Higher Education and its contribution to a diverse regional supply of human capital: does the binary/unitary divide matters?

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Abstract

Diversity has been an important topic of research for some time in higher education, though the purposes underlying this attention have varied across national and regional contexts. In many parts of the world, the term diversity has been emphasized with regard to variety among the programs or services provided by academic institutions, and differences among the types of institutions themselves. It is particularly important to discuss whether different dimensions of diversity may influence the degree of effectiveness of higher education (HE) in fulfilling its contribution and relevance to economic and social development. We are particularly interested in analyzing whether unitary or binary systems present significant differences in different dimensions of diversity that may be relevant to enhance higher education institutions' (HEIs) contribution to territorial cohesion, notably by enhancing the local stock of human capital and contributing to the social and cultural development of their regions. Therefore, we propose the following research questions: *Are there relevant patterns regarding different dimensions of diversity between unitary and binary HE systems? *In the case of binary systems, is it possible to find relevant differences in different dimensions of diversity between universities and more vocational HEIs? By looking at

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these questions, we aim at contributing both to the literature on HE institutional diversity and to the study of the role played by HEIs on regional development.

Keywords: Diversification, Diversity, Differentiation, Human capital, Binary systems, Unitary systems

1. Introduction

Higher education (HE) may have a very significant role to local and regional development through several channels. Several authors have argued that the formation of human capital is a major channel through which higher education institutions (HEIs) may influence regional economic dynamics (see, for instance, Justman and Thisse, 1997; Suedekum, 2005; Franco et al., 2010; and Abel and Deitz, 2012). HEIs' presence may also benefit new firm's creation and performance (see Lindelof and Lofsten, 2004 and Audretsch et al.'s, 2005). Geographical proximity between HEIs and new firms seems to matter to the "quality" of spillovers generated between different agents (Stahlecker and Koschatzky, 2004), and that the role of universities tends to be especially important in structurally weak regions where the production of intellectual capital is lacking (Baptista et al., 2011). These are important economic dimensions for the establishment of HEIs in a given territory and they seem to be even more significant in smaller and medium regions.

Some authors have pointed out that this contribution of HE to regional development is neither mechanic, nor should it be taken for granted. The mere existence of HEIs will not

guarantee the attainment of specific economic and social objectives (Chatterton and Goddard, 2000), as the former may suffer from a lack of engagement with local and regional needs. This can be seen in teaching, as the programs and scientific areas of an institution could be poorly aligned with regional economic needs due to rigidities in the composition of staff or to internal mechanisms of decision-making that may privilege other dimensions. Given the growing role that HEIs may play in regional development, it is relevant to see how different types of systems and institutions may contribute to enhance that role, notably through the supply of qualified labour that may match their regional needs. Hence, in this paper we will analyse to what extent the structure of HE systems is relevant for a diversified structure of programs and fields of study, and their spatial distribution across different regions of the same country. This will help us to understand to what extent are HEIs contributing to provide a diversified pool of graduates in a spatially diverse labour market, thus by creating opportunities for different regions and not only to the more important or wealthier ones.

It is particularly important to discuss whether diversity in the types of HEIs may influence the degree of effectiveness of HE in fulfilling its contribution and relevance to economic and social development. Hence, we are interested in analyzing whether unitary or binary systems present significant differences in different dimensions of diversity that may be relevant to enhance HEIs' contribution to territorial cohesion, notably by enhancing the local stock of human capital and contributing to the social and cultural development of their regions. Therefore, we propose the following research questions:

- Are there relevant patterns regarding different dimensions of diversity between unitary and binary HE systems?

- In the case of binary systems, is it possible to find relevant differences in different dimensions of diversity between universities and more vocational HEIs?

By looking at these questions, we aim at contributing both to the literature on HE institutional diversity, as well as to the study of the role played by HEIs on regional development. In section 2 we discuss different dimensions of diversity in HE, emphasizing the importance of sectoral and institutional diversification as dominant dimensions among other forms of diversification, and its relevance in local and regional development. In section 3 we focus on institutional diversity in HE and discuss to what extent different HE systems and HEIs differ in terms of diversity. In section 4 we present the methodology and data used in our study. Section 5 compares, in binary HE systems, universities and vocational HEIs in terms of different dimensions of diversity, and Section 6 compares binary and unitary HE systems. Finally, we present our main conclusions in section 7.

2. Higher Education's diversity and its responsiveness to external needs

Diversity has been an important topic of research for some time in HE, though the purposes underlying this attention have varied across national and regional contexts. In some systems, especially in North America, the term "diversity" is most often applied to concerns about the composition of the student body (Harper and Hurtado, 2010; Smith, 2016). Other strands of research have looked at the diversification of the academic profession and its impacts in HE dynamics (e.g., Whitchurch and Gordon, 2009; Teichler and Hohle, 2013). However, in other parts of the world, notably in Europe, the term "diversity" has been particularly associated to the issue of the variety of programs or

services provided by different HEIs, as well as to differences among the types of institutions themselves (Meek et al. 1996; Teichler, 1988; Kyvik, 2004), leading to an important debate about institutional and programmatic diversity and its implications (Huisman, 1997; van Vught, 2009).

Underlying these debates and policy developments are the views that HE's supply should be diverse and the extent of which different types of programs and competencies may require institutions with a different profile, possibly with some more academic oriented and others more professionally or vocationally oriented (Teichler, 2006 and 2008). Some stakeholders and policy-makers consider that in order to satisfy labour market needs, mass higher education systems should be composed of different types of institutions and that institutional diversity is a pre-condition for the aimed program diversity (Trow, 2009). By contrast, others are less emphatic on this and consider that different types of program may emerge even though institutions may have a similar institutional and legal framework, as competition and strategic behavior may lead some of them to specialize and to develop a different educational portfolio (Dill and Teixeira, 2000). Moreover, there is the risk that, even though institutions are established with a different mission, they may emulate the behavior of others, leading to institutional isomorphism and a lower degree of institutional diversification (see Meek et al; 1996).

Our understanding of the mechanisms and forces leading to diversity or to convergence is far from complete because much depends on the very complex interactions with the environment (Fulton, 1996) at the institutional and system's levels. Organisational theories are diverse and may lead to contradictory interpretations. For instance, the *'natural selection'* model can be used to forecast that with time institutional diversity

will decrease (Hanan and Freeman, 1977) due to elimination of weaker and less adaptable organisations, or on the contrary it can be used to explain an increase of diversity (Aldrich, 1979) due to market niches. From organisational theories it is possible mainly to derive some general propositions such as those put forward by van Vught (1996). Accordingly, he considered that the largest the uniformity of the environmental conditions of HE organizations, the lower the level of diversity of the higher education system; on the other hand, the larger the influence of academic norms and values in a HE organization, the lower the level of diversity of the HE system.

The relationship between HE and local and regional environments can be analyzed by looking at perspectives focused on organizational change and stability, notably by looking at the familiar approaches of resource dependency and the neo-institutional perspectives (for classical accounts see DiMaggio and Powell, 1983 and Pfeffer and Salancik, 1978). These perspectives are relevant when we discuss higher education's responsiveness to their environment and the way diversification may contribute to enhance that responsiveness. Whereas resource dependency theory suggests that HEIs' response is shaped by economic constraints, neoinstitutional theory emphasises the conformity of those challenges to HEIs' norms and values and the extent to which the latter may shape their response to those challenges (Gornitzka, 1999). Thus, although all HEIs' may be influenced by their economic environment and by the pecuniary and non-pecuniary rewards associated with these challenges, institutional differences may modulate their responses. Several regulatory forces (e.g., accreditation and quality assurance, funding, legal instruments) may be relevant in encouraging HEIs towards certain type of responses and in forging a differentiated response from different types

of institutions (see Bastedo and Gumport, 2001; Horta et al., 2008; Westerheijden et al, 2004).

The empirical analysis of diversity changes of HE systems and their institutions offers considerable difficulties. Meek and Wood (1998) recognised that there were only few national study cases of the relationship between policy initiatives and diversity, and that in practice there was virtually no cross-national research. Even worse, the available literature presents contradictory conclusions. A group of authors such as Parsons and Platt (1973) and Burton Clark (1978, 1983 and 1996) considered that HE systems have an innate tendency to differentiate and to increase their diversity. On the contrary, another group of authors including Riesman (1956), Birnbaum (1983) and Rhoades (1990) reached the conclusion that diversity would decrease.

With the spread of the *"market rhetoric"* in HE, diversity did not lose ground, but it was put in perspective in different ways (Dill and Teixeira, 2000). Some have argued that competition could lead some institutions to specialize and to innovate in order to differentiate from competitors (Geiger, 1996). However, others have argued that market forces may lead institutions to become more risk-averse and that a high degree of competition may lead to emulation and the so-called institutional isomorphism (Teixeira and Amaral, 2001). Thus, more recently, several empirical studies have tried to analyse the extent of which different forms of diversity in higher education may be better ensured either through stronger market or government regulation.

The complexity has also to do with the different acceptions of the term diversity. Hence, several typologies have been proposed in order to systematize its multidimensional and multi-level nature. Trow (1996) presented an operational definition of diversity

considering that it corresponded to the existence of different forms of post-secondary education with distinct and diverse missions educating and training for different professional careers, organised and financed in different ways and operating under diverse relationships with governments. This definition relates to the political goal of many governments of increasing diversity for offering a provision of education better adapted to a great diversity of individual qualifications, motivations, expectations and career aspirations (Goedegebuure and Meek, 1996).

Differentiation should be distinguished from diversity, the latter indicating the variety of entities within a system and the former suggesting dynamic process. According to the perceptive and much influential contribution of Huisman (1995) differentiation is the process in which new entities in a system emerge and diversity refers to the variety of the entities at a specific moment. One of the seminal contributions has been provided by the work of Birnbaum (1983), who has tried to systematize a large body of research through his distinction between internal and external diversity (within and between institutions). As we are mainly interested in external diversity, it is relevant to present the seven forms of diversity he has identified:

- Systemic - referring to the differences in institutional type, size, and control;
- Structural - referring to differences resulting from historical and legal foundations;
- Programmatic - involving issues such as the degree level, field of studies, comprehensiveness, and emphasis of programs and activities;
- Procedural - involving differences in the way different activities are provided;
- Reputational - referring to perceived differences in status and prestige;

- Constitutential - relating to differences in the populations served;
- Values and climate – which focus in the social environment and culture.

This typology has been followed by several other attempts. Kivinen and Rinne (1996) developed a similar typology, though with slight differences. In their case, they proposed the following 7 dimensions: Sectoral; Missions and their relative priorities; Programmatic; Duration of programs; Geographical; Communities served; and Funding. Marginson (1998) provided a more synthetic typology and distinguished between horizontal and vertical diversity. The former refers to the diversity between institutions where differences in function or activities have no necessary implication for institutional standing within the system, meaning a diversification not necessarily associated with differences in status or resource levels. By contrast, vertical diversity refers to a situation where the differences in function or activity are associated with differences of rank, whether formal or informal. This seems to be one of the most critical issues, but also one very sensitive, as it is very difficult to achieve a situation in which institutional differences are not translated into hierarchical or stratified relations between different types of HEIs.

The views about the desirable diversity have evolved significantly in various respects (Teichler, 2006 and 2008). One of the issues in the range of heterogeneity or homogeneity that policy-makers, external stakeholders, and institutions consider as desirable. Secondly, is to what extent that should be attained through different types of institutions or within institutions, and how severe these differences should be demarcated. Another emergent issue is the extent of which those institutional differences are based on formal issues (types of programs, fields covered, mission, etc)

or more informal or qualitative issues, as those derived from perceived reputation, impact of rankings, or other symbolic forms of differentiation. These latter aspects are clearly linked to the approach based on vertical/horizontal diversity/differentiation discussed by Marginson (1998).

Arguably, the most resilient approach to diversification in policy debates in Europe has been the systemic one, as many of the other types tend often to be related to it, notably regarding diversity of missions, types of programs or the relationship between the communities served by each institution. This has become particularly relevant in recent decades as there has been a significant debate in many countries about the degree of institutional differentiation that fits best an expanding and increasingly diverse student and labour markets (Meek et al. 1996; Kyvik, 2004). In Europe, we have seen diverse trends in various HE systems trying to promote greater differentiation, either through formal differentiation or through competition and strategic differentiation among HEIs (Taylor et al, 2008), even though one has often encountered this associated with debates about a two-tier system and the advantages and risks of those options.

Underlying these changes has been a debate about how different types of HEIs or different HE systems may impact on programmatic or spatial diversity and therefore helping to enhance the contribution of HE for economic and social development. In the following section, we will discuss this relationship between sectoral differentiation and its potential impacts in the production of a diverse pool of graduates, namely by exploring how institutions with different missions and profiles may contribute (or not) to a diverse supply of programs and advanced qualifications.

3. Sectoral Differentiation and the supply of qualified labor in European Higher Education – a few hypotheses

The debate about the impacts of institutional differentiation and diversity in HE has benefited from a stronger pursuit of empirical evidence for different dimensions and implications of diversity, either in the sense of cross-national comparisons or longitudinal analyses of system diversity (Huisman et al. 2007). These comparisons are relevant as HE systems are still significantly heterogeneous across Europe (Taylor et al, 2008), with some evolving towards greater institutional diversity, and others becoming more homogeneous over the last decades (Coates et al., 2013). Moreover, it has been argued that the distinctions between universities and non-university sector risked to become less pronounced and that the Bologna Process was likely to enhance that trend (De Weert, 2006).

Thus, in recent years there has been increasing attention on how to measure specialization and diversification in HE (Birnbaum, 1983; Neave, 2000; Teixeira and Amaral, 2001). Recent studies by Rossi (2009, 2010), Teixeira et al (2012a; 2012b; 2013 and 2014), and Lepori and Seeber (2014), have looked at various dimensions of diversity, trying to operationalize the aforementioned seminal conceptual contributions.

In principle, the main differences between both subsectors that integrate a binary HE system are mirrored in the orientation of their study programs (academically or professionally oriented), their mandate (or lack of it) to perform research activities, as well as the kind of research that institutions are expected to carry out (Huisman and Kaiser, 2001). Thereby, in binary systems the mission of the non-university sector is mainly associated with teaching oriented for vocational purposes, meaning that, in

general, the length of their study programs was shorter in these institutions than in the case of universities (Taylor et al., 2008). If the vocational training feature of the colleges and vocational HEIs persists, it is likely that lower level degrees (typically ISCED 5 and ISCED 6) should be better represented in this kind of institutions than upper degrees (ISCED 7 and ISCED 8). If that is the case, universities are likely to present a higher diversification in terms of degrees than colleges and vocational HEIs. (Hypothesis 1 – to be tested).

Another important difference is the fact that in most countries non-university sector was also planned to support regional development, as well as to establish a stronger relationship with local communities (Teixeira et al, 2014; Teichler, 2006). Taking that into account, we can expect colleges and vocational HEIs to be more widespread over different regions than universities (Hypothesis 2– to be tested). Furthermore, the distribution of universities should be stronger in urban areas, while the presence of colleges and vocational HEIs should be stronger in non-urban areas (Hypothesis 3 – to be tested).

It is also important to notice that there are certain fields of science that, by definition, have a higher predisposition for empirical applications, as well as for vocational purposes (see Becher and Trowler, 2001). In this sense, it is also likely to find differences in terms of the diversity of fields of science across both sub-sectors (Huisman, 1997; Teixeira et al, 2013). By contrast, universities tend to be more comprehensive, not the least because they are less likely to face restrictions in terms of scientific fields as their vocationally-oriented counterparts often do. Hence, colleges and vocational HEIs are

expected to be less diversified than universities in terms of fields of science covered (Hypothesis 4– to be tested).

In the sense that unitary systems are constituted by similar HEIs (only universities), it is also relevant to explore differences when comparing binary and unitary systems. Actually, the latter are expected to be more diversified in terms of degrees (Hypothesis 5 – to be tested). By contrast, their regional distribution is expected to be more concentrated than in binary systems due to the regional emphasis placed upon more vocational institutions (Hypothesis 6 – to be tested). We may also consider the hypothesis that in unitary HE systems the distribution of HEIs should be more balanced in urban areas than in non-urban ones, and vice-versa (Hypothesis 7 – to be tested). Finally, and concerning fields of science, it can also be expected that unitary HE systems exhibit a more diversified pattern than binary systems as different types of institutions are more likely to present greater diversification in terms of the fields of study covered (Hypothesis 8 – to be tested).

Table 1. Summary of the main hypotheses to be tested

	Binary Systems (Universities vs. Colleges and Vocational HEIs)	Unitary Systems vs Binary Systems
Degrees' Diversification	H1	H5
Spatial Diversification	H2	H6
Spatial Diversification across urban and rural areas	H3	H7
Programmatic Diversification	H4	H8

Therefore, four dimensions of diversification are tested in our analysis. Concerning Degree diversification, we focus on the type of degree offered (ISCED 5, 6, 7 and 7 Long Degree) and a higher diversification level means that in a given country, a given type of HEI/HE system has students more evenly spread between all types of degrees. For

Spatial Diversification, we test how spread the students are between the different NUTS 2 and NUTS 3 in each country, for each type of HEI/HE system. [5] We do a similar spatial analysis for urban and rural areas, in which we consider how the different NUTS 3 regions are divided, according to the EUROSTAT urban-rural classification. Therefore, we attempt to assess within each country, for each type of HEI/HE system how HE activity is diversified in the different categories of territories (urban-rural). Finally, the Programmatic Diversification refers to the different areas of scientific knowledge. The Fields of Education and Training 2013 classification (ISCED-F 2013) was used to distinguish between the different areas. Therefore, in a given country, a type of HEI/HE system more diversified means that the students are more evenly spread between the different areas of scientific knowledge. All these hypotheses (see table 1) will be tested in sections 5 and 6 of this article.

4. Data and Methodology

In order to test our hypotheses about diversification across different types of systems, we use the European Tertiary Education Register (ETER) database concerning the academic year 2011/2012. This dataset, whose aim is to provide a comprehensive

[5] Nomenclature of territorial units for statistics (NUTS) constitute a hierarchical system created in order to divide the economic territory of the EU. This division is carried out for harmonization purposes, namely regarding the production of European regional statistics, as well in what concerns the analysis and design of European regional socio-economic policies. Within this framework, NUTS 1 constitute the largest economic regions (being sometimes coincident with the countries themselves), while NUTS 2 correspond, generally, to the division of NUTS 1 into smaller territorial units (regions) that are used for the application of regional policies. Finally, NUTS 3 constitute even smaller territorial units (regions) used for specific diagnoses.

register of the European HEIs, results from a joint initiative of several Directorates General of the European Commission. Among other information, ETER provides data about HEIs' number of students[6] and graduates (by gender, ISCED, fields of education, nationality), international doctorates, and staff. Furthermore, it is also made available the location of the HEIs (geographic coordinates, city, NUTS 3, NUTS 2, country), as well as financial data, namely on their income and expenditure. Finally (and not being exhaustive), each institution is also attributed a legal status (public, private, or private government-dependent), a standardized institutional category (university, university of applied sciences, other), as well as its foundation year. All the data is collected at national level by the National Statistical Authorities (NSAs), with the support of the ETER national expert. The data is then managed, validated, and published by the ETER project team (for further details see Lepori et al. 2015).

One of the main distinctive features of ETER is that European HEIs (from different countries) constitute the statistical units of this dataset. Therefore, the main strength of this database is the fact that it provides harmonized data at HEIs level for a set of different European countries, thereby allowing inter-country analyses among HEIs. However, the methodological procedures adopted to the construction of this dataset dictate some limitations related to its scope and the level of disaggregation within each unit of analysis (HEIs). Concerning the scope, it is important to highlight the fact that it was established a set of criteria to determine which HEIs should be included in the dataset, and those that should be excluded. One of the main implications is the fact that

[6] Number of students concerns the number of individuals enrolled in each HEI at the beginning of the academic year (i.e. the last day of the first month of the winter semester academic year). Moreover, the total number of students is simply based on count of students according to the previously mentioned criterion.

"as a general rule, institutions with less than 30 FTEs of academic staff and less than 200 students should be included only in exceptional cases, specifically for institutions mostly awarding degrees at ISCED level 8" (Lepori, 2015). Therefore, it becomes clear that this dataset is not universal, and it excludes, in principle, very small HEIs. Another limitation of ETER is related to the fact that as the units of analysis are HEIs themselves, no disaggregated information is provided within each HEI. This fact can be particularly relevant in the case of HEIs divided into multiple campuses, thereby not existing information about each subunit. As a consequence, for some regions the number of enrolled students is overestimated. This happens due to the fact that for HEIs that have multiple campuses in different regions, ETER registers all enrolled students (regardless the campus where they are actually enrolled in) as if they were enrolled in the headquarters of the HEI.

Overall, this database for the academic year 2011/2012 includes information on 2673 HEIs[7], from 36 European countries, namely EU28 countries, EU candidate countries (Former Yugoslav Republic of Macedonia, Montenegro, Serbia, and Turkey), and EFTA members (Iceland, Liechtenstein, Norway, and Switzerland). From this group we have excluded those countries with very limited information (Croatia, Hungary, Montenegro, Romania, Slovenia and Turkey). Thus, our final sample includes 2270 HEIs located in 30 countries[8]. Whenever for a given country any relevant information on a given HEI is missing, this institution was not included in the sample for that specific purpose.

[7] In general, the data set excludes very small HEIs with less than 200 students and less than 30 staff members.

[8] In a nutshell, we include in our analysis data concerning all countries available in the dataset except those for which very limited information is available.

We have then split countries according to their HE systems, namely those having a binary or unitary system, by identifying as the former those systems where it is possible to find both universities and vocational HEIs, and unitary systems as those where there are no colleges or vocational HEIs (see table 2). In both systems and for most of the countries it is also possible find HEIs that fall in the category "other institutions" (being neither universities nor vocational HEIs). These institutions will be included in our analysis only for the comparison of binary and unitary HE systems (see section 6). Whenever our analysis focused exclusively in binary systems (see section 5), "other institutions" were not included in the analysis.

Table 2. List of countries assumed to have binary and unitary HE systems

Countries with Binary HE Systems			Countries with Unitary HE systems		
Austria	Belgium	Bulgaria	Czech Republic	France	Iceland
Croatia	Cyprus	Denmark			
Estonia	Finland	Germany	Italy	Liechtenstein	Luxembourg
Greece	Ireland	Latvia			
Lithuania	Netherlands	Norway	Macedonia	Malta	Spain
Portugal	Poland	Slovakia			
	Switzerland		Sweden		UK

Another dataset that was used, namely in order to split NUTS 3 regions according to an urban-rural typology was extracted from Eurostat[9]. According to this classification, regions are classified into three different categories: urban, intermediate, and rural. The classification is based in the share of rural population (population living in a rural grid) living within each region. According to this definition, urban regions are those where the

[9] http://ec.europa.eu/eurostat/statistics-explained/index.php/Urban-rural_typology_update

share of rural population is less than 20%, in intermediate regions the share of rural population lies between 20% and 50%, while in rural regions more than 50% of the population is considered to be rural.

In our analysis we use three different diversification indexes. Following Teixeira et al. (2013; 2014) we are going to adopt a spatial diversification index and a programmatic diversification index. Following the same line of reasoning we are also going to compute a degree diversification index. Concerning the spatial diversification index is defined as follows:

$$\text{Spatial Diversification Index}_j = 1 / (\sum_i (x_{ji} / X_j)^2) \quad (1)$$

Where x_{ji} represents the total number of students that are enrolled in the type of HEI (universities or colleges and vocational HEIs) /HE system (binary or unitary) j and in a given region i[10]. The spatial diversification index will be used to assess the validity of Hypotheses 2, 3, 6 and 7. Furthermore, the index will also be computed taking into account two different specifications about the definition of a region. Therefore, in a first step, region i will correspond to NUTS 2. Afterwards, we will deepen the level of regional desegregation considering region i as NUTS 3. Moreover, X_j is interpreted as the total number of students enrolled in a given type of HEI / HE system. The spatial diversification index will be also computed for each urban-rural typology (urban, intermediate, rural) within each country. If for any country there are less than two NUTS

3 per typology, the spatial diversification index per typology will not be computed. Given that we are going to perform inter-country comparisons, and that HE systems and the total number of regions within each country (n) vary largely (across countries), it is essential to normalize the Spatial Diversification Index obtained from the previous step according to the following formula:

$$\text{Normalized Spatial Diversification Index}_j = (\text{Spatial Diversification Index}_j - 1) / (n - 1) \quad (2)$$

The normalization guarantees the comparison between countries with different number of NUTS 2 or NUTS 3 regions. The values for the Spatial Diversification Index will always belong to the range [0, 1], with 0 meaning no diversification at all, and 1 perfectly diversified. In the case of total diversification, it means that the total number of students from a given type of HEI / HE system is equally distributed across all possible regions (n). Hence, the results between countries with different regions can be directly comparable after this normalization.

Again, following Teixeira et al. (2013; 2014) it was computed a programmatic diversification index (to assess the validity of hypotheses 4 and 8) which should be interpreted as previously, with the only difference that now i corresponds to the scientific area where students are enrolled in:

$$\text{Programmatic Diversification Index}_j = 1 / (\sum_i (x_{ji} / X_j)^2) \quad (3)$$

In order to divide students according to their fields of education, ETER organization adopted the Fields of Education and Training 2013 classification (ISCED-F 2013) at the first level (broad fields), which includes eleven possible different fields[11]. However, in some countries scientific fields' typology gathers fields 3 and 4, and fields 5 and 6, being the aggregate values registered in ETER in fields 3 and 5, respectively. Therefore, for the sake of comparability, only 9 scientific fields have been considered, aggregating for all countries fields 3 and 4, and fields 5 and 6. As previously, Programmatic Diversification Index was normalized, as in (2), with *n* now being equal to 9 (i.e. the total number of different scientific fields). Therefore, a given type of HEI/HE system will have a score ranging between 0 and 1, with a 0 meaning that a given type of HEI/HE system has only students in one scientific field and the value of 1 being attributed to types of HEIs/HE systems where the students are equally divided between all of the existing scientific fields – according to our classification.

Additionally, it was also computed the Degrees Diversification Index (being used to assess hypotheses 1 and 5) that follows exactly the same spirit as (1) and (3). The only difference concerning those expressions is that in this case *i* should be interpreted as a given degree level. The Degrees level considered were extracted from those adopted by the International Standard Classification of Education (ISCED). For this purpose, and taking into account the way ETER database was organized, we decided to include only

[11] According to this typology, study programs are categorized as: "General" (00), "Education" (01), "Humanities and Arts" (02), "Social Sciences" (03), "Business and Law" (04), "Natural Sciences, Mathematics and Statistics (05)", "Information and Communication Technologies" (06), "Engineering, Manufacturing and Construction (07), "Agriculture, Forestry, Fisheries and Veterinary (08), "Health and Welfare (09) and "Services" (10).

students enrolled at ISCED 5, 6, 7 and 7 long degree levels[12]. Following the same line of reasoning as before, the Degrees Diversification Index will be normalized according to (2). Again, the only difference regarding Spatial Diversification Index is that now n represents the total number of possible levels of degrees (i.e. 4 possible degree levels). Similarly, a given type of HEI/HE system will have a score ranging between 0 and 1, with a 0 meaning that a given type of HEI/HE system has only students in one degree level and the value of 1 being attributed to types of HEIs/HE systems where the students are equally divided between all of the existing degree levels.

Indexes have always been computed at the national level. In order to assess differences on diversification between universities and colleges and vocational HEIs, all indexes were computed for each one of these subsystems separately. Then, the results obtained for each country were analyzed, as well as compared with the results obtained for other countries. When comparing binary and unitary HE systems we have computed indexes for the HE system of each country as a whole (i.e. aggregating universities, colleges and vocational HEIs, and other existing institutions). Then, we compared differences in the diversification patterns for binary and unitary HE systems.[13]

5. Diversity in binary systems: universities vs. colleges and vocational HEIs

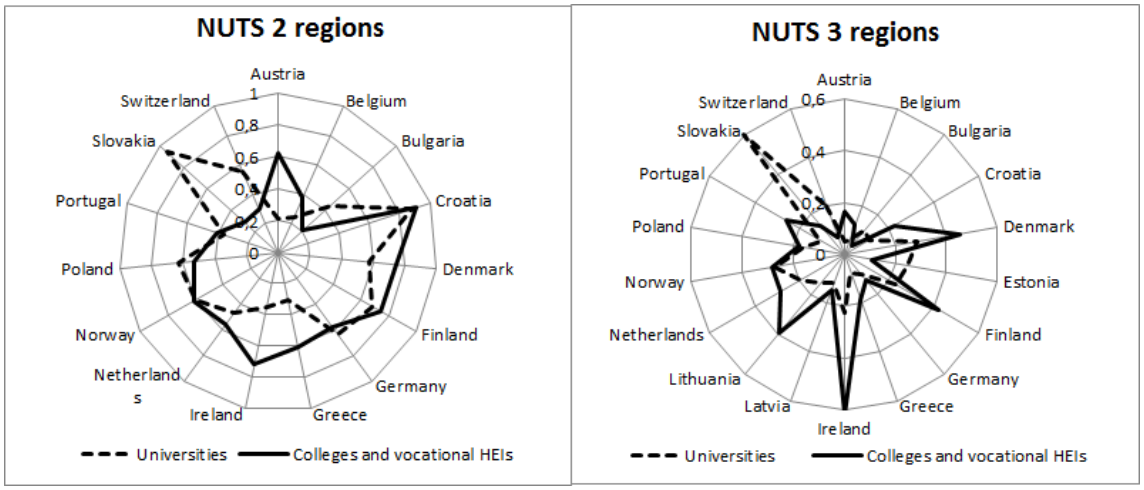
[12] ISCED 8 Courses (Doctoral Degrees) were not included due to the low number of enrolled students at this ISCED levels. Given that Universities of Applied Sciences are not usually allowed to provide ISCED 8 programs, the analysis underestimates slightly the degree diversification level of universities when compared to UAS.

[13] Due to the number of observations (countries) in our sample, statistical inference methods were not adequate to be used to analyze the existing differences between the subsectors.

We started our empirical analysis by looking at the spatial diversification. Figure 1 shows the results obtained for the computation of the normalized spatial diversification index[14]. On the left-hand side it was computed considering the distribution of enrolled students over NUTS 2 regions, within each country. As it was expected, in most of the cases the value of the spatial diversification index is slightly higher for colleges and vocational HEIs than for universities. This means that the regional distribution of students enrolled in HEIs tends to be more disperse in colleges and vocational HEIs than in universities. Moreover, if the level of regional disaggregation is deepened, despite the fact that the value of the spatial diversification index decreased overall, the distribution of enrolled students in colleges and vocational HEIs remained greater than in universities. These findings seem to confirm our initial view that colleges and vocational HEIs are more dispersed regionally (OECD, 2007; Teichler, 2008; Teixeira et al., 2014), and therefore we validate Hypothesis 2.

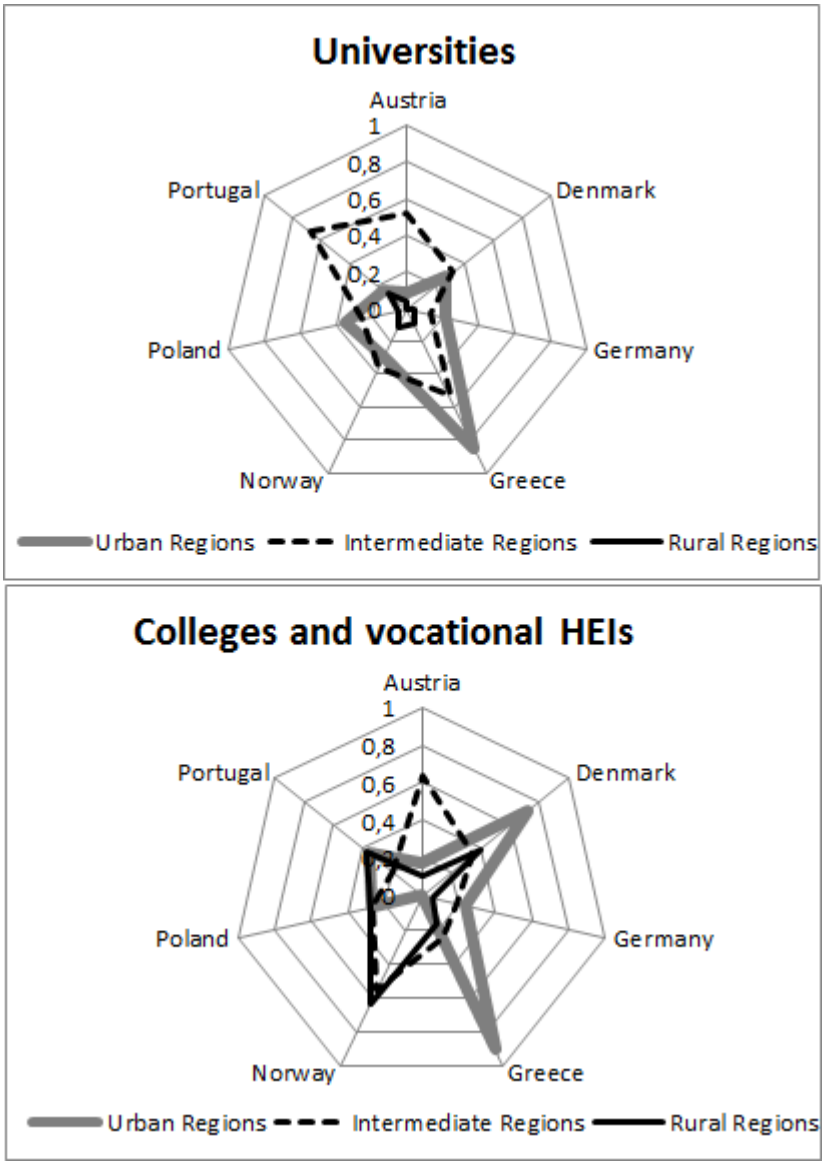
[14] In the case of HEIs that have multiple campuses in different NUTS 3, all enrolled students were counted as if they were enrolled in the headquarters of the HEI, which tends to underestimate the results obtained for the spatial diversification indexes.

Figure 1. Normalized spatial diversification index (NUTS 2 and NUTS 3 regions)



As seen in figure 2, the spatial diversification index of university sectors in rural regions is always very close to 0, whatever the country considered. The highest values for the spatial diversification index in rural regions were observed for Norwegian and Portuguese universities, though even in these situations they did not surpass 0.12 and 0.13, respectively. The distribution of enrolled students in intermediate or in urban regions seems to be much more homogeneous. In terms of colleges and vocational HEIs, the overall spatial diversification index in rural regions seems to be higher, notably in countries such as Norway, Denmark, Poland, and Portugal. It is also interesting to notice that in some cases the distribution of the students across rural areas is quite similar to the distribution that can be observed across intermediate areas. These results confirm in part the third hypothesis, namely the weak diversification of universities in rural areas and the stronger diversification of the colleges and vocational HEIs in these regions (Teichler, 2006).

Figure 2. Normalized spatial diversification index by urban / rural typology (NUTS 3 regions)



In terms of degrees offered by each type of institution, a first analysis of the data presented in table 3 indicates that while most of the enrolled students at colleges and vocational HEIs attend the most basic levels of education (ISCED 5 and ISCED 6 levels), at universities the share of enrolled students in higher levels of education is clearly higher (ISCED 7 and ISCED 7 long degree). This idea confirms our expectation that

colleges and vocational HEIs are more professionally oriented, awarding shorter degrees.

This picture is also confirmed by the results obtained for the degrees diversification index. As it can be observed in figure 3, for most of the considered countries, colleges and vocational HEIS present a much lower value for the degree diversification index than universities. For Bulgaria, Belgium, Estonia, Finland, Greece, Latvia, Lithuania, Netherlands and Switzerland it is either 0, or very close to it, meaning that enrolled students in colleges and vocational HEIs in these countries are all or almost all following the same degree (typically an ISCED 6 degree). These findings also support our Hypothesis 1, according to which universities are more diversified than colleges and vocational HEIs in terms of the length and type of degrees offered (Taylor et al., 2008).

Figure 3. Normalized degrees' diversification index

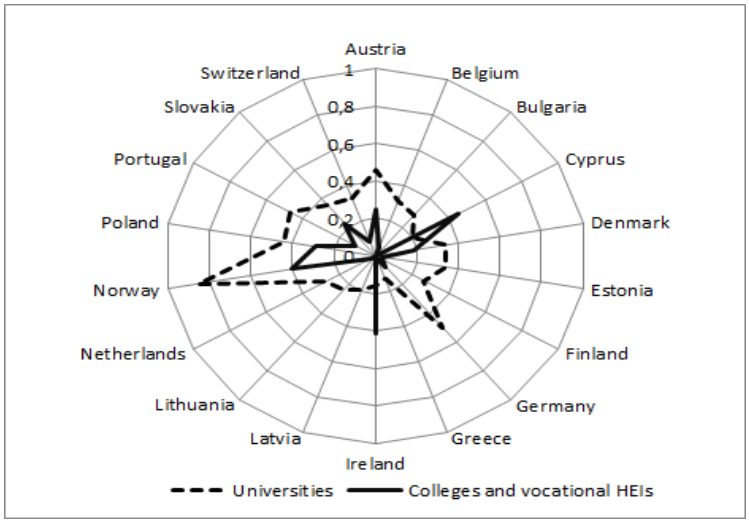


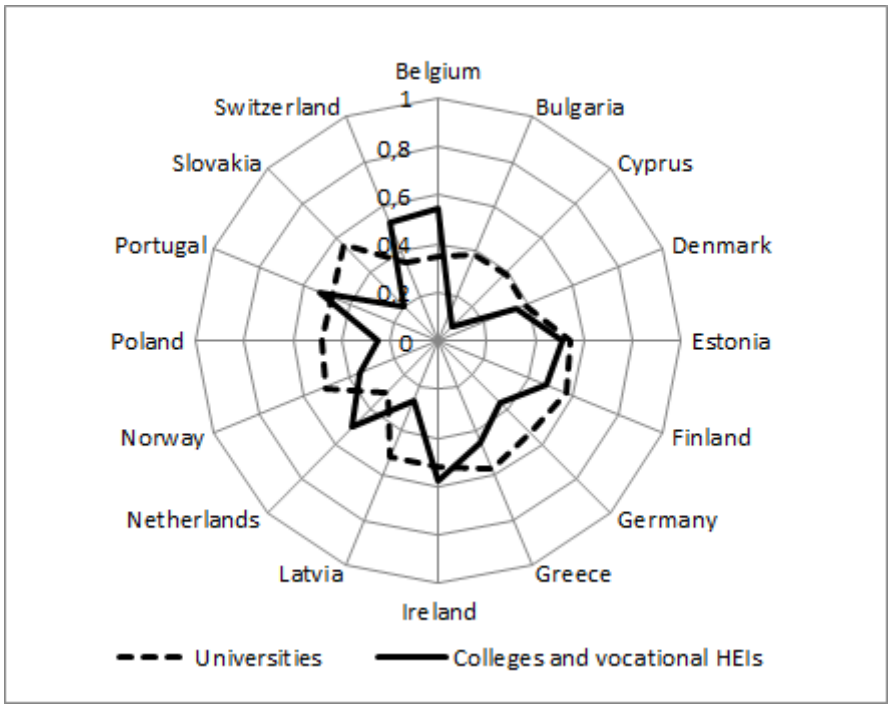
Table 3. Distribution of the enrolled students by type of HEI and degree level (academic year 2011/2012)

Country	Universities						Colleges and vocational HEIs					
	ISCED 5	ISCED 6	ISCED 7	ISCED 7 long degree	ISCED 8	Total Number of Students	ISCED 5	ISCED 6	ISCED 7	ISCED 7 long degree	ISCED 8	Total Number of Students
Austria	0,0%	47,1%	9,5%	34,1%	9,3%	289.302	0,0%	70,6%	27,5%	1,9%	0,0%	39.838
Belgium	0,0%	53,3%	36,3%	0,0%	10,4%	95.958	0,0%	93,5%	6,5%	0,0%	0,0%	133.049
Bulgaria	0,0%	69,1%	17,7%	11,8%	1,5%	265.559	0,0%	100,0%	0,0%	0,0%	0,0%	6.922
Cyprus	0,0%	73,4%	21,7%	1,9%	3,0%	23.305	41,6%	49,4%	8,9%	0,0%	0,0%	5.670
Denmark	0,0%	53,5%	39,1%	1,3%	6,1%	145.204	21,6%	76,9%	1,4%	0,0%	0,1%	91.941
Estonia	0,0%	60,6%	25,1%	8,2%	6,1%	49.290	0,0%	95,0%	4,8%	0,0%	0,2%	16.536
Finland	0,0%	58,8%	29,2%	0,0%	12,0%	168.983	0,0%	94,8%	5,2%	0,0%	0,0%	139.857
Germany	0,0%	42,2%	11,4%	39,5%	6,9%	1.545.499	0,0%	89,6%	9,7%	0,7%	0,0%	740.499
Greece	0,0%	74,6%	15,2%	0,0%	10,2%	237.512	0,0%	99,1%	0,9%	0,0%	0,0%	107.069
Ireland	2,3%	74,2%	15,5%	0,0%	8,0%	99.118	45,6%	47,9%	5,7%	0,0%	0,7%	73.740
Latvia	3,3%	73,9%	18,5%	0,0%	4,3%	49.206	100,0%	0,0%	0,0%	0,0%	0,0%	11.763
Lithuania	0,0%	72,4%	18,4%	7,0%	2,1%	122.986	0,0%	100,0%	0,0%	0,0%	0,0%	47.953
Netherlands	0,0%	63,3%	33,3%	0,0%	3,4%	253.405	0,4%	96,7%	2,9%	0,0%	0,0%	423.379
Norway	16,4%	36,6%	17,2%	22,1%	7,6%	109.960	27,3%	60,0%	10,5%	1,6%	0,6%	117.648
Poland	0,0%	53,0%	33,9%	10,5%	2,6%	1.465.081	0,0%	66,1%	30,8%	3,1%	0,0%	312.241
Portugal	0,0%	52,6%	16,8%	23,3%	7,3%	262.021	0,0%	85,4%	14,5%	0,0%	0,0%	124.973
Slovakia	0,0%	57,3%	30,5%	5,9%	6,2%	173.215	0,0%	69,2%	27,0%	0,0%	3,8%	31.461
Switzerland	0,0%	51,2%	30,2%	2,2%	16,4%	134.066	0,0%	88,9%	11,1%	0,0%	0,0%	68.258

Note: Croatia is missing because there was no data available at this level of disaggregation.

Concerning programmatic diversification, figure 4 also shows that in most countries the index is higher for universities than for colleges and vocational HEIs, meaning that enrollments in vocational HEIs are more concentrated in a few scientific fields than in universities. By contrast, countries such as Belgium, Ireland, Netherlands, Portugal and Switzerland exhibit a higher programmatic diversification in vocational HEIs than in universities. Aside from these exceptions, the results confirm our expectation that in terms of scientific fields universities are more diversified than colleges and vocational HEIs, as indicated by previous research (Huisman, 1995; Teixeira et al, 2013).

Figure 4. Normalized programmatic diversification index



Therefore, all hypotheses regarding the aggregate diversification patterns between universities and non-universities seem to be confirmed by our empirical results. However, there are a few exceptions to those patterns, which suggests that these results

need some additional qualifications. Before that, we will look at the comparisons between unitary and binary systems.

6. Dimensions of Diversity across European HE: unitary vs. binary systems

We now turn our attention to the comparison between unitary and binary HE systems. Figure 5 shows the differences between unitary and binary HE systems according to their spatial diversification empirically measured. When considering enrolled students across NUTS 2 regions, it is apparent that binary HE systems are more diversified than unitary ones. However, deepening the level of regional desegregation (moving from NUTS 2 to NUTS 3), the spatial diversification index decreased overall, regardless of the country and system considered. Moreover, the difference between binary and unitary systems has significantly eroded, with both types of systems demonstrating, on average, a very similar value of spatial diversification index. This result does not corroborate our initial hypothesis that binary HE systems would have institutions and a distribution of students spatially more diversified than unitary ones (hypothesis 6). Actually, this result indicates not only that in unitary HE systems there are universities that have regional implementation, but also that this regional focus is not weaker than in binary systems. Hence, it seems that different forms of differentiation emerge in unitary systems. It is also important to notice that for both types of systems diversification varies widely across countries.

Figure 5. Normalized spatial diversification index (NUTS 2 and NUTS 3 regions)

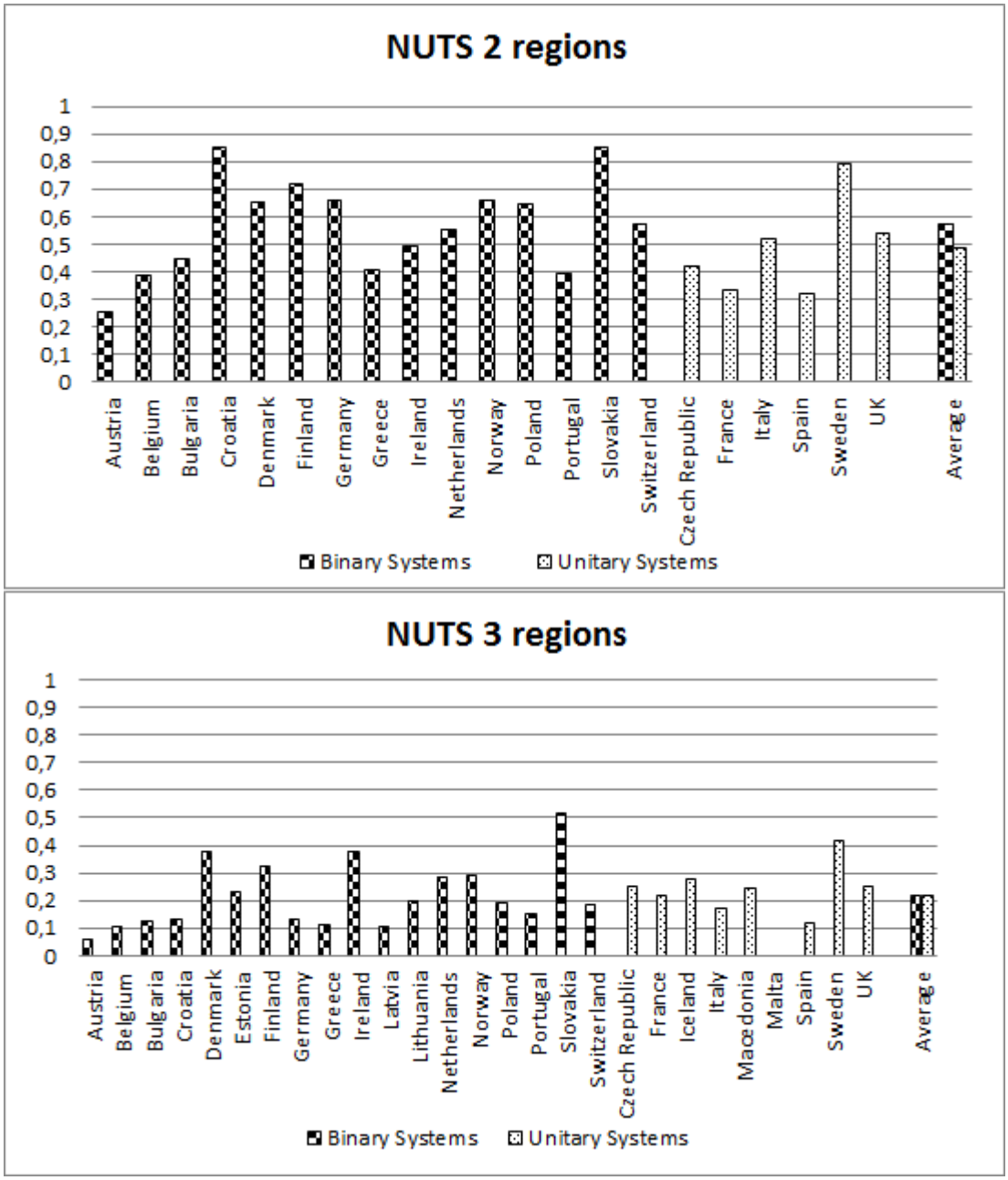
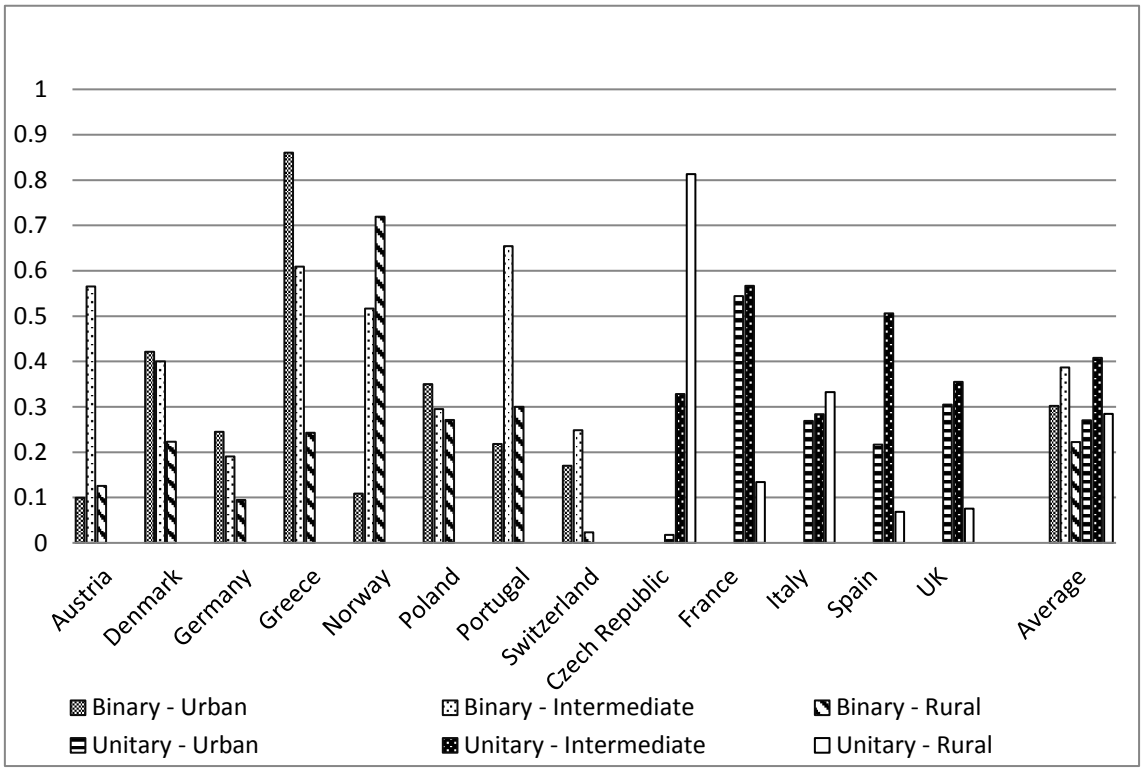


Figure 6 presents the results obtained for the spatial diversification index when each country is split into urban, intermediate and rural regions. It seems that, on average, binary systems demonstrate a greater distribution of enrolled students across urban regions, while unitary systems show a more homogenous distribution for intermediate and rural regions. This contrasts with our expectation that in unitary systems the latter

would present higher levels of diversity in urban areas, while the binary would be more diversified in non-urban areas (hypothesis 7). Looking at each country, one does not identify any clear pattern between different types of systems. Moreover, even within each system it is possible to conclude that there are visible differences across countries.

Figure 6. Normalized spatial diversification index by urban / rural typology (NUTS 3 regions)



Concerning the degrees' diversification index (figure 7), both binary and unitary systems present very close average values for the diversification index (being slightly higher for binary systems than for unitary ones). Nevertheless, these values are below 0.3, suggesting that enrolled students are not distributed in a very homogenous way across the different degrees. These results do not confirm our expectation that unitary systems would present higher diversification levels than binary systems, in terms of degrees (hypothesis 5). The more diverse nature of universities on this matter could have

influenced unitary systems in having institutions that have a more diverse pattern in terms of the degrees offered compared to binary systems, which are composed also by non-university institutions. Looking at each country individually, it is relevant to point out that both Norway and France exhibit diversification indexes surpassing by large the average values for the set of countries that have binary and unitary HE systems, respectively. By contrast, in countries like Greece, Luxembourg, Macedonia and Spain, the degrees' diversification index does not surpass 0.1, indicating that most of the students are enrolled in the same type of degree.

Figure 7. Normalized degrees' diversification index

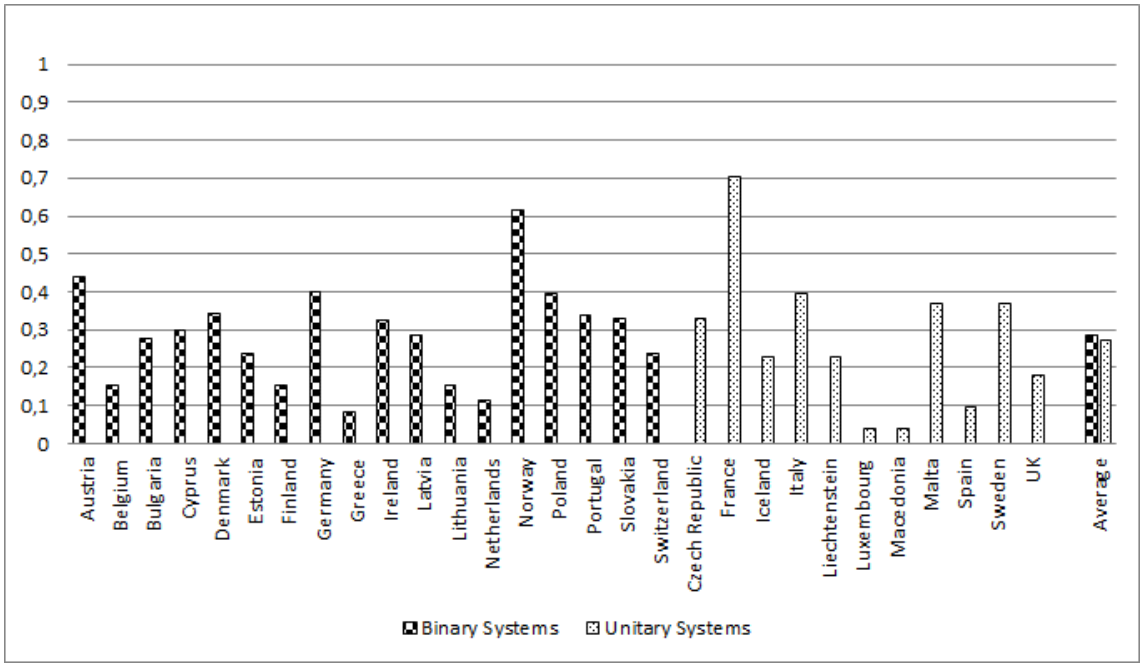


Figure 8 shows the results obtained for the programmatic diversification index in binary and unitary systems. In this case, the difference between the values computed for both types of systems is larger than previously, but again binary systems are those that show greater diversification. When observing the results at the country level, we see that countries with binary systems do not seem to diverge much from those with unitary

systems. Again, these findings contrast with the expectation that programmatic diversification should be higher in unitary HE systems (hypothesis 8). This suggests that in unitary systems there are other processes of differentiation akin to that promoted through the establishment of colleges and vocational HEIs in binary systems.

Figure 8. Normalized programmatic diversification index

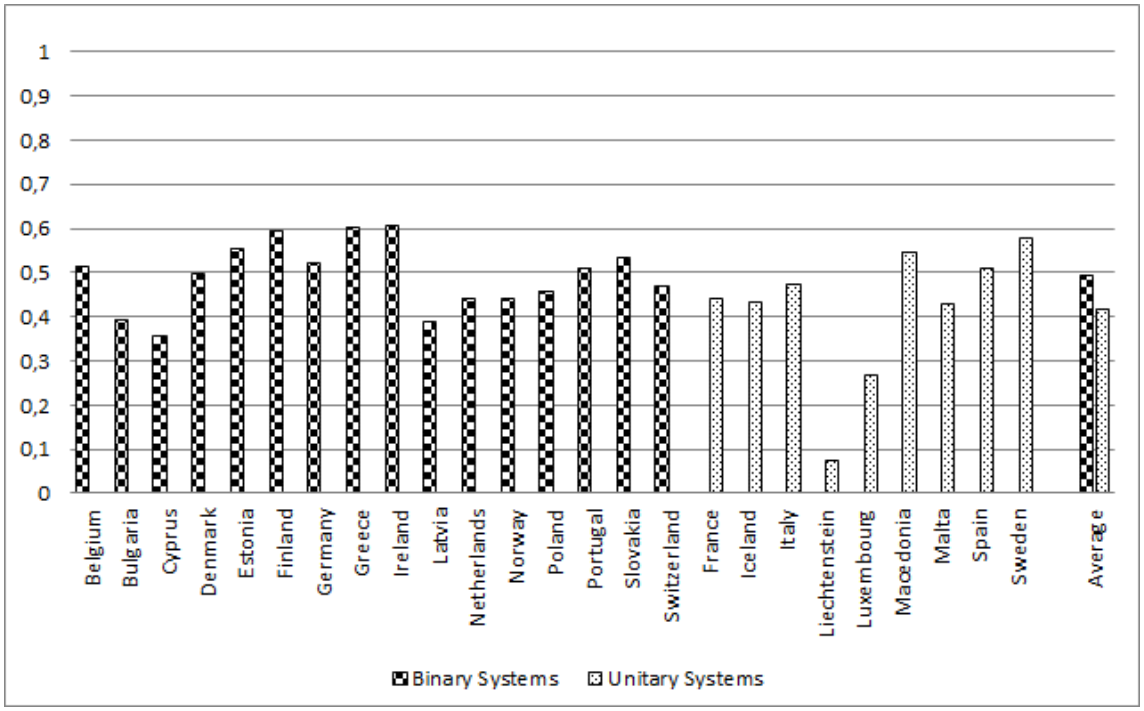


Table 4. Summary of the results concerning the main hypotheses that were tested

	Binary Systems (Universities vs. Colleges and Vocational HEIs)	Unitary Systems vs Binary Systems
Degrees' Diversification	H1: Validated	H5: Not Validated
Spatial Diversification	H2: Validated	H6: Not Validated
Spatial Diversification across urban and rural areas	H3: Validated	H7: Not Validated
Programmatic Diversification	H4: Validated	H8: Not Validated

In table 4 we summarize the results obtained for the different hypotheses that were tested, namely concerning differences between types of HEIs, and differences between binary and unitary HE systems. Overall, the results suggest the existence of relevant differences in terms of diversity between universities and vocational HEIs. By contrast, when different dimensions of diversity are compared, differences do not seem to be substantial between unitary and binary systems. Empirically, it was possible to observe that in countries where binary HE systems operate, colleges and vocational HEIs work as a driving force towards diversification at regional level in general, and particularly in rural areas. Moreover, students enrolled at colleges and vocational HEIs are more concentrated both in terms of fields of science and degrees and the share of enrolled students that attend ISCED 5 and ISCED 6 degrees is much higher than in the case of the universities. On the other hand, the comparison of the average values for the diversification indexes, from a set of European countries with binary and unitary systems, revealed that binary ones are not substantially more spatially diversified than unitary ones, even when taking into account exclusively rural areas. Similarly, unitary systems did not demonstrate to be particularly more diversified than binary ones concerning programmatic and degrees diversification index. This suggest that in unitary HE systems there should be universities that play a similar role to that played by colleges and vocational HEIs in binary systems.

7. Conclusions

The expansion of HE has often led to a greater emphasis in the degree of institutional, programmatic, and geographical diversity, as HE tried to cater for an increasingly diverse

population and for a growing set of missions and needs. In this article, we have tried to contribute to our understanding about the relationship between different types of HEIs and HE systems and other formal dimensions of diversity in HE (spatial, degrees, and programmatic). Our results indicate that more vocationally-oriented institutions' work as a driving force towards diversification at the regional level, especially in less urban areas, in countries with binary systems. Thus, vocational higher education seems to play a prominent role in supplying qualified labor at the regional level and in more peripheral regions. Moreover, and despite of the frequent claims about academic drift, we also found evidence that in several European countries vocational HEIs have kept a strong professional orientation that differentiates them from their university counterparts. However, this may be more the result of regulatory constraints than of explicit institutional strategies, something that would need to be examined in more detailed institutional studies.

On the other hand, when comparing binary and unitary systems, we have observed that the binary systems were not much more spatially diversified than unitary ones. Interestingly, the features presented by universities in binary systems (spatially less diversified and more diversified in terms of degrees and fields of science) did not seem to prevail in unitary systems. This suggests that in unitary systems there are other dynamics of differentiation that play a role akin to that played by vocational HEIs in binary systems, namely in terms of their regional implementation and the orientation of their study programs for professional purposes.

Overall, our results suggest that HE systems are responsive to local and regional needs, regardless of the degree of sectoral differentiation. This responsiveness means that

certain types of diversification may happen either through sectoral differentiation (as in binary systems) or through institutional differentiation (in unitary ones) as the differences regarding programmatic or scientific breadth do not seem to be substantial when comparing the two types of HE systems. This result seems to be particularly relevant given the tensions often emerging in policy circles regarding the need to differentiate missions and institutional profiles and the emphasis often placed upon sectoral differentiation in order to attain that purpose of greater responsiveness to diverse student and labor markets. Hence, it seems that contextual forces and regulatory forces may also contribute in a relevant manner to hinder or to enhance the various dimensions of diversification.

Our results also seem to confirm prior studies that there are tensions in binary systems that often lead to increasing closeness between university and non-university sectors through vocational and academic drifts, i.e., universities adopting some features of the non-university sector's mission and the latter covering some of the roles that were allocated to the university sector. One of the leading reasons for this seems to be the market pressures associated with both university and non-university sectors competing for the same pool of potential students, especially in a context of receding demographics, as it is happening in many European countries. Nonetheless, this would need to be complemented by a much more detailed analysis of the curriculum of different types of programs to understand to what extent generic similarities or differences are supported by content analysis.

Overall, our results indicate that diversification is a major feature of both binary and unitary systems and that HEIs seem to play an increasingly important role on regional

development, notably by the provision of qualified labor. Moreover, our results also indicate that there are different possible routes to attain that and that each system requires a specific set of regulatory tools to promote a diverse pool of graduates. Given the growing relevance of HEIs in regional development, we hope that this exploratory study will contribute to attract more attention and more empirical studies regarding the way different types of HEIs and systems may (or may not) contribute to enhance regional capabilities through the formation of diverse human capital and its matching with local needs.

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