Competition for talent. Country and organizational-level effects in the internationalization of European Higher Education Institutions

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Abstract

This paper analyzes the competition for skilled human resources between European Higher Education Institutions (HEI) through a multi-level model predicting their ability to attract foreign researchers. Predictions of the model are tested on a dataset on internationalization of 601 HEIs in 8 European countries. We show that (1) the model is able to explain a large proportion of the variance in the levels of internationalization of academic staff between HEIs; (2) country factors are more important than HEIs' characteristics in driving internationalization; (3) research-oriented HEIs in attractive countries have a larger share of international staff, whereas this happens only to a limited extent with similar HEIs in low attractive countries; (4) the association of research orientation with internationalization is mediated by the HEI's international network.

These results have relevant implications for HEI's hiring strategies, as well as for national policies concerning careers and the mobility of researchers. We suggest that policies should be tailored to structural conditions of HEIs and countries, whereas imitating the approaches of highly attractive places might be damaging. Less-attractive countries should rather focus on training and career opportunities for young national researchers, as well as on instruments to keep linkages with national expatriates.

Keywords. Competition for talent. Internationalization. Queuing models of labor markets. Higher Education, multi-level models.

1 Introduction

The ability to attract skilled people is considered a central dimension of the competition between organizations, especially in knowledge-intensive sectors (Schultz 1961; Grant 1996). In the private sector, a number of studies investigate the antecedents of employee mobility, firms recruiting strategies (Marx, Strumsky and Fleming 2009), as well as the implications of employee mobility for organizational survival (Wezel 2006), for diffusion of knowledge in the industry (Agrawal, Cockburn and McHale 2006), and between public research organizations and companies (Almeida and Kogut 1999, Breschi and Lissoni 2009; Edler, Fier and Grimpe 2011). While most studies focus on regional or national contexts, competition for skilled workers at the international level is becoming increasingly important (OECD 2008, Freeman 2010).

Competition for people is even more relevant to public research organizations as it can be argued that in public research competition between organizations mostly takes places through the acquisition of skilled researchers (Bozeman, Dietz and Gaughan 2001).

Empirical studies also display associations between mobility and quality at the individual, organizational, and country level. Mobile researchers are on average more productive than non-mobile ones (Cruz-Castro and Sanz-Menéndez, 2010; Horta, Veloso and Grediaga 2010), while inside universities foreigners are more productive than nationals (Mamiseishvili and Rosser 2010; Gaulé and Piacentini 2012). At the organizational level, highly reputed universities display higher shares of academic staff from abroad (Horn, Hendel and Fry 2007, Horta 2009). At national level there is evidence that foreign-born research contributes disproportionately to US science (Levin and Stephan 1999).

The available data points to the increasing international mobility of academics (Ackers and Gill 2008; MORE 2010), as an outcome of changes in the academic profession (Welch 1997, Enders and Musselin 2008), as well as to international competition between universities for skilled researchers (Horta 2009). Flows of researchers from Europe to the US (De Grip, Fouarge and Sauermann 2010) raise concerns about the risks of brain drain and its negative implications for national research systems (Davenport 2004).

In this context, the objective of this paper is to provide evidence on the factors accounting for the ability of Higher Education Institutions (HEI) to attract foreign academics. More specifically, we focus on the relative importance of the characteristics of the considered HEIs on the one hand and those of the hosting country on the other hand.

Indeed, surveys of academics show that their mobility decisions are largely driven by the reputation of host HEIs, the research resources available, and the match between the job position and their research interests (Agarwal and Ohyama 2013; De Grip, Fouarge and Sauermann 2010, Ivancheva and Gourova 2011). At the same time, HEIs are embedded in national systems which are expected to influence the attractiveness towards researchers from abroad through factors well known in migration studies, including national wealth and wages (Ehrenberg and Smith 2011), opportunities for highly-skilled workers (Borjas 1987), regulations and structures of academic labor markets (Musselin 2004; Enders and Musselin 2008). To our knowledge, the relative importance of organizational and country factors in academic mobility has never been investigated, despite being critical in understanding international competition for skilled people.

In this respect, our paper offers three main contributions. First, by combining two complementary streams of literature – economics of migration on one hand (Borjas 1987, Ehrenberg and Smith 2011) and queuing theories of labor markets on the other (Reskin 1991) – we develop a multi-level model to explain the ability of HEIs to attract foreign researchers, which includes country-level and HEI-specific factors.

Second, we test our predictions by exploiting a newly developed dataset on the internationalization of HEIs in a number of European countries (Lepori and Bonaccorsi 2013). We demonstrate that (1) the model is able to explain a large portion of the variance in the share of foreign academic staff in our sample; (2) country factors

are more important than HEIs' characteristics in driving internationalization; (3) research oriented HEIs in attractive countries display a high level of internationalization, whereas it remains comparatively limited for highly reputed HEIs in low attractive countries; (4) the association of research orientation with internationalization is mediated by the international network of the considered HEI.

Third, we discuss implications for HEI's hiring strategies, as well as for national policies concerning careers and the mobility of researchers. We suggest that policies should be tailored to the specific conditions of HEIs and countries, whereas imitating the approaches of highly reputed places might be counterproductive. Less-attractive countries should focus on developing training and career opportunities for young national researchers (Heitor, Horta and Mendonça 2014), as well as on instruments to keep linkages with expatriates, to increase return mobility (Baruffaldi and Landoni 2012). At the organizational level, recruitment and human resource management strategies need to be tailored to the specific academic segment where HEIs are competitive.

2 Theoretical framework

To analyze the international mobility of academics, we focus on two different processes: (1) the decision to move from one country to another and (2) the matching between applicants and jobs on the academic labor market (Becker 1973). While most studies treat them separately, dealing first with determinants of international flows, and second with the fate of immigrants in domestic labor markets, the characteristics of the academic labor market require dealing with both processes simultaneously.

Determinants of migration decisions. Micro-economic models explain the decision to move as the outcome of a utility maximization process, where migrants compare the fixed costs of mobility with the (uncertain) opportunities offered by the hosting country's labor market (Massey, Arango, Hugo, Kouaouci, Pellegrino and Taylor 1993; Ehrenberg and Smith 2011), in relation to general macroeconomic conditions like the level of wages and employment rates (Todaro 1969, Borjas 1990, Arango 2000, Todaro and Smith 2011). Self-selection effects related to skills of potential migrants are important, especially when analyzing migration between rich countries (Borjas 1987). Therefore, migrants generally do not constitute a random sample of the workers in their home country.

Economics of science supports the insight that scientists are highly rational in their career and mobility choices, maximizing their life-time utility (Agarwal and Ohyama 2013; Stern 2004), but subject to social norms of science where, especially for academic researchers in the public sector, non-pecuniary rewards like reputation and intellectual challenge are highly important (Stephan 1996).

Surveys confirm that the most important factors influencing the migration decisions of academics are related to research, like the reputation of the HEI, the availability of financial resources (e.g. infrastructure, hiring of researchers), the match between one's own research interests and the profile of the position offered (De Grip, Fouarge and Sauermann 2010, Ivancheva and Gourova 2011); with economic factors like salary level coming

second. Expectedly, studies of academic mobility show that international mobility tends to increase with the reputation of researchers, as the potential benefits are larger (van Bouwel 2012).

Queuing models of labor markets. While microeconomic approaches assume that the matching between supply and demand of work takes place through changes in wage levels, queuing models build on the insight that labor markets are characterized by wage rigidity and permanent disequilibria; accordingly, in the hiring of workers, the match between people and jobs is considered to be the central process in determining the distribution of worker's groups between occupations (Sorensen and Kalleberg 1981; Fernandez and Mors 2008). These characteristics are shared by academic labor markets; where wages are almost fixed, there is a structural excess of labor supply, and micro-level matching between individuals' competences and job specifications are central to the hiring process (Agarwal and Ohyama 2013).

Queuing models represent labor markets as a set of queues: employers rank the workers willing to fill a particular job in order of their preferences, while workers rank all jobs available to them. The matching process takes place as employers hire workers as high as possible in their labor queue, whereas workers accept a job as high as possible (Reskin 1991). These models have been extensively adopted to explain segregation mechanisms (e.g. based on gender) between groups of workers (Petersen and Saporta 2004).

A key insight of queuing approaches is that much of the segregation is generated at the early stages of the hiring process – when individuals decide whether to apply for a job and are sorted into different queues while progressing through the process (Fernandez and Mors 2008; Fernandez-Mateo and King 2011). These studies demonstrate that explicit employer preferences are not the main mechanism accounting for segregation and point to the role of social networks in reproducing the existing social structure of employees through job referrals (Fernandez and Fernandez-Mateo 2006).

There is evidence of the importance of these mechanisms in academia, as the academic world is characterized by enduring social stratification and hierarchies both at the departmental (Weakliem, Gauchat and Wright 2012) and university level (Webster 1992). This translates into a phenomena of social closure and the emergence of systematic patterns in hiring, where core departments almost exclusively hire PhD graduates from other core departments, whereas peripheral departments tend to be colonized by the core ones (Han 2003, Burris 2004).

2.1 A multi-level model of academic migration

There are strong arguments for queuing models in academic labor markets (van Bouwel 2012), as these are structured around lasting prestige hierarchies of HEIs determining both workers' rankings of potential jobs and employers' rankings of applicants (Allison and Long 1987, Burris 2004).

Therefore, we represent the hiring process as a set of queues characterized by different job levels and worker's quality. Moreover, HEIs are embedded in countries characterized by different levels of *attractiveness* for

foreign academics. In this process, the HEIs will select the best candidate in their employees queue, whereas workers will choose the best position available in their queue.

We do not assume that HEIs have explicit preferences for nationals, when the quality of the candidates is similar. While they could be preferred because of linguistic reasons and knowledge of national context, HEIs are also informed that foreigners tend to perform better in terms of scientific production (Franzoni, Scellato and Stephan 2012).

Therefore, we assume that the largest part of the difference in internationalization of HEIs is generated by variation in the composition of their applicant's queue. We suggest that both country and HEI factors influence the share of foreigners in the HEI queue.

a) *Country attractiveness* is expected to influence the number of foreign hires through two mechanisms. On one hand, given the costs of screening international positions, foreigners are expected to focus on a limited number of potential sites and to prioritize those in the more attractive countries, as they have a higher chance of finding suitable positions there. The same mechanism is expected to apply through each stage of the hiring process: for instance, when they are invited to interviews, candidates will select a limited number of sites, and for similar quality, prioritize HEIs in more attractive countries, as this provides additional benefits – like better employment for partners, better opportunities to change jobs, etc.

Therefore, even if academics value primarily the HEI quality, they will tend to be sorted into more attractive countries. Two characteristics of academic hires are likely to strengthen this effect: on one hand, in academia, horizontal or downward mobility is more frequent than upwards mobility, and accordingly, applicants at a given level of quality are expected to be offered a number of similar positions in terms of quality in different countries. On the other hand, the academic hiring process is particularly complex, where candidates go through different stages, from screening job openings, to submitting a dossier, to interviewing, and to final negotiation – thus sorting effects are more powerful.

b) *HEI characteristics* are expected to influence the share of international applicants through different mechanisms. First, more research oriented and less teaching oriented HEIs will be more attractive to potential applicants; since this applies both to nationals and foreigners, it would not *per se* generate differences in internationalization. However, mobility increases with the level of quality (as the pay-off of mobility is larger for high-quality workers): therefore, the worker's queue of high quality HEIs will still comprise a higher share of foreign candidates.

Second, in the academic job market, information about open positions is mostly conveyed through peer networks and direct contacts of resident faculty (Murray et al. 1981). Referred applicants – i.e. people to which the position has been advertised directly by colleagues and, possibly, have been encouraged to apply – are likely to have a better match with the position and therefore have higher chances of success. In the labor market literature there is consistent evidence of the importance of job referrals and that, therefore, hires tend

to reproduce the network of current employees (Marsden and Gorman 2001). Therefore, HEIs with a more international network are expected to attract a higher share of applications from abroad.

At the same time, there is empirical evidence that more research-oriented HEIs also have a more international network of collaborations (Seeber, Lepori, Lomi, Aguillo and Barberio 2012), a finding which is consistent with social stratification theories where the most reputed organizations (those more research-oriented in academia) are also better connected (Burris 2004). This provides a second mechanism through which research orientation is associated with higher shares of international staff, as mediated through the international network of the considered HEI.

This model foresees strong cumulative mechanisms: on the one hand, the level of international networking of HEIs is associated with their current stock of foreign academics (Jonkers and Cruz-Castro 2013), while in turn influencing the share of foreigners in the next round of hires. On the other hand, since internationally mobile researchers are on average more productive than nationals (Horta, Veloso and Grediaga 2010, Mamiseishvili and Rosser 2010), a larger share of foreign hires is likely to translate into the higher quality of an HEI.

We hold evidence that the layering of countries in terms of attractiveness, as well as of HEIs in terms of quality, is highly stable across a period of several decades. Accordingly, we expect that differences in the shares of foreign hires are lasting and translate into differences in the share of foreigners among total academic staff, being the dependent variable in our study. The cross-sectional design of our study is thus specifically aimed towards explaining lasting differences between HEIs in terms of internationality.

2.2 Hypotheses

H1. The level of internationalization of HEI staff increases with the level of national wealth, research investment, and the quality of the national research system.

As explained, our model foresees that country attractiveness increases the level of internationalization of HEIs because of sorting effects, even if academics in their hiring decisions mostly consider HEI quality. National wealth is a central factor in attracting people in most migration studies; research investment and the quality of the national research system are measures of the sector-specific opportunities offered by countries.

H2. The share of international staff of HEIs increases with research orientation and decreases with teaching load.

This hypothesis is a consequence of the model, since surveys of academics show that the main criteria for academics to evaluate the quality of job offers are characteristics like international reputation, intensity of research and low teaching load and the share of foreign applicants increases for high-quality positions.

Teaching load is also expected to have a direct effect on the selection process, since teaching-oriented HEIs are likely to have an explicit preference for nationals because of language and better knowledge of the national context.

H3. We expect that the share of international staff of an HEI increases with its level of international networking and that the relationship between HEI research orientation and the share of international staff is mediated by the HEI's international network.

This hypothesis is a consequence of the importance of job referrals in the hiring of academics: when an HEI has more international relationships, potential foreign applicants are better informed on job opportunities and motivated to apply through these relationships. Further, more research-oriented HEIs are also expected to display a more internationally-oriented network, thus leading to the mediation effect.

We control in the regressions for other HEI characteristics, which might influence their level of internationalization. These include the legal status, their size, the geographic centrality of the city where the HEI is located, since it is an important factor in the relocation of people (Taylor 2004), and the disciplinary composition, as levels of academics' mobility are higher in Natural and Technical Sciences (Cañibano, Otamendi and Solís 2011).

H4. The association between the share of international staff and HEI characteristics becomes weaker with decreasing country attractiveness.

This hypothesis deals with the interaction between country attractiveness and HEI characteristics and is justified by the sorting effect of country attractiveness. Namely, when a high-quality HEI is located in a low-attractive country, most of the potential foreign hires will sort out of the applicant's queue during the hiring process when they get offers from equivalent HEIs in more attractive countries. Moreover, these HEIs will receive a larger number of national applications given their high relative quality in the country. Therefore, the difference in internationalization between HEIs is expected to decrease with decreasing country attractiveness.

3 Methodology and data sources

3.1 Sample

Our sample is composed by 601 HEIs in eight European countries, namely Germany, Italy, Latvia, Lithuania, Slovenia, Spain, Switzerland, and the United Kingdom. The largest number of observations are in Germany (288), the UK (127), and Italy (75).

The sample has been derived from the European Micro Data dataset (EUMIDA), a dataset covering most of the higher education field in European Union countries, Norway and Switzerland. EUMIDA provides data derived from national statistical sources for the year 2009 at the level of individual HEIs on staff, students, graduates, organizational characteristics. Data on foreign academic staff are available only for the eight considered countries. 12 cases have been excluded because of missing data or their specific features (graduate schools with only PhD students; distance education universities).

The coverage of our sample in the considered countries is quite extensive, since it includes all PhD awarding HEIs, as well as a large number of non-doctorate awarding institutions and covers about 78% of all

undergraduate students in tertiary education and nearly 100% of PhD students. Accordingly, we do not expect significant biases in this respect, while the limited number of countries and the unequal distribution of cases by country raise a few robustness issues.

For purposes of descriptive analysis, we further employ country-level data on foreign staff for a larger set of 18 countries for which we hold aggregated data.

3.2 Internationalization

We measure *internationalization* through the share of foreign academic staff (*share foreign academics*), defined as academics not having the nationality of the country (UOE 2006). It includes employees who are mostly involved in education and research, excluding technical and administrative personnel.

This implies that some foreign staff might have entered in the country before being hired as academics, including foreigners born in the country and those immigrated for study reasons. Therefore, some differences between countries in the share of foreign academic staff might be due to their general attractiveness to foreigners rather than for academic hiring directly. However, would most foreign academic staff have been educated in the country, there would be no reasons why they would be distributed differently than nationals across HEIs (as shown by our data).

Moreover, in some countries PhD students might be included among academic staff: we consider that their mobility has different characteristics when compared to academics (largely temporary, more distributed geographically, quality is less measurable); since practices in this respect vary among the considered countries, our cross-sectional design minimizes the risk that this might bias our results.

Since we hold data on total staff (and not on new hires), it is critical that our independent variables are stable for a period comparable to the mean renewal time of academic staff. We consider a timeframe between 10 and 20 years to be reasonable, since academic staff does not only include tenured professorial positions.

3.3 Country-level variables

In our analysis, we use a single country-level variable labeled *attractiveness*, which is meant to summarize country-level factors making a country more attractive to foreign researchers.

Scores of attractiveness are constructed from four indicators:

- *Higher Education Research and Development Expenditures per inhabitant in purchasing power parities (HERD)*. This indicator measures the national research investment in higher education, normalized by the size of the country and corrected by national price differences. The data used is from EUROSTAT (2008).
- *Number of researchers in the higher education sector as a percentage of the total workforce*. This indicator measures the amount of research positions offered in the national higher education system, normalized by the demographic potential of country. The data used is from EUROSTAT (2009).

- *Average impact of national scientific publications*. This indicator is calculated by averaging the number of citations to national publications, normalized by the world average for each scientific field (van Raan 2004). The relative citation impact for the years 2001-2005 has been used (source: OECD). Data is missing for Bulgaria, Latvia, Lithuania, and Slovenia. Missing values were interpolated based on HERD, which is correlated to 0.90 for the remaining 14 countries.
- *Gross Domestic Product (GDP) per Inhabitant in purchasing power parities* as an indicator for overall country wealth. Source: EUROSTAT (2009).

These indicators are strongly correlated for the 18 countries in which we hold data on foreign academic staff, the highest correlation being between HERD and GDP (0.87), respectively quality (0.90). These correlations point to wide-ranging relationships where wealthier countries are at the same time investing more in research and producing higher levels of research quality.

A factor analysis extracts a single factor explaining 79% of the variance in the four indicators; we use regression scores as a measure of *country attractiveness*. Attractiveness is highly correlated with other variables, which might explain the share of foreign academics, such as salaries of professors (0.844**; nine countries), share of foreign population (.594**), and share of foreign PhD students (.785**), thus displaying the robustness of the construct.

To test the stability of attractiveness, we constructed regression scores on the three indicators for which historical data is available (GDP, HERD, and number of researchers) for the year 1998; the resulting scores are correlated to 0.93** with those for the same variables in 2009. While we do not hold historical data on publication impact, it is likely that they are very stable as well, given the strong stability of reputational hierarchies in academia. Overall, attractiveness scores are likely to be very stable on a timeframe relevant for our investigation.

International advertisement. Based on different sources (EURYDICE 2008; Fernandez-Zubieta and Bavel 2011), a dummy was constructed to identify the countries where academic positions are regularly advertised internationally.

3.4 University-level variables

We introduce four measures associated with research and teaching orientation.

Reputation. We use the product between normalized impact factor and total number of publications of the concerned HEIs (“brute force” indicator; van Raan 2008), normalized with the number of academic staff. This indicator builds on the insight that the international visibility of an HEI is related both to quality and the number of publications. Data is derived from the SCIMAGO institutional rankings for the year 2011 (http://www.scimagoir.com/), which is based on data from the period 2005-2009. We have data for 277 HEIs in the dataset – the other HEIs are not covered since they had less than 100 publications in Scopus in the reference period. Despite normalization by size, this indicator remains correlated with output (as a result of

scaling properties of research output; van Raan 2008); accordingly, when the level of output approaches the threshold, it approaches 0 as well. We then set the indicator to 0 for the remaining HEIs in the sample.

Research intensity. The share of PhD students over undergraduate students is a widely used indicator of research intensity (Bonaccorsi, Daraio, Lepori and Slipersaeter 2007).

Teaching load. Teaching load is calculated as the number of undergraduate students per unit of academic staff.

University type. Two countries in our sample (Germany and Switzerland) are characterized by binary higher education systems, with two types of HEIs holding different status, where so-called Universities of Applied Sciences (UAS) are expected to focus more on professional education and regional transfer without the right to grant a doctorate (Kyvik and Lepori 2010). Accordingly, we introduce a dummy variable which is 1 for universities and 0 for UAS

Expectedly, these four variables are significantly correlated, the largest correlation being between reputation and research intensity (.503**) and the smaller between teaching load and the university type (-187**). In order to reduce collinearity issues, we extract two main factors, which account for 84% of the variance in the original variables, and we use their respective regression scores as independent variables. The first factor loads strongly on reputation and research intensity and is therefore labelled as *research orientation*, the second factor loads strongly on teaching load and is therefore labelled *teaching orientation*.

Further, we control for a number of characteristics, which might influence the level of internationalization.

Disciplinary characteristics. We introduce dummy variables to characterize HEIs, which by their disciplinary composition are expected to display a higher share of international academic staff. We consider two cases: *technical HEIs* (share of students in natural and technical sciences above 50%) on the one side, and *business HEIs* as well as a few cases of internationally oriented subjects (for example universities in international or oriental studies) on the other. These cases have been coded by hand based on descriptive information.

Border HEI. This dummy variable characterizes universities near the national border and whose official language is the same as in neighboring countries, hence we expect a higher share of international staff.

Urban centrality. We use the Globalization and World Cities Network (GARC) classification of cities 2010 (Taylor 2004; http://www.lboro.ac.uk/gawc/world2010.html). We attribute to cities a numeric score from 1 (alfa++ cities) to 9 (gamma- cities) and then we compute 1/score, setting missing values to 0; thus our variable takes the value 1 for London, 0.33 for Frankfurt, Madrid, and Milan, and then it decreases towards 0.

Legal status. We introduce a dummy for *private HEIs* (including government-dependent private), following definitions in educational statistics.

Size. We measure size as the number of *total staff* (Full Time Equivalents measured in thousands), also including administrative and technical personnel.

To measure the impact of social relationships, we introduce as an indicator of *international collaboration* the share of publications with a foreign co-author (*international co-publications*) derived from the SCIMAGO institutional ranking. Data for 277 HEI's are available.

It is slightly problematic to ascertain the stability of HEI-level indicators. There is evidence that, while higher education displays strong dynamics of growth across time, the structure of the system remained remarkably stable: in Europe, the largest and most reputed universities have been founded in the Middle Ages, whereas rapid growth is found for smaller and more teaching-oriented HEIs (Bonaccorsi and Daraio 2007). In our dataset, more than 1/3 of the HEIs have been founded after 1970, but these only account for 1/5 of the total academic staff. Concerning reputation, historical analysis displays stability of HEI hierarchy over a period of several decades (Webster 1992). While we cannot exclude changes for a few HEIs, we do not expect this to influence overall results as the core of the system is composed by old and very stable organizations.

3.5 Analyses and models

First, we perform an analysis at the country level using aggregate values for the share of foreign academic staff. This analysis can be performed on a larger number of countries, but it does not consider the impact of HEI characteristics. We also compare staff results with PhD students to investigate whether country attractiveness has a similar impact on their internationalization.

Second, we provide descriptive statistics for university-level data to analyze the relative importance of country vs. HEIs characteristics, to compare distributions across countries and to identify (country-level) outliers.

Third, we run regression models in order to analyze the impact of independent variables on the proportion of foreigners among total academic staff. This variable can be interpreted as the average of n_{jk} binary variables, assuming the value 1 if the academic position is occupied by a foreigner and 0 if it is occupied by a national, while n_{jk} = total number of academics in HEI j within country k. As a matter of fact, the share of foreign academic staff it is the outcome of a number of (largely independent) events of hiring, in which there has been a matching between the job position offering and the interests of the candidates.

We are interested in predicting the proportion of successes for each group (i.e. HEI):

$$P_{jk} = \overline{Y}_{jk} = \frac{1}{n_{jk}} \sum_{1}^{n_{jk}} y_{ijk}$$

Where y_{ijk} are binary variables that can be conveniently modelled through a logistic regression. Therefore, we estimate the following multi-level model (Snijders and Bosker 2004):

$$logit\{P_{jk}\} = \beta_0 + \beta_1 x_{jk} + \beta_2 x_k + u_{jk} + u_k \quad (1)$$

$$\text{VAR}(\varepsilon_{ijk}) = P_{jk}(1 - P_{jk})/\, n_{jk} \quad (2)$$

Where P_{jk} is the proportion of foreigners in the HEI j within country k, whereas x_k are the country-specific covariates and x_{jk} are the HEI-specific covariates. The HEI-level random intercept u_{jk} takes into account that hiring decisions within the same HEI are not (conditionally) independent, whereas the country-level random intercept u_k takes into account within-country correlations.

Since for this type of models maximum-likelihood estimates are known to provide biased results, we estimate the model through Bayesian Markov Chain Monte Carlo methods (Snijders and Bosker 2004; MCMC), which produce chains of model estimates and sample the distribution of the model parameters. Models up to 500,000 iterations were run in order to obtain good levels of convergence.

We provide two measures of fit. First, $R^2_{dicho}$is calculated as the ratio of variance of the linear predictor, divided by the total variance:

$$R^2_{dicho} = \frac{\sigma^2}{\sigma^2 + VAR(e_{ijk}) + VAR(u_{jk}) + VAR(u_k)}$$

Where σ^2 is the variance of the linear predictor. It can be interpreted as the amount of total variance in the model which is explained by the independent variables, excluding the random effects (Snijders and Bosker 2004).

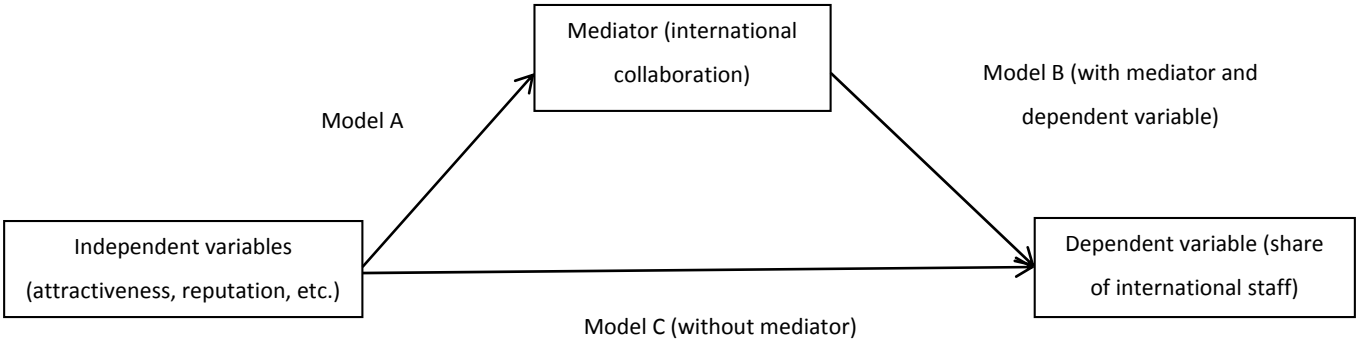
Second, R^2_{pseudo} is calculated as follows:

$$R^2_{pseudo} = ESS = 1 - \frac{\left(\sum_{jk} E(P_{jk}) - HEI_{jk}\right)^2}{VAR(HEI_{jk})}$$

Where $E(P_{jk})$ is the expected value of the share of foreigners from the model, whereas HEI_{jk} is the observed share for HEI j within country k. This definition is identical to the R^2 measure for linear models, even if in our case it does not have the same statistical meaning, as it is not assumed that errors are normally distributed. However, it is informative of the ability of the model to reproduce the observed values. Since the logistic function is not linear, $E(P_{jk})$ cannot be calculated from the linear predictor alone, but requires simulating random draws from the variance functions and averaging the scores.

To test the mediation of effect of international collaboration we adopt a procedure which involves estimating a set of different regressions (MacKinnon 2007; Figure 1).

Figure 1. Mediation model (adapted from MacKinnon 2007**).**



In a first step, the model without the mediator is estimated, as for mediation, it is essential that there is a relationship between independent and dependent variables (model C). Second, a model is estimated *with the mediator as a dependent variable*, as for mediation to hold, the mediator has to be associated with the independent variables (model A). This model is specified in the same way as the models for foreign academic staff, but with n_{jk} = total number of publications of HEI j within country k (since the dependent variable is the share of publications with international collaboration). Finally, a model for foreign academic staff is estimated including both the independent variables *and* the mediator (model B): in case of full mediation, the effect of the independent variables is absorbed by the mediator and hence its coefficient becomes non-significant, in the case of partial mediation, the coefficients become smaller but remains significant.

To assess whether the mediation effect is statistically significant, a test is run combining the significance of the relationship between independent variables and mediator (model A) and the one between mediator and dependent variable (model B) (Sobel test; MacKinnon, Lockwood, Hoffman, West and Sheets 2002).

4 Results

4.1 Country-level data

Table 1 displays the share of foreign academic staff and PhD students at the country level for 18 countries.

Table 1. National level data

Sources: foreign staff data from the EUMIDA database; data for additional countries has been retrieved from EUROSTAT and from ERAWATCH national reports (Belgium, Bulgaria, Czech Republic, Denmark, France, Hungary, Norway, Poland, Portugal). Data are based on staff numbers, not on HEI averages. Data on foreign PhD students from Eurostat.

Country	% foreign staff	% foreign PhD	Attractiveness	Int. advertisement
Belgium	0.05	0.32	0.63	0
Bulgaria	0.01	0.06	-1.49	0
Czech Republic	0.04	0.1	-0.81	0
Denmark	0.11	0.2	1.43	1
France	0.07	0.41	0.22	1
Germany	0.097	0.09	0.33	1
Hungary	0.02	0.07	-0.88	0
Italy	0.028	0.08	-0.08	0
Latvia	0.02	0.01	-0.66	0
Lithuania	0.02	0.01	-0.46	0

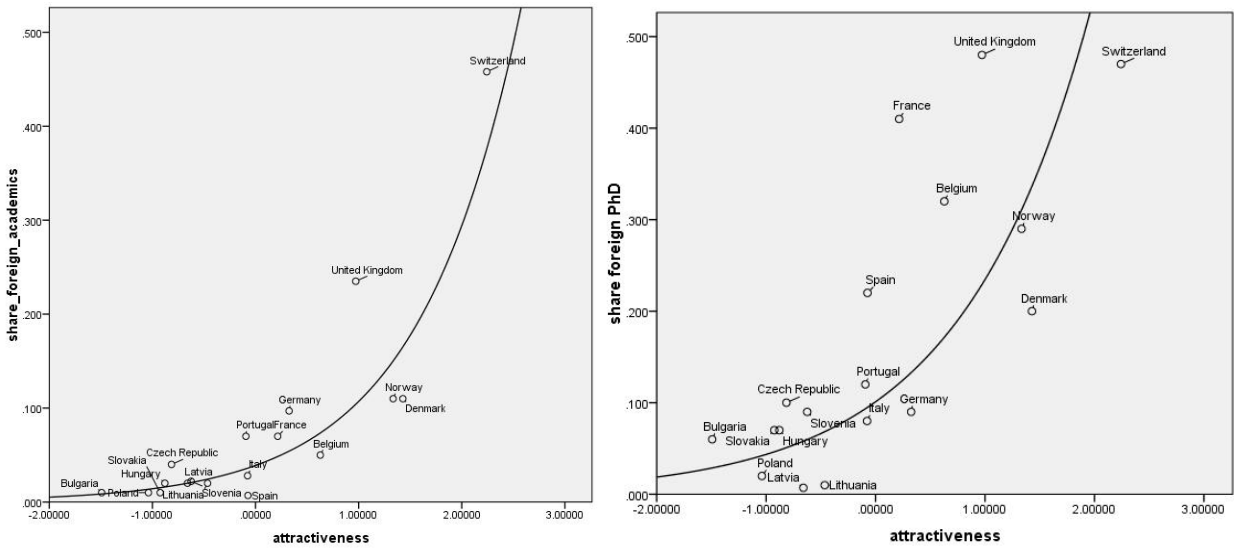
Norway	0.11	0.29	1.33	1
Poland	0.01	0.02	-1.04	0
Portugal	0.07	0.12	-0.09	1
Slovakia	0.01	0.07	-0.92	0
Slovenia	0.022	0.09	-0.62	0
Spain	0.007	0.22	-0.07	0
Switzerland	0.458	0.47	2.24	1
United Kingdom	0.235	0.48	0.97	1

Switzerland emerges as the most internationalized system, with 46% of foreign academic staff, followed by the UK with 24%. Also Germany shows a high share of foreign academic staff, while Italy, Spain, and Eastern European countries have marginal shares. Results for foreign PhDs are similar, but internationalization is spread to a larger group of countries and there are fewer countries with very low shares of foreigners.

There is a strong correlation between the attractiveness index and the share of international staff. A logistic function, which is expected as we are measuring proportions, yields a R^2 coefficient of .75 (Figure 2). Correlations with the composite indicator of attractiveness are higher than with individual indicators, supporting the assumption that attracting foreign employees is driven by the aggregate of national characteristics. Data on foreign PhD students provides similar results, but with slightly lower levels of fit (R^2 .46).

Figure 2. Internationalization at country level

X axis: attractiveness. Y axis: % of foreign academic staff (left) and of foreign PhD students (right).



When considering academic staff there is little evidence of any influence of language – only the UK being slightly above the fit line – for PhD students four countries are situated above the regression line, namely the UK, France, Belgium, and Spain. These countries share a widely spoken international language, but also the characteristic of having been colonialist countries: a large influx from their former colonies might account for the higher share of foreign PhD students. This does not have a similar impact on the share of foreign academic staff as many of these students are expected to come back to their home country after earning their degree.

Further, there is a significant difference in the share of foreigners between countries who advertise internationally academic staff positions (median .11 against .02; p<.001 Mann-Whitney two-tailed test) and PhD students (median .29 against .07; p<.01). However, the same applies for attractiveness (median .97 against -.66; p<.001), thus displaying that attractive countries are at the same time internationally open.

Country-level analyses provide some relevant insights: first, internationalization of academic staff is strongly associated with country characteristics, including research quality and research investment, which are in turn highly correlated among them; the same applies for PhD students, indicating that country attractiveness has a similar impact on both. Second, there is no evidence that language matters for attracting academic staff, while language (and past colonialist relationships) are relevant for attracting foreign PhD students. Finally, more attractive countries tend to be more internationally open in their recruitment.

4.2 University-level data: descriptive statistics

Descriptive statistics (Table 2) shows that some variables are strongly skewed; the median is much lower than the mean, reflecting the presence of a few cases with scores well above the mean.

Table 2. Descriptive statistics. N= 601

	Mean	Median	STDEV	Min	Max
Share foreign staff	.10	.05	.12	.00	.82
Country attractiveness	.44	.33	.60	-.66	2.24
Research orientation	.00	.24	1.00	-1.69	5.99
Teaching orientation	.00	-.05	1.00	-3.11	5.21
Urban centrality	.07	0.00	.20	.00	1.00
International co-publications	.37	.37	.08	.11	.64
Academic staff	1.71	.83	2.22	.01	13.96
	0	1			
Technical HEI	515	88			
Business HEI	581	22			
Border HEI	586	17			
Private HEI	520	83			

This applies particularly for our dependent variable, namely the share of foreign academic staff. There are 70 HEIs with no foreign academic staff, of which 35 are in Germany (mostly non-university HEIs), 16 in Spain, 13 in Latvia. At the same time, there are 9 HEIs - five in Switzerland, two in the UK, and one in Slovenia – where more than half of the staff members are foreign.

Table 3. Correlation table, N=601

	share foreign academic	Country attractiveness	Research orientation	Teaching orientation	Urban centrality	Int. coll.	Border HEI	Technical HEI	Business HEI	Private HEI	Academic staff
share foreign academic	1	.591**	.309**	-.362**	.301**	.558**	.337**	-.030	.179**	-.048	.147**
Country attractiveness		1	-.019	-.266**	.135**	.442**	.319**	-.019	-.031	-.131**	.002
Research orientation			1	.000	.223**	.543**	-.039	-.125**	-.003	-.168**	.544**
Teaching orientation				1	-.074	-.550**	-.149**	-.055	.036	.056	-.187**
Urban centrality					1	.104	-.042	-.003	.063	-.042	.114**
Int. coll.						1	.250**	-.059	.068	-.069	.171**
Border HEI							1	-.012	.018	.020	-.038
Technical HEI								1	-.081*	-.092*	-.010
Business HEI									1	.325**	-.119**
Private HEI										1	-.262**
Academic staff											1

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation table (Table 3) provides preliminary support to our hypotheses. As expected, the share of foreign academic staff is strongly correlated with country attractiveness, as well as to a slightly lower extent with research orientation and teaching orientation. Correlation with international collaboration is also very high, providing support to the hypothesis on the importance of international networks in attracting foreign academics. Correlations with most control variables are also significant with the exception of technical and private HEIs.

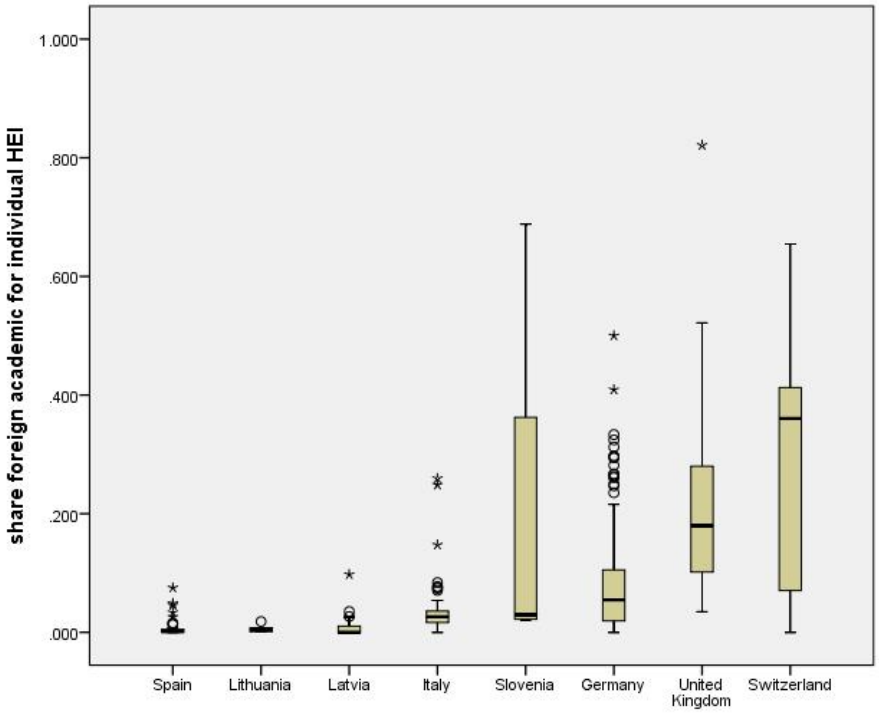
Correlations between independent variables are rather limited, with the exception of the correlation between research orientation and the number of academic staff, which is expected given the scaling effects in scientific production. International collaboration is strongly correlated with country attractiveness, research orientation and teaching orientation.

4.3 Distributional analysis

Consistently with hypothesis H4, boxplots by country display large variations at the HEI level in more internationalized countries (Switzerland and UK), but stronger homogeneity in less internationalized countries (particularly Italy and Spain; see Figure 3). Low levels of internationalization also characterize highly reputed universities in these countries, like the University of Milan (3% foreign staff), Autonomous University in Barcelona (6%), and Madrid (3%), while the only universities displaying higher levels of internationalization are either specialized (Bocconi; 15%) or in a very special geographical position (Bolzano; 26%).

Figure 3. Boxplot of the share of foreign academic staff per HEI grouped by country

Individual data points are shares of foreign academic staff per HEI. The lower level of the boxes is set to the 1Q, the higher level to the 3Q, the line in-between represents the median of each country distribution; the bars correspond to 5%-95% of the distribution. Individual points represent outliers and extreme cases. (Identified as values above the 3rd quartile of country distributions by more than 1.5 interquartile ranges, respectively 3 interquartile ranges). Slovenia contains only 4 HEIs, including a border HEI with a very large share of international staff (Nova Gorica).



Variance analysis provides further evidence. About 40% of the variance in foreign staff is at the country level, thus showing that both country and HEI differences are important (ANOVA random effects model). Further, there is a strong correlation between country means and variance, the correlation coefficient being 0.99 (excluding Slovenia which comprises only four universities).

Finally, 30 outliers are identified, most of them in countries with lower levels of internationalization and comprising about 3% of total academic staff in the sample. Their analysis is important for technical reasons, as these might impact regressions, and for substantive reasons, because they are informative of specific situations leading to higher levels of internationalization.

There are no outliers in Switzerland and one in the UK, which is the London Business School. The eight outliers in Germany are small-scale specialized HEIs, like art schools, business schools, and international universities; the eight Italian outliers include two business schools (Bocconi and Luiss), one border university (Bolzano), as well as a few specialized HEIs. On the contrary, the eight outliers in Spain include some of the largest universities (University of Barcelona, University Carlos III in Madrid); a closer look at the data shows that these are the only Spanish HEIs with a sizeable number of foreign academic staff.

4.4 Determinants of internationalization at the university level

Table 4 summarizes the results of the binomial regressions with the share of foreign academic staff as the dependent variable.

Table 4. Multilevel regression results

Binomial logistic. Dependent variable: share of foreign academic staff.
***Coefficients calculated for the general mean of the variable since a null score of this variable is meaningless.**
Significance levels (t test): '<0.1, *<0.05, **<0.01, *<0.001.**

	empty			country			full			controls		
		S.E.	Sig.		S.E.	Sig.		S.E.	Sig.		S.E.	Sig.
cons	-3.275	0.857	***	-4.245	0.239	***	-4.686	0.289	***	-4.207	0.265	***
country attractiveness				1.629	0.234	***	1.309	0.251	***	0.959	0.317	*
research orientation							0.393	0.046	***	0.374	0.050	***
teaching orientation							-0.384	0.051	***	-0.376	0.050	***
Border HEI										1.075	0.239	**
urban_centrality										0.564	0.175	*
Technical HEI										-0.081	0.102	
Business HEI										1.219	0.212	**
Private HEI										-0.139	0.142	
Total staff*										-0.011	0.019	
Country level variance	4.971	4.218		2.900	3.167		2.834	2.869		2.582	2.693	
HEI level variance	0.996	0.075		0.997	0.075		0.688	0.054		0.593	0.048	
Individual level variance	1.000	0.000		1.000	0.000		1.000	0.000		1.000	0.000	
R2 dicho	0.000			0.197			0.233			0.227		
R2 pseudo	0.000			0.296			0.397			0.520		

The model including attractiveness explains a large share of the country-level variance. The coefficient of attractiveness remains significant despite the small number of countries and is not strongly affected by the introduction of HEI-level variables, supporting the hypothesis that it represents a true country effect (H1).

The models including HEI variables are significantly superior to the country model, thus demonstrating their ability to explain differences between HEIs (H2). The full model explains 52% of the variance in the original sample, a remarkable fit since binomial regressions do not minimize the fit with original data. As expected, the coefficient of research orientation is positive, while teaching orientation is negative, and strongly significant. Some control variables are also significant (border HEI, urban centrality, business HEI) and bear the expected sign; however they do not substantially affect the results concerning our variables of theoretical interest.

Table 5 presents results concerning the mediation effect of international collaboration. First, we run the full model on the sample of 277 HEIs for which we have data on international collaborations as a benchmark. Second, we test the association between the predictor (reputation) and the mediator (international collaboration) through a model with the latter as a dependent variable. Third, we run a model with international staff as a dependent variable, including both the predictors and the mediator as independent variables (MacKinnon 2007).

Table 5. Mediation effect of international collaboration

Binomial logistic. Significance levels (t test): '<0.1, *<0.05, **<0.01, *<0.001. Country level df= (n countries) – 2. 8 countries and 277 units.**

***Coefficients calculated for the general mean of the variable since a null score of this variable is meaningless.**

	Full			Int. Collaboration			Mediation model		
Dependent variable	share foreign acad			share int. copub			share foreign acad		
		S.E.	Sig.		S.E.	Sig.		S.E.	Sig.
cons	-4.043	0.708	***	-0.699	0.102	***	-5.728	0.501	***
country attractiveness	1.825	0.420	**	0.144	0.106		1.747	0.425	**
research orientation	0.272	0.100	**	0.243	0.040	***	0.027	0.105	
teaching orientation	-0.245	0.090	**	-0.109	0.038	**	-0.175	0.086	*
Border HEI	0.576	0.281	*	0.162	0.113		0.463	0.258	
urban_centrality	0.430	0.203	*	-0.097	0.087		0.493	0.196	*
Technical HEI	-0.077	0.131		-0.152	0.051	**	0.037	0.122	
Business HEI	1.332	0.365	***	0.032	0.148		1.361	0.343	***
Private HEI	-0.242	0.419		-0.231	0.167		-0.039	0.401	
Total staff*	-0.012	0.018		-0.002	0.007		-0.007	0.018	
International collaboration							3.929	0.685	
Country level variance	2.201	1.952		0.061	0.085		2.296	2.385	
HEI level variance	0.407	0.045		0.070	0.007		0.356	0.040	
Individual level variance	1.000	0.000		1.000	0.000		1.000	0.000	
R2 dicho	0.329			0.052			0.448		
R2 pseudo	0.715			0.417			0.776		

Results support H3. First, the full model with the reduced sample provides very similar results as the one with the full sample, supporting the robustness of our findings. As expected, restricting the sample to the largest and most reputed HEIs – the 277 out of 601 HEIs in the subsample include 85% of total academic staff – improves the fit – the model now explains 71% of the variance in the original sample. Second, the share of international collaboration is significantly associated to HEI characteristics, notably with the research and teaching orientation, as it would be expected.

Third, in the model including the mediator, international collaboration is a highly significant predictor of the share of international staff, absorbing virtually the whole effect of research orientation; on the contrary, teaching orientation remains significant. The mediation effect itself is highly significant (Sobel test, test-statistics 4.17, p<.001***; MacKinnon, Lockwood, Hoffman, West and Sheets 2002).

Since our data are cross-sectional, results cannot be interpreted directly as a proof that the mediation effect holds, but rather that cumulative effects lead to a stable association between HEI research orientation, international networking, and the share of foreigners. In fact, introducing the collaboration variable does not significantly affect the model's fit and predictions showing that its effect is not independent from research orientation.

In order to assess the strength of the effects, Table 6 calculates the percentage change in the share of foreign academic staff for a change between 1Q and 3Q in the predictors, and 1 to 0 for the dummy variables.

Table 6. Strength of the predictor's effect

Values have been calculated for the median HEI in the sample (5% of foreign academic staff for staff) and for a change in the predictor as given in the table. Values are calculated for the full model (601 HEIs), except for international collaboration (mediation model, 277 HEIs).

***range between 1Q and 3Q of the independent variable. **Restricted sample (N=277).**

Variable	Range	Change	% change in foreign academic staff
Country attractiveness*	.97 – (-.07)	1.04	148%
Research orientation*	.77-(-1.11)	1.78	85%
Teaching orientation*	.52-(-.63)	1.15	-34%
Border HEI	0 – 1	1	165%
Urban centrality	0 – 1	1	69%
Technical HEI	0 – 1	1	-7%
Business HEI	0 – 1	1	199%
Private HEI	0 – 1	1	-12%
Total staff (1000)*	2.29-.22	2.07	-2%
International collaboration**	0.42 – 0.33	0.09	39%

The table displays the importance of country attractiveness in determining differences in internationalization of HEIs: the predictor's change corresponds to the attractiveness difference between the UK and Spain or Italy. Therefore, country factors imply that the average share of international staff in the former country is more than two and half times the one in the latter, consistently with descriptive statistics.

Among HEI characteristics, research orientation has the largest impact (the two dummies for border and business HEI apply to few cases). The impact of teaching orientation is somewhat smaller and negative, while urban centrality has a significant impact, but only when comparing most places in Europe with the most central one (London). In the mediation model, the impact of international collaboration is quite large as expected.

Finally, given the multiplicative character of logistic coefficients, the model correctly foresees that the impact of HEI characteristics is stronger in high attractiveness countries (H4). In the UK (average share of foreign staff 24%), an increase in research orientation by 1 point translates into an increase in the share of foreigners from 24% to 31%, whereas in Italy (average 3%) only from 3% to 4%.

Figure 4. Combined effect of country attractiveness and research orientation on the share of foreign academic staff

Predictions calculated from the full model

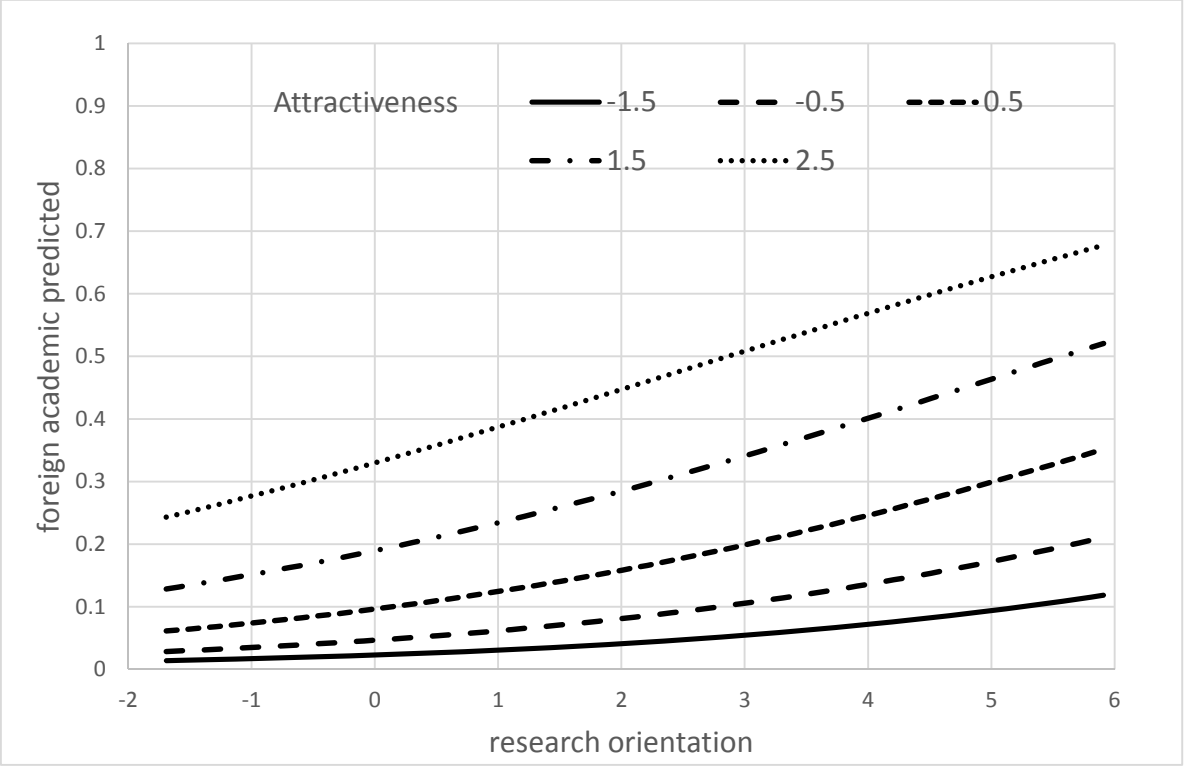


Figure 4 plots this effect for the whole range of attractiveness as in Table 1 and for the range of research orientation in our dataset. In countries with low attractiveness, even extremely research-oriented HEIs do not internationalize to a high level, whereas in attractive countries this happens as soon as HEIs are (moderately) oriented to research.

4.5 Robustness tests and deviant cases

Even if the models provide results in line with the expectations, we ran a series of robustness tests on the model including all variables (without international collaboration).

a) *Alternative specifications of the model*. These tests aim to assess whether our results are an artifact of the choice of the statistical method and, especially, of the use of logistics regression and of a multi-level model. Therefore, we ran two frequently used models for proportion data in econometrics (Papke and Wooldridge 1996; Ramalho, Ramalho and Murteira 2011), i.e. a (single-level) proportional logistics and a double-censored tobit regression, both with clustered standard errors by country. Country attractiveness and research orientation are significant in both specification, whereas teaching orientation has a negative coefficient in all specifications, but is not significant in the fractional logistics (p=.12).

b) *Dropping cases*. These tests aim to assess whether dropping a number of cases (at the HEI and country level) significantly affects the results. We run therefore models by excluding the outliers or one of the two largest countries in the dataset (Germany and the UK) or Switzerland, since it outlier for country-attractiveness. All coefficients of HEI-level variables are not significantly affected, country attractiveness

remains positive and significant in all models, even if the size of the coefficient is somewhat affected when dropping one country.

Overall, the results turn out to be remarkably robust; the small number of countries, which makes an exact estimate of the impact of country attractiveness somewhat problematic (but does not influence our overall results).

c) Finally, an analysis of *deviant cases*, i.e. of the cases where the model does not predict correctly the observed level of internationalization, is performed to test whether large differences can be explained by specific HEI characteristics.

We identify 34 cases for which the difference between predicted and observed shares of foreign staff is at least 0.2. The average number of academic staff for these HEIs is 397 (against 867 for the whole sample). These cases account for a large share of the unexplained variance – the explained sum of squares increases from 0.52 to 0.73 when excluding them.

6 out of 7 cases for which observed levels of internationalization are lower than predicted are teacher-training universities in Switzerland. This can be explained by their specific function and that the job market in this profession was largely closed to foreigners until a few years ago.

The 27 cases for which the model predicts higher levels than observed are more heterogeneous; nevertheless, most of them display some specificities, which might lead to a higher share of foreign staff. These include two border universities (Nova Gorica and Lugano), three business schools (London Business School, European School of Management and Technique, University of St. Gallen), three Academies of Arts, a Jewish academy, two international universities in Germany, and a private university in Italy. The two large HEIs in this group are EPFL and the UAS of Western Switzerland, which have not been coded as border universities, but are rather close to the French border and share the same language.

This analysis shows that the model explains quite well the level of internationalization of general and large HEIs; deviant cases concern smaller and specialized HEIs and can be largely explained by specific subject specialization or geographical position.

5 Discussion and conclusions

Empirical results support our hypotheses concerning internationalization of European Higher Education Institutions. They confirm previous (largely anecdotal) insights that the HEI's research (vs. teaching) orientation have a strong impact on their capacity of attracting foreign academics. Moreover, the characteristics of the hosting country –its economic wealth and the strength of the national research system – largely influence internationalization, while in less attractive countries, even reputed HEIs are not able to attract significant numbers of foreigners. Finally, we demonstrated that the ability of attracting foreign academics is strongly associated with HEI international network.

These results are surprisingly robust despite a few limitations of the dataset, namely that data refer to the employed staff rather than to actual hires, their cross-sectional nature and the limited number of countries considered. The on-going development of a multi-annual register of HEIs in Europe, supported by the European Commission, might provide better data in a few years. Complementarily, analyses on countries where disaggregated data at disciplinary level are available would allow investigating quantitatively the interplay between disciplinary and HEI characteristics, which was not possible with the data we used.

In our view, findings have implications for the theoretical understanding of academic hiring, as well as for the design of empirical studies. Further, they bear lessons for public policies and managerial decisions at the level of individual HEIs.

First, we provided empirical evidence that queuing models of labor markets, with their focus on the micro-matching process between workers and job offers, provide a suitable conceptual framework in order to analyze academic hiring. Two features of these models are particularly relevant for academic hiring, namely the multi-stage nature of the process, where sorting of candidates in the early stages accounts for most of the selection effect, and the importance of social relationships in attracting and selecting candidates. Importantly, queuing models are well-suited to investigate other relevant issues in academic hiring, like sorting by gender.

Our study innovated by explicitly introducing in queuing models a multi-level structure, in order to analyze how the interplay between the country and HEI level accounts for the observed patterns. The underlying assumption was that the structure of the hiring process plays a central role in magnifying the importance of country attractiveness, despite the fact that the main focus of academics is the quality of the HEI offering a position. Namely, academics are likely to be confronted with a number of largely equivalent (but uncertain) job offerings. Accordingly, when they are restricting the range of offerings during the hiring process, they are likely to take into account also the characteristics of the hosting country and thus sorting out of foreigners will occur in the less attractive countries. This process does not forcefully require hiring policies favoring nationals or lack of transparency.

We suggest that these features are shared by other knowledge-intensive sectors, at least where organizations are mostly national-based and thus that our approach would be more generally relevant for studies of international competition for talent.

Second, in terms of the design of future empirical study, these findings suggest a shift in focus from understanding the determinants of mobility (through surveys of academics) and characteristics of hiring policies (at national and HEI level) towards a micro-level analysis of the hiring process itself, since it is at this level that demand and offer come together and determine the observed hiring patterns. In this respect, they indicate the need of analyzing the whole hiring process and, especially, of collecting data on the early stages, like applications sent and shortlisted, since most of the sorting occurs at this stage. Such studies would be an essential complement to broader statistical analyses in order to refine our theoretical understanding of the phenomenon.

Third, policy implications of this work can be discussed in relationship to the debate on academic careers at the European level. Namely, promotion of international mobility and open international hiring have been a central dimension of the strategy towards a European Research Area (Commission of the European communities 2000). A large number of documents and studies have been published (Commission of the European communities 2001, CEC 2008), highlighting the obstacles to international mobility of researchers and proposing measures to overcome them, like more transparency and openness in hiring, reduction of administrative and social security barriers, improving internationally available information and setting up mobility schemes at the European level. Progress in this area is generally considered as slow and variable between ERA countries (European Commission 2011).

Our results indicate that the opening of the academic labor markets is likely to have strong distributive effects, with the leading research countries profiting of it, while for the less attractive countries in Europe the outcome is less clear and these are not likely to profit substantially from increased intra-European mobility. Further, the interaction between country and HEI characteristics implies that also good quality HEIs in a less attractive country will not benefit of opening, as the most internationalized HEIs in these countries are either private or on the border, while there is no evident link with their research orientation. To some extent, opening policies might even be counterproductive, by increasing the incertitude on careers of national researchers and leading the best academics to seek for positions abroad.

While this does not fundamentally question the rationale of opening the European labor market, it suggests that the mix of policies needs to take into account the competitive position of individual countries. More specifically, our results support the insight that the most beneficial policies for less attractive countries would be to focus on the formation of national human capital (Heitor, Horta and Mendonça 2014) and to improve the screening process in hiring, so that high quality national workers are given a fair chance of obtaining the best jobs. Less-attractive countries clearly need to strike carefully the balance between opening and transparency in hiring on the one hand, offering secured career prospects to the best nationals on the other hand in order to retain them. Complementarily, since these countries will lose some of their best people, policies aimed at maintaining linkages with expatriates would be a sensible strategy, since linkages increase return mobility and allow for the transfer back of part of their expertise through research collaboration (Baruffaldi and Landoni 2012).

At the HEI level, our results imply that HEIs need to take into account both their level of reputation and the attractiveness of the country in which they are located when defining hiring policies. For instance, well reputed HEIs in less attractive countries could focus on identifying and hiring the best nationals available on the market and concentrate their efforts on expatriates, as these might be willing to apply for a job of suitable quality in their home country. For less reputed HEIs in attractive countries, international hiring might be an option to profit from the attractiveness of the country (while hiring in the domestic market might be difficult given the competition from more reputed HEIs). On the contrary, for similar HEIs in less attractive countries, a more suitable strategy to improve the quality of their staff would be to selectively retain their best graduates.

When HEIs are in the less-attractive part of the system, the quality of the selection process becomes even more critical to identify the few talented academics, which for any reason might be interested in joining the organization.

Overall, the message emerging from these results is that internationalization is largely an outcome of deep structural characteristics of national systems, as well as of individual HEIs, but at the same time contributes to the reinforcement of quality differences by directing flows of talented researchers selectively towards the best HEIs in the best countries. In this context, improving the general conditions of the research system is more important than promoting internationalization per se. Furthermore, the balance between opening and favoring national candidates, as well as the measures to promote international mobility, need to be carefully tailored to the situation in each country and individual HEIs. Imitating the policies and practices of the most reputed places will not necessarily lead to satisfactory results.

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