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Abstract
This paper investigates the effect of international postdoctoral mobility on academic career. International postdoctoral appointments might either help to expand researchers' scientific and technical human capital while at the same time ensuring career stability or disconnect the researcher from the national academic network making her return and career in the home country academic system more difficult. We use duration models on individual data to predict time to first appointment and getting a tenured position (promotion from assistant to associate or full professor positions). Using a panel dataset of 18 thousands Italian academics in all disciplines over 30 years, we find that international postdoctoral appointments, while being weakly related to a slower entry in the academic system, have a positive effect on career outcomes and reduce the waiting time for tenure. This provides evidence that early stage international mobility is beneficial for academics' career in the long-term. We use institution-based bibliometric indicators to measure different dimensions of social capital/network which affect researchers' career, namely: localism, home country linkages and expanding the scientific network.

Keywords: Academic career, International mobility, Italian university system, Academic labor market , Social capital

JEL Classification: I21, I23, J61, J45, M51

1. Introduction

International mobility of highly skilled workers is a growing phenomenon, with important implications for human resource management, innovation and policy. International mobility is increasingly part of a broader phenomenon of globalization of the careers of the highly skilled, involving also the expansion of mass higher education, growth in the number of international students and increasing international collaborations (Freeman 2010). A large majority of movements are not permanent and involve more than one destination (Newland 2009). If migrants do not remain in the host country, in some cases, they return to their country of origin, and in others, they move to a third country (Van Bouwel 2010).

The inadequacy and lack of appropriate data to assess the phenomenon of researcher mobility has been repeatedly pointed out by scholars and policy makers (CEC 2004; Ackers 2005; Fontes 2007; Didou-Aupetit 2009). Traditional migration or labor statistics and censuses allow to picture flows of highly skilled human resources (Cañibano and Woolley, 2015) but not the movements of researchers, which is more complex and often circulatory (Jöns 2007). In this view, researchers are different from other migrants in that they are motivated by the nature of their profession to move internationally in order to secure better opportunities to advance their careers, exchange ideas and broaden their knowledge (Ackers, 2005).

In this paper we focus on the effect of international research appointments and social capital/network on job outcomes at different career stages: time to entry as assistant professor and getting a tenure position – e.g. being promoted from assistant professor to associate or, in a small number of cases, to full professor. International mobility, in fact, may help or harm in speeding up career progression and ensuring career stability. We focus on international mobility due to its growing importance and pervasiveness in structuring public policies (Stephan 2012). In fact, the evidence regarding the ability of international mobile academics to provide benefits to their own countries in terms of spill-overs (Ackers, 2005; Saxenian, 2005) fosters policy initiatives aimed at encouraging national academics to go abroad and migrant academics to return (Hunter et al. 2009).

Given the lack of empirical evidence, the major limitation of previous studies is that they usually rely on cross-section survey data, covering a limited span of time and scientific areas. This paper overcomes this main limitation. We built a unique database of doctorate holders in all disciplines from Italian universities who obtained their degree in the period from the first cycle (1986) until 2007. The doctorates who pursued an academic career in Italy have been identified by matching with academics in the official archives of the Italian Ministry of Education and followed in their career until 2015. From this matched databased we identified those academics that undertook a postdoctoral appointment before entering the Italian academic system (about 44%). To classify mobility in the postdoctoral period we used affiliation information reported on scientific publication data from Scopus.[1] Postdocs have been classified in either internationally mobile (about 8%) or not (about 36%).

The paper aims to answer the following questions: are internationally mobile postdocs faster/slower than national postdocs in entering the national academic career/getting tenure? Does social capital/network affect returnees career timing and path?

[1] We are aware that, due to different publication practices, using this approach underestimate postdoctoral mobility in social and human sciences, in the econometric estimation we will start first with a reduced sample of only Science, Technology, Engineering, Mathematics and Medicine (STEMM) + Economics fields researchers and then present a robustness check for all our sample (results are robust to the inclusion of Human and Social Sciences).

2. International mobility, social capital and academic career results

In the economics of science, the analysis of mobility and social capital/network in relation to career advancement has received less attention than the determinants of scientific productivity (Allison and Long 1990; Long et al. 1993). However, the relationship between mobility and careers is complex and worth to be studied: mobility, in fact, may have different effects on careers and on knowledge production depending on the type of mobility and the career stage at which it occurs (Fernandez-Zubieta et al., 2015).

Especially at the early stages of a career, international mobility can provide training in leading research groups which can either result in the establishment of a career in the new institution and country (Becher and Trowler 2001) or in the acquirement of specialist tacit knowledge that can then be applied at the sending institution or in the home country (Stephan 2012). Indeed, Musselin (2004) finds that academics participating in postdoctoral fellowships perceive their international mobility to be a personal strategy aimed at improving their career prospects back home.

However, evidence about international return mobility is mixed (Mahroum 2001). Those who participated in international mobility perform better and have a higher international network than their peers (Cañibano et al. 2008; Jonkers 2011; Franzoni et al. 2012; Scellato et al. 2012). Many of these studies, however, conflate different mobility types (Ackers 2005), and there is evidence in the literature that not all internationally mobile academics benefit from their experience (Jonkers, 2011; Cruz and Sanz-Mendez, 2010; Melin 2005).

Here we focus on the concept of scientific and technical human capital (STHC), which can help to further explain the link between mobility and career advancement. Bozeman et al. (2001) describe the notion of STHC as: "the sum of scientific, technical and social knowledge, skills and the resources embodied in a particular individual". Job mobility contributes to scientist's STHC to the extent that it increases the number of different collaboration and strengthens pre-existing relationships. Most often, international mobility is a strategic decision of the researcher to go to work somewhere special where a specific team/professor is working on a particular area of research to broaden up her knowledge and more generally enrich her STHC.[2] For this reason it is possible to expect a positive relationship between mobility and career success.

However, Heining et al. (2007), using a sample of 243 German professors in the field of economics, do not find any clear evidence. In particular, Heining et al. (2007) explain this result by suggesting that "moving destroys (or at least weakens) the ties in social networks which could turn out important for the tenure decision". Given labor market conditions, the interaction between human capital enhancing international mobility and social capital/network determines the effect of international mobility on career. Four major factors play a role. First social capital/network can be analyzed in the form of inbreeding and localism, where the former is the tendency of a university to recruit new staff especially among the ranks of local graduates, while the latter is the more general tendency to fill professorial position through internal careers, as opposed to attracting scientists from other institutions. The literature provides evidence of both positive and negative effect of inbreeding on career. Hargens and Farr (1973) look at the number of years it takes for an assistant professor to be promoted to an associate position, and find that inbred scientists wait for longer than others, even after controlling for differences in terms of productivity. Perotti (2002) documents a number of instances in which Italian selection committees preferred local candidates to much better qualified external ones. More generally,

[2] However, in tight labor markets, postdoctoral period both national and international might not be a choice but a necessity making crucial to control for local market conditions.

localism is denounced as a factor of backwardness in the academic systems (Abbot, 2006, Godechot and Louvet, 2008).

Secondly, we explore the importance of professional knowledge networks at the international level, which corresponds both to a professional need and to a factor shaping the mobility of researchers. Mahroum (2000) defines "scientific mobility as a process of networking and extending one's social space […] stimulated by a need for professional socialization". When academic factors are dominant in the decision to move, migration can be temporary and return can naturally follow through purposefully created linkages. Following this line of reasoning, maintaining home country linkages might increase the probability of becoming aware of opportunities and make it easier to find an opportunity and the necessary information and support when a researcher returns (Ackers, 2005). Furthermore, it has been empirically shown that these linkages may be necessary for reintegration in the national work market (Gill, 2005; Morano-Foadi, 2005).

Furthermore, when universities decide to fill a vacancy or offer a tenure, they may give positive consideration to the size and reach of candidates' personal network, since the latter may add to the university's visibility and access to resources (Gonzalez-Brambila et al., 2006). As individual performances are often hard to evaluate only on the basis of past scientific production and citations (especially when junior scientists are considered, whose publication list is likely to be short), prospective recruiters or promoters may look for other signals of quality, and the ability of expanding the scientific network is one of these. Expanding this notion, new social ties an individual may have established in universities and research labs, by moving across different institutions, can be considered as a relevant form of social capital/network.

3. Institutional framework: The Italian academic career system

The academic labor market in Italy is very different from other non-European countries, especially compared to the USA. The main feature is that this labor market is highly regulated. Since the employees at Italian universities are civil servants, the wage, the contract length, the tasks (teaching load and others) are determined by law and cannot be bargained at the local level. In order to understand the factors which determine success in this market it is crucial to understand these regulations.

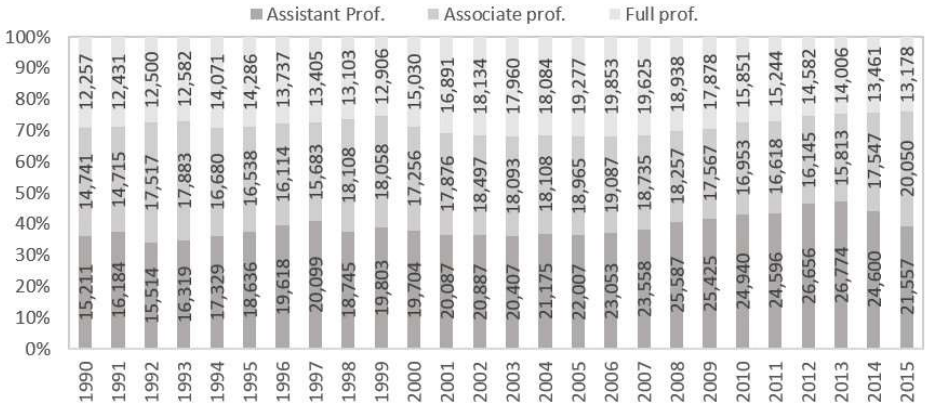
The Italian academic system is composed of 97 universities (30 private and 67 public) and 9 special higher education institutions. The latter usually grant only masters and PhD courses, being more research oriented than most of the other universities. Three out of the 67 public universities are polytechnics. Eleven out of the 30 private institutions are distance-learning universities. The university system is divided into 372 sectors of discipline ("settori scientifico disciplinari" – SSD), grouped into fourteen research areas, as designated by the Italian National University Council (CUN). Sectors of discipline are categorized for homogeneity within each research area, and the selection of research candidates is conducted by recruitment commissions within each academic discipline in both national and local recruitment systems.

The Italian academic system has three main positions called "Ricercatore universitario" (assistant professor), "Professore associato" (associate professor) and "Professore ordinario" (full professor). Each professor working at an Italian university is then categorized by a level of arrangement (full professor, associate professor and assistant professor) and by one out of 372 sectors of discipline. Each vacancy is coded in a standardized format, and each filled position becomes tenured after a review conducted three years after hiring. Salaries in public universities are set by law and vary only by level of arrangement and seniority. Schools and departments are prevented from differentiating wages among professors, linking payment to

research productivity and/or teaching loads, though professors can be paid for teaching more than the 120 hours of frontal teaching required by contract. As a consequence, in addition to celebrity and funds attraction, the strongest incentive to scientific productivity for individuals working in academia derives from expected promotion (being hired as assistant professor, being promoted to associated or full professor). Given the public nature of the employment contracts, university professors can only be hired through public competitions that should grant publicity of the vacancy, selection of the selecting committee based on objective criteria, transparency of the selection process.

In 1990 there were 42,209 professors active in Italian universities. In the time period considered, 45,795 academics entered in the Italian system and 33,219 exited, thus in 2015 the number of professors grew to 54,785. Figure 1 summarizes the number and the share of Italian professors by academic position in this time period.

Figure 1: Share of Italian professors by academic position 1990-2015

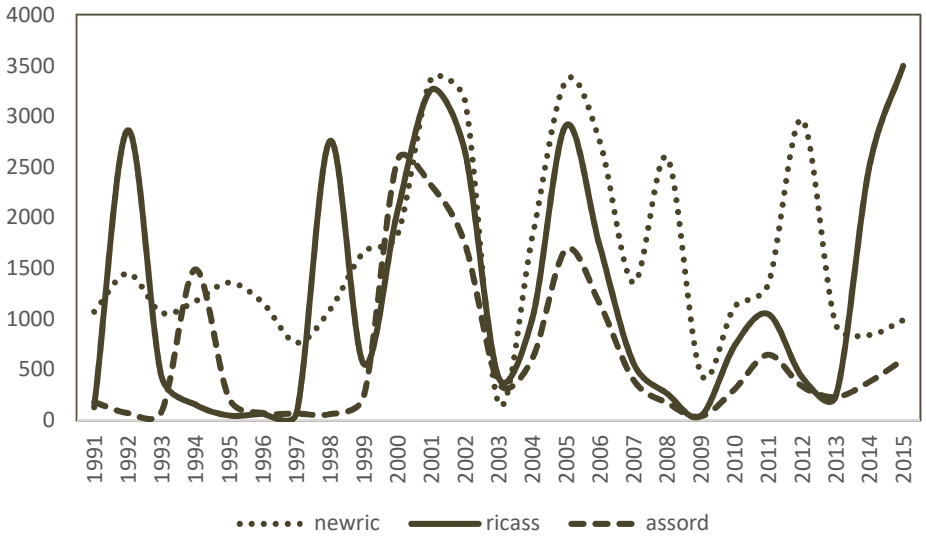


Since 1979, standardized competitions were held to hire assistants, associate and full professors and until 1998 almost all academic recruitment was substantially centralized. Despite the legislative prescription of one concourse every two years, a three to four years interval occurred. National commissions of five members were chosen by lot within a pool of elected professors (from a pool of 15[3]) belonging to the same discipline. Commissioners declared which of the candidates had the qualifications to be promoted to associate/full professorship. Eligibility was given to a number of candidates greater than the available positions (usually 20% higher) for each discipline. Universities with opening positions drew by multilateral bargaining between them from the list of eligible applicants to fulfil their vacancies. Starting in 1999[4], recruitment procedures became entirely local, and each university could hold its own selection procedure (both for assistants, associates and full professors). Local commissions were comprised of five members: one belonging to the institution itself and the four others elected by the full set of Italian professors of that discipline. After 2005, a new reform act[5] established that the commission's members had to be drawn by lot in a pool of professors of three times the size of the local commission, elected by popular vote amongst the discipline's affiliates. The commissions initially declared three qualified candidates for each concourse, but moved to two between 2007 until 2008, and only one thereafter. In the following years, universities with open

[3] See DL 31/1979 and DPR 382/1980.
[4] "Berlinguer reform", DPR 390/1998.
[5] "Moratti reform", DL 230/2005.

vacancies could hire any candidate who had obtained a qualification. The most recent reform[6] (in 2010) introduced a two-step procedure with a national habilitation and local concourses to recruit professors. Figure 2 shows the number of new assistant professors and newly promoted associate and full professors of in Italian academia.

Figure 2 - Yearly entrances and promotions in Italian academia, 1990-2015



4. The data: Italian academic system 1986-2015

We have collected information from three primary sources: the National Library of Florence (BNCF), the Italian Ministry of education (MIUR) and the bibliographic Scopus database. From BNCF we retrieved all doctoral dissertations discussed in Italian universities from I cycle (1986) to 2007. BNCF online public access catalogue provides information on: author, title of the thesis, supervisor, PhD university, scientific field and year of degree. From MIUR we obtained administrative data on academic positions, disciplinary areas, university affiliation and personal information, such as birth year and gender, for all academics working in Italian universities from 1990 to 2015. Using these two sources of information, we identified PhD holders who pursued a scientific career in Italian academia.

The identification of academics who hold an Italian doctoral degree was pursued through the record linkage between academics from the MIUR data and doctorate holders from Italian universities from BNCF data. We performed the matching relying on four fields: name, gender, scientific area and year of PhD. We were thus able to identify the population of researchers with doctoral degree from Italian universities who have worked at least for one year in Italian academia. For further details on the retrieval process from BNCF, the record linkage procedure and its results see Coda Zabetta (2018). To reduce the potential selection bias in our empirical analysis, we use data on 18,039 doctorate holders who entered Italian academia as assistant professors within 10 years after the PhD and are active in 2015.

For these researchers, we retrieved from Scopus all scientific articles published in international journals since their first publication to 2015. Within this group of researchers, 15,385 (85%)

[6] "Gelmini reform", L 240/2010.

published at least one paper on Scopus journals. In total we gathered 285 thousands publications.

We use the following procedure in order to identify authors. Using Scopus API, we downloaded all available personal information for the academics in our data. This information includes: affiliation, scientific research area and Scopus Author-ID, the latter is a unique identifier for each author inside Scopus database.

A recent study (Kawashima et al., 2015), evaluated the accuracy of the Author ID in the Scopus bibliographic database. They matched bibliographic records between Scopus and an open database which manages all the information of the largest public fund for academic researchers, then they calculated recall and precision of the Scopus Author-ID for researchers. They found that recall and precision were around 98% and 99% respectively.

Then, we assigned all academics in our data and authors' record downloaded from Scopus to a broad disciplinary category. In order to attribute comparable disciplinary categories for authors and individuals, we aggregate disciplines defined by MIUR and Scopus disciplinary areas into the following categories: Agriculture; Chemistry; Biology; Physics; Mathematics and Computer Science; Architecture and Engineering; Medicine and Veterinary; Economics and Management; Humanities and Law, Sociology and Political Science. Finally, in each broad disciplinary category we matched authors with academics in our data using the information on Scopus Author-ID, their surnames, names and affiliation.

After filtering, duplicates and incomplete records were deleted obtaining a consistent database of 285,283 scientific publications with at least one Italian author. We then employed a matching procedure to assign the corresponding author identifying codes to each research product (it might be possible that one paper is co-authored by two or more different individuals belonging to Italian academia).

We proxy early career mobility using the affiliation reported in the publication collected from Scopus. In this way we are able to identify those researchers who, after the PhD and before the first appointment in Italian academia, spent a research period at least in a postdoctoral position (we do not take in to account short research stays, which usually do not resolve in a publication).

A crucial point that has to be made here is that bibliometric research allows us to track mobility only to the extent that researchers publish and that their affiliation is stated on their publication in a way that can be traced back to them.

A number of studies lend some qualified support to the use of these data for tracking mobility. Laudel (2003) and Conchi and Michels (2014) compared scientist mobility records derived from bibliometric data with those derived from alternative data sources, including CV and self-reported data from scientist surveys. Moed et al. (2014) evaluate the potential and limitations of the bibliometric approach in terms of author profile accuracy and interpretation, looking at the coherence between related statistics and scientist mobility as implied in Scopus publication records for authors in 17 countries. The authors conclude that the bibliometric approach is promising since error rates for units of assessment with indicator values based on sufficiently large numbers are estimated to be fairly below 10%.

Using affiliation data from Scopus we then identified affiliation with a single address per author (in order not to take into consideration virtual mobility) and categorized the country of the reported institution. In this way, we are able to identify researchers' mobility if: i) the researcher publishes; ii) the affiliation is reported in the publication; iii) authors are single-affiliated (we do not take into account multiple affiliations per a single author). To identify and disambiguate affiliation reported on publication data we used GRID database. Table 1 and Table 2 and Figure 3 present some exploratory information for the international mobile academics. Interestingly,

while the absolute number increases moving from the first to the second cohort, more than doubling in terms of share of PhD holders, we highlight a decrease relative to the total number of PhD granted from 9% to 7%. The US is the most important destination for international postdocs, followed by the UK. The top 10 destinations account for 89% of mobility with 55% in European countries.

Table 1. Number of PhD, international mobiles and share by gender and cohort

	All	*M*	*F*	*Cohort 86-96*	*Cohort 97-07*
# PhD	18039	10358	7681	4908	13131
# postdoc abroad	1375	906	469	442	933
% postdoc abroad	8%	9%	6%	9%	7%

Table 2. Share of international mobiles for the top 10 destinations by gender and cohort

Country	*All*	*M*	*F*	*Cohort 86-96*	*Cohort 97-07*
United States	34%	33%	35%	37%	32%
United Kingdom	15%	14%	15%	14%	15%
France	11%	11%	11%	11%	11%
Germany	10%	10%	8%	8%	10%
Switzerland	6%	6%	5%	7%	5%
Spain	4%	4%	3%	2%	4%
Netherlands	3%	3%	4%	5%	3%
Belgium	2%	2%	2%	2%	2%
Canada	2%	2%	2%	3%	2%
Sweden	2%	2%	2%	2%	2%

Figure 3 - Geographical international mobility of Italian Postdocs

5. Econometric methodology

We estimate a duration model of career entry and getting a tenured position (being promoted from assistant to associate or full professor) as a function of international postdoc appointments. We assume that each academic is subject to the probability of entry or being tenured conditional on her status as a PhD holder or assistant professor. In the duration analysis an academic is at risk of entering Italian academia since the year of PhD and of receiving tenure from the first appointment as assistant professor.

We make use of the Cox-proportional hazard model where the dependent variable is the time that elapses from PhD to first appointment as assistant professor, for the time-to-entry analysis, and from first appointment until promotion to associate or full professor position, for the time-to-tenure analysis. This model is written for any individual i:

$$h(t) = h_0(t) \times \exp(\alpha_1 PD_{Abroad_i} + \alpha_2 PD_{Italy} + \beta SOC\_CAP_i + \gamma \boldsymbol{X}_{i,t})$$

where h_0 is the baseline hazard, *PD_Abroad* is a set of dummy variables which take value one if the researcher spent a postdoctoral period abroad (in the time-to entry analysis, the variable is time variant) and *PD_Italy* is a dummy variable which takes value one if the researchers did a postdoc in Italy, this allow us to compare the hazard rate for an international postdoc with the one for an Italian postdoc. We also include a set of variables that aim to capture the social capital/network effect (*SOC_CAP*) and $X_{i,t}$, which is a vector of individual characteristics, some of them time-variant. Age and its squared term are included to control for a possible age effect on promotion. Gender, PhD, and university type indicators are also used as controls. Performance measures are included to assess the importance of merit for entry/tenure.

Standard models that control for confounding factors may fail if the treatment, postdoctoral mobility in our case, is time-variant (Robins, 1999). For example, controlling for past values of productivity, which affect later research appointments and promotion, can lead to biased estimates. To address this problem of reverse causality between postdoc appointments and entry/tenure, we use Coarsened Exact Matching (CEM; Iacus et al., 2012) approach to match each internationally mobile academic to a peer who has not participated in a postdoc abroad based on pre-mobility observable characteristics (gender, birthyear, PhD year, rank of PhD university, publications and citations during the PhD). This strategy considers a postdoc as a treatment with a lasting effect on academics' careers. Postdocs are usually done by junior academics and can serve as a treatment affecting future career paths. We thus divide the sample into a treated group and an untreated control group and apply Cox proportional hazard model to this matched sample. Further details of CEM methods are reported in Appendix A.

According to the Italian legislation, scientific performance ought to be the key determinant for career advancement. It is most common to measure productivity by counting publications and citations in international scientific journals (though these indicators have important limitation especially for humanities and social sciences). We extracted from Scopus all scientific articles published between starting of the PhD and 2015, authored by at least one individual in our sample, together with their citations in 2015. We constructed the two variables cumulative number of publications by year (*CumPub*) and cumulative number of average citations by year (*CumAvgCit*). Following previous literature, we also include the dummy *Precocity* for those who published during the PhD.

To measure the social capital/network effect we started by including a variable that identifies if the focal academic got her first position/tenure in her alma mater (*Inbreeding*) and interreacted

it with international postdoctoral mobility to assess whether return to the home country was speeded up by a tight social network (existent in the original PhD granting institution). For what concerns the home country linkages, we try to capture them by a variable based upon information on researchers' affiliation, as derived from the Scopus records.[7] We are able to derive from publication records the exact affiliation of each coauthor and build a record of the network of our focal researcher. With this information we built the variable *PD_Abroad_Coauth_ITA*, if more than 75% of the coauthors with whom the focal researcher has published while abroad were affiliated to an Italian university, which signals a strong connection with Italian academia for researchers who were abroad and might help to speed up their return home.

As we downloaded publications for the academics on our sample since their PhD year, we are able to identify whether the coauthors with whom the researchers have published during the postdoctoral period were old acquaintances or new co-authors. With this information we built the variable *PD_Abroad_Coauth_NEW*, if more thatn75% of coauthors with whom the focal researcher has published while abroad were not among her previous coauthors, this would indicate that the postdoc had expanded her scientific network during the international mobility increasing her human capital and her probability of entry and tenure.

Among the variables related to STHC, the literature surveyed above pays particular attention to the prestige of the PhD-granting institution. We identified the top universities in Italy (according to ARWU ranking[8]) and created the dummies *Top_Uni_PhD* for the PhD granting institution, and *Top_Uni*, for the university at which the focal researcher was employed before tenure.

Finally we control for disciplinary differences in the availability of new jobs and promotion opportunities, by inserting in all regressions a dummy variable for each university, scientific area and calendar year.

Given the strategy used to identify international postdoctoral mobility (based on publications), we focus our analysis on the Science, Technology, Engineering, Mathematics and Medicine (STEMM) + Economics scientific areas, as in those fields international mobility is more common and using Scopus to trace mobility is more reliable as journal publications is the normal way of communicating research results.[9] we present a robustness check that included all scientific fields (see Appendix B).

Table 3 describes the variables used in the empirical analysis and Table 4 presents the summary statistics. Table 5 show that on average international mobile academics entry later, are more frequently promoted but that they are not significantly promoted sooner than they peers.

[7] Each Scopus record lists, in separate fields, the authors' names, and their affiliations, with a one-to-one correspondence between names and affiliations.

[8] We have also created three other alternative rankings of Italian universities based on: a) national competitive funding success, b) national excellence program success and c) national Research Assessment. We obtained similar results in the models.

[9] For example, both in the UK REF and in the Italian RAE, STEMM and Economics fields were considered bibliometric fields (Geuna and Piolatto, 2016)

Table 3. Description of the main variables

Variable	*Description*
PD_Abroad	1: Researcher spent a postdoctoral period abroad
PD_Abroad_USA	1: Researcher spent a postdoc period in the US
PD_Abroad_EUR	1: Researcher spent a postdoc period in a European country
PD_Abroad_OTH	1: Researcher spent a postdoc period in a non-US and non-European country
PD_Abroad_Coauth_ITA	1: Researcher has >75% IT co-authors during postdoc abroad
PD_Abroad_Coauth_FOR	1: Researcher has ≤75% IT co-authors during postdoc abroad
PD_Abroad_Coauth_NEW	1: Researcher has >75% new co-authors during postdoc abroad
PD_Abroad_Coauth_OLD	1: Researcher has ≤75% new co-authors during postdoc abroad
PD_Italy	1: Researcher spent a postdoctoral period in Italy
Inbred	1: Researcher is first employed at the PhD granting university
Precocity	1: Researcher has published a scientific article during the PhD
CumPub	Cumulative number of publications by year
CumAvgCit	Cumulative number of average citations by year
Top_Uni	1: University at which the researcher is employed is listed in ARWU
Top_Uni_PhD	1: PhD university is listed in ARWU
Gender	1: Researcher is female
Age	Researcher's age

Table 4. Descriptive statistics of main variables.

Variable	*Mean*	*SD*	*Min*	*Max*
Years since first appointment	7.71	3.65	1	24
Tenured	0.51	0.50	0	1
PD_Abroad	0.11	0.32	0	1
PD_Italy	0.50	0.50	0	1
PD_Abroad_USA	0.05	0.21	0	1
PD_Abroad_EUR	0.06	0.24	0	1
PD_Abroad_OTH	0.01	0.09	0	1
PD_Abroad_Coauth_ITA	0.02	0.15	0	1
PD_Abroad_Coauth_FOR	0.09	0.29	0	1
PD_Abroad_Coauth_NEW	0.08	0.27	0	1
PD_Abroad_Coauth_OLD	0.04	0.19	0	1
Inbred	0.59	0.49	0	1
CumPub	17.82	35.75	0	943
CumAvgCit	21.18	26.08	0	878
Precocity	0.64	0.48	0	1
Female	0.40	0.49	0	1
Age	42.96	5.39	29	63
Top_Uni_PhD	0.81	0.40	0	1
Top_Uni	0.69	0.46	0	1

Table 5. Number of years to first appointment and tenure and percentage of tenured academics (by groups of researchers)

Variable	*Years to first appointment*		*Years to tenure*		*Tenured*	
	No	*Yes*	*No*	*Yes*	*No*	*Yes*
PD_Abroad	3.02	4.95***	8.11	7.78**	0.51	0.55***
PD_Italy	2.32	4.16***	8.08	8.05	0.58	0.44***
Inbred	3.23	3.25	7.65	8.34***	0.54	0.49***
Cohort8697	3.30	3.12***	7.93	8.20***	0.37	0.72***
Female	3.05	3.51***	7.81	8.60***	0.57	0.41***
Precocity	3.15	3.29***	7.76	8.24***	0.52	0.50**
Top_Uni_PhD	3.01	3.30***	7.69	8.14***	0.45	0.53***

Significance test of mean differences with "No" group.*p<0.10, **p<0.05, ***p<0.01

6. Results and discussion

Time-to-entry

Table 6 reports the results of the Cox model estimations for time to entry to assistant professor position, investigating the effect of having spent a postdoctoral period abroad and social capital/network, while Table 7 reports the results of the same model for the restricted sample of matched academics. Since the matching is done considering postdoctoral mobility abroad (which is our main phenomenon of interest) as a treatment, the variable regarding postdoctoral mobility within Italy loses its explanatory power and is no longer significant, the associate coefficients should thus be interpreted carefully. We do not report coefficients for control variables, which are consistent with those reported in Table 6, in order to make the table more readable (the results are available upon request).

Columns 1 shows the effect of holding a postdoctoral appointment Abroad and in Italy, while in column 2 the positions Abroad are divided in three groups according to the country in which they occur. Doing a postdoc abroad delays entry as assistant professor both compared to those that did not do it and to those researchers that did it in Italy (test of equality Chi-Squared 11.92, p-value=0.0006). However, in the CEM estimation (see Table 7) the effect is smaller and with a weaker significance.

What seems to matter the most at this first career stage are the variables which try to take into account the social capital/network. From column 3 we can see that researchers who get the first appointment in the PhD granting institution, where they have already strong acquaintances, have a higher hazard of getting the position faster than their peers (the variable loses its significance in the matched sample). The coefficient of the interaction term with postdoctoral mobility abroad is positive, even if small in magnitude, but is not significant.

In the last two columns of Table 6 we introduce the variables related to home country linkages while abroad (column 4) and the enlargement of the scientific network (column 5). The results, especially looking at the matched sample in the corresponding columns of Table 7, show that keeping a lot of contacts with the home country or keeping on working with the old network makes the reentry much quicker compared to those that work with foreign authors or new colleagues.

Table 6. Survival analysis: risk of entry in t

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	0.688***		0.659***		
	(0.034)		(0.049)		
PD_Italy	0.812***	0.812***	0.811***	0.812***	0.812***
	(0.019)	(0.018)	(0.018)	(0.018)	(0.019)
PD_Abroad_USA		0.664***			
		(0.049)			
PD_Abroad_EUR		0.722***			
		(0.047)			
PD_Abroad_OTH		0.619***			
		(0.094)			
Inbred			1.050**		
			(0.022)		
PD_Abroad×Inbred			1.078		
			(0.099)		
PD_Abroad_Coauth_ITA				0.960	
				(0.106)	
PD_Abroad_Coauth_FOR				0.650***	
				(0.034)	
PD_Abroad_Coauth_NEW					0.556***
					(0.033)
PD_Abroad_Coauth_OLD					1.135*
					(0.085)
CumPub	1.003***	1.003***	1.003***	1.003***	1.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CumAvgCit	1.001***	1.001***	1.001***	1.001***	1.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Precocity	1.212***	1.212***	1.206***	1.213***	1.206***
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Female	0.914***	0.914***	0.912***	0.914***	0.915***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Age	1.157***	1.157***	1.156***	1.157***	1.159***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Age^2	0.998***	0.998***	0.998***	0.998***	0.998***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Top_Uni_PhD	0.932***	0.932***	0.932***	0.932***	0.932***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	11414	11414	11414	11414	11414
Observations	49131	49131	49131	49131	49131
Log likelihood	-95364.7	-95364.0	-95361.0	-95359.7	-95335.8
Chi-squared	3169.0	3170.4	3176.4	3178.9	3226.7

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01

This is an interesting results, since it may reveal two distinct modes of scientific workforce management in Italy. On the one hand, postdoctoral appointments in general are grudgingly accepted by young doctorate holders since they may delay the access to an assistant professor position. On the other hand, if during the foreign postdoc the researcher continues working with Italian academics and her old scientific network has an higher probability of getting sooner an assistant professor position. Maintaining a strong connection with the home country network seems to pay in term of speed of entry.

We find weak evidence of a positive effect for those researchers that get their first academic position in the university where they did their PhD (*Inbred*), though the effect is not significant in the CEM estimation. But we do not find a statistical significant effect for those that went abroad and then went back to their alma mater to become assistant professor.

As in previous literature control variables provide evidence for a positive productivity effect in terms of publication and citation as well as a positive precocity effect. Age has an inverted U shape tendency and female researchers takes longer to get to the assistant professor position.

Evidence for the US suggests that the prestige of the PhD-granting institution is one of the most useful predictors of career advancement, even after controlling for productivity (Hargens and Hagstrom, 1967, Allison and Long, 1990). In the case of continental Europe, however, results are more mixed (Sabatier et al., 2006; Heining et al., 2007; Gaughan and Robin, 2004). In our estimation we find a weak but statistically significant negative correlation between the ranking of the university and the probability of entry.

Time-to-tenure

To provide a first impression of the survival process for the time to tenure analysis, Figure 2 depicts the hazard curve (left) and the Kaplan-Meier survival estimate (right) for the observations split by our main variable of interest, namely the dummy *PD_Abroad*, which takes value 1 for researchers who spent a postdoctoral period abroad.

We can observe that academics who spent a research period abroad exhibit a higher hazard of being tenured (left) and a steeper survival curve (right) which means that their probability of not getting a tenured position is decreasing faster with respect to those without international experience.

Figure 2. Kaplan-Meier survival estimate (left) and hazard curve (right) by type of international postdoctoral mobility.

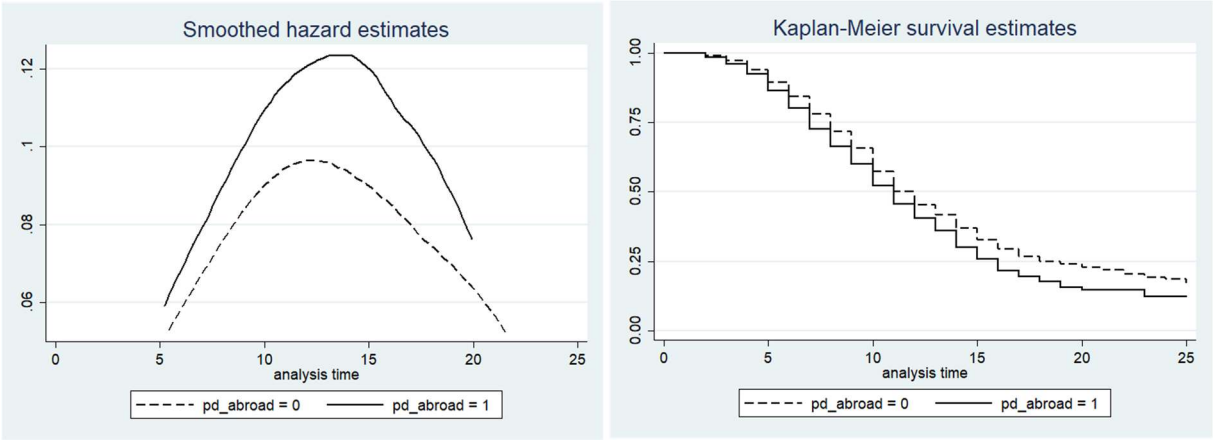


Table 7. Survival analysis: risk of entry in t (CEM sample)

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroa	0.891*		0.873		
	(0.056)		(0.082)		
PD_Italy	1.097	1.097	1.097	1.095	1.109*
	(0.063)	(0.062)	(0.063)	(0.062)	(0.063)
PD_Abroad_USA		0.884			
		(0.080)			
PD_Abroad_EUR		0.907			
		(0.072)			
PD_Abroad_OTH		0.826			
		(0.144)			
Inbred			1.105*		
			(0.060)		
PD_Abroad×Inbred			1.044		
			(0.121)		
PD_Abroad_Coauth_ITA				1.308**	
				(0.160)	
PD_Abroad_Coauth_FOR				0.825***	
				(0.056)	
PD_Abroad_Coauth_NEW					0.722***
					(0.052)
PD_Abroad_Coauth_OLD					1.723***
					(0.169)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	1985	1985	1985	1985	1985
Observations	10323	10323	10323	10323	10323
Log likelihood	-131367	-131367	-13134.3	-13131.3	-13108.6
Chi-squared	547.0	547.3	552.1	558.3	603.6

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01

Table 8 shows the results of the Cox model estimations for promotion from assistant professor to associate or full professor positions, investigating the effect of having spent a postdoctoral period abroad.

The baseline Cox results for promotion (column 1) show that postdoctoral appointments have a strong positive effect, indicating that academics benefit from their additional experience in terms of career advancement getting tenure faster. International postdoc have a stronger effect than national postdocs (test of equality Chi-Squared 44.54, p-value: 0.0000)

In column 2 we split international postdoc positions into appointments to the USA, which are assumed to be the most valuable due to the global status of their institutions, Europe and other countries. Indeed we find that visits to the USA increase the likelihood of being promoted more than visits elsewhere.

In column 3 we relate inbreeding (i.e. working at the PhD awarding institution) with postdoctoral appointments. We expect a greater effect from postdoctoral appointments for

inbred academics who can take advantage of institutional links since their PhD training. Results in columns 3 show that the main effect for inbreeding is negative, thus, time to promotion is longer for inbred academics than for non-inbred academics. This results is in line with the US-based evidence discussed above, but contradicts previous studies focusing on promotion in Italian academia (such as Perotti, 2002). The interaction term with postdoctoral mobility abroad is positive, following our expectation that this type of research appointments is particularly important for inbred academics, but not significant.

Column 4 shows that researchers whose co-authors in the postdoctoral period are for the large majority Italian, are at a higher risk of being tenured with respect to researcher who are more involved in collaborations with foreign researchers. However the two coefficients are not significantly different (p-value=0.58).

Column 5 shows that, for researchers who have the vast majority of new co-authors (i.e. co-authors with whom they had not collaborated before) acquired during the postdoctoral period, the effect on tenure is positive, significant and larger in magnitude with respect to the baseline estimation and compare to those having more old co-authors.

Looking at our control variables, Age has a significant and non-monotonic impact on the scientists' velocity to tenure, while Gender has an important negative impact in all the specifications considered. Scientific productivity, measured by number of publications and citations, have a positive impact on getting tenured, while estimates of the dummy variable Precocity suggest that having published during the PhD has still an impact (lower than on entry) on the hazard of obtaining a tenure. Finally, the prestige of the PhD granting institution has a positive and significant impact on tenure, confirming the US-based empirical evidence discussed above, while the prestige of the institution at which the researcher is currently employed lowers her hazard of being tenured, signaling that academics at top universities generally wait longer before getting tenured.

Table 9 shows the previous results replicated for the restricted sample of CEM matched academics. All main results hold also for the restricted matched sample. The positive effect of having a mainly Italian coauthor network is no significantly different (p-value=0.84) while the effect of network enlargement with new coauthors still plays a role though less strongly than in the full sample.

Table 8. Survival analysis: risk of being promoted in t

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	1.629***		1.573***		
	(0.080)		(0.106)		
PD_Italy	1.211***	1.211***	1.216***	1.211***	1.211***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)
PD_Abroad_USA		1.751***			
		(0.116)			
PD_Abroad_EUR		1.562***			
		(0.095)			
PD_Abroad_OTH		1.462***			
		(0.215)			
Inbred			0.804***		
			(0.025)		
PD_Abroad×Inbred			1.053		
			(0.085)		
PD_Abroad_Coauth_ITA				1.700***	
				(0.155)	
PD_Abroad_Coauth_FOR				1.611***	
				(0.086)	
PD_Abroad_Coauth_NEW					1.777***
					(0.100)
PD_Abroad_Coauth_OLD					1.414***
					(0.099)
CumPub	1.035***	1.035***	1.035***	1.035***	1.035***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
CumAvgCit	1.006***	1.006***	1.006***	1.006***	1.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Precocity	1.176***	1.175***	1.184***	1.176***	1.182***
	(0.040)	(0.040)	(0.041)	(0.041)	(0.041)
Gender	0.697***	0.698***	0.700***	0.698***	0.697***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Age	1.147***	1.147***	1.148***	1.147***	1.146***
	(0.048)	(0.048)	(0.048)	(0.048)	(0.048)
Age^2	0.998***	0.998***	0.998***	0.998***	0.998***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top_Uni_PhD	1.123***	1.124***	1.069*	1.123***	1.123***
	(0.045)	(0.045)	(0.042)	(0.045)	(0.045)
Top_Uni	0.915***	0.914***	0.999	0.915***	0.916***
	(0.030)	(0.030)	(0.034)	(0.030)	(0.030)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	11414	11414	11414	11414	11414
Observations	112639	112639	112639	112639	112639
Log likelihood	-47034.8	-47033.4	-47009.5	-47034.7	-47030.5
Chi-squared	6268.6	6271.4	6319.2	6268.9	6277.3

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01

Table 9. Survival analysis: risk of being promoted in t (CEM sample)

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	1.412***		1.229*		
	(0.132)		(0.144)		
PD_Italy	1.016	1.025	1.005	1.015	1.015
	(0.102)	(0.103)	(0.101)	(0.102)	(0.102)
PD_Abroad_USA		1.590***			
		(0.176)			
PD_Abroad_EUR		1.307***			
		(0.132)			
PD_Abroad_OTH		1.567**			
		(0.295)			
Inbred			0.674***		
			(0.067)		
PD_Abroad×Inbred			1.244*		
			(0.158)		
PD_Abroad_Coauth_ITA				1.435***	
				(0.182)	
PD_Abroad_Coauth_FOR				1.404***	
				(0.137)	
PD_Abroad_Coauth_NEW					1.477***
					(0.146)
PD_Abroad_Coauth_OLD					1.295**
					(0.147)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	1985	1985	1985	1985	1985
Observations	19098	19098	19098	19098	19098
Log likelihood	-6427.0	-6424.6	-6418.6	-6427.0	-6426.0
Chi-squared	1113.9	1118.6	1130.6	1113.9	1115.8

8. Discussions and Conclusions

In this paper we have examined the effect of international research appointments and social capital on career outcomes in Italy in terms of the length of time until first appointment and time to tenure. We have assembled data on affiliations, productivity and careers of researchers active in Italian academia in between 1986 and 2015. We focused on international postdoctoral research appointments, which on the one hand may help to expand existing scientific and technical human capital while on the other may cut the social capital/network of the researcher making return in the academic system of the home country more difficult.

In addition to international mobility, we have considered both individual and social determinants of promotion to professorial positions for assistant professor. As for individual determinants (such as productivity, gender, and precocity), our results are in line with the US-based evidence, although some differences were found with previous literature which investigated Italian academia.

Coming to social determinants, we focused on social capital/network that contributes to enhance an individual scientific potential (scientific and technical human capital). We distinguished three different dimensions of the notion of social capital and we have produced individual and bibliometric indicators that try to capture their specificities.

We found some weak evidence that postdoctoral positions abroad slow down the entry in the Italian academic system. In this career phase, keeping a lot of contacts with the home country or keeping on working with the old network makes the reentry much quicker compared to peers that work with foreign authors or new colleagues during their international postdoctoral appointments.

On the other hand, we found that expanding the own scientific network during the postdoctoral period abroad accelerates academic careers in Italy. In particular, the ability of expanding the scientific network in universities and research labs, by moving across different institutions, is a relevant form of social capital an valuable in the long term. We found that maintaining connections to Italian academia and especially working with old coauthors while being abroad is beneficial in terms of time to entry. While enlarging the focal researcher network during her postdoctoral period abroad has an weakly positive effect on time to tenure. Also, we did not find an effect of localism: international returnees who work at their PhD granting institution did not get tenured sooner than their peers. We used coarsened exact matching to match each academic to a peer who has not participated in international mobility based on pre-move observable characteristics, obtaining results which confirm the robustness of our findings.

Table 10. Summary table of main findings

	Entry	Promotion
Inbreeding	No effect Weak direct (+)	No effect Yes direct (-)
Italian Network	Important positive	No effect
Old/New Network	Important positive	Weak positive

These results present some interesting insights into the role of research visits for career advancement. Our findings suggest that early career international research appointments avoid some of the barriers to job mobility: career insecurity, instability, and difficulty of re-entry, and are therefore more likely to lead to promotion. This makes a case for governments to provide better incentives for employing organizations to also reward other types of mobility. A better understanding of individual scientists' career incentives and constraints, of the type we tried to provide with our study, may help to evaluate recent reforms in Italy, which modified many aspects of academic careers, including recruitment and promotion.

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Appendix A

We use Coarsened Exact Matching to find a match for each academic. Matching is based on observable characteristics before the international research visit:

- no differential in publications and citations pre-move.
- similar birthyear and PhD year distribution.
- similarly distributed across PhD institution and PhD ranking.

The desirable output of this procedure is a sample of balanced treated and controls. For this case, I found 1,053 treated academics with one-to-one coarsened exactly matched controls over all the possible 1:1 couples (Table A1).

The matching returned two groups that are not statistically different in any of the matching criteria. Table A2 shows descriptive statistics of pre-treatment variables for the group of academics who participated in research visits and those that did not. The test of the means in Table A3 shows that the difference in time to promotion is significant.

Iacus et al. (2012) propose a measure of imbalance (*L1*) that is the semi-sum of the absolute differences between relative frequencies of treated and controls for each identified strata in this case. *L1* for the entire population is 0.96 (highly unbalanced distribution of treated and controls). This means that a substantial number of cells in the multidimensional matrix have zero controls (or treated). Comparing the *L1* of the matched population with the previous one provides evidence of the unbalanced reduction due to CEM. *L1* is equal to 0.80 after CEM, this means higher rate of balancing between treated and controls.

Table A1. Treated and un-tread units by CEM group.

Variable	*Controls*	*Treated*
All	16,664	1,375
Matched	1,053	1,053
Un-matched	15,611	322

Table A2. Descriptives of matched units by treated and controls.

	Controls				*Treated*			
Variable	*Mean*	*SD*	*Min*	*Max*	*Mean*	*SD*	*Min*	*Max*
Female	0.35	0.48	0	1	0.35	0.48	0	1
Birth year	1968	5.46	1953	1980	1968	5.46	1053	1980
PhD year	1999	4.82	1987	2007	1999	4.83	1986	2007
Top_Uni_PhD	0.12	0.32	0	1	0.12	0.32	0	1
Rank_Uni_PhD*	0.47	0.30	0	1	0.48	0.32	0	1
Pubs_PhD	3.36	3.92	0	21	3.87	3.74	0	22
AvgCits_PhD	15.70	31.56	0	292	17.44	28.44	0	179.50

*Note: to create the variable Rank_Uni_PhD, we ranked all institutions based on PRIN funding received by universities in each scientific area in the period 2001-2010. Funding values were normalized linearly, dividing each value for the maximum amount received in the sample for each scientific area, in order to have a one-to-one relationship between original and normalized values.

Table A3. T-test; international postdoctoral positions.

Variable	*Controls*	*Treated*
Tenured	0.50	0.54**
Years until promotion	8.42	7.68***

Appendix B

Although our measure of postdoc may be affected by propensity to publish in journals in the Social Sciences and Humanities to check for robustness of our results we run previous models with the complete sample.

Table B1. Survival analysis: risk of entry in t

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	0.685***		0.672***		
	(0.032)		(0.048)		
PD_Italy	0.797***	0.797***	0.795***	0.797***	0.798***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
PD_Abroad_USA		0.677***			
		(0.048)			
PD_Abroad_EUR		0.709***			
		(0.044)			
PD_Abroad_OTH		0.600***			
		(0.088)			
Inbred			1.083***		
			(0.017)		
PD_Abroad×Inbred			1.039		
			(0.092)		
PD_Abroad_Coauth_ITA				0.942	
				(0.102)	
PD_Abroad_Coauth_FOR				0.649***	
				(0.033)	
PD_Abroad_Coauth_NEW					0.548***
					(0.032)
PD_Abroad_Coauth_OLD					1.158**
					(0.084)
CumPub	1.002***	1.002***	1.002***	1.002***	1.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CumAvgCit	1.001***	1.001***	1.001***	1.001***	1.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Precocity	1.268***	1.268***	1.259***	1.268***	1.260***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Female	0.921***	0.921***	0.918***	0.921***	0.922***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Age	1.067**	1.067**	1.066**	1.067**	1.068**
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Age^2	0.999*	0.999*	0.999*	0.999*	0.999*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top_Uni_PhD	0.954**	0.955**	0.954**	0.954**	0.955**
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	18039	18039	18039	18039	18039
Observations	82153	82153	82153	82153	82153
Log likelihood	-159238	-159237	-159225.1	-159233.4	-159204.7
Chi-squared	4769.7	4770.9	4795.5	4779.0	4836.2

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01

Table B2. Survival analysis: risk of entry in t (CEM sample)

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	0.890*		0.857*		
	(0.054)		(0.077)		
PD_Italy	1.065	1.064	1.063	1.062	1.071
	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)
PD_Abroad_USA		0.873			
		(0.078)			
PD_Abroad_EUR		0.918			
		(0.071)			
PD_Abroad_OTH		0.808			
		(0.135)			
Inbred			1.062		
			(0.056)		
PD_Abroad×Inbred			1.073		
			(0.121)		
PD_Abroad_Coauth_ITA				1.285**	
				(0.155)	
PD_Abroad_Coauth_FOR				0.827***	
				(0.054)	
PD_Abroad_Coauth_NEW					0.724***
					(0.051)
PD_Abroad_Coauth_OLD					1.664***
					(0.158)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	2106	2106	2106	2106	2106
Observations	11028	11028	11028	11028	11028
Log likelihood	-14074	-14074	-14073.0	-14069.2	-14047.1
Chi-squared	572.0	572.6	574.9	582.6	626.7

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01

Table B3. Survival analysis: risk of being promoted in t

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	1.561***		1.518***		
	(0.072)		(0.095)		
PD_Italy	1.185***	1.185***	1.189***	1.184***	1.184***
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
PD_Abroad_USA		1.639***			
		(0.104)			
PD_Abroad_EUR		1.531***			
		(0.088)			
PD_Abroad_OTH		1.373**			
		(0.186)			
Inbred			0.812***		
			(0.020)		
PD_Abroad×Inbred			1.044		
			(0.080)		
PD_Abroad_Coauth_ITA				1.699***	
				(0.147)	
PD_Abroad_Coauth_FOR				1.527***	
				(0.076)	
PD_Abroad_Coauth_NEW					1.683***
					(0.089)
PD_Abroad_Coauth_OLD					1.374***
					(0.092)
CumPub	1.037***	1.037***	1.037***	1.037***	1.037***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
CumAvgCit	1.005***	1.005***	1.005***	1.005***	1.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Precocity	1.176***	1.177***	1.184***	1.177***	1.182***
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Female	0.728***	0.729***	0.732***	0.728***	0.728***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Age	1.125***	1.124***	1.124***	1.125***	1.124***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Age^2	0.998***	0.998***	0.998***	0.998***	0.998***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Top_Uni_PhD	1.167***	1.167***	1.119***	1.168***	1.167***
	(0.036)	(0.036)	(0.034)	(0.036)	(0.036)
Top_Uni	0.887***	0.886***	0.959*	0.887***	0.887***
	(0.021)	(0.021)	(0.024)	(0.021)	(0.021)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	18039	18039	18039	18039	18039
Observations	170947	170947	170947	170947	170947
Log likelihood	-79936.0	-79935.0	-79897.5	-79935.4	-79932.4
Chi-squared	9666.6	9668.5	9743.5	9667.9	9673.8

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01

Table B4. Survival analysis: risk of being promoted in t (CEM sample)

	(1) Baseline	(2) By Dest.	(3) Inbreeding	(4) ITA Coauth.	(5) New Coauth.
PD_Abroad	1.319***		1.216*		
	(0.117)		(0.130)		
PD_Italy	0.967	0.972	0.960	0.964	0.965
	(0.093)	(0.094)	(0.093)	(0.093)	(0.093)
PD_Abroad_USA		1.434***			
		(0.151)			
PD_Abroad_EUR		1.243**			
		(0.120)			
PD_Abroad_OTH		1.454**			
		(0.249)			
Inbred			0.714***		
			(0.069)		
PD_Abroad×Inbred			1.198		
			(0.148)		
PD_Abroad_Coauth_ITA				1.395***	
				(0.168)	
PD_Abroad_Coauth_FOR				1.297***	
				(0.120)	
PD_Abroad_Coauth_NEW					1.359***
					(0.127)
PD_Abroad_Coauth_OLD					1.240**
					(0.135)
University FE	Yes	Yes	Yes	Yes	Yes
Scientific area FE	Yes	Yes	Yes	Yes	Yes
Calendar year FE	Yes	Yes	Yes	Yes	Yes
Individuals	2106	2106	2106	2106	2106
Observations	19846	19846	19846	19846	19846
Log likelihood	-7020.5	-7019.1	-7013.9	-7020.3	-7020.0
Chi-squared	1199.4	1202.2	1212.5	1199.8	1200.4

Exponentiated coefficients. * p<0.10, ** p<0.05, *** p<0.01