

# Collaboration and competition in European higher education systems

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## 1 Introduction

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The aim of the paper is twofold. First, we will provide insight on collaboration patterns between Higher Education Institutions (HEIs) in Europe by matching data on links between web domains with structural characteristics of HEIs as derived from the EUMIDA dataset. Second, we will develop experimental test of the antecedents of cooperation, by taking into account geographical and institutional factors, as well as the extent of competition in research and educational markets. Finally, we will discuss the implications of these results for understanding patterns of collaboration and competition in higher education systems.

Theoretically, the paper builds on the literature on institutionalized markets ((White, 2002)) and on competition between spatial multipoint competitors ((Haveman & Nonnemaker, 2000)), as well as on recent empirical results on the characteristics of network formation between these competitors ((Lomi & Pallotti, Forthcoming)). Empirically, it builds on the census of higher education institutions developed in the EUMIDA project ((A. Bonaccorsi et al., 2010)), as well on interlink data provided by the Cybermetrics lab ((Ortega, Aguillo, Cothey, & Schanhorst, 2008)). Matching these two types of data allows providing novel insights on cooperation patterns between higher education institutions in Europe.

## 2 Background and theoretical framework

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### 2.1 Universities as spatial multipoint competitors

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The theoretical framework of this paper builds on the idea of higher education institutions as multiproduct organizations developing different profiles and competing on different markets, which are highly differentiated in terms of the characteristics of the product, their spatial location and their institutional setting, as related to different structure of higher education national policies ((A. Bonaccorsi & Daraio, 2007)). Research in the field has widely discussed the specific characteristics of higher education markets, related to their public nature (quasi-markets), but also to the specificities of the products delivered by HEIs ((Teixeira, Jongbloed, Dill, & Amaral, 2004)).

Unlike a conventional representation of markets as exclusively competitive arenas, where the relationship between producers and customers is solely mediated through price signals, higher education and research markets can be considered as highly institutionalized social settings ((White, 2002)), where meaningful economic exchange – like buying research services – can take place only in the context of shared norms and values – for example concerning definition and operationalization of research quality –, as well as of a dense set of network ties which allow the construction of trust, signaling and the sharing of information ((Spence, 2002)).

Hence the notion that markets mostly function as coordinating devices between actors ((Lepori, 2011)) and that in institutionalized markets organizations competing in the same niche are more likely to cooperate ((Ingram & Yue, 2008)). The mechanisms which have been discussed in the literature include symbiosis, mutual forbearance, deterrence and collusion to exclude other competitors from markets.

In the case of higher education institutions, products markets are highly differentiated according to the type of product, its quality, but also the spatial location; available data show that educational markets at the bachelor level and to a lesser extent at the master level are strongly localized in regional or, at most, national settings, whereas PhD education is much stronger internationalized; academic research markets tend to be highly international in terms of products and reputation (e.g. scientific publications), but less in terms of competition for resources, where national settings are prevalent, while knowledge transfer might have a global reach for cooperation with multinational companies, whereas it is more localized for transfer towards small and medium enterprises.

This organization of markets implies that in many cases two universities will compete at the same time on multiple market segments with a different spatial reach, e.g. competing for bachelor students at the regional level, whereas competing for academic reputation at the international level; hence, HEI become a case of what is known as multipoint spatial competitors ((Haveman & Nonnemaker, 2000)).

Our hypothesis is thus that the strength of collaborative relationships between HEIs will be influenced by the extent to which these HEIs are competing on the same market, e.g. we expect that HEIs competing at the same time for students in the national markets and for reputation at the international level will show stronger cooperation than those competing just on the student national market. Of course, this patterns of market-related cooperation will be superposed to other forms of relationships related to belonging to the same institutional space, to the same country, linguistic region or to the same legal type of HEIs (e.g. universities or colleges). As we will be able to match data on interlinks with structural data on HEIs, it will be possible also to control for these institutional factors and to try to disentangle the two effects.

We finally notice that this hypothesis implies that the creation of inter-organizational ties has a strong impact on the specific structure of each market segment, as it determines to a large extent the competitors present, the boundaries of the market and their relative position; hence, the proposed approach has strong implications for understanding how competition between HEIs and in (research and educational) markets take place.

To summarize, the objectives of the paper are the following.

- To test the feasibility of developing collaboration measures between HEIs by using interlinking data and matching these data with structural data on European HEIs.
- To test the hypothesis of stronger collaboration between HEIs positioned in the same market segments by using structural data on HEIs from the EUMIDA dataset and by controlling on other structural antecedents (type of HEI, language, country).
- To derive implications in terms of the competition in higher education systems and highlight their relevance also for policy and regulation of HEI markets

## 2.2 Using web-links to characterize university collaborations

In the recent years, the diffusion of the World Wide Web has offered a new data source to examine scientific collaboration beyond existing approaches based on co-authorships or citations derived from international databases ((Glänzel & Schubert, 2004; Noyons, 2004)), as well as from patent databases for technical collaboration ((Breschi & Lissoni, 2004)). Since the early '2000, a few studies have used Web site interlinking between the web domains of higher education institutions in order to characterize their patterns of collaboration ((Thelwall, 2002)). A few later studies provides valuable insights on smaller sets of HEIs, located in a single country, on the characteristics of web

links and on the determinants of collaborations ((Bar-Ilan, 2004; Vaughan, Kipp, & Gao, 2007)); these studies generally confirm that interlink analysis can be used to study relationships among universities. A recent large-scale study on European universities has showed a complex network structure, where national-based networks are superposed to a pan-European network between selected international universities ((Ortega et al., 2008)).

As compared to the use of co-authorship maps to analyze university cooperation, this approach is attractive for two reasons: first, it allows to take into account also collaboration related to other institutional activities, like education and knowledge transfer and, second, it allows extending the analysis to a broader set of institutions beyond the most visible international universities towards including regional universities and non-university type of institutions. This is particularly relevant when addressing multipoint competition, as even international universities are likely to compete with regional HEIs in some specific markets, like undergraduate education and transfer.

### 3 Data sources and methods

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Besides the originality of the theoretical approach, which leads to specific predictions to be tested, the novelty of this work comes from the fact that, for the first time, it is possible to match for a large-scale sample webometrics data with structural characteristics of HEI on a large and international samples of organizations, covering all European countries. Previous studies either worked on a smaller national context ((Bar-Ilan, 2004; Vaughan et al., 2007)) or relied on webometrics data only ((Ortega et al., 2008)). We shortly explain below the characteristics and availability of data, as well as the type of analysis foreseen.

*Organizational data.* These will be derived from the EUMIDA dataset, which includes basic data on HEIs in 27 European countries for the year 2008. Total number of organizations in EUMIDA is about 2,500, but the analysis will be limited to the smaller set of research-active institutions, about 1,400 HEIs, including almost all doctorate-awarding HEIs.. For these HEIs, a set of data has been collected which includes information on students and degrees (by level of education and subject domain), staff, revenues and expenditures, geographical location ((A. Bonaccorsi et al., 2010)).

*Interlinking data.* The interlinking data were collected from two different mirrors of the Yahoo! Search engine, both using the same database. We use the Spanish (es.yahoo.com) and the British (uk.yahoo.com) servers for quality control, as the automatic script was unable sometimes to extract the correct figures for one of the two sources. This was mainly due to restrictions in connections due to limited bandwidth available. The collection took place during several weeks in January 2011. This procedure was performed using the following syntax:

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linkdomain:univdomain1 +site:universitedomain2
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The total number of requests were 344450 (twice 415\*415) as the chosen population consisted of 415 European universities that were ranked among the Top 1000 Higher education institutions of the 2010 edition of the Ranking Web of Universities, also known as Webometrics Ranking ([www.webometrics.info](http://www.webometrics.info)). The main webdomain of each university were selected, except when the university has more than one central domain. In those cases, both domains were ranked and the best one was chosen (sometimes being the older, not the current one). We plan to extend the coverage to the whole of EUMIDA research active institution by spring 2011.

Each web domain will then be related with the name of HEIs in EUMIDA dataset in order to allow the matching of the two datasets. As the EUMIDA database includes both information on name and geographical location at NUTS3 level, we anticipate that this will be a relatively straightforward exercise.

*Analysis of the collaboration patterns.* The matrix of interlinks between HEIs in the sample will be analyzed by using social network analysis techniques, both through standard regressions and through Exponential Random Graph Models in order to look to the overall structure and connectivity of networks ((Lomi & Pallotti, Forthcoming)).

As input of this analysis we will use both potential structural antecedents of cooperation from the EUMIDA dataset (country, types of HEI, language) and measures of the overlap between market niches of HEIs build by using EUMIDA data on geographical localization, subject specialization in education, share of foreign students and research intensity (based on number of doctoral students).

This analysis will provide both measures of antecedents of HEI cooperation and insights on the overall structure and connectivity of HEI networks.

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