10	6
32	(Luxembourg)	-0.52	0	1

5.3.5. Country scores 2014

The calculated country scores of the 2014 analysis are presented in Table 5.2 in a rank order. This table also shows (Column IV) the change in rank from the 2012 score for each country. Note that a negative value indicates that a country **improved** its relative score or decreased its rank, i.e. gained a position in the rank order. Some countries, such as Malta, Poland, Croatia and Bulgaria changed their position by ten positions or more. In most cases, this is due to sharp changes in the indicators with which we measure policy. This can be seen by comparing Column IV with Column V, which reports for each country the hypothetical change in the ranking position that would result if the 2014 ranking would be computed with the same weights as for 2012[13]. However, it is apparent that the change in the weights used for constructing the ranking was an important determinant of the change in the rank of some countries, such as the UK, Turkey, Spain and Bulgaria, most of which are in the lower part of the ranking. Finally, note that the name of four countries (Denmark, Turkey, Greece and Luxembourg) are written in brackets. These are the countries for which data on at least two, out of the six policy variables, were missing and had to be imputed (see Appendix A for more details on missing data and imputation). It is not a case that Turkey, Greece and Luxembourg are reported in brackets both in Table 5.1 and 5.2. These are the countries for which it has been most difficult to find data.

5.4. Sensitivity analysis 2014

Scores may be affected by variations in indicators. To gain a deeper understanding of the robustness of the scores we have performed the same analysis as before but now by omitting variables (like the autonomy variables or employer's satisfaction) or by adding up private and public expenditures. We may conclude from the results that indeed the exclusion of variables generally has quite some impact at the bottom of the ranking. The group of countries leading the ranking remains – in contrast – relatively stable: the position of Cyprus, Norway, Denmark, the Netherlands, the UK, Sweden, Malta, and Finland are hardly affected. This is probably due to the fact that, irrespective of the specification used to compute the scores, the distribution of the ranking score tends to be skewed to the right, and is very dense at the left. This means that the scores of the countries at the lower end of the scores are so close together that a minor change in the variable included in the model can change their position in the rank order. In the top part of the ranking score distribution the scores are relatively wide apart. An omission of variables then has less impact on the rank-order. Two histograms representing the distribution of the ranking scores are reported in the Appendix I for 2012 and 2014. These histograms have been used to divide the countries in three groups: the high, average and more modest performers. The top are the most robust (the leading 6 countries), medium are defined as the group of the next 13 and

[13] For example, according to our measures, Malta increased substantially public funding and financial aid to students, the two most important indicators in the construction of the ranking. This is the main reason behind Malta's dramatic rise in the ranking. However, the fact that the relative weights for these two variables pushed Malta forth by 4 extra positions in the ranking (as with the same weights as in 2012, Malta would rank 4 positions lower).

more modest as the lowest 13. This distinction is used in the comments on the spider diagrams of Appendix B.

5. 5 Conclusion

Summary of results from the 2012 analysis:

- Research performance is positively and significantly related to public expenditure
- Enrolments are negatively and significantly related to the factor representing private expenditures and organisational autonomy
- The latter factor is also related to graduation rates (but this result is only significant at a 10% confidence level)
- All three performance factors are positively related to policy autonomy, but the coefficients are not significant
- The variables controlling for the size and composition of the population are not significant
- Innovation 2010 = 0.68 Research performance 2010 – 0.49 Enrolments & mobility 2010 – 0.04 Graduation rates 2010
- Innovation 2010 = 0.40 Public funding 2008 + 0.08 Organisational autonomy & private expenditures + 0.04 Policy autonomy

Summary of results from the 2014 analysis:

- Public funding is important for research performance
- Graduation rates are positively related to private expenditures (only significant at the 10% level)
- Autonomy is positively related to research performance and enrolment rates, but this relationship is not significant.
- Innovation 2012 = 0.69 Research performance 2012 – 0.39 Enrolments & mobility 2012 – 0.09 Graduation rates 2012
- Innovation 2012 = 0.38 Public funding 2010 + 0.06 Autonomy 2008 – 0.02 Private expenditures
- Good policy starts by making substantial funds per student available for university education. Policies to increase university enrolment with insufficient funding per student undercut the innovative potential of the country.
- Good policy is the proper mix between research and education for the sake of the richness of education. Employer satisfaction with university graduates is larger in countries with a substantial research performance (in terms of attractiveness to foreign researchers or in top-publications) than elsewhere.

Note that our analysis refers to policies from 2008. Since then many changes were introduced in the national regulation of higher education institutions, so that the results of the analysis may be different if more recent data were used. In chapter3 we look at the policy changes, as well as at the new available data, while in chapter 4 we look at the

changes in the variables to conclude in chapter 5 how the world has changed between the 2012 and this report.

Cyprus, Norway, Denmark, the Netherlands, the UK, Sweden, Malta, and Finland, appear in the top group according to our ranking, suggesting that the higher education policies of these countries are the most supportive of the national innovation systems. The UK is the only EU country with a comparatively large population in the top league (our indicators being scaled to population size).

The middle group includes Germany, Belgium, Croatia, Austria, Iceland, Ireland, Italy, Slovenia, Portugal, Spain, Hungary and Estonia. A third group follows with Switzerland, France, Lithuania, Bulgaria, Poland, Turkey, Romania, Latvia, Slovakia, the Czech Republic, Luxembourg and Greece. The relatively low score for some countries, like Luxembourg, is largely due to the fact that they spend less on universities than their European counterparts with a similar or lower GDP per capita. The expenditure per student as a percentage of GDP per capita in Luxembourg is proportionally lower than the Czech Republic for example. This mismatch may come from the novelty and small size of its university system: the University of Luxembourg was created in 2003. Greece appears at the end of the scale. The Greek score is due to its financial commitment (Greece having among the lowest funding for higher education and financial aid according to our 2008 pre-crisis data). It also relates to government's policy on autonomy: Greece has low policy and managerial autonomy scores. Greek universities are unable to manage their assets by borrowing money, or to introduce new programs - a significant factor for educational performance according to our study.

Our higher education policy assessments are only partially similar to the innovation level of countries, simply because our assessment tries to measure the contribution of higher education policies, rather than innovation per se. For example, Switzerland has comparatively high level of productivity and employment in innovative industries. It is also a top European performer in terms of our indicators of research and graduate employment performance (with for example 91.8% of graduates in employment three years after graduation in 2009). But our assessment is critical of Switzerland because of a comparatively low percentage of financial aid to students, which yet has to be solved by an inter-cantonal agreement. This is tantamount to saying that Switzerland could even do better in innovation, if its higher education policies were to improve. Conversely, some countries have a low level of innovation despite high public investments in higher education, as it is the case for France and Germany. This situation may be changing. French and German reforms in autonomy and funding of 2008 may not have translated into statistically visible results yet. Germany has announced a large investment in higher education in the form of the excellence initiative which may carry Germany towards a higher score in the future.

Chapter 6

Summary and conclusions

This is the second and final report of the Foundation Empower European Universities on the State of Universities for Progress in Europe[14]. It builds on the following notions on universities and innovation:

- The EU wants to be more innovative.
- European universities have a central role to play through their research and teaching in furthering the level of economic innovation, leading to higher productivity and higher economic growth.
- Many European countries could substantially improve their university policies, if they want to promote innovation in their country, by learning from each other.

We want to derive 'what' good policy is from the experience of 32 European countries[15]. Policy is recognised in the legislative environment and the funding of universities. These should be such that universities feel to the maximum empowered to deliver the graduates who have the skills to be innovative on the labour market. At the same time equality of opportunity and thus the full realisation of all available talents is served by student loans and grants. Notice that we tie the contribution of universities first and foremost to the quality and quantity of the graduates.

The 'legislative' environment is described in terms of the room it gives to universities to follow their mission (which is often – in the case of public universities – determined by the State). This is captured with 'autonomy'. This report extends the data used for analysis with data on private expenditures to universities (both for 2010 and 2012) and with data on employers' satisfaction with graduates in the 32 countries. Our conclusions are not based on a causal model but rather on an accounting framework.

In this as in the previous report we find the following:

- Good policy starts by making substantial public funds per student available for university education. Policies to increase university enrolment with insufficient funding per student undercut the innovative potential of the country. Notice that we are not speaking about absolute figures but rather about 'effort': per pupil expenditures in relation to GPD per capita. This is a short cut for the finding that there are very few countries with a high level of innovation and low per student expenditures (relative to GDP per capita). We notice that –presumably in the absence of data on the quality of the skills of graduates- good public funding interacts with

[14] The first report is Hoareau et al. (2012), which is available at www.empowereu.org/publications.
[15] The report covers all EU countries, plus Iceland, Norway, Switzerland and Turkey.

innovation through 'research performance', which is a summary measure for citations, for the place of country's universities in the top of rankings etc.

- The only available measure for graduate skill quality is employer's satisfaction. It turns out that employers are more satisfied with the skills of their graduates when the research performance in that country is high. This might be considered a signal that the quality of university teaching is enhanced by the quality of the research (rather than the size of the research). It appears that good public funding is a necessary condition for universities to be effective for innovation.
- The role of private funding could not be well established. Private funding is high at both ends of the distribution of countries according to their level of innovation. As a result it has no significant (statistically) impact on innovation in our accounting framework.
- Student support not only serves equality of opportunity, but also innovation. Student support is part of 'good funding'.
- The legislative framework for universities is here expressed in organisational, financial and policy autonomy, all measured in a very rough way with a survey in which respondents could give their judgements on a number of items related to these three types of autonomy. Autonomy of universities is expected to be closely related to their effectiveness for innovation. Autonomy seems to be positively related to research performance and enrolments, although, these relationships were not significant in our sample.

Changes 2012-2014

This report repeats the 2012 analysis with the data of two years later and with the assessments of correspondents from the 32 European countries on university policies in the context of university performance and innovation, while deepening the analysis with data on the satisfaction of employers with graduates, and expanding the accounting framework with variables which represent the size and composition of the population. As one would expect, the conclusions remain by and large the same:

- There remains a substantial difference in university policies between the 32 European countries. Those of Northern Europe seem far more effective in promoting economic innovation and economic growth than those in the South and East (with exceptions).
- There seems to be very little policy discussion on the importance of university policy for innovation.
- In the recent past the discrepancy between Northern/Western Europe and Southern/Eastern Europe has slightly decreased: there are signs of 'catching up' within European countries in terms of resources for universities and in the performance of universities in terms of education and research. Countries which were some years ago below the median have increased public expenditure and

financial aid to students, and have been increasing not only enrolment but also graduation rates.

- European countries continue to experience an increase in research publications. Despite this, their international competitiveness (as measured by the number of universities in the top 500 of the Shanghai ranking) is decreasing. Other countries outside of Europe are simply moving faster.
- The successful transition of graduates to the labour market still receives little attention, both in Government policy and in university policy. The recent increase in graduate unemployment is likely to be due to the economic crisis in Europe, but also to the inadequate preparation (in terms of knowledge, skills and competencies) for the evolving labour market.
- Employers in a number of the new member states are generally more dissatisfied with the skills of graduates than employers in Northern European countries.
- Public expenditure per student as a percentage of GDP per capita has stagnated between 2008 and 2010.
- Student contributions occupied the policy debate of a majority of European countries, either in terms of a reform of the financial aid or of the tuition and fee systems.
- Our measure of quality of university policy (i.e., the part of economic innovativeness that can be predicted on the basis of university policy) shows stability across countries, as our assessment is not much affected by the new data and methodological procedure. Europe's 'top' higher education systems (the top 1/4th) in terms of university policy remain Norway, Malta, Cyprus, Denmark, Sweden, the Netherlands, Finland and the UK[16]. Several countries have increased the quality of university policy since the base year due to an increase in resources available to higher education (or more efficient use thereof). These countries include Malta, given their large increase in public expenditure and financial aid.

Note that this was an accounting framework and not a causal model. Still the findings are indicative. In no-regret policy making they should definitely be addressed.

[16] This group also includes small country outliers. For example, Cyprus remains in the top group due to a high public expenditure per student as a percentage of GDP per capita. Some additions to the top group include Malta given its high and increasing levels of public expenditure.

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Appendix A

Data sources and missing data

A.1 Data description

Table A-1 Description of the variables and relative data source

INDICATOR	DESCRIPTION	VALUES	YEARS	SOURCE
Public expenditures	Expenditure per student as a % of GDP per capita. Tertiary. Public expenditure (current and capital) includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other privates entities)	%	2008-2010	World Bank
Financial aid	Financial aid to students as % of total public expenditure on education, at tertiary level of education (ISCED 5-6)	%	2008-2010	Eurostat Author's computation based on World Bank and Eurostat data
Private expenditures	Private expenditure per students as a % of GDP per capita (ISCED 5-6)	%	2008-2010	
Organisational autonomy	Extent to which a university is allowed to decide on its own organisational structures, own internal authority, responsibility and accountability structures, as well as institutional leadership	From 1 to 5 (1 low, 5 high)	2008	CHEPS, INCHER, NIFU-STEPS (2008)
Financial autonomy	This indicator is closely related to a university's ability to attract income from additional funding sources, to be able to decide on the internal allocation of funds, to build reserves and to borrow funds on the capital market	1 to 3 (1 low, 3 high)	2008	CHEPS, INCHER, NIFU-STEPS (2008)
Policy autonomy	Ability of public universities to constitute their own academic community in terms of student and staff selection and to determine their teaching and research programmes.	1 to 3 (1 low, 3 high)	2008	CHEPS, INCHER, NIFU-STEPS (2008)
Mobility	Students from abroad: inward mobile students by percentage of student population in the host country	%	2010-2012	Eurostat
Enrolment rates	Students (ISCED 5-6) as % of total population	%	2010-2012	Eurostat
Graduation rates	Graduates in ISCED 5 and 6 / enrolment number (all ages both categories)	%	2010-2012	Eurostat
Graduate employment ratio	Employment rates for graduates (ISCED 5-6, age 25-34) relative to overall employment rates in the 25-34 age group	%	2010-2012	Eurostat

New entrants	New entrants to the first stage of tertiary education (programmes that are theoretically based/research preparatory or giving access to professions with high skills requirements - level 5A), any age as a percentage of total population	%	2010-2012	Eurostat
Ranking performance	Number of universities in the top 500 (ARWU ranking) divided by population in million inhabitants in a given country	Ratio	2011-2013	Authors' computation based on the Academic Ranking of World Universities and Eurostat data
Top publications	Scientific publications within the 10% most cited scientific publications worldwide as a percentage of total scientific publications of a country	%	2007-2009	Innovation Union scoreboard dataset 2014
Public-private research cooperation	Public private co-publications per million inhabitants	Ratio	2008-2011	Innovation Union scoreboard 2014 (dataset non normalised scores)
ERC grants	ERC wins (starting investigators grant) per call year per million inhabitants	Ratio	2011-2013	Authors' computation based on European Research Council and Eurostat data
Employment in Knowledge Intensive Activities	Employment in Knowledge Intensive Activities (KIA) as % of total employment	%	2009-2012	Eurostat
Labour productivity	Labour productivity per hour worked, calculated as real output (deflated GDP measured in chain-linked volumes, reference year 2005) per unit of labour input (measured by the total number of hours worked).	PPS€; euro per hour worked	2010-2012	Eurostat
Population	Total population	Count	2008-2010	Eurostat
HEIs	Total number of higher education institutions	Count	2012	Webometrics
Old dependency ratio	Old-age dependency ratio (population 60 and over to population 20 to 59 years)	Ratio	2008-2010	Eurostat
Young dependency ratio	Young-age dependency ratio (population aged 0-19 to population 20-59 years)	Ratio	2008-2010	Eurostat

A.2 Missing data

Missing data for the 2012 analysis were imputed in a comparable manner to the first edition of this report. This means that for every variable with missing data (target variable), we used data from the previous or following years (provided that these years were not more than four years far away from the target year), or we looked for another variable (or more than one) which is well correlated with the target variable. After finding the data from previous years or the other suitable variable(s), we imputed the missing values through regression. Missing data for the 2014 analysis were imputed on the basis of the respective values for the 2012 analysis.

Table A-2 reports the number of missing data for the 2012 analysis and for the 2014 analysis. The variables used for imputation when data from the time series of the target variable were not available are reported in Column V of Table A-2, which provides an overview of missing data. Note that, as a result of how Table A-2 has been constructed, Column V is left empty for the variables enrolment rate, graduation rate, and new entrants, despite the fact that there are missing values for these variables. The reason is that the missing values for these variables have been imputed only on the basis of records for the target variables themselves in different years.

The entire dataset used for the analysis, including the variables used for the imputation of missing values, is available at www.empowereu.org. Additional information can be requested directly to the authors.

Table A-2: Number of missing data in the 2012 and 2014 analysis for every variable, with a description of the variables used for the imputation, when relevant

INDICATOR	2012 analysis	2014 analysis	Variable used for imputation
Organisational autonomy	1	1	Financial autonomy
Financial autonomy	0	0	
Policy autonomy	0	0	
Public expenditures	5	6	Total public expenditure on education as % of GDP (source: authors' computations based on Eurostat data)
Financial aid	5	3	Expenditure on education as % of GDP (source: authors' computations based on Eurostat data)
Private expenditures	10	10	Ratio of expenditures on private higher education institutions over total expenditures on higher education institutions (7 countries); ratio of students attending private higher education institutions over total students (source: authors' computations based on Eurostat data)
Mobility	9	5	Ratio of foreign to total students in higher education (source: authors' computations based on Eurostat data)
Enrolment rate	1	0	
Graduation rate	1	1	
Employment rate	0	0	
New entrants	3	0	

Employers satisfaction	1	1	Relative graduate unemployment ratio (source: authors' computations based on Eurostat data)
Ranking performance	0	0	
Top publications	0	0	
Public-private cooperation	0	0	
ERC grants	0	0	
Employment in Knowledge Intensive Activities	0	0	
Labour productivity	4	4	GDP per capita (source: authors' computations based on Eurostat data)
Population	0	0	
HEIs	0	0	
Old dependency ratio	0	0	
Young dependency ratio	0	0	

Appendix B Country reports and spider-diagrams[17]: explaining the relative position of Government university policy

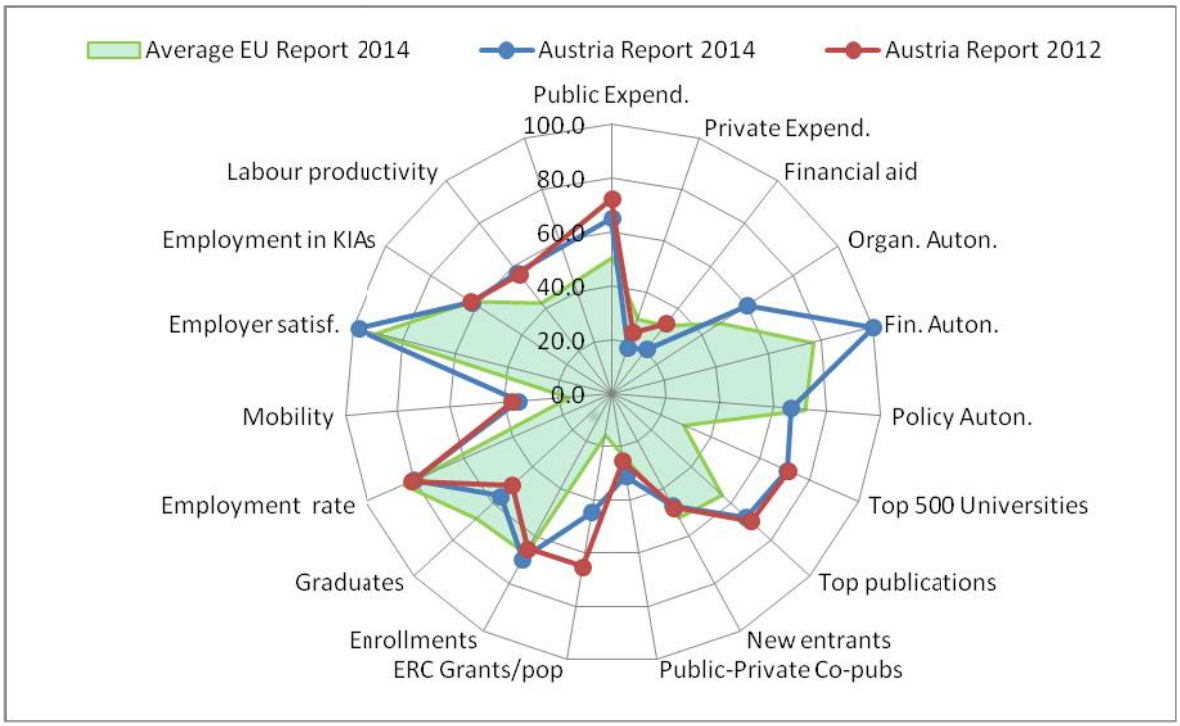
Note that we have used the following categorisation of the scores into groups based on the density diagram of Appendix J:

high group: first 6 countries

medium: 13 countries with ranking positions 7-19

modest group: last 13 countries.

AUSTRIA



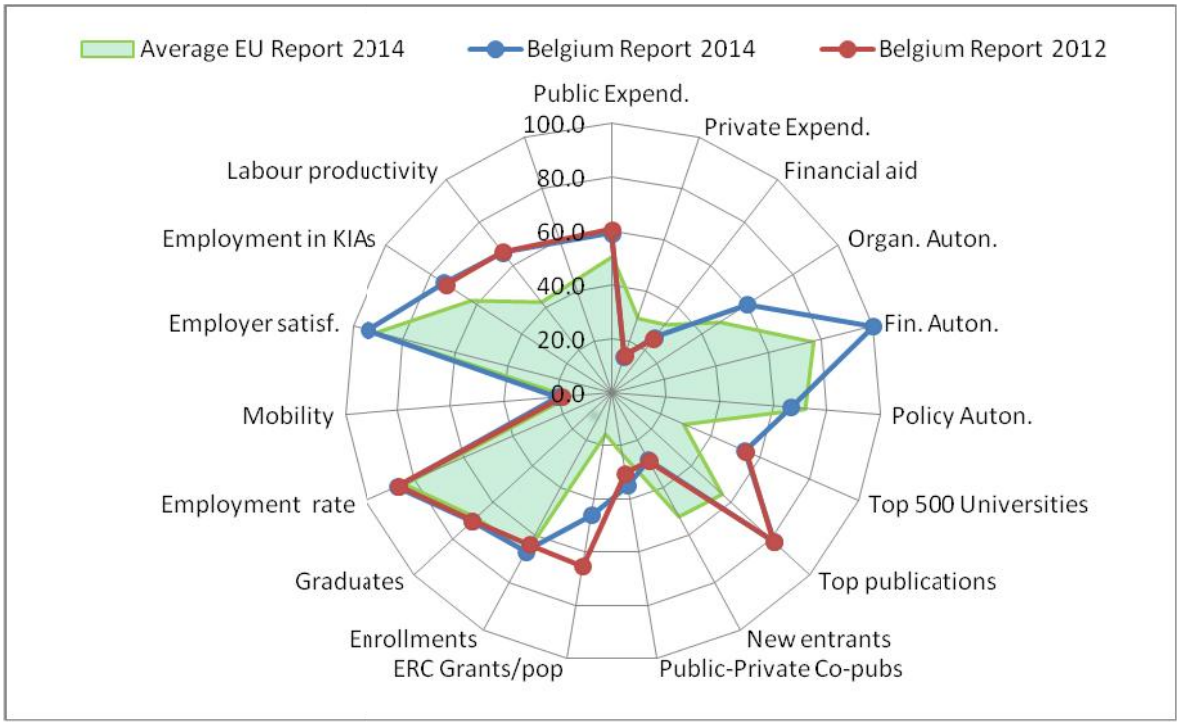
In Austria higher education policies seem to bear an average relation to economic innovation, thanks to its rather high levels of organisational and financial autonomy.
Even if it remains higher than the EU average, public funding for higher education has decreased between 2008 and 2010; at the same time, public universities have been unable to charge tuition fees because of missing regulations, resulting in an overall loss of funds.
Some indicators of research performance, such as the number of ERC awards and highly cited publications have slightly deteriorated. This is also visible in the position of Austrian

[17] Note that in the spider diagrams the highest value of each indicator (among the 32 countries of our analysis) has been set equal to 100 and other values have been calculated proportionally.

universities in recent global rankings[18]. On the other hand, the number of private-public co-publications has increased. Student graduation rates have slightly increased but continue to be lower than the European average: a recent amendment to the 2002 Universities Act[19] is meant to tackle this problem. This amendment aims to optimise the study conditions in popular disciplines by increasing teacher-student ratios (through a new type of professorial posts) in these fields.

In 2013, the Austria's federal government has facilitated the contacts between universities and industry by the creation of collaborative projects between universities, other higher education institutions and industry[20]. Austria stands out for its student attractiveness, demonstrated by a presence of international students that is substantially higher than the average European average[21]. However, much of this attraction is explained by the inflow of German students in fields in which there are serious restrictions in the number of places (numeri fixi) in Germany.

BELGIUM



[18] For example, only one Austrian university (which happens to be the biggest, namely the Vienna University) appears on the list of the top 200 universities of the Times Higher Education Ranking of 2013, losing ground compared to the previous years (139th position in 2011, 162th position in 2012 and 170th position in 2013).

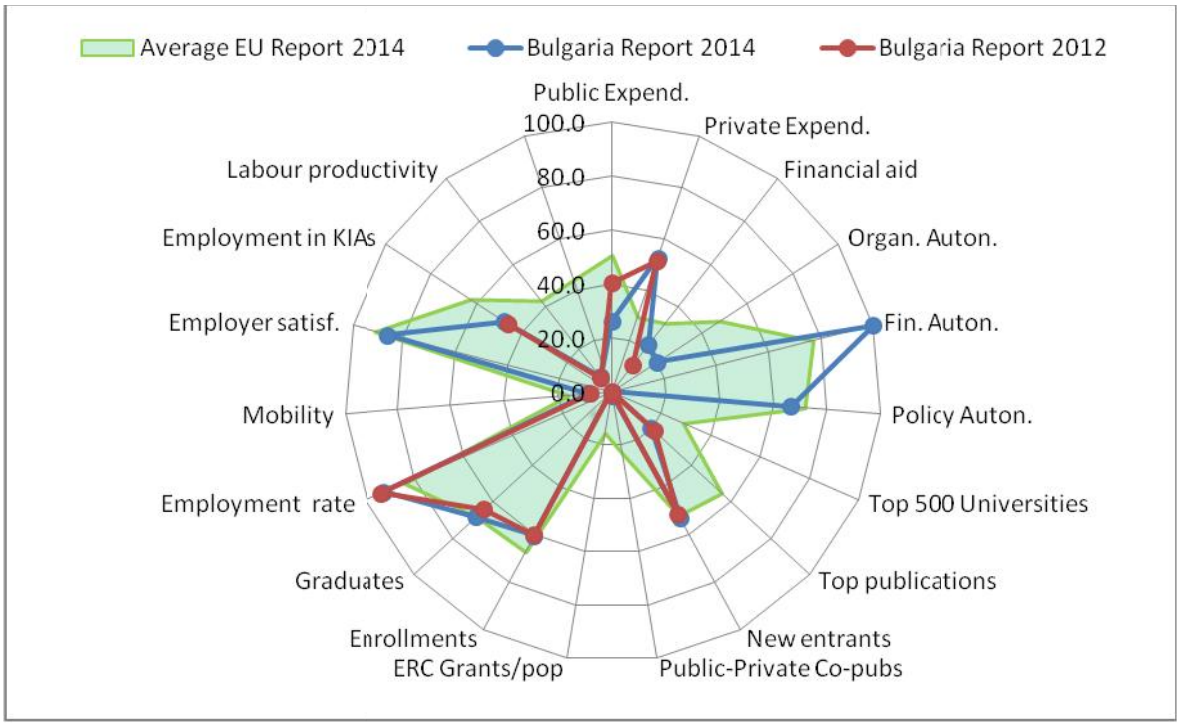
[19] Austrian Legislation. (2013). UG 2002 Federal Law Gazette BGBl no. 52 of20 March 2013.

[20] Funding boost for universities, industry collaboration. (2013, September 21). *University World News*.

[21] Mobility data for the report 2012 has been imputed.

While no major higher education reforms have been taken in the last few months, the policy contribution to economic innovation in Belgium continues to be average, thanks to the rather high levels of public expenditure and of organisational and financial autonomy.
Public funding and private funding remained more or less constant between 2008 and 2010, and financial aid increased moderately. Also research outputs continue to be higher than average. Similarly, inbound mobility rates have increased and are higher than European average. The Flemish government has recently approved the action plan on mobility: "Brains on the move" which may help to inflow of international students in Flemish universities. Graduation rates and graduate employment rates have remained approximately in line with the European average.

BULGARIA

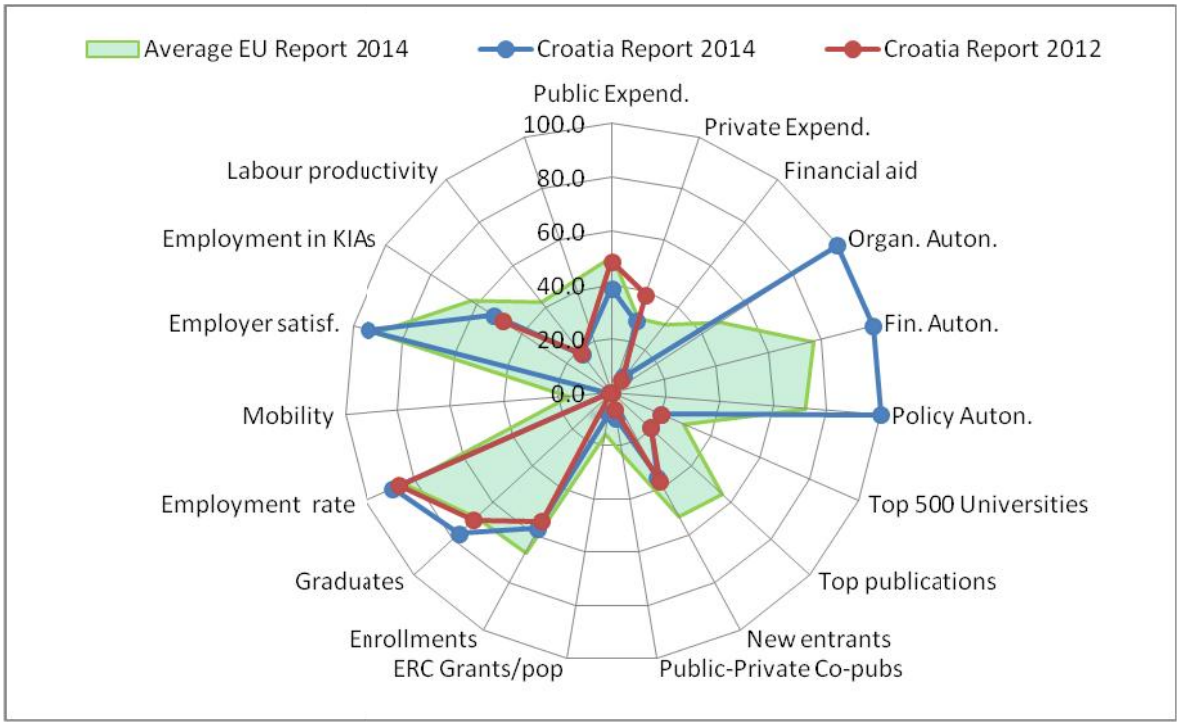


Overall, Bulgaria's higher education policy contribution to economic innovation continue to be modest, due to the low levels of public funding which in 2010 have further decreased (without being compensated by an increase in private expenditure). During the past months, in response to the economic crisis, some universities (e.g. Sofia University) have decided to increase the tuition fees for their study programmes and others are planning to increase them, despite several student protests[22].

[22] Bulgarian students join anti-government protests, occupy university buildings. (2013, October 28). *Euronews*.

The research performances of the country are still modest in comparison to the European average. By contrast, both the enrolment rate (which remains approximately stable) and the graduate employment rate are higher than the European averages.
The new Law on the Loans to Undergraduate and PhD Students facilitates access to higher education to people, regardless of their social background[23]. The percentage of international students is still low but slowly increasing.

CROATIA

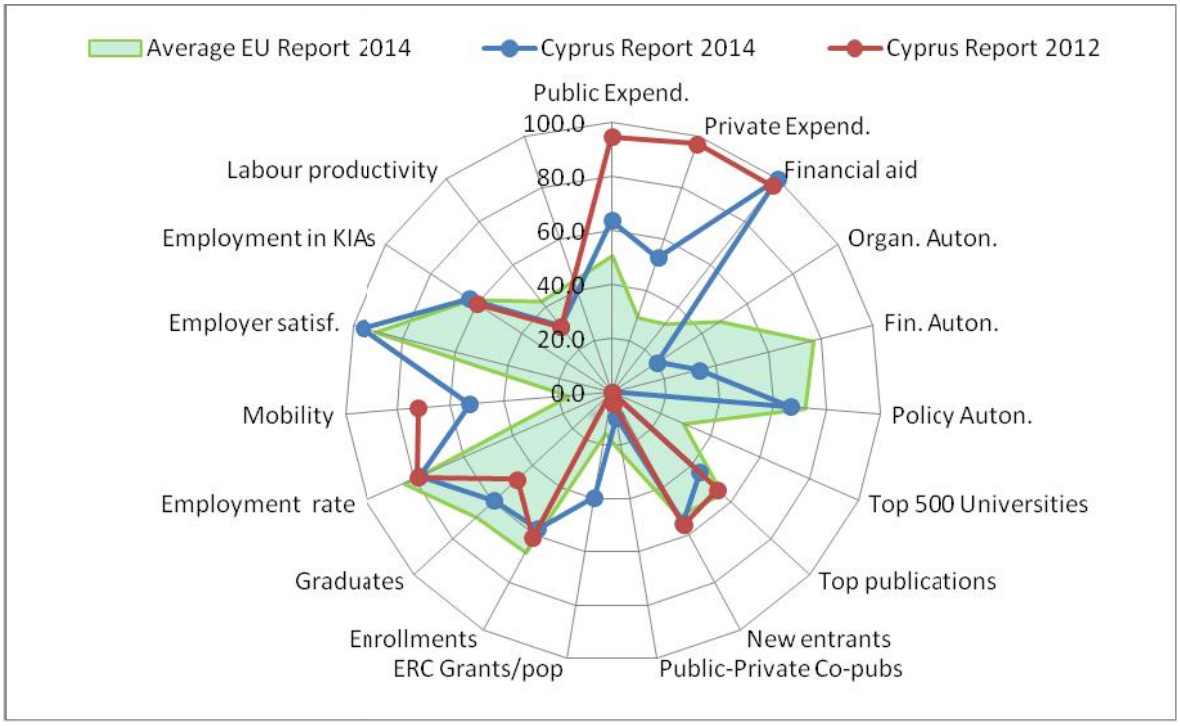


In Croatia, higher education policies moderately contribute to economic innovation[24], thanks to high levels of university autonomy (which seem to compensate for low public and private funding). However, a downward trend is foreseeable as public funds for universities have decreased between 2008 and 2010 and this decrease has not been matched by a corresponding increase in private expenditure or to any other relevant policy reform.
In addition, amendments to the current legislation have increased State control on higher education[25]. Croatian universities' research performance is still modest. On the positive side, the Country has registered an increasing number of graduates.
The recent inclusion of Croatia in the European Union (on July 1st 2013) as the 28th member state can potentially lead to an increase of incoming international students[26]. Access to

[23] Ministry of Finance of the Republic of Bulgaria (2011).
[24] Note that labour productivity values have been imputed.
[25] Croatian Legislation. (2013). Amendments to the Act on Research and Higher Education of 15 July 2013, Official Gazzete 94/201. http://narodne-novine.nn.hr/clanci/sluzbeni/2013_07_94_2132.html

major EU funds could also be highly beneficial for universities' contribution to innovation if these funds are allocated for university education and research.

CYPRUS



Despite the current economic crisis, in Cyprus higher education policy continues to give a strong contribution to economic innovation, thanks to its financial aid system for students and to its high public and private expenditures (which have decreased but continue to be higher than the EU average).

However, the harsh economic crisis that the economy has been facing and the fiscal austerity measures that have been taken by the Cypriot Government can compromise the performance of universities and their capacity to contribute to the economic innovativeness of the country in the upcoming years. Professional promotions for full and associate professors as well as the hiring of new academic and administrative personnel have been frozen in the past months; very recently, in October 2014, the Cypriot Government has made the promotion possible, provided that they are not accompanied by any salary increase. The educational grants that all Cypriot students are granted by the Ministry of Finance have been reformed and are currently based on family income criteria[27].

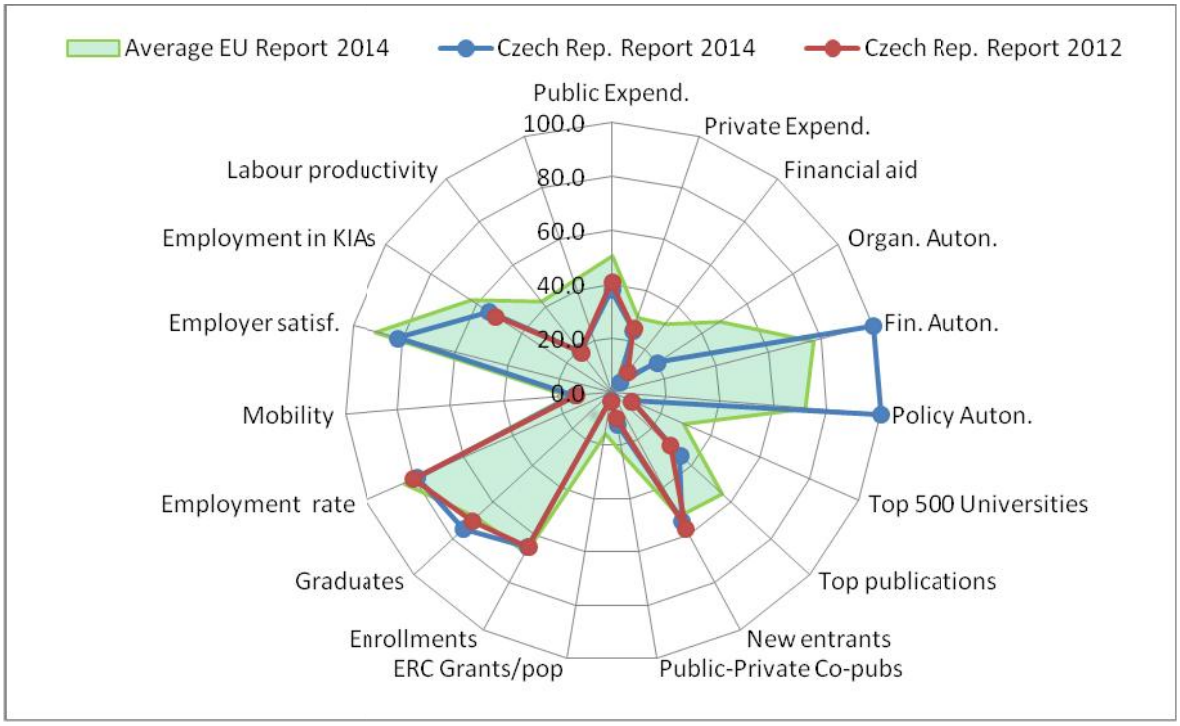
Although some indicators of research performance have decreased, such as the number of highly cited publications, other indicators of research performance, including the number of

[26] In the academic year 2011/12 for the first time Croatia had incoming Erasmus students (European Commission, 2013).

[27] Eurydice (2013).

ERC grants awarded, have increased. According to our Cypriot correspondent, academic staff has been incentivised to apply to EU research competitions and tenders, resulting in an improvement of efficiency and, in turn, in the relative stability of research performance.
Graduation rates have increased, but student mobility, enrolments and graduate employment rates have decreased.
The largest number of unemployed is found among those with elementary occupations whereas very few professionals are left unemployed[28]. In addition, it is worth noting that the University of Cyprus as well as the Cyprus University of Technology have recently decided to increase the number of students and to allow some Cypriot students that cannot afford to continue their studies abroad, to transfer to Cyprus[29]. Moreover, the Open University of Cyprus has reduced its fees by 10% for all students starting in the academic year 2014-15 in order to make it easier for students to continue with their studies under the current hard economic period. The House Education Committee has recently advocated a simplification of procedures necessary to register foreign students to reduce the administrative burden for foreign applicants[30].

CZECH REPUBLIC



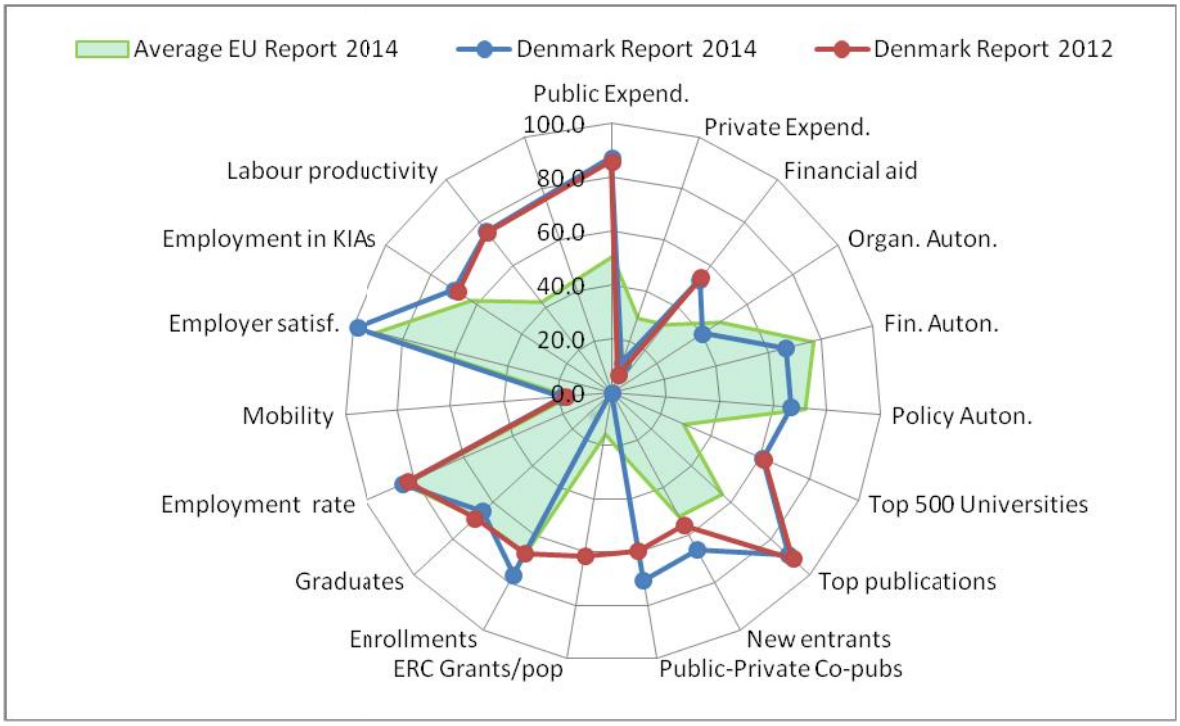
In the Czech Republic, higher education policies bring a modest contribution to economic innovation. Public expenditure has decreased between 2008 and 2010, while private

[28] Cyprus unemployment hits 14%, yet wages are up. (2013, January 8). *Financial Mirror*.
[29] Cyprus Government Planning Bureau (2013).
[30] State urged to simplify rules to attract foreign students. (2013, April 17). *Cyprus Mail*.

expenditure remained approximately constant and below the European average level. Financial aid for students – which was already substantially below the European average – further decreased and no publicly subsidised loans are provided. An amendment of the Higher Education Act (which has come into force since the end of January 2013), established that students who exceed the legal length of study have not to pay a "late fee" when they take leave for parenthood[31]. While the Government established that 22.5% of the higher education institutions institutional funding had to be assigned according to specific quality and performance indicators[32], research performances (e.g. highly cited publications and public-private co-publications) have gone up slightly compared to our previous analysis, even though all research indicators remain below the European average.

Graduation rates have remained slightly higher than the European average. The presence of international students in Czech Republic is growing possibly due to the strengthening of the National Agency for European Educational Programmes (NAEP) which has been operating for 5 years[33].

DENMARK



Denmark is one the top-10 performing countries in our analysis, thanks to high levels of public expenditure and student financial aid[34].

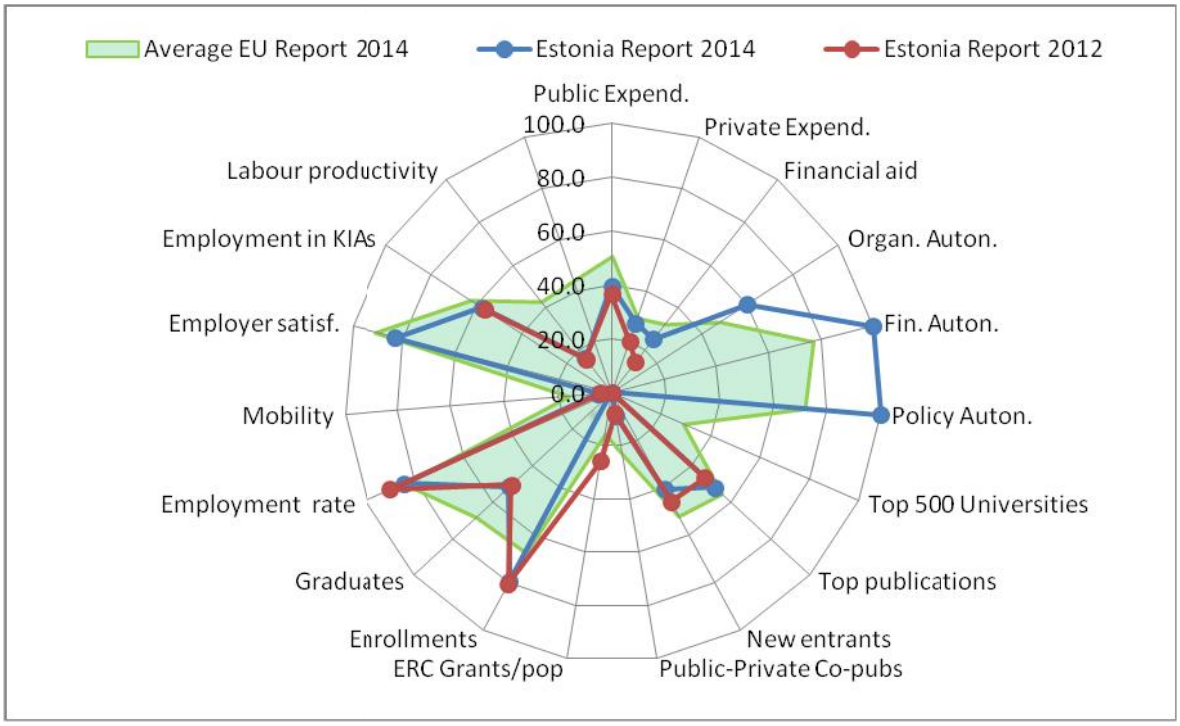
[31] Eurydice (2013).
[32] *Ibidem*.
[33] Note that the mobility data used in our analysis have been imputed
[34] Public and private expenditures data for the report 2014 have been imputed.

In order to limit governmental expenditure and improve the efficiency of studies, the Study Progress Reform – which is expected to come into effect for current and future students from the academic year 2014/15 - has introduced new frameworks for higher education programmes which support the active completion of the studies, and revised grants for students living with their parents[35].

All research indicators – except for the number of ERC Starting Investigator Grants won by Danish researchers that had a sudden drop - remain high. The Danish research landscape is likely to benefit from an agreement between the main political parties that has been made to create a new large innovation foundation.

Enrolment and graduate employment rates continue to be higher than the European average, while graduation rates have decreased slightly between 2010 and 2012. The Government has announced plans, yet to be implemented, for a further restriction on the admission to some university programmes. Meanwhile, international inward mobility has increased between 2009 and 2012[36].

ESTONIA



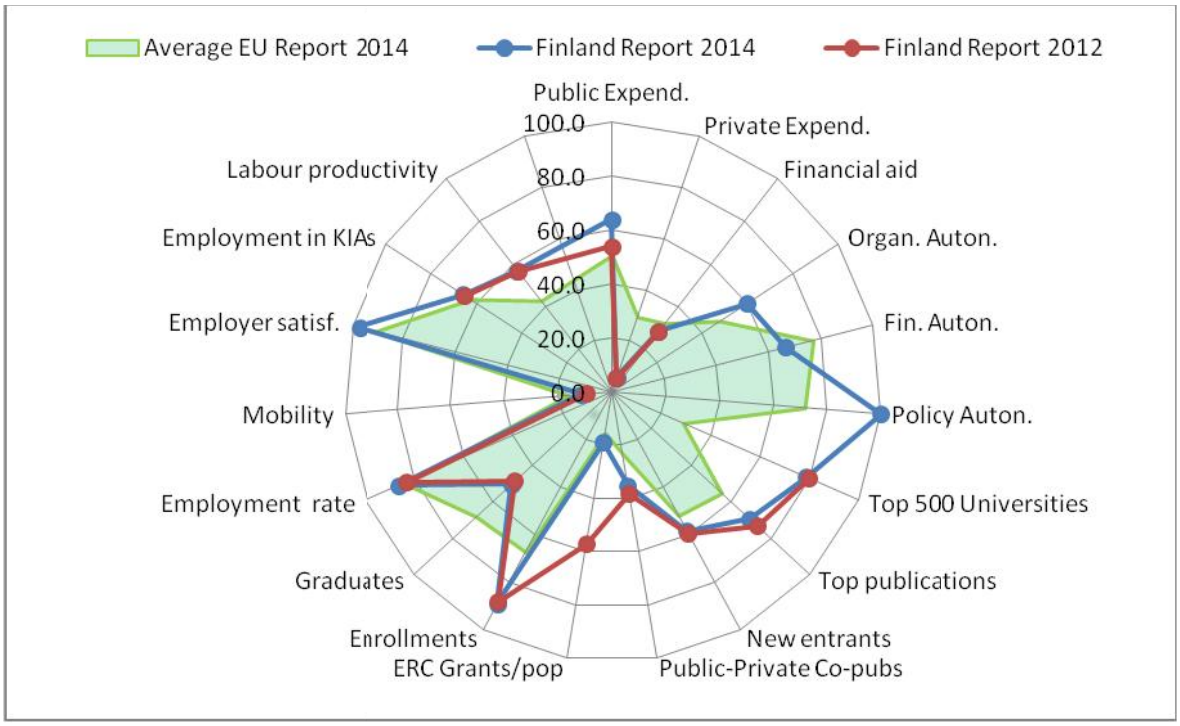
Despite both public and private expenditure remain lower than the EU average, the Estonian contribution of higher education to economic innovation is average, thanks to the high levels of university autonomy. At the end of 2012 a higher reform has been approved which has come into force during the academic year 2013/14 (see Box 1). The reform has increased

[35] Eurydice (2013).
[36] Danish Ministry of Science, Innovation and Higher Education (2013).

public expenditure by making full-time studies in Estonian public higher education institutions free of charge since the academic year 2013/2014[37]. It has also changed the student support system from merit-based to needs-based (i.e. mainly based on students and/or his/her family income), facilitating the access to higher education institutions for students coming from lower socioeconomic backgrounds[38].

Estonia has gradually improved several of its research performance indicators[39](e.g. the number of highly cited publications as well as that of public-private co-publications). In addition, student mobility and graduation rates have increased even if they remain lower than the European average.

FINLAND



Higher education policies in Finland have had an average impact on economic innovation, thanks to the high levels of organisational and policy autonomy and to an increase in public expenditure.

The research performances continue to be relatively high. However, while the enrolment rate is higher than European average, the graduation rate is lower. The Youth Guarantee - which came into force from the start of 2013 - ensures that everyone aged between 25 and 30 obtains a study place, a place in on-the-job training or rehabilitation three months after

[37] Eurydice (2013).

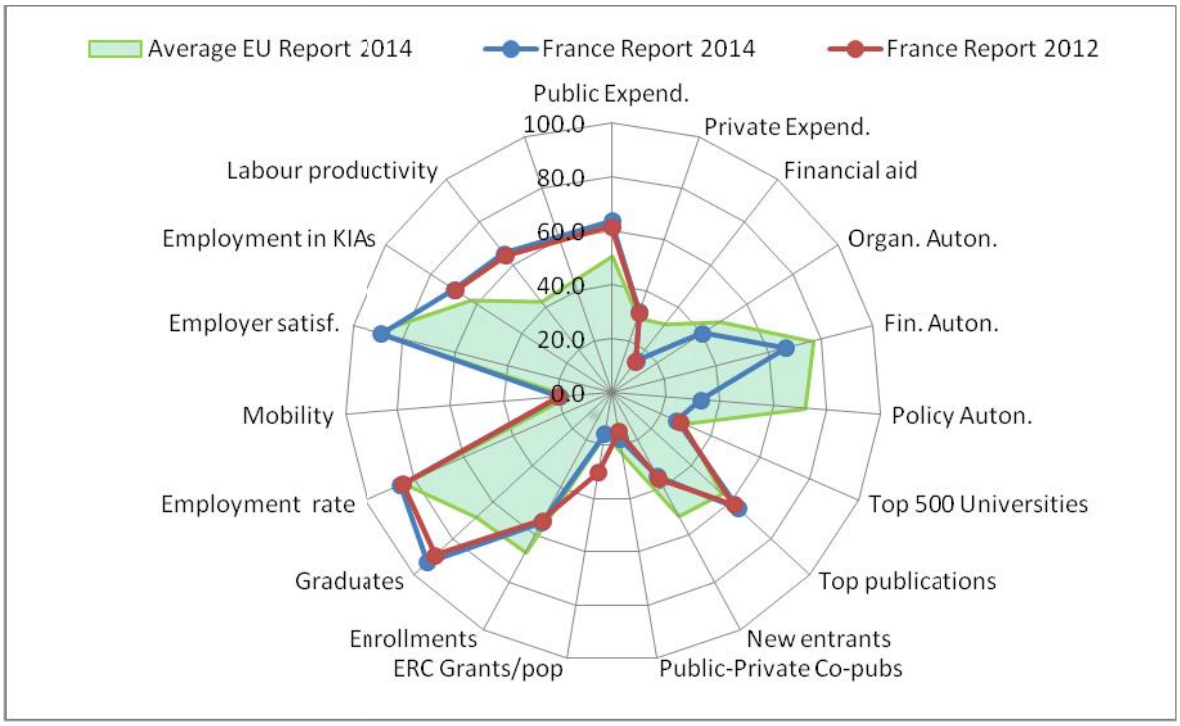
[38] *Ibidem*.

[39] According to global rankings, the trend seems promising: the 2013 list of QS World University Rankings shows an improvement in Estonia's University of Tartu (UT) and in Tallinn University of Technology (TTU), which have reached the top 500 list for the first time.

becoming unemployed[40]. Therefore, the measure is expected to increase the enrolments and the graduate employment rate.

No major policies have been taken to affect student attractiveness. The proposal to change legislation to allow for students from outside Europe to be charged tuition fees for degree programmes (approved in December 2012) may negatively affect the percentage of incoming overseas students – which registered an increase between 2010 and 2012, though still remaining below the EU average.

FRANCE



The rather low levels of university autonomy make that in our model French higher education policies have a rather low contribution to economic innovation[41]. Considerable financial and public efforts have been made by the French Government to enhance investment in R&D, to support excellent research units, and to facilitate networking between innovative teams (e.g. *Laboratoires d'excellence*) between 2008 and 2013[42]. Several universities have begun to merge to strengthen their governance and international competitiveness. But the deficit in innovation, compared to other countries remain. The

[40] Finnish Ministry for Education and Culture (2012) 'The Youth Guarantee in Finland provides employment, training and a customised service', http://www.minedu.fi/export/sites/default/OPM/Julkaisut/2013/liitteet/The_Youth_Guarantee_in_Finland.pdf?lang=en

[41] Note that the inbound mobility rates for the reports 2012 and 2014, the graduation rate for the report 2014 and the new entrant's value for the report 2012 have been imputed.

[42] Ministère de l'Enseignement supérieur et de la Recherche (2011).

relationships between Higher Education and business/industries has to be improved as well as the participation into European programmes. Measures have been taken to support less privileged students. Funds for student support have increased, targeting mainly students coming from lower socio-economic backgrounds[43]. A reform of the student housing system has been approved, implying a substantial increase in the number of public student accommodations and a facilitation of the procedures necessary to rent private accommodations to students[44].

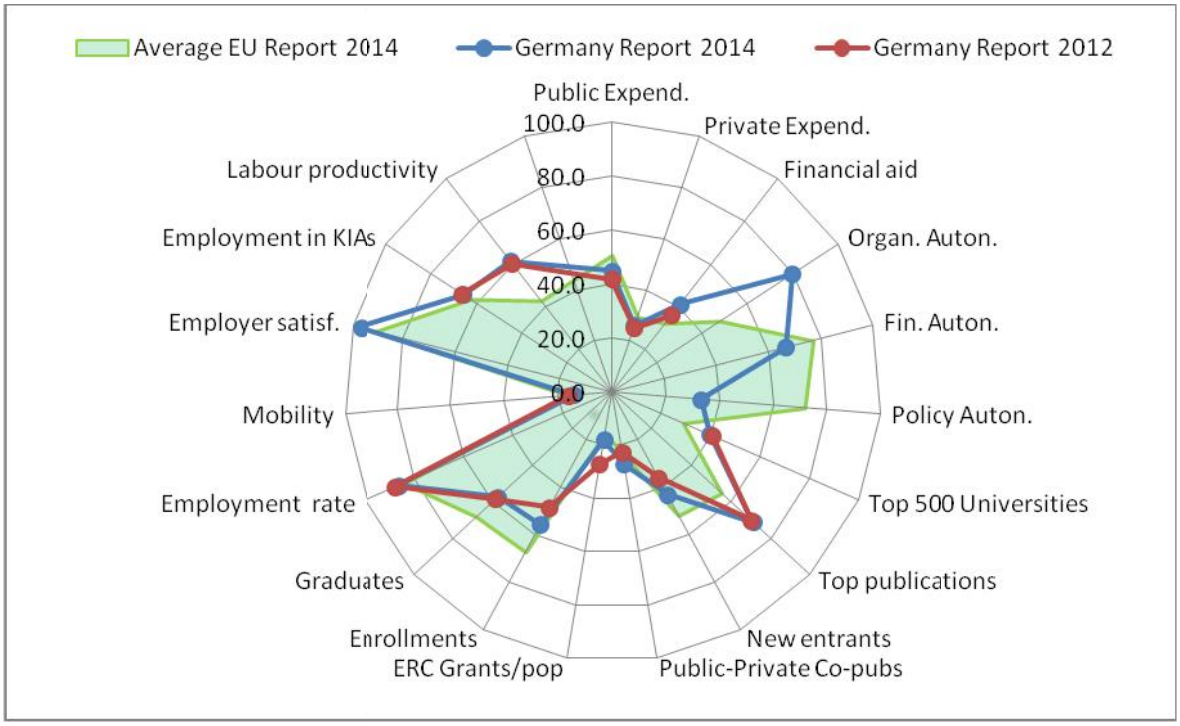
The number of highly-cited publications has slightly increased and has become higher than European average, but the number of Starting ERC grant wins has decreased. France risks slipping in international rankings[45] perhaps because of the low use of English language in French universities and difficulties to attract foreign students. The French Parliament has recently approved a law to allow universities to teach classes in English[46].

Graduation rates in French universities are significantly higher than the European average ones. Enrolment rates may increase thanks to a law adopted in 2013[47] which aims at reducing the interruptions between high school (*lycée*) and university by establishing measures to support and inform young people regarding their future possible specialisations. The inclusion of graduates in the labour market remains good even if there are some disparities between degrees; the same recent law[48] also establishes important measures to improve graduates' job opportunities. The measures include the creation of a "*Sup'Emploi*" committee with the following goals:

- to involve the business world in the design of training strategies;
- to increase of the number of students in work-linked training by 2020;
- to encourage PhDs to access to the labour market outside of universities;
- to promote entrepreneurship at universities[49].

[43] Gouvernement Français. (2013 a)
[44] Gouvernement Français. (2013 b).
[45] A rite of passage for students in France gets poor grades. (2013, June 29). *The International Herald Tribune*.
[46] French Legislation. (2013). Law no. 2013-660 of 22 July 2013 on Higher Education and Research.
[47] French Legislation. (2013). Law no. 2013-660 of 22 July 2013 on Higher Education and Research.
[48] *Ibidem*.
[49] This is expected to be implemented though the call for projects *Pôles Étudiants Pour l'Innovation, le Transfert et l'Entreprenariat* in all French universities (Eurydice, 2013).

GERMANY



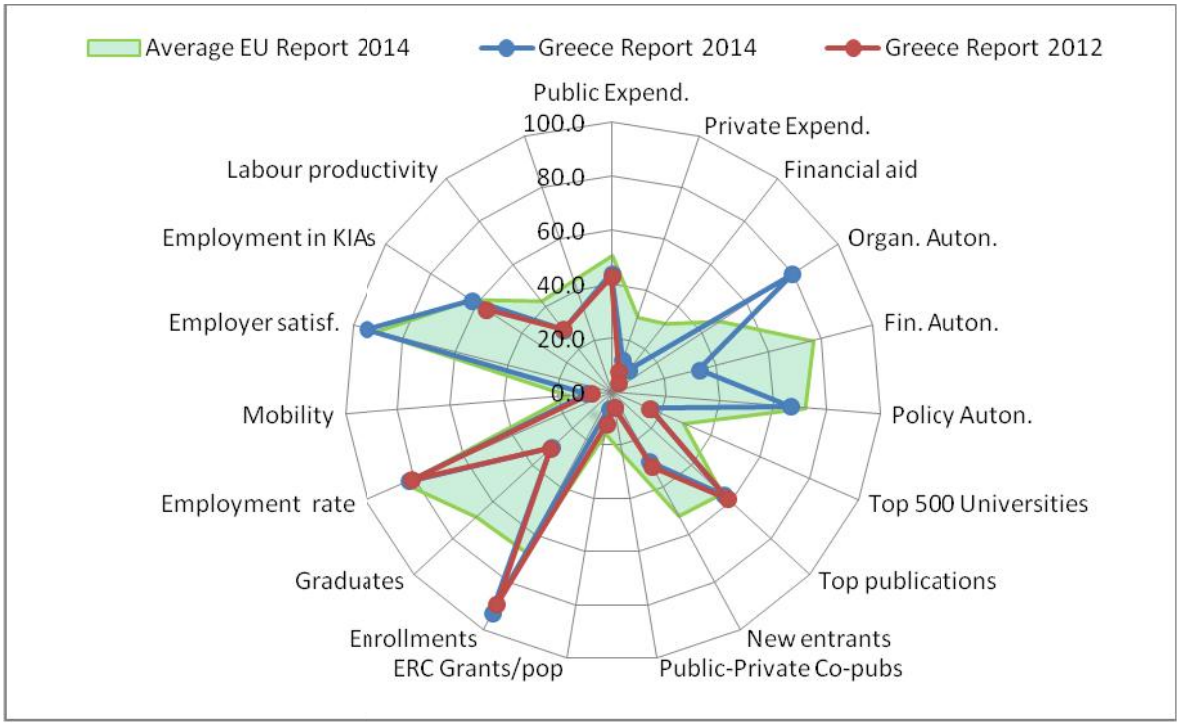
In Germany no major higher education reform has been taken in the past months. Overall, the low public and private expenditures in higher education have made the German higher education policy give a modest contribution to economic innovativeness[50]. The financial autonomy of universities and private expenditures are expected to decrease in the next months due to the abolition of tuition fees in most of the German states: as of the academic year 2013/14, in 15 of the 16 German Länder studying is free of charge[51].

At the same time, the number of both highly cited publications and public-private publications has increased. Graduation rates have decreased and remain lower than the European average but graduate employment is still higher than the European average. Student mobility has decreased even if no major recent policy change has been taken affecting student attractiveness.

[50] Public expenditures data have been imputed.

[51] Currently students have to pay fees only in Lower Saxony where, most likely, they will be cancelled from the next academic year 2014/15 (Eurydice, 2013).

GREECE



The contribution of higher education policy to economic innovation remains modest in Greece, due to low levels of all the policy indicators (except for organisational autonomy)[52]. Severe austerity measures have led universities to lose about 14.9% of their public officials (7.7% have been transferred to other public entities while the rest 7.2% is expected to lose their jobs)[53]. The number of Greek faculties has been reduced by 24% (from about 534 to 129) in 2013; two universities (i.e. University of Western Greece and University of Central Greece) have merged with other universities and several other departments of universities and technical institutions have been either closed or merged with other departments[54].

Research performance indicators have been generally lower than the European average (except for the number of highly cited publications which has remained in line with the average) and none of them has improved since the base period. Enrolment rates increased between 2010 and 2012, but graduation rates decreased. Law 4009/2011 (which introduced a threshold to the number of years a student can remain registered in a university before graduating) has still to be implemented. According to a recent survey by the Graduate Barometer[55], over 90% of the Greek graduates were worried about their careers.

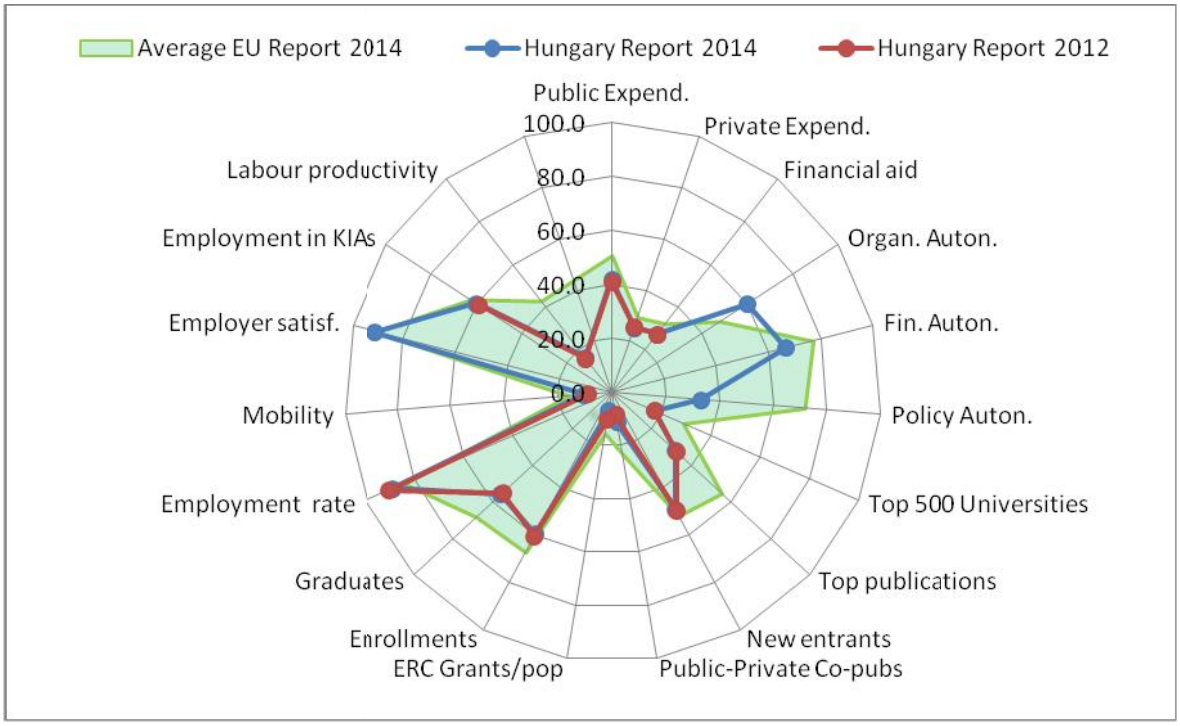
[52] However, missing values for public and private expenditures, student financial aid, as well as for the inbound mobility rate have been imputed; the number of new entrants into higher education has been imputed only for the 2012 report.

[53] Data on job-cuts have been kindly provided by the employees' union of the Athens University of Economics and Business.

[54] The Greek Ministry of National Education and Religious Affairs (2013), http://www.minedu.gov.gr/grafeio-typoy-kai-dimosion-sxeseon-main/deltia-typoy-main/9469-19-03-13-dt.html.

[55] Trendence Institute (2013).

HUNGARY



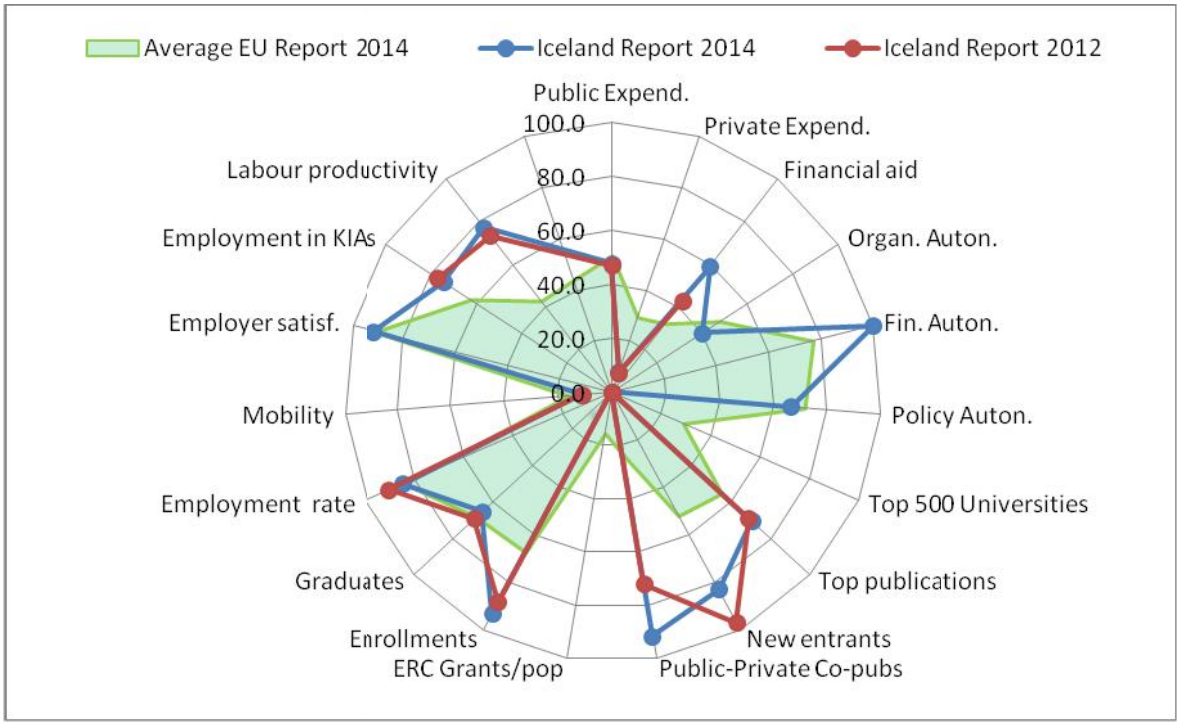
The policy contribution to economic innovation has been modest in Hungary, due to levels of public and private expenditure and of student financial aid which remain below the EU averages[56]. Public expenditure remained approximately stable between 2008 and 2010. Yet the Hungarian higher education budget had reached its historic lowest in 2013[57]. In December 2012[58], the Government approved a reform to retire public servants aged 62 or older affecting hundreds of university professors and associate professors.

A student loan scheme with subsidised interest rates has been introduced in the academic year 2012/13[59]. All the research performance indicators as well as the enrolment and graduation rates remained lower than the average of our sample.

Student inward mobility increased but remained relatively low. The recent policies are focused on slowing down the brain drain[60] rather than on attracting new foreign students.

[56] Note that private expenditures have been imputed.
[57] European University Association (2013).
[58] Hungarian Legislation. (2012). Governmental Decree of 27 December 2012.
[59] Eurydice (2013).
[60] As reported in The International Herald Tribune (2013, February 18). in 2012 a law established that students who attend state-funded universities must stay in the country to work for two years for every year they study; in June 2013 this has been modified and currently, students have to work in Hungary as many years as they have got State support for, within 20 years after graduation.

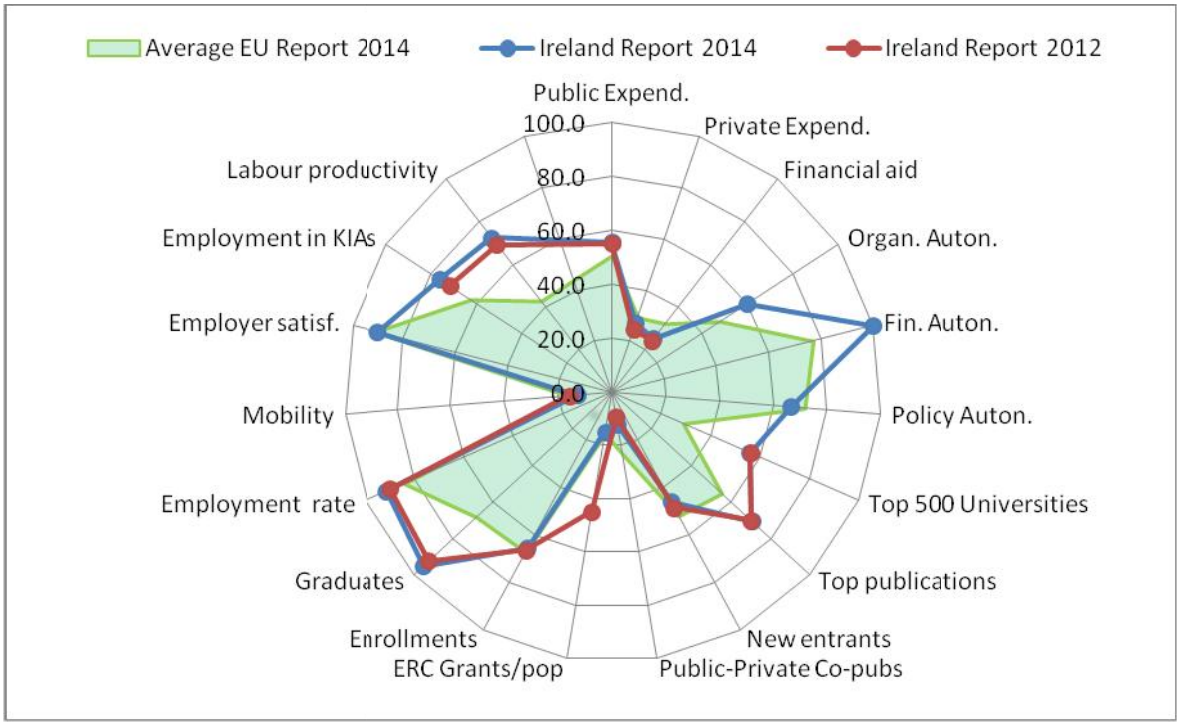
ICELAND



The policy contribution to economic innovation in Iceland was average mostly as a result of its good system of student financial aid, as well as the high levels of financial autonomy that university can make use of[61]. Iceland had a slight increase in public and private expenditures as well as a remarkable enhancement of student financial aid between 2008 and 2010.
Enrolment rates further increased, remaining considerably higher than the European average. A reform under discussion in 2013 aimed at making the transition between high school and university easier, so that youngsters start university courses earlier than what it is currently customary (i.e. at the age of twenty or older)[62].

[61] Note that labour productivity values have been imputed.
[62] Eurydice (2013).

IRELAND



The policy contribution to economic innovation in Ireland is average, thanks to the good levels of public expenditure in higher education as well as of the organisational and financial autonomy that universities have. In recent months, the Irish higher education system has shifted its focus towards the STEM- disciplines which could raise the public benefit of higher education investments.[63]

Public expenditure for tertiary education remained approximately stable between 2008 and 2010. However, the public budget for universities decreased by almost one fourth between 2008 and 2012 due to the economic recession of 2008[64]. Registration fees to be paid by students are expected to increase to 3000 Euro by 2015; at the same time, the income thresholds for student grants will be reduced by 3 % starting the academic year 2013/14[65].

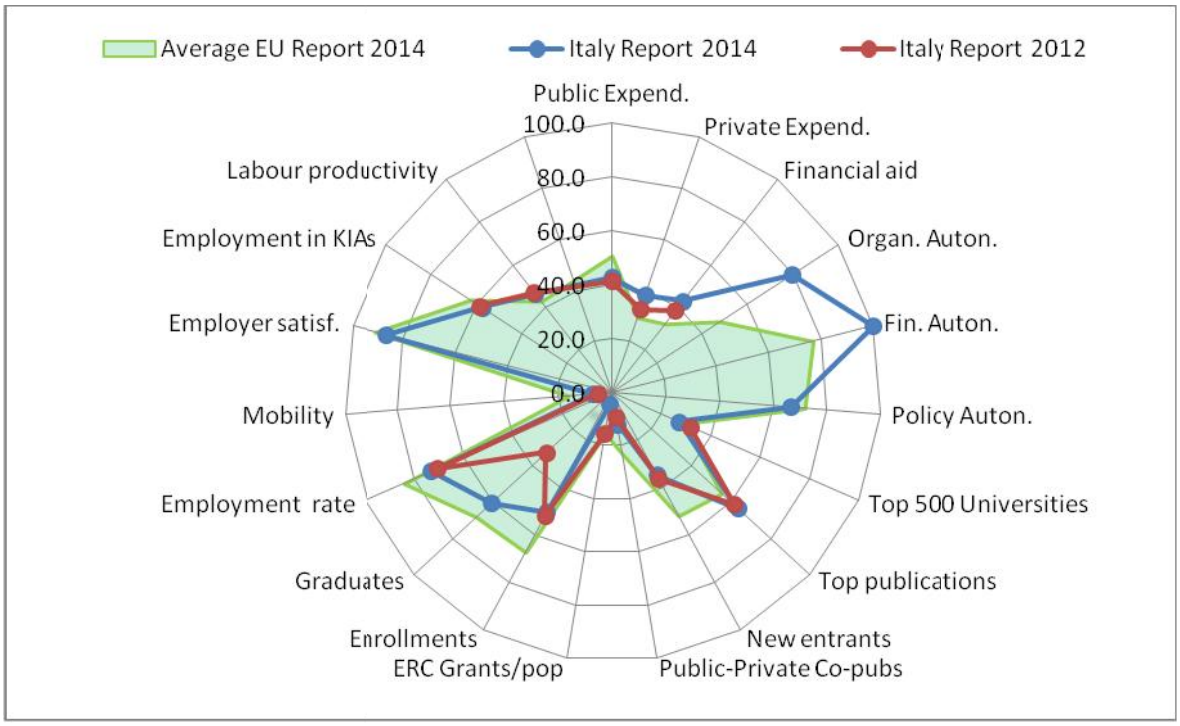
The number of highly cited publications as well as co-publications has increased slightly, although the number of ERC grants has decreased significantly. Research performance remains high (probably as a result of the investments of the previous decade). There is an increased emphasis - strongly supported by the Higher Education Authority[66] - to seek EU grants or funds. Graduation rate and graduate employment rate have increased and are above the European average.

[63] HEA (2012, 2013).
[64] European University Association, 2013.
[65] Eurydice (2013).
[66] HEA (2013).

The percentage of inbound foreign students was lower than the European average in 2012. However, after a decrease between 2007 and 2011, overseas and international students in Irish colleges have recently increased[67].

The Strategy for Science, Technology and Innovation for 2006-2013 has ended[68]; a review is likely resulting in a consolidation of designated research priority areas, the establishment of national research institutes, and a redistribution of research funding towards these institutes and away from other higher education institutions.

ITALY



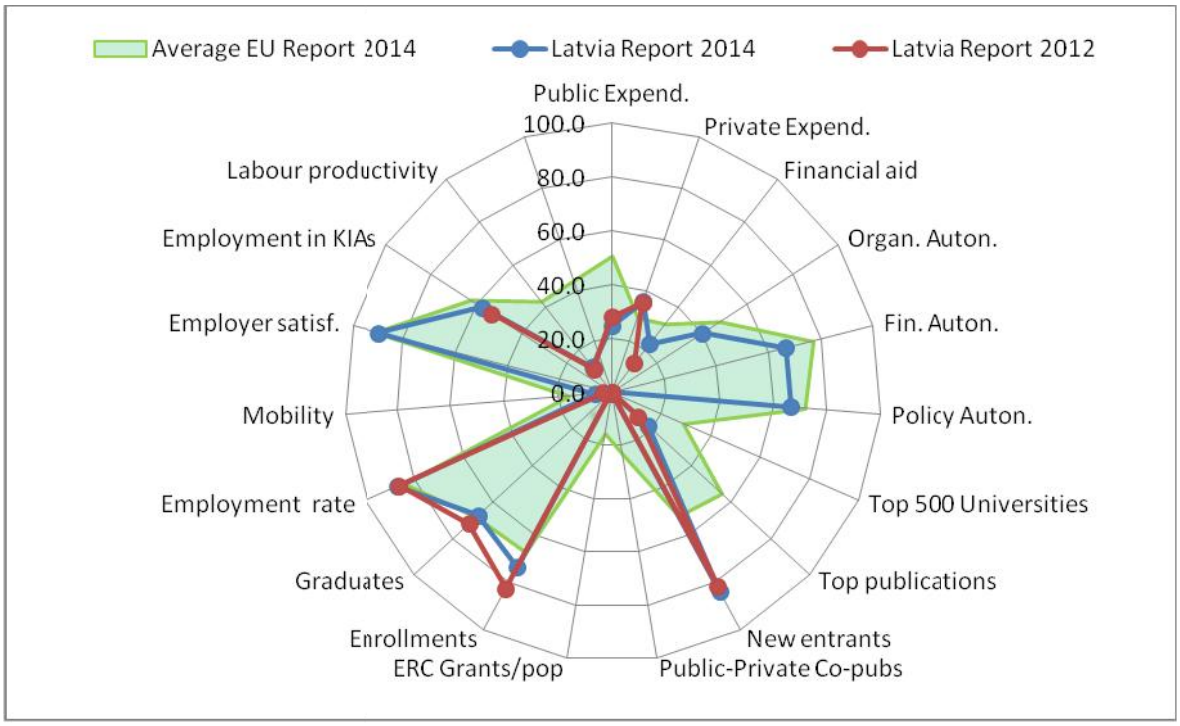
In spite of the rather low public expenditures, the Italian higher education policies have an average score in our ranking[69] thanks to good levels of organisational and financial autonomy and of student financial aid. Public and private expenditures have increased slightly between 2008 and 2010[70], but the public expenditures remain under the European average.

The general university reform regulated by Law 240 of 2010 - which foresees, *inter alia*, a student's support system more favourable for students with difficult socio-economic

[67] Significant increase in overseas students attending Irish colleges. (2013, September 13). *The Irish Times*.
[68] Irish Department of Jobs, Enterprise and Innovation. (2013).
[69] Note that the inbound mobility rates have been imputed.
[70] European University Association (2013).

backgrounds - was still being implemented in 2013[71]. A system to monitor quality in teaching and learning has been introduced in 2013 and relies on a self-assessment tool[72].
Some indicators of research performance have slightly improved (e.g. the number of co-publications and of highly cited publications). The graduation rates significantly increased between 2010 and 2012 but they still remained under the average of our sample. Enrolment rates have remained fairly stable (and below the European average), and graduate employment rate has slightly increased.

LATVIA

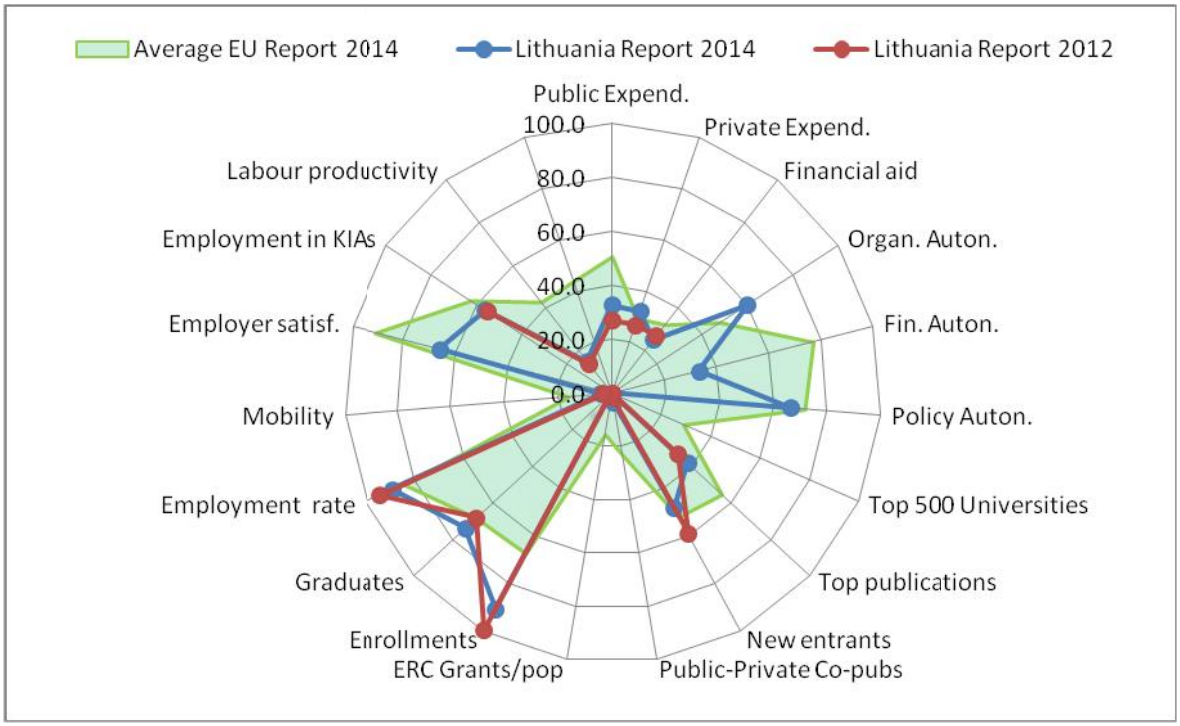


The contribution of higher education to economic innovation in Latvia is modest, as all the policy indicators remain under the European average[73]. Public expenditures have decreased between 2008 and 2010, together with the introduction of a new performance based funding model for higher education and for research institutes in 2014[74]. The widening of the access to higher education is expected to be designed and implemented by the end of 2014[75]. Despite some good signs (e.g. increase in number of highly cited publications), research indicators are still very modest in comparison to the European average.

[71] Eurydice (2013).
[72] Italian Legislation. (2012). Decreto Legislativo 19/2012 of 27 January 2012; Italian Legislation. (2013). Decreto Ministeriale 47/2013 of 30 January 2013.
[73] Note that inbound mobility rate has been imputed for the report 2012.
[74] Eurydice (2014).
[75] *Ibidem*.

Various education indicators, including enrolment rates and graduation rates have decreased between 2010 and 2012. In addition, Latvia is experiencing shortages in some disciplines, also due to its particularly low percentage of graduates specialised in STEM disciplines[76].

LITHUANIA

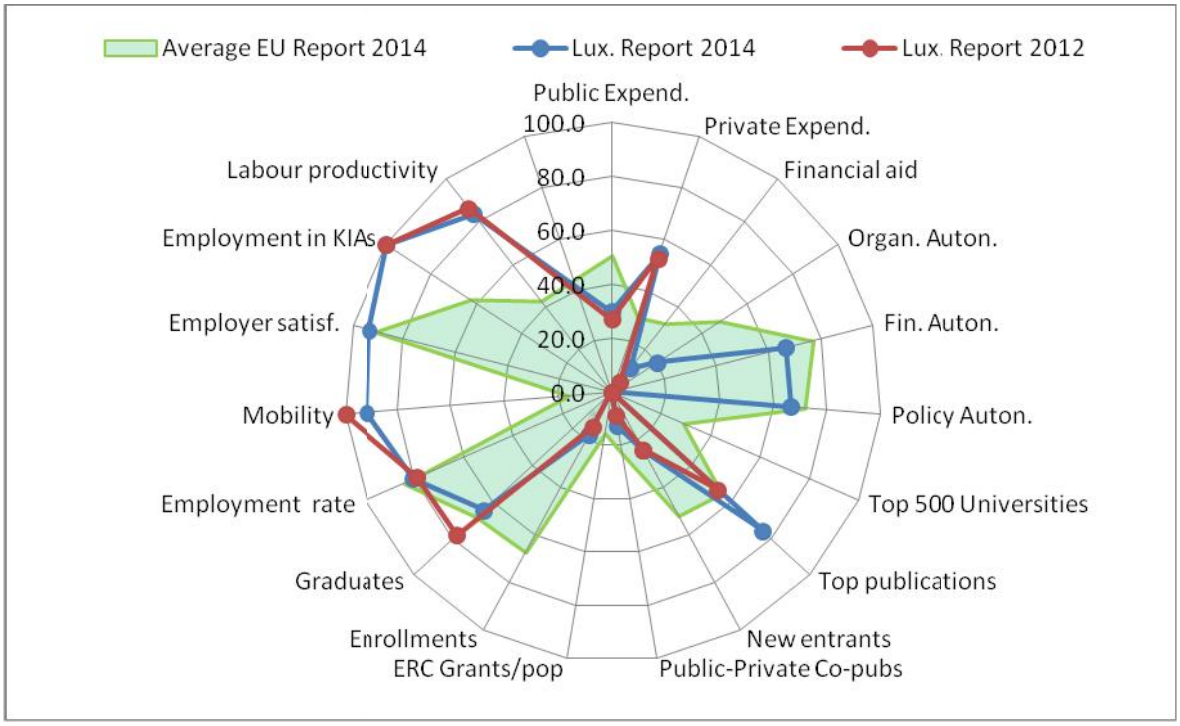


Higher education policies continue to give a modest contribution to economic innovativeness in Lithuania; in fact, apart from the organisational autonomy and private expenditure (which are rather medium-high), all the other policy indicators remain below the European averages. Public and private expenditure indicators increased slightly between 2008 and 2010, but the expenditures devoted to financial aid for students decreased.

Research performance indicators continue to be modest despite an increase in co-publications. Graduation and student mobility rates increased but new entrants to tertiary education, enrolment and graduate employment rates decreased between 2010 and 2012. A set of measures (implemented in 2013) may allow Lithuania to strengthen the relationship between higher education and labour market needs[77]. In addition, a debate is in its initial phase regarding a new funding scheme for studies.

[76] Latvian higher education structure fails to meet needs of national development. (2013, January 2). *Baltic News Service*.
[77] Eurydice (2013).

LUXEMBOURG

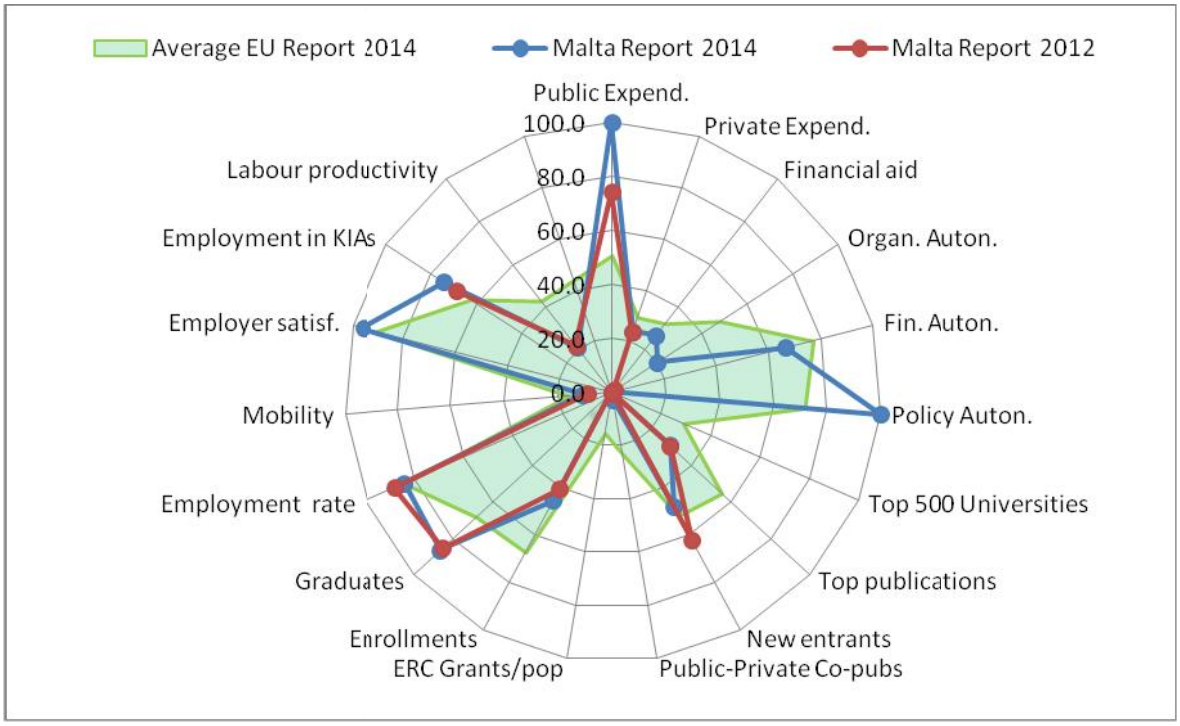


Despite an exceptionally high private expenditure, higher education policies seem to have only a modest impact on economic innovativeness, due to its limited university autonomy and the low levels of public expenditure and student financial aid[78]. As emphasised by our correspondent, since Luxembourg is a small country, it may be able to swiftly change policies and, in turn, have a rather quick impact on economic innovation.

Overall, some research indicators, including the number of highly cited publications, have increased and are above the European average. The enrolment rate slightly increased between 2010 and 2012 whereas the graduation rate decreased.

[78] However, this statement is based on imputed (missing) data for some policy and performance indicators (i.e. public and private expenditures as well as student financial aid for the reports 2012 and 2014; inbound mobility, enrolment, graduation and new entrants' rates for the report 2012).

MALTA

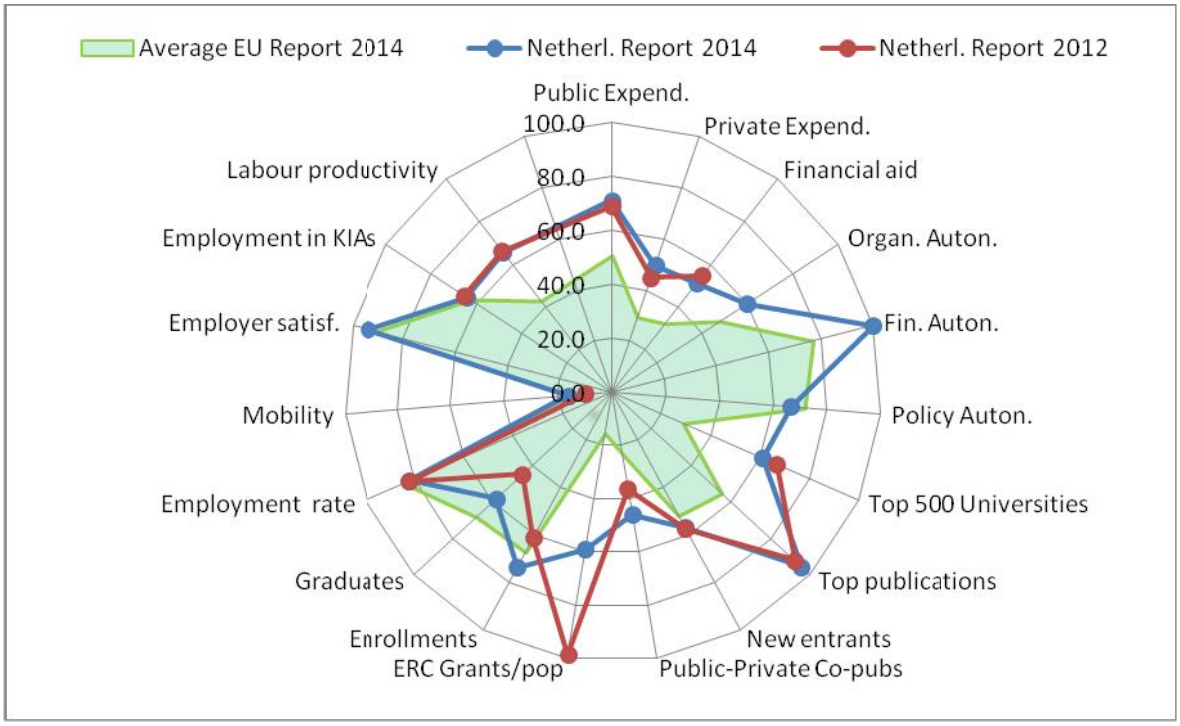


Higher education policies give a high contribution to economic innovativeness in Malta, thanks to the exceptionally high levels of public expenditure and policy autonomy[79]. Public expenditure as a percentage of GDP per capita increased noticeably between 2008 and 2010. In addition, athough research performance tends to be lower than the European average, graduation rates have been higher than the European average.

This is not in contradiction to the overall state of the Maltese economy, in which many economic output indicators have remained lower than the European average: despite an increase in KIA-jobs, labour productivity continue being low. But this paradox is well explained by the time lags: it is to be expected that present policies in Malta bode well for future innovation.

[79] Note that private expenditures values have been imputed for the reports 2012 and 2014, whereas student financial aid and inbound mobility rates have been imputed for the report 2012.

NETHERLANDS



The contribution of higher education policies to economic innovation in the Netherlands is high compared to most other European countries. This is due both to the high levels of public expenditures and financial aid and to the organisational and financial autonomy that Dutch universities can make use of.

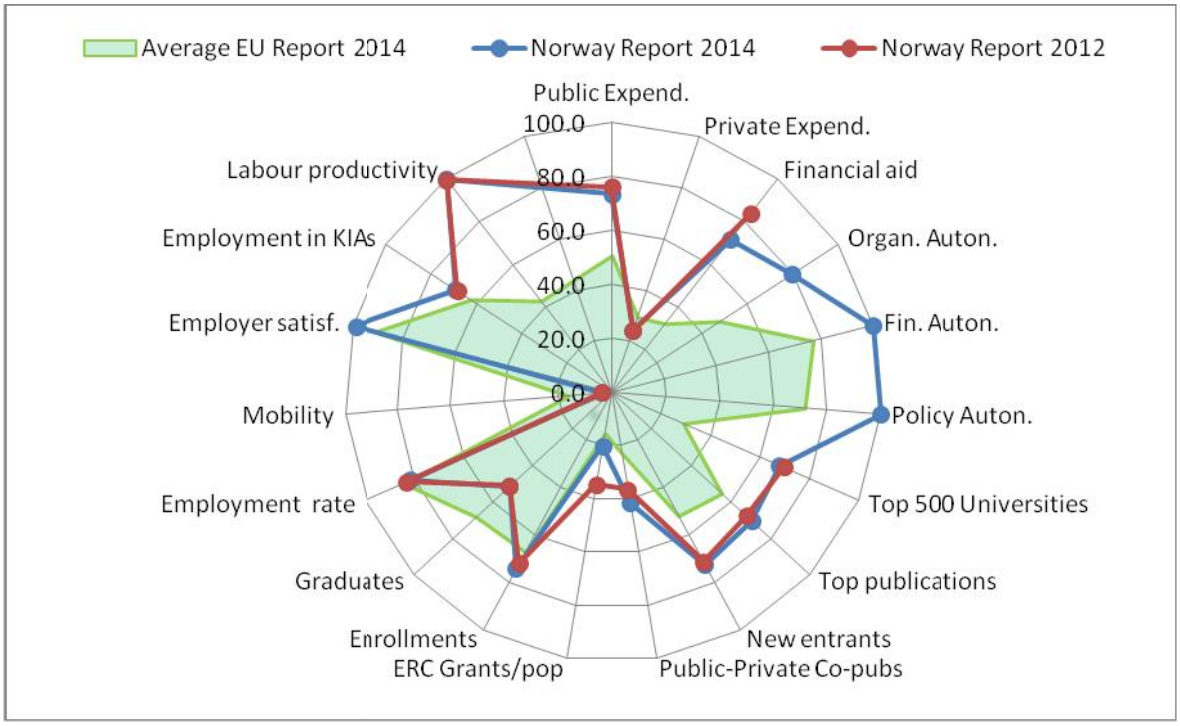
Public expenditure increased slightly between 2008 and 2010. The FES (Economic Structure Enhancement Funds) have been suspended; at the same time, the Netherlands Organisation for Scientific Research has received new funding opportunities through the *Topsectorenbeleid* initiative[80]. Dutch universities continue to be top players in research performances[81]. Graduation rates increased between 2010 and 2012 but remained below the European average. In order to improve graduation rates, a 'study choice check' has been introduced for new students. New students are entitled to a 'study choice check' offered by the university at which they have enrolled; the purpose of this check is to see whether there is a good match between the student (his interests and expectations of the study, his ambitions, his motivation, etc.) and the content of the study. The aim is that, by improving the quality of the match, student drop-out will be reduced and the success rate will improve[82].

[80] NWO (2013).

[81] e.g. 12 universities are in the top 200 of the Times Higher Education world rankings - the highest placed is Leiden University at number 64 - and the Dutch system is ranked third for "best value higher education system in the world".

[82] For more information see: http://www.vsnu.nl/selectie-en-matching.html

NORWAY



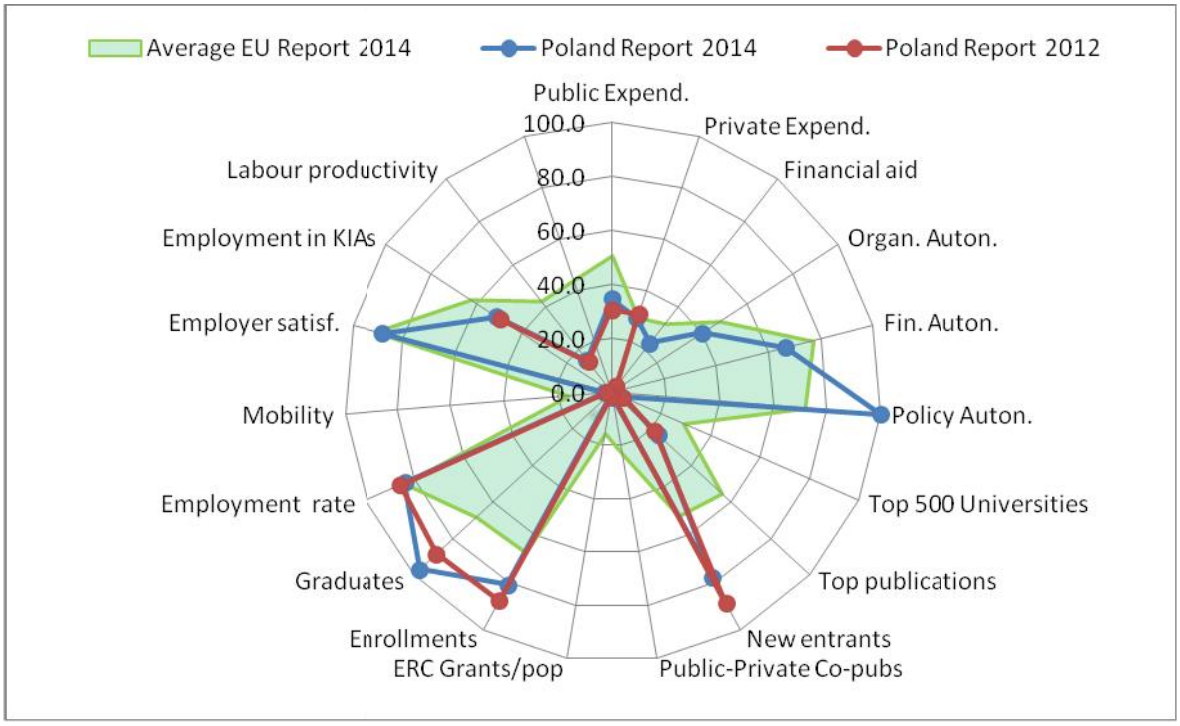
In Norway the contribution of the higher education policies and performance to economic innovation is the highest in our sample of countries, thanks to the high levels of university autonomy, public expenditure and student financial aid[83]. Public expenditures have decreased between 2008 and 2010, although it remained far above the European average. The percentage of financial aid to students decreased between 2010 and 2012 and it was forecasted to further decrease. Students pay no tuition fees and free university canteen meals are provided for over 85% of students[84], making Norway's higher education one of the least expensive systems for students[85]. All the research indicators remain higher than the European average.

Although enrolment rates are higher than the European average, graduation and graduate employment rates are still lower. Inward mobility is lower than the average even though Norway currently offers more than 200 masters degrees taught in English without charging tuition fees to the students. Perhaps the high living costs in Norway are an explanation[86]. The Government seems to concentrate on incentivising outward mobility: a legislative

[83] Note that private expenditures values have been imputed.
[84] Eurydice (2013).
[85] The Global Search for Education. (2013, July 5). *The Huffington Post*.
[86] Foreign citizens studying a degree in Norway can receive support from the government loan fund if they have a registered relationship in Norway, with a Norwegian or a foreigner with permanent residence in Norway. Citizens from the European Union or the EEA with employee status in Norway have the right to receive government support if the course is related to their work.

proposal of October 2013 aims at increasing state funding support for Norwegians studying in abroad.

POLAND

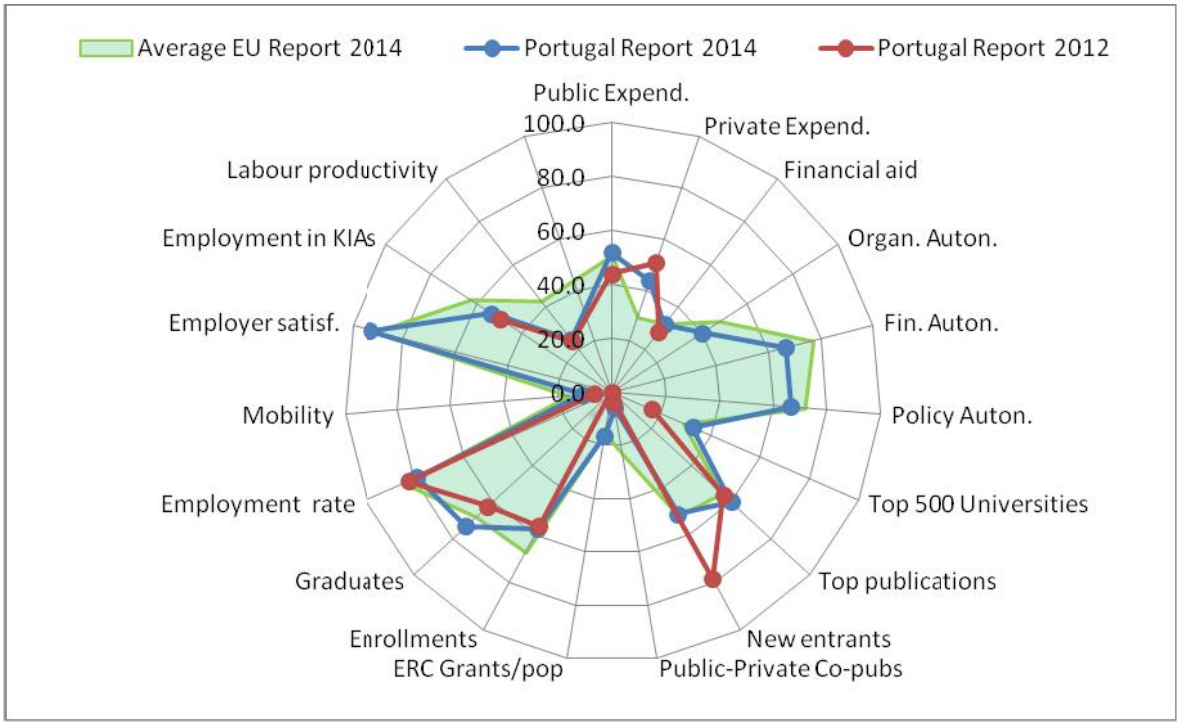


Despite its high level of policy autonomy, the low public and private expenditures make the Polish higher education policy have an average score in our ranking[87]. Public expenditure and financial aid to students have started increasing. In addition, investment plans have been devised using European structural and cohesion funds. Despite these recent efforts to improve the quality of universities and bring it to European averages, the research performance of Polish universities remains significantly below the European average. On the other hand, graduation rates continue to be remarkably higher than the European averages. Poland still shows low student attractiveness compared to other European countries; however, international students are gradually increasing in Poland[88].

[87] However, note that private expenditures have been imputed.

[88] Poland: Europe's new university destination?. (2013, April 2). *The Guardian*; Perspektywy Educational Foundation. (2013).

PORTUGAL

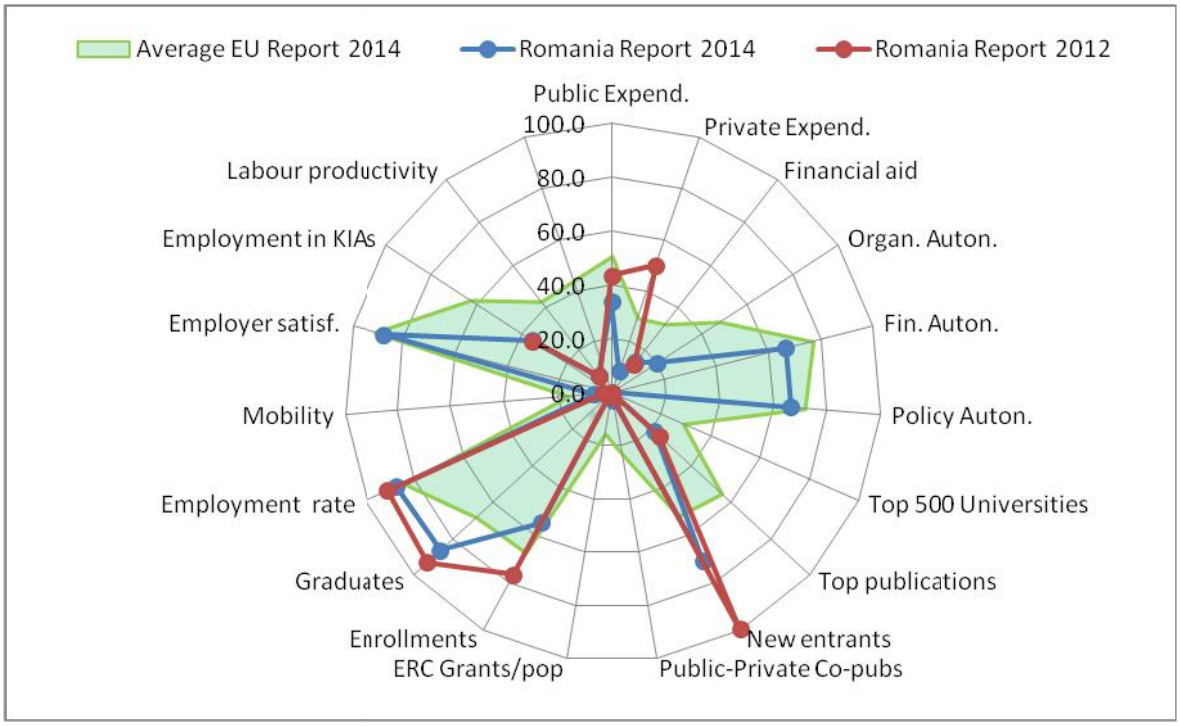


The relatively high level of public expenditure (which has increased between 2008 and 2010[89]) is a major reason why higher education policy brings an average contribution to economic innovation in Portugal[90]. Research performance indicators are in line with the European average or higher (except for the number of public private co-publications per million inhabitants, which is actually the only research performance indicator lower than the European average)[91]. Due to the recent austerity measures which affect public HE funds, the Portuguese researchers have been further incentivised to apply to European tenders and grants. Graduation rates have increased, while graduate employment (as well as the overall employment) rates have decreased. At the same time, the rise in youth unemployment seems to be accompanied by a higher differentiation in the economic situation of graduates[92]. The percentage of international students has increased between 2009 and 2012, despite an austere public higher education environment.

[89] However, recent austerity measures taken by the Portuguese government are likely to reduce future levels of public expenditure (European University Association, 2013).
[90] Note that this statement is based on imputed values for private expenditures.
[91] Two Portuguese universities (i.e. University of Lisbon and University of Porto) are now classified among the world's top 400, according to the Academic Ranking of World Universities 2013 whereas in 2012 and 2011 only one (i.e. University of Porto) was classified among the top-400 and in 2010 no Portuguese universities was listed in the world's top-400 universities. However, it is worth noting that the rise of the University of Lisbon has been associated with its merger with the Technical University of Lisbon.
[92] Figueiredo et al. (2013).

The former government embarked in a profound reform of the higher education system which is still ongoing, and is coupled with a fertile debate about possible changes in the higher education system (without being combined by major developments).
The main topics for debates in 2014 have been centred on a performance-based funding formula, the restructuring of the higher education system, the quality of learning, access and lifelong learning as well as knowledge transfer and regional clusters.

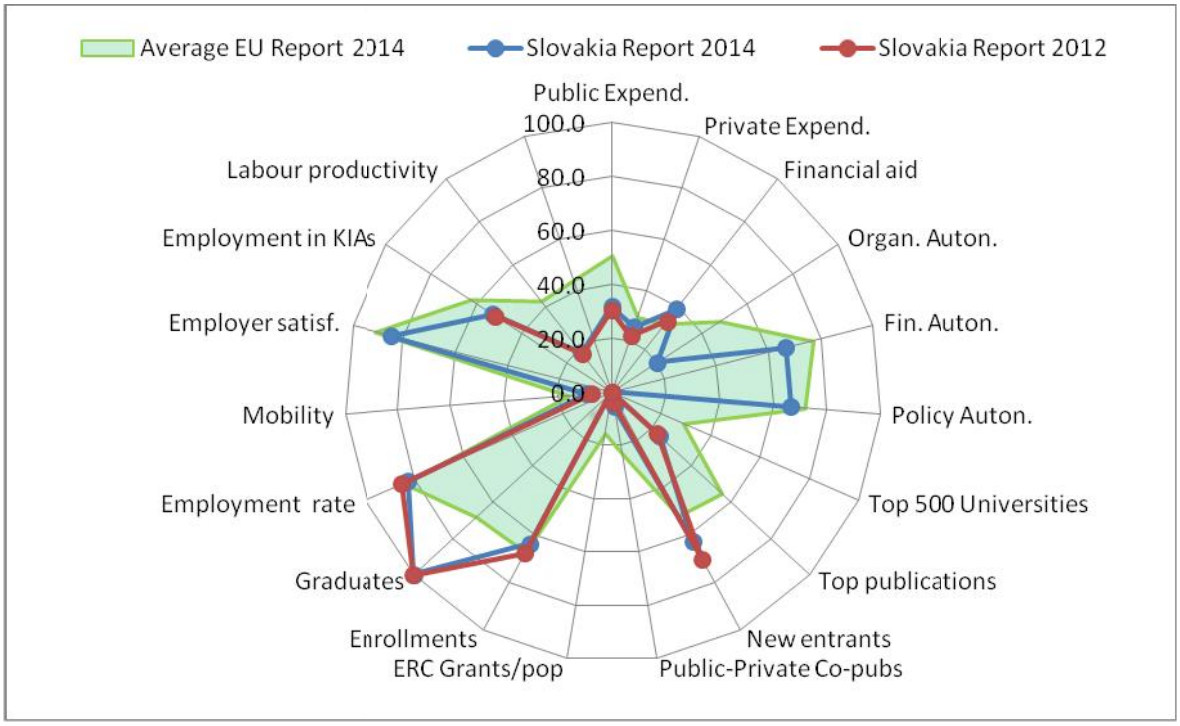
ROMANIA



In Romania the low levels of financial aid for students and of organisational autonomy make that the higher education policies are likely to have little impact on the economic innovativeness[93].
Inward mobility has been lower than the European average but increasing. Graduation and graduate employment rates decreased but remained significantly higher than the European average.
Romania has recently established some guidelines to increase its number of graduates and it has approved a plan to guarantee university autonomy and public liability[94].
The research performance of Romanian universities is still modest, all the research indicators remaining considerably below the European average.

[93] Note that public expenditures values have been imputed for the reports 2012 and 2014, whereas private expenditures and student financial aid values have been imputed for the report 2012.
[94] Eurydice (2013).

SLOVAKIA

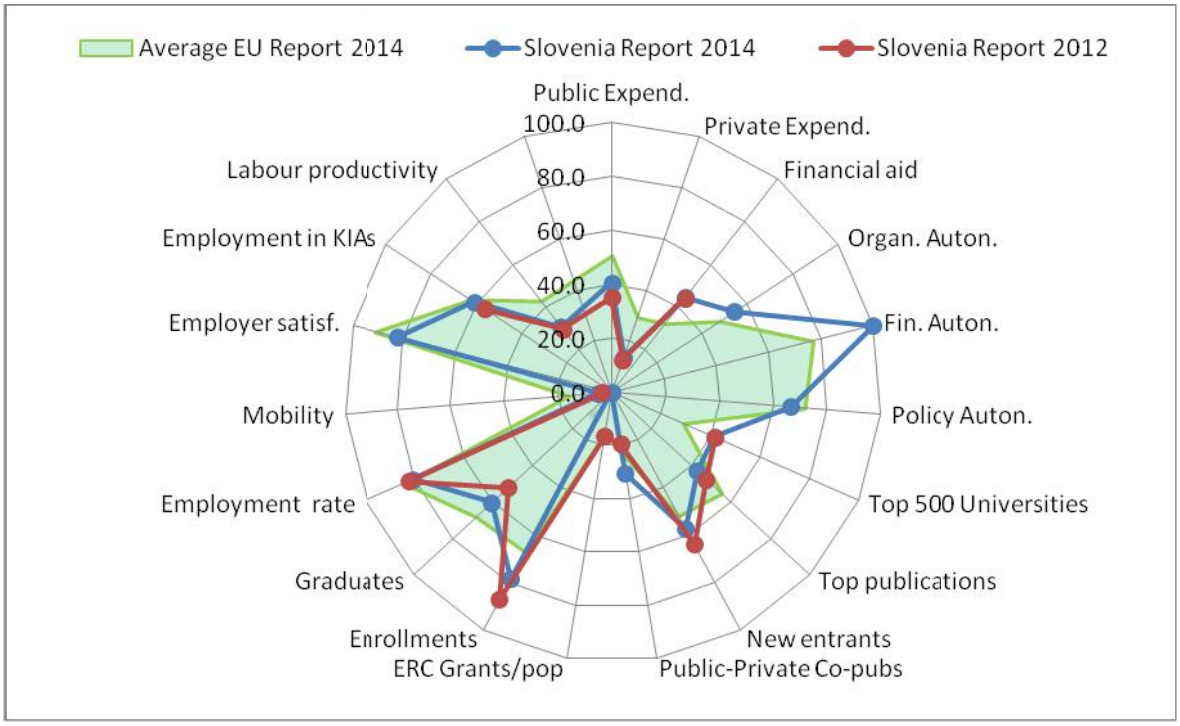


Higher education policies bring a modest contribution to economic innovativeness in Slovakia, as all the policy indicators (except for student financial aid) are below the European averages. However, public and private expenditures as well as financial aid to students have increased. Changes in the distribution of student financial aid are expected through the Student Loan Fund with the Education Support Fund[95].

In September 2012, the amendment to the Higher Education Act, which had been approved in February 2012, entered into force: it has changed the higher education accreditation procedure, i.e. the guaranty of the study programmes will be bound to a team of university teachers who has to meet the established criteria, and not to a single person. This reform is also expected to provide more autonomy to higher education institutions in the design of their study programmes in the coming few years[96]. The research performance of Slovakian universities remains modest. Enrolment, graduation and graduate employment rates have decreased, but graduation rates are still noticeably higher than the European average. The presence of international students is slowly growing but continues to be low compared to other European countries.

[95] Eurydice (2013).
[96] *Ibidem*.

SLOVENIA



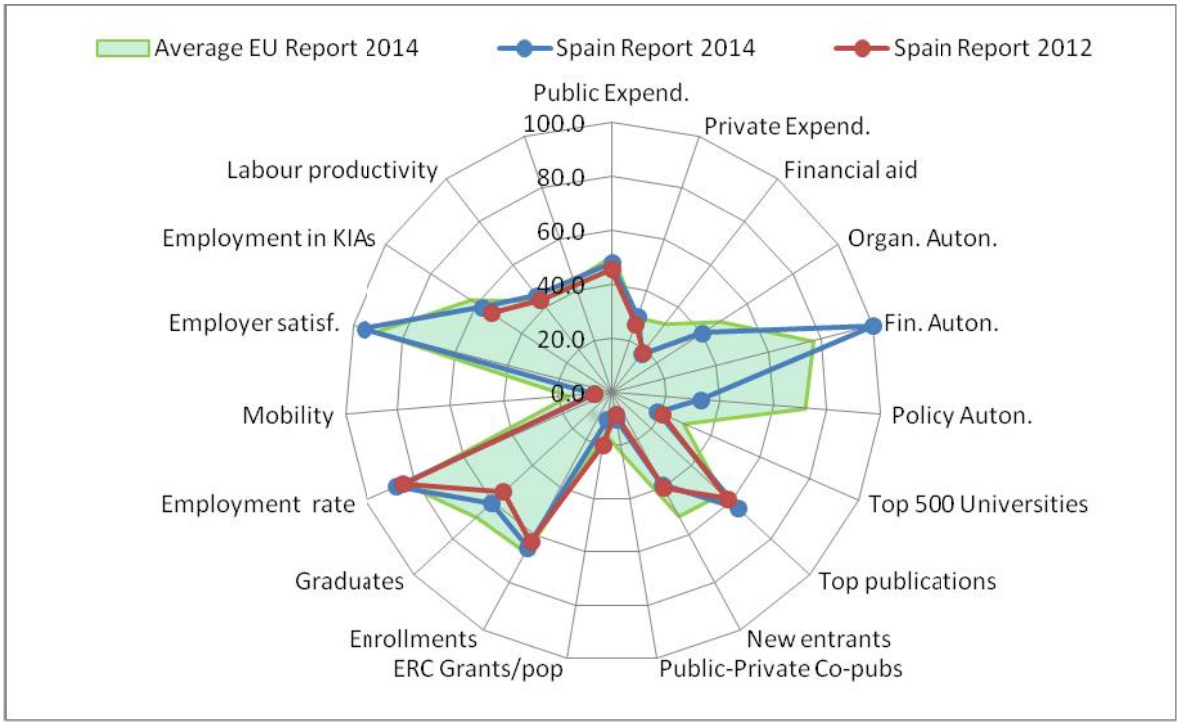
Higher education policies bring an average contribution to economic innovation in Slovenia, thanks to its rather high student financial aid and to the organisational and financial autonomy that universities can enjoy[97]. Public expenditure increased and private expenditures remained approximately stable between 2008 and 2010, but the Fiscal Balance Act and the Excise of Rights to Public Fund Act of 2012 introduced in response to the economic crisis has had dire consequences on public expenditures in the last couple of years. Recent amendments to the Higher Education Act aim to facilitate scientific research and boost Slovenian research performance. The percentage of highly cited publications and winning starting ERC grants is decreasing, but Slovenia is the Central and Eastern European countries with the highest proportion of private and public co-publications.

Graduation rates have increased in comparison to 2010 even if they remain below European average. At the same time, graduate employment rates have decreased. In June 2013 the Government issued the Act on Emergency Measures in the Field of Labour Market and Parental Care to promote youth employment[98]. This Act may also be able to attract more foreign students in the next years, thanks to the establishment of new scholarships and advantages available also to foreign students.

[97] Note that the value for organisational autonomy has been imputed.

[98] Slovenia Legislation. (2013). Act on Emergency Measures in the Field of Labour Market and Parental Care (Ur.l.RS No. 62/2013- ZIUPTDSV).

SPAIN



Low levels of public expenditures and of policy and organisational autonomy make higher education policies give a modest contribution to economic innovation in Spain. Most of the research and education performance of the Spanish higher education systems remained below European average (except for the percentage of highly cited publications which increased and went beyond the average). On the positive side, graduation rates increased (even if they remained below the European average).

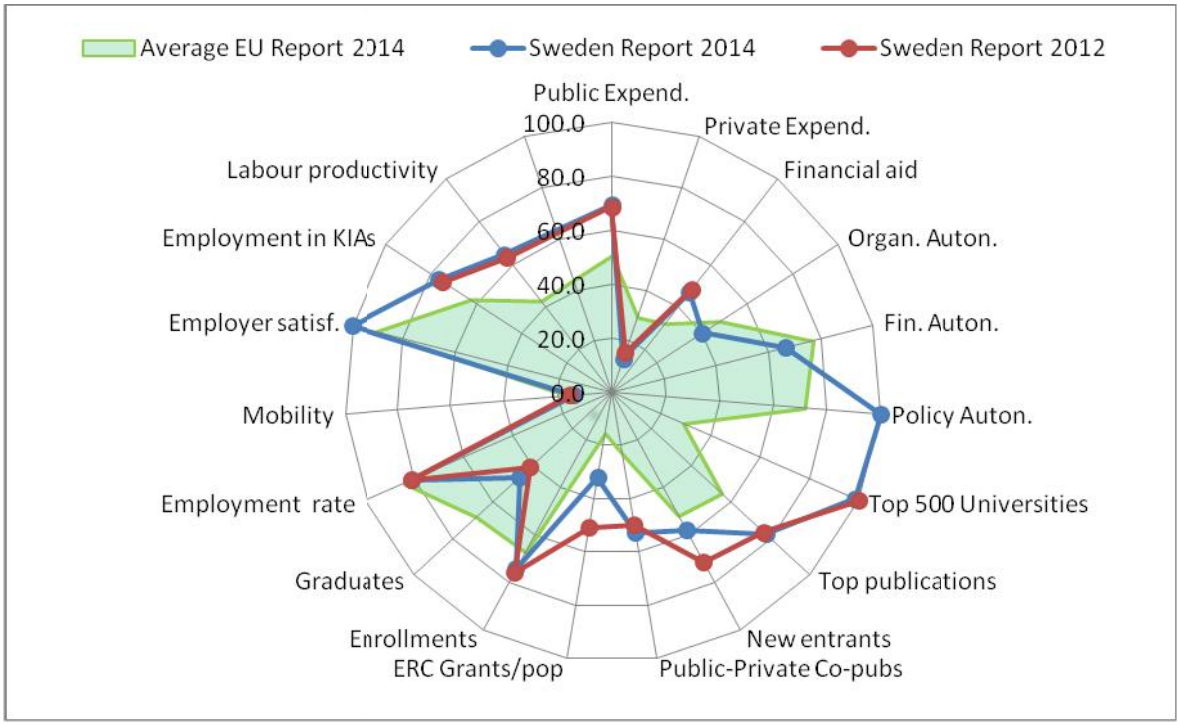
The Government established in 2012 that university students themselves had to pay in the form of tuition fees between 15 % and 25 % of the total cost of their studies (the exact proportion was to be established by each Autonomous Community).

The Royal Decree 609/2013 establishes a new allocation formula that considers grants in proportion of family income and student achievement, and that especially includes the unfavourable economic situation of those families that are below the threshold for family income and residency requirements outside the family home[99]. However, the application and development of the budget and structure of the new scholarship-scheme has been affected by various issues, including a delay of the payment of the aids, budget cuts leading to a decrease in total amount available, and reductions in the number of scholarships[100]

[99] Spanish Legislation. (2013). Real Decreto 609/2013 of 2 August 2013.

[100] Some commentary on this:
http://sociedad.elpais.com/sociedad/2014/04/29/actualidad/1398791611_869673.html;
http://sociedad.elpais.com/sociedad/2014/04/29/actualidad/1398780460_451452.html;
http://sociedad.elpais.com/sociedad/2014/04/24/actualidad/1398362594_387099.html ;

SWEDEN

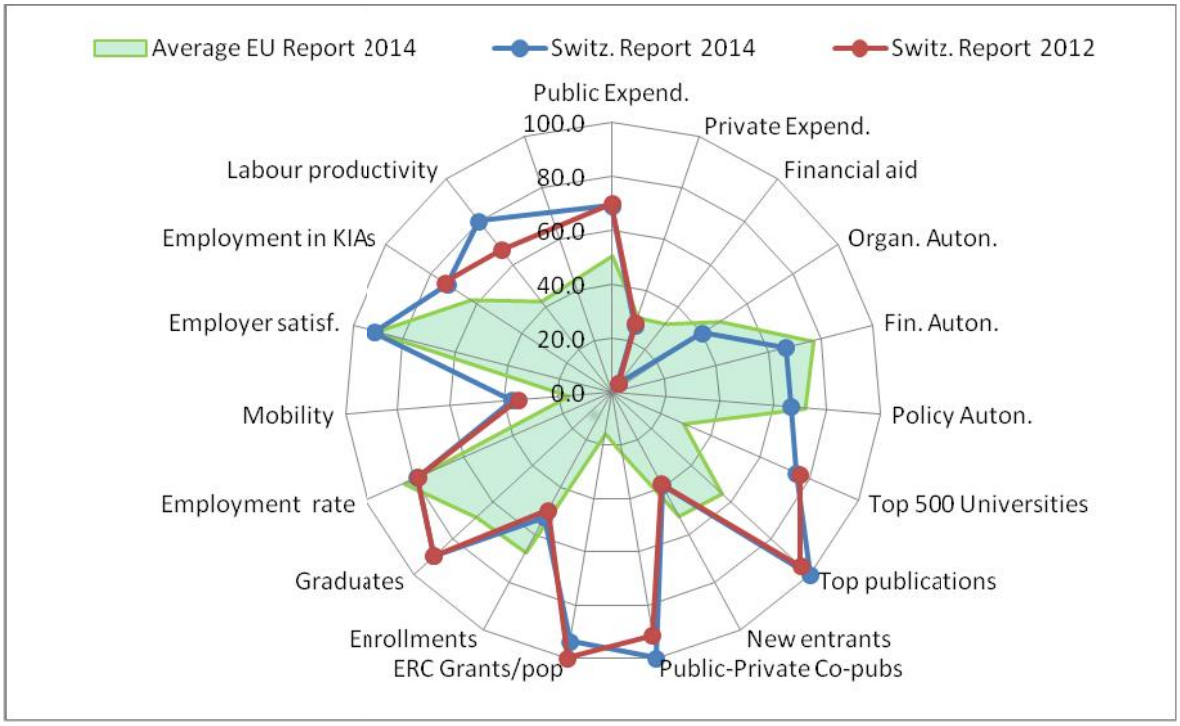


The contribution of higher education policies to economic innovativeness in Sweden has been high thanks to the high level of public expenditure and financial aid, as well as thanks to the large policy autonomy that Swedish universities can make use of. Public and private expenditures have remained approximately stable. All Sweden's research indicators remained higher than the European average. Inward mobility and student enrolment however declined slightly. The number of seats available in higher education institutions from the academic year 2013/14 has been reduced. This reduction is accompanied by a declining demographic curve; this is likely to translate into lower funds at disposal of higher education institutions and into a reduction of the subject areas offered by each university in the upcoming months.

Graduation rates in Swedish universities – despite a slight increase between 2010 and 2012 - remained lower than the European average.

http://sociedad.elpais.com/sociedad/2014/02/25/actualidad/1393361604_815606.html
http://sociedad.elpais.com/sociedad/2013/12/16/actualidad/1387227726_593486.html.

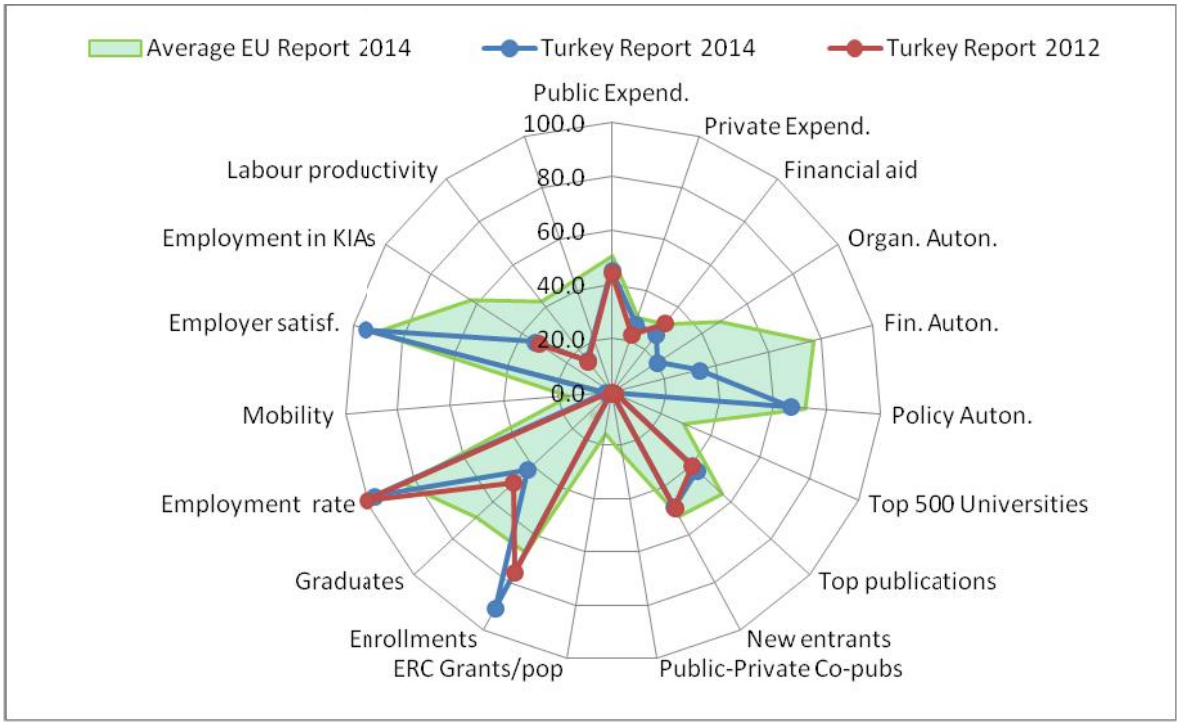
SWITZERLAND



Despite the high public expenditures on HEIs, because of the low autonomy of universities, Swiss higher education policy has only an average impact on economic innovativeness[101].
Public expenditure and financial aid remained approximately stable. In March 2013, the *Intercantonal Agreement on the Harmonisation of Education Contributions* entered into force making those cantons which signed it incorporate the minimum standards for eligibility, age limit, duration of support and maximum rates into their cantonal legislation[102].
Swiss universities continue to have very high research performances compared to the European average. Student enrolment rates remained lower than the average of our sample; however, international student and graduation rates were markedly higher than the European average.

[101] Note that this statement is based on imputed data for private expenditures, labor productivity and employers' satisfaction.
[102] Eurydice (2013).

TURKEY



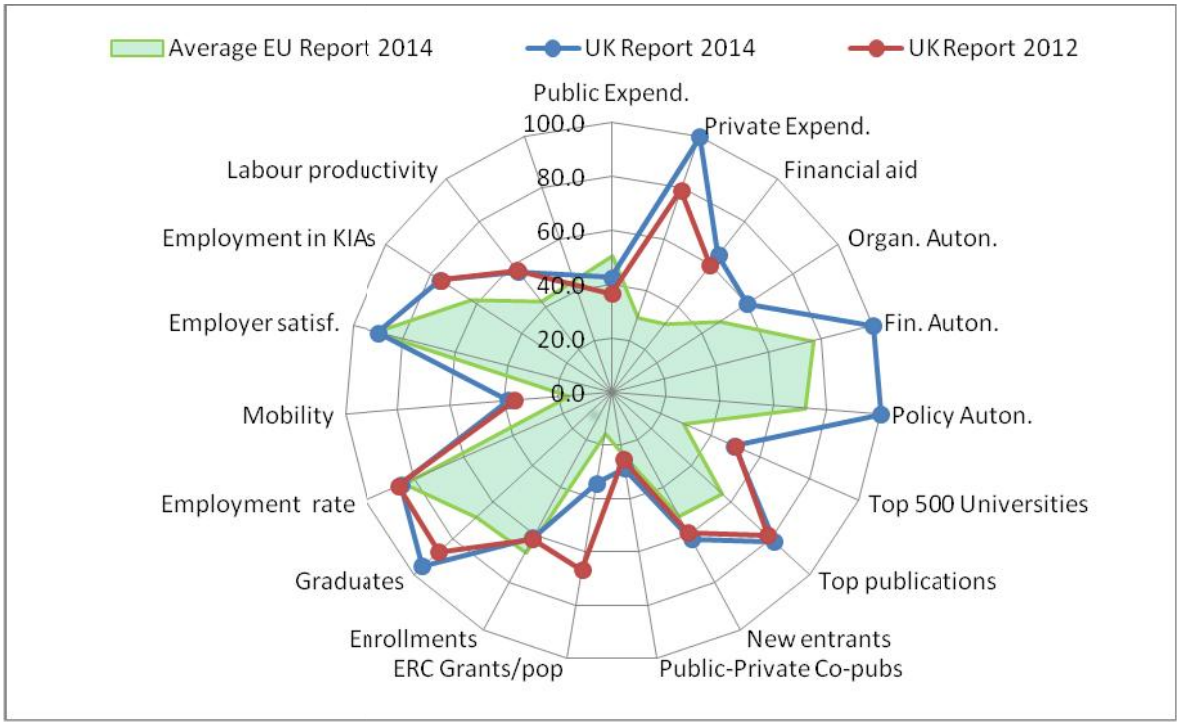
Turkish higher education policies have a moderate impact on economic innovation as all the policy indicators are below the European averages[103].

Nonetheless, Turkish policies in higher education have been rather extensive in 2012 and 2013: the Government has made substantial efforts to increase the number of universities and create a university in each Turkish province that did not have one. Student fees have been cancelled as of 29 August 2012[104]. Research indicators remained remarkably lower than the European average. On the positive side, graduate employment significantly higher than the average of the 32 countries of our analysis.

[103] This assessment relies on imputed (missing) data for some policy, education performance and economic output indicators (i.e. public and private expenditures, student financial aid, inbound mobility and labour productivity).

[104] Eurydice (2013).

UK



The high levels of private expenditure, of student financial aid, and of university autonomy continue to make the UK one of the top-10 performing countries in our analysis. Public and private expenditure as well as expenditure on financial aid increased between 2008 and 2010. Research indicators were much higher than the European average, as were student mobility, graduation rates as well as graduate employment rates.

The UK went through a major and somewhat experimental change in its funding model, where students were expected to bear a larger portion of the costs of higher education through a subsidised loan scheme.

The Chancellor of the Exchequer (finance minister) has announced a lift on the cap on student numbers that universities could recruit. An increase in student number would be paid by selling the student loan book on the commercial market. The net costs of this measure are still debated, especially in light of the costs of the unlimited recruitment policy which took place 20 years ago[105].

[105] The official statement:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263942/35062_Autumn_Statement_2013.pdf
Some commentary on the policy is here:
http://www.timeshighereducation.co.uk/comment/leader/out-of-the-blue-into-the-red/2009859.article;
http://www.timeshighereducation.co.uk/news/hepi-compares-expansion-plan-to-ponzi-scheme/2009977.article ; http://www.timeshighereducation.co.uk/comment/opinion/uncapping-the-sector-is-a-risky-business/2013135.article; http://www.timeshighereducation.co.uk/news/numbers-expansion-plan-is-economic-nonsense/2009677.article .

Appendix C

The autonomy of universities in Europe

Table D-1 Values for the three variables of autonomy (source: CHEPS, INCHER, NIFU-STEPS, 2008)

	Organisational autonomy	Financial autonomy	Policy autonomy
Austria	3	3	2
Belgium	3	3	2
Bulgaria	1	3	2
Croatia	5	3	3
Cyprus	1	1	2
Czech Republic	1	3	3
Denmark	2	2	2
Estonia	3	3	3
Finland	3	2	3
France	2	2	1
Germany	4	2	1
Greece	4	1	2
Hungary	3	2	1
Ireland	3	3	2
Italy	4	3	2
Latvia	2	2	2
Lithuania	3	1	2
Luxembourg	1	2	2
Malta	1	2	3
Netherlands	3	3	2
Poland	2	2	3
Portugal	2	2	2
Romania	1	2	2
Slovakia	1	2	2
Slovenia	.	3	2
Spain	2	3	1
Sweden	2	2	3
UK	3	3	3
Iceland	2	3	2
Norway	4	3	3
Switzerland	2	2	2
Turkey	1	1	2
AVG	2.40	2.31	2.16
STDEV	1.10	0.69	0.63

Appendix D

Employer satisfaction with graduate skills

This appendix reports aggregate measures of the answer to Question 31 of Eurobarometer's (2010) employer survey: "Higher education graduates recruited in the last three to five years have the skills required to work in my company". The possible answers are strongly agree, agree, disagree, strongly disagree and DK/NA. For the purposes of our analysis, we aggregate the first two types of answer as 'agree' (so that 'agree', as it appears in Table D-1, includes 'strongly agree' and 'agree'); and the second two types of answers into 'disagree' (so that 'disagree', as it appears in Table D-1, includes 'strongly disagree' and 'disagree') .

Table D-1 Results from the Eurobarometer Survey

Country	N	Agree	Disagree
Austria	195	96%	3%
Belgium	187	92%	6%
Bulgaria	189	84%	14%
Croatia	199	92%	7%
Cyprus	97	94%	3%
Czech Rep.	181	80%	16%
Denmark	198	96%	3%
Estonia	192	81%	16%
Finland	195	95%	4%
France	389	86%	12%
Germany	364	95%	3%
Greece	193	92%	8%
Hungary	195	89%	10%
Ireland	191	88%	8%
Italy	368	85%	13%
Latvia	186	88%	12%
Lithuania	181	65%	32%
Luxembourg	92	91%	4%
Malta	99	94%	4%
Netherlands	195	92%	7%
Poland	376	86%	12%
Portugal	183	91%	7%
Romania	182	86%	13%
Slovakia	187	83%	17%
Slovenia	195	81%	18%
Spain	386	94%	6%
Sweden	194	98%	1%
UK	342	88%	7%
Iceland	94	89%	11%
Norway	195	97%	3%

Switzerland	N/A	N/A	N/A
Turkey	185	93%	7%
Total/Average	6605	89%	9%
Standard deviation	85.2	6.74%	6.29%
Minimum	92	64.6%	1%
Maximum	389	98%	31.5%

Appendix E List of correspondents

Surname	First name	Country	Position	Institution
Amaral	Alberto	Portugal	Professor	University of Porto and CIPES - Centre for Higher Education Policy Studies
Apostolov	Georgi	Bulgaria	Associate Professor	South-West University "Neofit Rilski", Blagoevgrad
Bekhradnia	Bahram	UK	President	Higher Education Policy Institute
Borg	Carmen	Malta	Professor	University of Malta
Dedze	Indra	Latvia	Project manager	University of Latvia, Academic Department
De Wit	Kurt	Belgium	Head of Data-management	University of Leuven, Educational Policy and Quality Department
Dolenec	Danijela	Croatia	Policy officer	Institute for Development of Education
Florea	Silvia	Romania	Director of UNESCO Chair	Lucian Blaga University of Sibiu
Groot	Wim	Netherlands	Professor	University of Maastricht , TIER - Top Institute for Evidence Based Education Research
Haaristo	Hanna-Stella	Estonia	Analyst	Praxis - Centre for Policy Studies
Hallen Hedberg	Jenny	Luxembourg	Head of IR	University of Luxembourg
Hazelkorn	Ellen	Ireland	Professor	Dublin Institute of Technology
Holtta	Seppo	Finland	Professor	Department of Management Studies of the University of Tampere
Hunter	Fiona	Italy	Consultant	Independent consultant, trainer and researcher in Higher Education
Marhl	Marko	Slovenia	Vice-rector for int. affairs	University of Maribor, IREG - Obs. on academic ranking and performance
Marchwica	Wojtek	Poland	Professor	Jagiellonian University in Krakow
Mizikaci	Fatma	Turkey	Lecturer	Ankara University, Faculty of Educational Sciences
Normand	Romuald	France	Associate professor	University of Strasburg, SAGE - Society, Actors and Government in Europe
Oddershede	Jens	Denmark	Rector	University of Southern Denmark
Panaretos	John	Greece	Professor	Athens University of Economics and Business, Department of Statistics

Pashiardis	Petros	Cyprus	Professor	Open University of Cyprus
Paulsdottir	Gudrun	Sweden	President	EAIE - European Association of International Education
Psarakis	Stelios	Greece	Associate Professor	Athens University of Economics and Business, Department of Statistics
Siwinski	Waldemar	Poland	Founder and President	Polish Education Foundation Perspektywy
Stueckradt	Michael	Germany	Chancellor	University of Cologne
Teixeira	Pedro	Portugal	Director	CIPES, Centre for Higher Education Policy Studies
Temesi	Joszef	Hungary	Professor and Department Chair	Corvenius University of Budapest
Vidal	Javier	Spain	Professor	University of Leon
Zelvys	Rimantas	Lithuania	Vice-Rector for Research	Lithuanian University of Educational Sciences
Ziegele	Frank	Germany	Director	CHE, Center for Higher Education Development

Appendix F: Topics of policy changes: correspondents' observations

In this appendix policy changes are grouped according to the following categories: A change in system includes reforms of the funding allocation schemes, or of the quality assurance system. A change in student contribution includes changes in tuition fees and financial aid to students. A change in autonomy includes regulatory changes in the relationship between universities and the Central Government. Enrolment includes changes in student recruitment or the number of student places. Graduation covers measures aiming to influence student graduation rates; 'employment' measures to increase student employment rates. Mobility covers measures related to inward and outward student mobility. Research covers policy changes related to the research output of universities.

	System	Student contribution	Autonomy	Enrolment	Graduation	Employment	Mobility	Research
Austria					*	*		
Belgium							*	
Bulgaria		*						
Croatia			*					
Cyprus		*		*			*	
Czech Rep.		*					*	
Denmark		*		*	*		*	
Estonia	*	*						
Finland		*		*		*		
France		*						*
Germany		*						
Greece	*							
Hungary	*	*					*	
Ireland	(*)	*						
Italy	*	*						
Latvia	*							
Lithuania		*				*		
Lux.								
Malta				*				
Netherl.					*			*
Poland	*							
Portugal	*							
Romania			*	*				
Slovakia	*	*						
Slovenia	*					*	*	
Spain		*						
Sweden				*				
UK		(*)		*				
Iceland				*	*			
Norway							*	

Switz.		*						
Turkey	*	*						
Total	11	17	2	8	4	4	7	2

Appendix G

Factor loadings and regression coefficients, 2012 analysis

Table G-1 Factors and factor loadings: university policy

	P1 - Public expenditures & aid	P2 - Organisational autonomy & private expenditures	P3 - Policy autonomy
Public expenditures	0.80	-0.01	-0.03
Private expenditures	0.32	-0.69	0.14
Financial aid	0.89	-0.04	0.04
Organisational autonomy	0.17	0.81	0.14
Financial autonomy	0.04	0.45	0.62
Policy autonomy	-0.01	-0.13	0.86

Table G-2: Factors and factor loadings: university performance

	Q1 - Research performance	Q2 - Enrolments & mobility	Q3 - Graduation rates
Mobility	0.10	-0.81	0.14
Enrolment rate	0.01	0.90	-0.14
Graduation rate	-0.08	-0.09	0.95
Graduate employment ratio	-0.33	0.48	0.34
New entrants	-0.05	0.65	0.38
Ranking performance	0.90	-0.02	-0.21
Top publications	0.89	-0.22	-0.17
Public-private research coop.	0.88	0.04	0.12
ERC grants	0.91	-0.10	-0.03
Employers satisfaction	0.46	-0.32	-0.28

Table G-3 Coefficients (t-values in brackets) of the regressions of the performance factors (Q1, Q2, and Q3) on the policy factors (P1, P2, and P3) and the control variables factors (C1 and C2)

	Q1 - Research performance	Q2 - Enrolments & mobility	Q3 - Graduation rates
P1 - Public expenditures & aid	0.49** (3.16)	-0.17 (-0.94)	-0.29 (-1.69)
P2 - Organisational autonomy & private expenditures	0.37** (2.30)	0.32 (1.68)	-0.33* (-1.89)
P3 - Policy autonomy	0.11 (0.71)	0.09 (0.49)	0.12 (0.69)
C1 - Country size	0.05 (0.33)	-0.07 (-0.40)	0.04 (0.23)
C2 - Population structure	-0.02 (-0.13)	-0.24 (-1.22)	-0.22 (-1.25)
R^2	0.39	0.14	0.28

** Significant at the 5% confidence level; * significant at the 10% confidence level

Table G-4 Coefficients (t-values in brackets) of the regressions of the innovation factor (E1) on the performance factors (Q1, Q2, and Q3) and the control variables factors (C1 and C2)

	E1 - Innovation
Q1 - Research performance	0.68** (6.25)
Q2 - Enrolments & mobility	-0.49** (-4.47)
Q3 - Graduation rates	0.04 (0.35)
C1 - Country size	-0.06 (-0.55)
C2 - Population structure	-0.1 (-0.88)
R^2	0.69

** Significant at the 5% confidence level; * significant at the 10% confidence level

Appendix H

Factor loadings and regression coefficients, 2014 analysis

Table H-1 Factors and factor loadings: university policy

	P1 - Public expenditures & aid	P2 - Autonomy	P3 - Private Expenditures
Public expenditures	0.81	-0.02	-0.39
Private expenditures	0.01	0.01	0.93
Financial aid	0.75	-0.03	0.42
Organisational autonomy	0	0.73	-0.17
Financial autonomy	-0.03	0.81	0.14
Policy autonomy	0.38	0.4	0.08

Table H-2: Factors and factor loadings: university performance

	Q1 - Research performance	Q2 - Enrolments & mobility	Q3 - Graduation rates
Mobility	0.27	-0.79	0.01
Enrolment rate	0.07	0.88	-0.21
Graduation rate	-0.05	-0.19	0.89
Graduate employment ratio	-0.38	0.39	-0.11
New entrants	0.11	0.66	0.46
Ranking performance	0.84	0.06	-0.21
Top publications	0.84	-0.21	-0.25
Public-private research coop.	0.88	0.14	0.06
ERC grants	0.79	-0.26	0.01
Employers satisfaction	0.46	-0.12	-0.51

Table H-3 Coefficients (t-values in brackets) of the regressions of the performance factors (Q1, Q2, and Q3) on the policy factors (P1, P2, and P3) and the control variables factors (C1 and C2)

	Q1 - Research performance	Q2 - Enrolments & mobility	Q3 - Graduation rates
P1 - Public expenditures & aid	0.57** (3.56)	0.06 (0.32)	-0.06 (-0.32)
P2 - Autonomy	0.21 (1.27)	0.22 (1.17)	-0.08 (-0.39)
P3 - Private Expenditures	-0.15 (-0.96)	-0.3 (-1.63)	0.33* (1.73)
C1 - Country size	0.12 (0.75)	0.01 (0.08)	-0.06 (-0.33)
C2 - Population structure	-0.05 (-0.27)	0.26 (1.32)	-0.05 (-0.24)
R^2	0.38	0.16	0.11

** Significant at the 5% confidence level; * significant at the 10% confidence level

Table H-4 Coefficients (t-values in brackets) of the regressions of the innovation factor (E1) on the performance factors (Q1, Q2, and Q3) and the control variables factors (C1 and C2)

	E1 - Innovation
Q1 - Research performance	0.69** (5.84)
Q2 - Enrolments & mobility	-0.39** (-3.24)
Q3 - Graduation rates	-0.09 (-0.76)
C1 - Country size	-0.05 (-0.42)
C2 - Population structure	0.14 (1.17)
R^2	0.64

** Significant at the 5% confidence level; * significant at the 10% confidence level

Appendix I

Distribution of ranking score

Figure I-1: Distribution of the 2014 ranking score

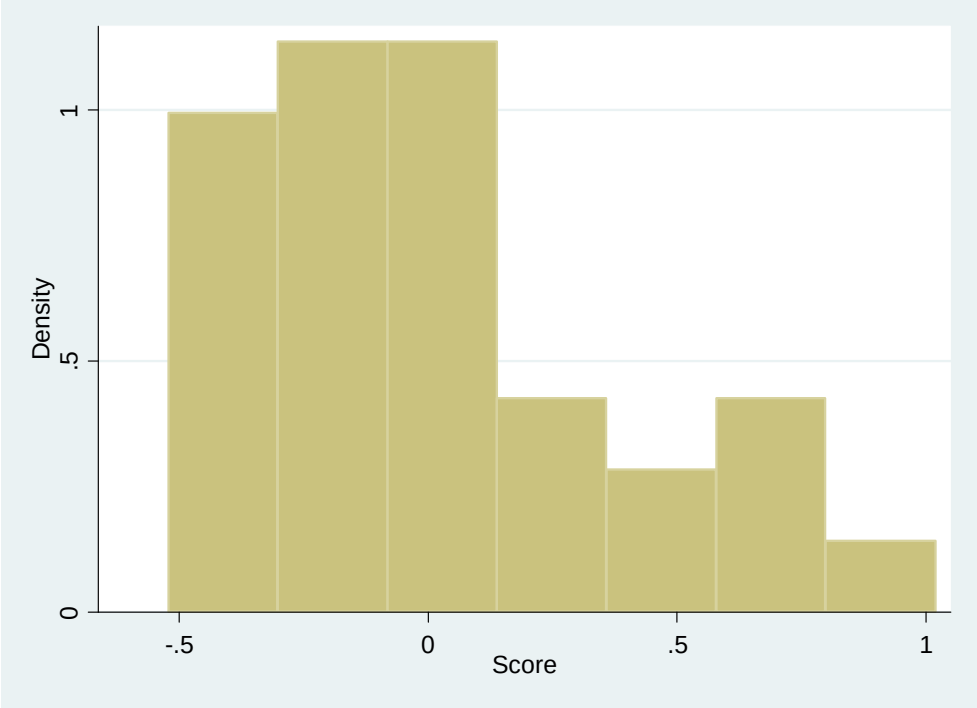


Figure I-2: Distribution of the 2012 ranking score