It Takes Time but It Pays: International Postdoctoral Mobility and Career Effect in Italian Academia

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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's academic system more difficult. We use duration models on individual data to predict time to first appointment and time to promotion (from assistant to associate or full professor positions). Using a panel dataset of 18 thousand 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 finding weakly significant effects for the first two. Usual control variables are significant and robust.

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

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1 Introduction

When scientists are mobile across national borders or cooperate with each other, knowledge is disseminated, and new combinations of knowledge are created. From an individual perspective, international mobility of scientists, especially in the early phase of their career, it is increasingly regarded as a strategy to boost success in academia. Whether international mobility actually influences scientists' careers, is a question which has been explored by several studies in the last decade (Cañibano et al., 2020; Kotsemir et al., 2022; Liu & Hu, 2022; Tartari et al., 2020). However, the empirical evidence is still fragmented and results are not univocal (Netz et al., 2020).

While increasing attention has been given to the impact of scientific mobility on productivity (Franzoni, Scellato, Stephan, 2014; Geuna, 2015), the inadequacy and lack of appropriate data to assess the impact of researcher mobility on academic career has limited the studies realized. Traditional migration or labor statistics and censuses allow to picture flows of highly skilled human resources (Cañibano & 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; Liu & Hu, 2022).

Given the lack of suitable data, only a handful of studies have been carried out, in few European countries, with mixed results. For example, Cruz-Castro and Sanz-Menéndez (2010) and Sanz-Menéndez et al. (2013) focus on Spain and find a negative effect of long stays abroad on occupational outcomes. On the other hand, studies focusing on Germany (Lutter & Schröder, 2016; Zhao et al., 2022), Russia (Kotsemir et al., 2022) or Japan (Lawson & Shibayama, 2015) find a significantly positive impact of experience abroad on the attainment of a tenured position in the respective academic systems.

The main limitation of these previous studies, however, is that they usually rely on cross-sectional survey data, covering a limited span of time and scientific areas. This paper overcomes this limitation. We built a unique database of doctorate holders in all disciplines, who obtained their degree in Italian universities in the period from the

first PhD 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 University and Research and followed in their career until 2015. From this matched databased we identified those researchers that undertook a postdoctoral (hereafter PD) appointment before entering the Italian academic system. To classify mobility in the PD period we used affiliation information reported in scientific publication data from Scopus. About 20% of postdoctoral researchers were classified as internationally mobile.

In this paper we focus on the effect of international PD appointments and social capital/network on job outcomes at different career stages: time-to-entry as assistant professor and time-to-promotion to associate or, in a small number of cases, to full professor. International PD 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, 2015). 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).

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

The setting of our paper is important as Italy is among the top countries in terms of academic research performance, for example ranking third for percentage of scientific publications in world top 10% most cited paper just after the US and the UK (Abbott, 2018). The governance of the Italian academic system is comparable to other continental European state systems such as the French and the Spanish, all of which have gone through a series of reforms in the last 30 or so years to introduce more competition and evaluation. Finally, the Italian scientific system has always been internationally well connected and traditionally Italian researchers have spent period of time abroad, though the system is not too inward open with only a very small percentage of foreign

nationals working in the Italian university system (Carriero et al., 2023; Franzoni et al., 2012).

We use survival models to estimate time to entry and time to promotion and we confirm our results with a matched sample approach. We provide evidence that international PD appointments, while being weakly related to a slower entry in the academic system (international PD researcher returning to Italy get an assistant professor position 0.64 years later than the non-internationally mobile peers), have a positive correlation with career outcomes with a reduction of the waiting time for tenure of 1.2 years, which corresponds to a significant decrease of 10-15% relative to their peers without international PD experience. We also show that career entry and progression are weakly correlate with three different dimensions of social capital/network: localism, home country linkages and persistence in the composition of the co-author network.

2 International mobility, social capital and academic careers

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 & 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 (Fernández-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 & 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, 2015). Indeed, Musselin (2004) finds that academics participating in PD 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., 2020; Franzoni et al., 2012; Liu & Hu, 2022; 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 (Cruz-Castro & Sanz-Menéndez, 2010; Jonkers, 2011; 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.[1] 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, they 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. Three 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 & Farr (1973) look at the number of years it takes for an Assistant Professor to be promoted to an Associate

[1] 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.

Professor position, and find that inbred scientists wait for longer than others, even after controlling for differences in terms of productivity. Durante et al. (2011) document a number of instances in which Italian selection committees preferred local candidates to much better qualified external ones. More generally, localism is denounced as a factor of backwardness in the academic systems (Abbott, 2006; Godechot, 2016).

Secondly, we explore the importance of home country 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).

Thirdly, 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 it may indicate acceptance and recognition by the international scientific community and may add to the university's visibility and access to resources (Gonzalez-Brambila et al., 2008). 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. 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. Specifically, moving abroad and developing new ties with foreign researchers enable the internationally mobile researcher to be linked to a richer and more diversified international network compared to the researchers that stayed in the home country. Conversely, researchers who relocated

abroad but continued to engage in research and publish with the connections they established during their PD period demonstrate a commendable level of persistence in their collaborative network. This sustained commitment not only underscores their dedication to ongoing scientific inquiry but also highlights the enduring value of the relationships forged during their initial research endeavours.

3 Institutional framework: The Italian academic career system

The academic labour market in Italy is similar to that of other European countries such as France and Spain. 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 determining success in this market it is crucial to understand these regulations.

At the end of 2010s, the Italian academic system was 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 were prestigious technical universities. Eleven out of the 30 private institutions were distance-learning universities. The university system was 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: assistant professor, associate professor and full professor. Positions used to become tenured after a review conducted three years after hiring, however since 2012 (law n.240/2010) the assistant professor position has been transformed with a mix of temporary 5 years entry contract and tenure track contract with a starting 5-years temporary position. 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 profes-

sors, 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.

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, reaching the maximum in 2008 to then decrease to 54,785. Figure 1 summarizes the number and the share of Italian professors by academic position in this time period.

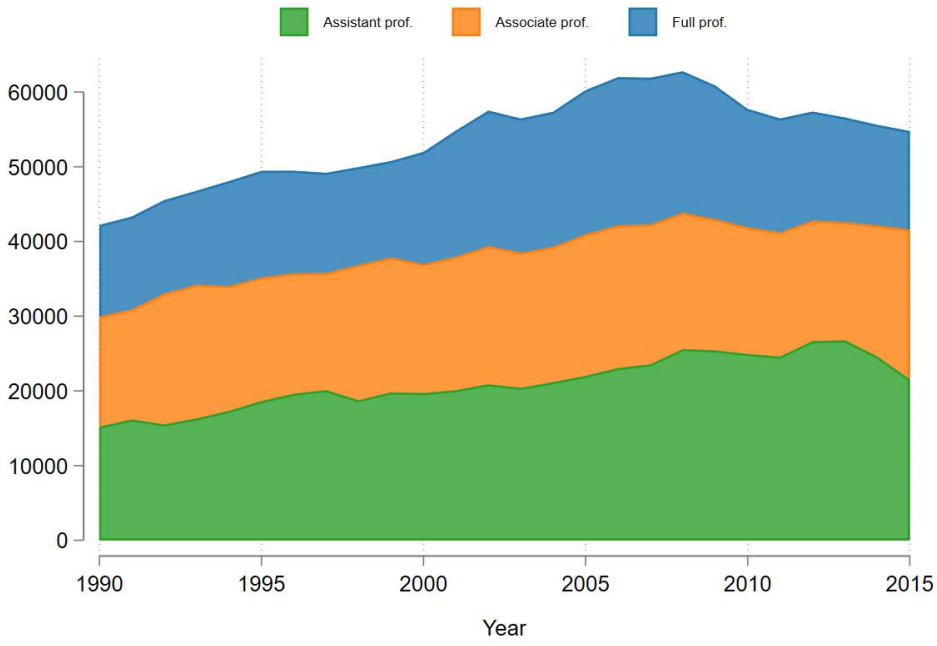


Figure 1 – Share of Italian professors by academic position 1990-2015

Since 1979, standardized competitions were held to hire assistants, associate and full professors and until 1998 almost all academic recruitment was substantially centralized with national commissions.[2] Despite the legislative prescription of one con-

[2] National commissions of five members were chosen by lottery within a pool of elected professors (from a pool of 15) belonging to the same discipline. Commissioners declared which of the candidates had

course every two years, a three to four years' interval occurred. Starting in 1999, recruitment procedures became entirely local, and each university could hold its own selection procedure. [3] The most recent Gelmini reform (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 in Italian academia. As in other national university systems the entry and promotions are quite cyclical.

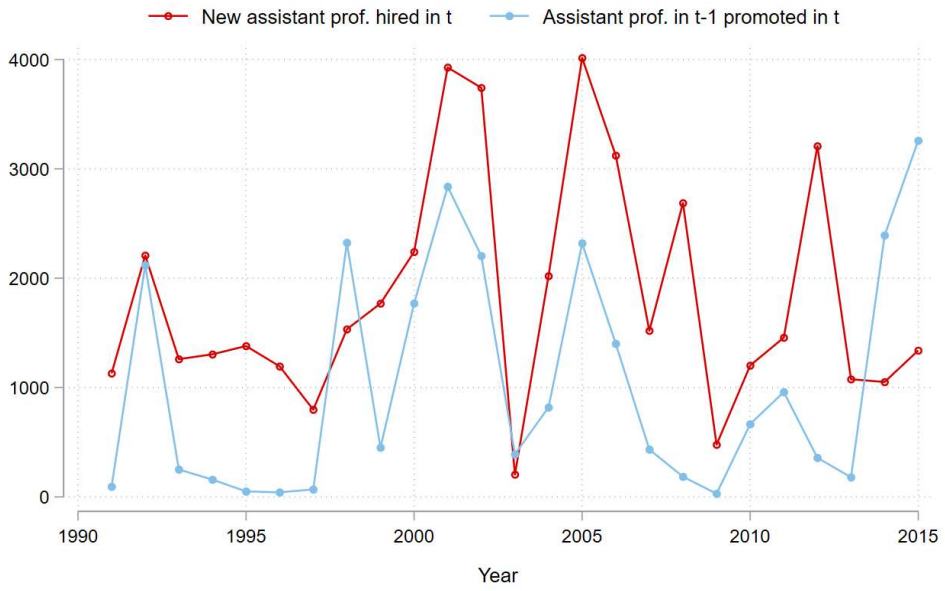


Figure 2 – Yearly entrances and promotions in Italian academia, 1991-2015

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.

[3] 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 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 vacancies could hire any candidate who had obtained a qualification.

4 Data

We have collected information from three primary sources: the National Library of Florence (BNCF), the Italian Ministry of education (MIUR) and Elsevier's Scopus database. From BNCF we retrieved all doctoral dissertations discussed in Italian universities from I cycle (1986) to 2006 (ca. 76 thousands doctoral theses). The BNCF's online public access catalogue furnished details, including theses' author, title, supervisor, granting institution, scientific field and year. From the MIUR we obtained administrative records on all academics working in Italian universities from 1990 to 2015. These records encompass academic positions, disciplinary domains, university affiliations, and individual data, such as birth year and gender. Using these two sources of information, we identified PhD holders from Italian universities who pursued an academic career in Italy.

We achieved the identification of academics holding an Italian doctoral degree by employing record linkage between academics listed in the MIUR dataset and individuals with doctorate degrees from Italian universities as recorded in the BNCF dataset. This matching process was grounded in four key fields: name, gender, scientific domain, and year of obtaining the PhD. As a result, we successfully identified the population of researchers possessing doctoral degrees from Italian universities and who have engaged in academic work within Italy for a minimum of one year. Additional insights into the retrieval process from BNCF, the methodologies used for record linkage and data cleansing, along with the outcomes of these procedures, can be found in Coda Zabetta and Geuna (2020).

Our analysis narrows down to a subset of these researchers, specifically the 18,039 individuals who achieved doctorate degrees and entered Italian academia as assistant professors within ten years following their PhD completion. Furthermore, all of these individuals were part of the Italian academic workforce in the year 2015 (i.e., they did not migrate nor retire before the end of our observational period).

For these researchers, we extracted from Scopus all scientific articles published in international journals from their initial publication to the year 2015. As a result, we find that a significant portion of them – comprising 15,385 individuals, approximately

85% – published at least one paper in Scopus-indexed journals throughout their entire career until 2015. In total we collected 285 thousand scientific articles.

To identify authors, our initial step involved utilizing the Scopus API for conducting author searches, using the first name, last name, and the institution where the academic earned their PhD from our dataset. This process aimed to retrieve relevant author information from Scopus's database. Subsequently, we employed the gathered information to establish a connection between each academic in our sample and a corresponding Scopus Author Identifier (AU-ID). This identifier is unique to each author within the Scopus database[4]. For comprehensive technical details concerning the procedures employed, including handling errors, author identification, field matching, and more, please refer to Appendix A.

4.1 Identification of scientists' early career mobility

We proxy early career mobility by using the affiliations reported in the scientific publications obtained from Scopus. This methodology enables us to detect researchers who, following their PhD and before their initial appointment within Italian academia, engaged in a research period, usually in a post-doctoral (PD) position. However, we disregard short research visits that typically do not lead to any published work. This technique permits us to monitor mobility to the extent that researchers produce at least one paper and specify their affiliation on the publication, allowing for traceability.

Several studies provide qualified validation for the utilization of this data for tracking mobility (Conchi and Michels, 2014; Zhao et al., 2022). Laudel (2003) and Aman (2018) conducted comparisons between scientist mobility records extracted from bibliometric data and those derived from alternate data sources such as CVs and self-reported information from researcher surveys. Moed and Halevi (2014) assess the potential and

[4] Prior research (Kawashima & Tomizawa, 2015) conducted an assessment of the accuracy of Scopus Author IDs within the bibliographic database. This involved cross-matching bibliographic records between Scopus and an open database that encompasses comprehensive details of the largest public fund for academic researchers. The study subsequently computed the recall and precision of Scopus Author IDs for researchers. The outcomes revealed that both recall and precision were approximately at 98% and 99%, respectively.

constraints of the bibliometric method in terms of the precision and interpretation of author profiles. Their evaluation covers the coherence between related statistics and scientist mobility, as inferred from Scopus publication records for authors across 17 countries. The findings of these studies collectively indicate the promise of the bibliometric approach, as the error rates for units of evaluation with indicator values based on sufficiently large datasets are estimated to be substantially below 10%.

Utilizing affiliation information extracted from Scopus, we proceeded to select the institutional affiliations for each author as mentioned in their scientific publications. This procedure enabled us to identify researchers' mobility in scenarios where: i) the researcher has published; ii) the publication includes the affiliation details. When an author reported multiple affiliations[5], we selected the first one, which we regarded as a representation of their primary affiliation (OECD, 2017). To ensure accuracy and disambiguation of affiliation data from publication records, we employed the Research Organization Registry (ROR) database.

For our empirical analysis, we intend to compare internationally mobile scientists with their counterparts who did not leave Italy during the PD period. Since our methodology relies on the publication records of scientists to identify international mobility, it is possible that some scientists who did not publish during this period may have still undertaken PD research abroad without publishing. To mitigate this issue and ensure a more accurate comparison between internationally mobile scientists and their non-mobile peers, we refine our sample selection criteria. Specifically, we limit our sample to researchers who were actively engaged in research during their postdoctoral period, meaning they published at least one scientific article between completing their PhD and obtaining their first position as assistant professors in Italian academia. Thus the final sample comprises a total of 9,912 scientists[6].

Table 1 and Figure 3 provide preliminary insights into the characteristics of internationally mobile academics. Notably, as we transition from the first to the second cohort, there is a rise in the absolute count of mobile individuals. However, the intriguing observation lies in the decline of the proportion of internationally mobile PhDs, from 24% to 18%. Women researchers

[5] Only 9.4% of the author-publication pairs reported more than one affiliation.
[6] They represent 55% of the total sample. Within the Natural Sciences (including mathematics, physics, chemistry, biology, and earth sciences), they constitute 89%; in Medicine and Veterinary (together with agricultural) fields, they account for 77%; in Architecture and Engineering, they make up 64%; in the realm of Social Sciences, they represent 28%, and in Humanities and Law, they constitute 14%.

exhibit lower mobility rates compared to their men counterparts, with percentages of 16.6% and 21.7%, respectively.

From a geographical point of view, PD mobility encompasses a broad spectrum of 50 different countries. The United States stands out as the top destination, attracting 45% of mobile PD scholars, followed by EU countries, in particular the United Kingdom, France, and Germany. Collectively, all EU countries account for 46% of mobility. The remaining 9% is directed towards various other countries.

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

	All	M	W	Cohort 86-96	Cohort 97-07
Nb. PhDs	9,912	5,852	4,060	2,578	7,334
Nb. PD abroad	1944	1268	676	615	1329
Share PD abroad	19.6%	21.7%	16.6%	23.9%	18.1%

Notes: we only consider researchers that published at least one article in Scopus indexed journal between the PhD and the first appointment as assistant professor

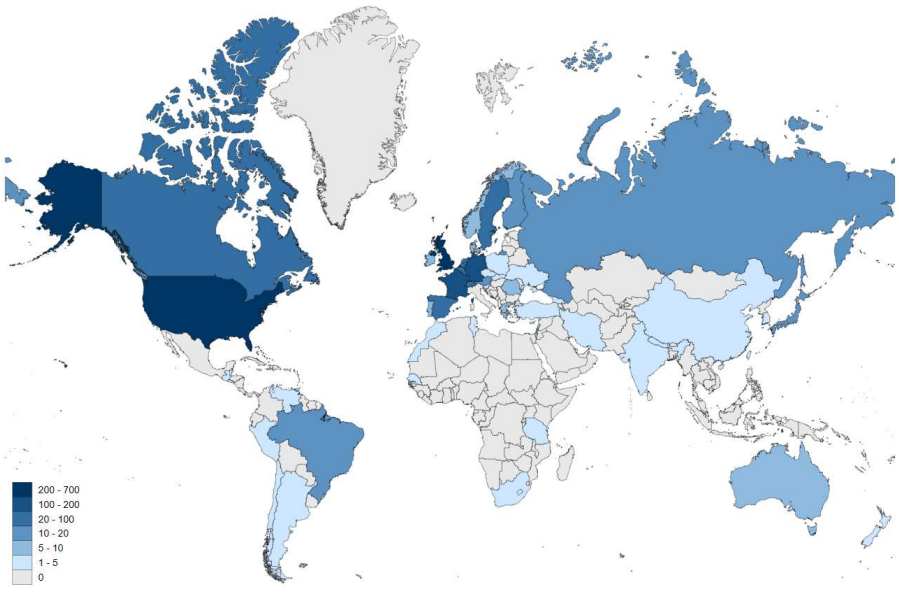


Figure 3 – Geographical international mobility of Italian international postdocs

5 Econometric methodology

We estimate a duration model as a function of international post-doctoral appointments taking into account two moments in researchers' career: from PhD to the first appointment as assistant professor; and from entry to the promotion to associate or full professor. We assume that each academic is subject to the probability of entry, or being promoted, 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 being promoted since the year of 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-promotion" analysis). This model is written for any individual i:[7]

$$h(t) = h_0(t) \times \exp(\alpha PD_Abroad_i + \beta SOC_CAP_i + \gamma \boldsymbol{X}_i + \boldsymbol{\delta}_{y,a,u})$$

where h_0 is the baseline hazard, PD_Abroad_i is a dummy variable which take value one if the researcher spent a PD period abroad. To better explore the main effect, we include in different specification a set of variables that aim to capture the social capital/network effect (SOC_CAP_i). In each model we include $\boldsymbol{X}_i$, which is a vector of individual characteristics. Precocity (i.e., the presence of pre-PhD publications) researchers' gender, age at PhD and first appointment (only for the time-to-promotion analysis), and their squared term, are included to control for possible effects. Performance measures (yearly number of publications and citations) are included to assess the importance of merit for entry/promotion. Finally, $\boldsymbol{\delta}_{y,a,u}$ represents indicators of PhD year, scientific area, and university, which are also included as controls.

Standard models that control for confounding factors may fail if the treatment, PD mobility in our case, is time-variant (Robins, 1999). For example, controlling for past values of productivity, which affect later research appointments and promotion,

[7] In Appendix C we present robustness checks for several alternative parametric survival models, finding consistent results with respect to our baseline estimations.

can lead to biased estimates. To tackle the issue of reverse causality between PD appointments and entry/promotion in academia, we employ the Coarsened Exact Matching (CEM) approach, as introduced by Iacus et al., (2012). This method involves matching each internationally mobile academic with peers who were actively engaged in research during their postdoctoral period but did not undertake a postdoctoral appointment abroad. The matching process relies on observable characteristics existing prior to mobility, including gender, birth year, year of PhD completion, university attended, university ranking, publications, citations during the PhD, and their scientific field. This approach treats a postdoctoral appointment abroad, typically pursued by junior academics, as a form of treatment with long-lasting effects on academics' career trajectories.

We thus divide our sample into two groups: the treated group, consisting of internationally mobile academics, and the untreated control group, comprised of their matched counterparts. Subsequently, we apply a Cox proportional hazard model to this matched sample to analyze the data. For additional details regarding the CEM procedure, please refer to Appendix B for a more comprehensive explanation.

Time-to-entry and time-to-promotion depend also on the social capital and the connections that the researcher is able to create with peers and the academic community. We test this effect making use of three proxies for researchers' social capital/network.

First, we include a variable that identifies whether the focal academic got her first position in her alma mater (*Inbreeding*). We interact this variable with international PD appointments to assess whether return to the home country is speeded up by a tight social network existent in the original PhD granting institution. In the time-to promotion analysis we explore whether these ties have long lasting effect on promotion.

We then try to identify the strength of the connection between a researcher in a PD appointment and her home country. We make use of two dummy variables: *PD_Abroad (Home Linkages>TH)* and *PD_Abroad (Home Linkages<TH)*. These two

variables are based upon information on researchers' co-authors' affiliation, as derived from the Scopus publications records[8]. The two variables are calculated as follows. We retrieve for each internationally mobile researcher in our sample all the publications during the PD period. We then identify all the unique co-authors' affiliations and compute the share of Italian and foreign co-authors' affiliations in the post-doctoral period. Finally, we create the two dummies which take value one, respectively: if the share of Italian affiliations among co-authors is higher (or lower) than a certain threshold (TH) computed by scientific area. In the empirical analysis we will show how the results change setting different thresholds.

Finally, only for the time-to-promotion analysis, we explore whether it is rewarding, in terms of faster promotion, to maintain scientific collaborations with the PD co-authors. We make use of two dummies: *PD_Abroad (Old Network>TH)*, which takes value one if the share of co-authors which are old collaborators from upto the end of the PD period is higher than a set TH; and, similarly, *PD_Abroad (Old Network<TH)*, which takes value one if this share is lower than the TH, computed by scientific area.

Since scientific performance plays a pivotal role in career advancement, our analysis incorporates controls for scientific productivity and quality. To quantify this, we calculate the annual number of publications and the average number of citations, adjusted for the number of co-authors of each scientific article. We obtain these data by extracting all scientific articles authored by individuals in our sample from Scopus, along with the total number of citations each article has received.

We compute the number of publications and the average number of citations per year for two distinct periods within our analysis: the first period spans from the time of the PhD to the first academic appointment, while the second period extends from entry into academia to the year of promotion (or the last year of observation for individuals who were not promoted in our observational period).

In our regression models, we employ the natural logarithms of these two measures, denoted as *Log_Pubs* and *Log_Cits*, respectively. Additionally, we introduce a binary

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

variable, *Precocity*, which takes a value of 1 for researchers who published at least one scientific article during their PhD.

To account for potential disciplinary variations in job availability and promotion opportunities, we include indicator variables in all our regression analyses. These indicators capture differences associated with each PhD year, scientific area, and university of affiliation. This approach allows us to control for the specific characteristics and dynamics within these categories and helps ensure that our analysis accurately reflects the influence of these factors on our outcomes of interest.

Table 2 provides an overview of the variables utilized in the empirical analysis, while Table 3 outlines the descriptive statistics of the primary characteristics within the sample. Specifically, 20% of individuals pursued a PD position abroad, with 9% in the United States and the European Union, and the remaining 2% elsewhere in the world. Additionally, 61% of the PhD recipients secured their initial Assistant Professor position at the same university where they earned their PhD. Notably, at the conclusion of the observational period, 18% of scientists exhibited a pattern of inbreeding. Women researchers constitute 41% of the sample, and the average age at the time of obtaining a PhD was 31 years.

Table 2 – Description of the main variables

Variable	Description
PD_Abroad	1: PD period abroad
PD_Abroad_USA	1: PD period in the US
PD_Abroad_EUR	1: PD period in an EU country
PD_Abroad_OTH	1: PD period outside US and EU
PD_Abroad (Home Linkages>TH)	1: share of Italian co-authors' affiliations
PD_Abroad (Home Linkages<TH)	higher/lower than the threshold (TH)
PD_Abroad (Old Network>TH)	1: share of co-authors who are acquaintances
PD_Abroad (Old Network<TH)	from PD is higher/lower than threshold (TH)
Inbred	1: Employment at the PhD granting university
Precocity	1: published a scientific article during the PhD
Log_Pubs	Natural log of number of publications by year
Log_Cits	Natural log of number of citations by year
Female	Researcher is female
Age_PhD	Researcher's age at PhD

Table 3 – Summary statistics of main variables

	Mean	Std Dev	Min	Max
Time-to-Entry	3.84	2.57	1	10
Promoted	0.50	0.50	0	1
Time-to-Prom	7.97	3.66	1	24
PD_Abroad	0.20	0.40	0	1
PD_Abroad_USA	0.09	0.28	0	1
PD_Abroad_EUR	0.09	0.29	0	1
PD_Abroad_OTH	0.02	0.13	0	1
Inbred_Entry	0.61	0.49	0	1
Inbred_Prom	0.28	0.45	0	1
N_Pubs_Entry	0.71	0.75	0	12.70
N_Pubs_Prom	0.58	0.52	0	7.54
N_Cits_Entry	1.30	2.62	0	98.98
N_Cits_Prom	1.29	1.77	0	38.98
Precocity	0.65	0.48	0	1
Female	0.41	0.49	0	1
Age_PhD	30.78	2.53	25	39
Observations	9912			

6 Results and discussion

6.1 Time-to-entry

Table 4 reports the results of the Cox model estimations for time to first appointment as assistant professor, investigating the effect of having spent a PD period abroad as well as social capital/network, while Table 5 reports the results for the restricted sample of matched academics using CEM.

Table 4 column 1 shows the effect of having spent a PD period abroad on the time elapsed from PhD to the first appointment as assistant professor in Italian academia. The estimated hazard ratio for *PD_Abroad* is 0.769, indicating that internationally mobile postdocs experience 23% lower hazard to entry Italian academia. To give an idea of the magnitude of the effect, easier to interpret than the hazard ratio, we estimate the average treatment effect (ATE) i.e., the difference in the time to first appointment if everyone spent a PD period abroad instead of if no one did. The estimated average time-to-entry for all non-internationally mobile postdocs is 3.7 years. With a PD appointment abroad, the average time-to-entry is estimated to be 0.64 years more,

which corresponds to a significant increase of 17% relative to the previous case (14% for the CEM sample).

In column 2 the variable of interest *PD_Abroad* is divided in three groups according to the country in which the mobility occurred. Irrespectively of the destination, doing a PD abroad delays entry as assistant professor compared to those that did it in Italy, especially in the case of postdocs mobile outside USA and Europe. In the estimation for the CEM sample (see Table 5) the magnitude of the coefficient and its significance are similar.

Table 4 – Risk of first appointment in t, baseline results

	(1)	(2)	(3)
PD_Abroad	0.771***		0.774***
	(0.021)		(0.033)
PD_Abroad_USA		0.809***	
		(0.030)	
PD_Abroad_EUR		0.767***	
		(0.028)	
PD_Abroad_OTH		0.636***	
		(0.050)	
Inbred_Entry	1.047**	1.047**	1.049*
	(0.023)	(0.023)	(0.026)
PD_Abroad × Inbred_Entry			0.769***
			(0.026)
Log_Pubs_Entry	3.417***	3.433***	3.417***
	(0.162)	(0.162)	(0.162)
Log_Cits_Entry	0.785***	0.783***	0.785***
	(0.024)	(0.024)	(0.024)
Precocity	1.162***	1.161***	1.162***
	(0.030)	(0.030)	(0.030)
Female	0.972	0.973	0.972
	(0.021)	(0.021)	(0.021)
Age_PhD	1.198**	1.192**	1.198**
	(0.092)	(0.091)	(0.092)
Age_PhD^2	0.998**	0.998*	0.998**
	(0.001)	(0.001)	(0.001)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	9912	9912	9912
Log likelihood	-82222.9	-82218.7	-82222.9
Chi-squared	1615.2	1623.7	1615.2

Notes: The coefficients reported in the table are hazard ratios. SE in parenthesis; * p<0.1 ** p<0.5 *** p<0.01.

Table 5 – Risk of entry in t, baseline results (CEM sample)

	(1)	(2)	(3)
PD_Abroad	0.743***		0.807***
	(0.035)		(0.062)
PD_Abroad_USA		0.735***	
		(0.047)	
PD_Abroad_EUR		0.776***	
		(0.045)	
PD_Abroad_OTH		0.621***	
		(0.094)	
Inbred_Entry	1.032	1.029	1.081
	(0.053)	(0.053)	(0.072)
PD_Abroad X Inbred_Entry			0.712***
			(0.041)
Log_Pubs_Entry	3.745***	3.767***	3.747***
	(0.392)	(0.395)	(0.392)
Log_Cits_Entry	0.809***	0.810***	0.808***
	(0.051)	(0.051)	(0.050)
Precocity	1.210***	1.208***	1.209***
	(0.070)	(0.070)	(0.069)
Female	0.943	0.939	0.942
	(0.060)	(0.060)	(0.060)
Age_PhD	1.281	1.234	1.256
	(0.526)	(0.511)	(0.509)
Age_PhD^2	0.996	0.997	0.996
	(0.007)	(0.007)	(0.007)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-10428.0	-10427.1	-10427.4
Chi-squared	1364.4	1308.2	1330.7

Notes: The coefficients reported in the table are hazard ratios. SE in parenthesis; * p<0.1 ** p<0.5 *** p<0.01.

In column 3 we interact *PD_Abroad* with the first proxy for social capital/network: the dummy variable *Inbred*. We can see that the coefficient for *Inbred*, which represents the hazard ratio of postdocs in Italy who get the first appointment in the PhD granting institution, where they have already strong acquaintances developed during the doctorate years, have a higher hazard of getting the position faster with respect to their internationally mobile peers. However, the inbreeding variable is only significant at the 10% level, and the coefficient is not significant in the CEM matched sample (see Table 5). Both coefficients of *PD_Abroad* and the interaction of the latter with *Inbred* are below one, and their difference is not significant, hence inbreeding (getting the

first position as assistant professor in one's *alma mater*) is not an important characteristic in explaining time-to-entry for internationally mobile postdocs.

In Table 6, we split the *PD_Abroad* variable into two complementary variables based on the network developed by the researcher during their PD period. Specifically, we focus on the share of the researcher's co-authors based in Italy. In the three columns of Table 6, we set different thresholds (abbreviated as TH) for this percentage to observe how the *PD_Abroad* variable reacts to different cases, ranging from less extreme to more extreme. We begin in column 1 with a TH corresponding to the first quartile (Q1), which means that the variable *PD_Abroad (Home Linkages)>TH* takes the value 1 for those researchers who had a share of co-authors based in Italy during their PD abroad higher than the first quartile of the distribution. In contrast, *PD_Abroad (Home Linkages)<TH* is in this case the complementary variable when the share is less than or equal to the first quartile. In columns 2 and 4, we increase the TH to the second and third quartile (Q2 and Q3 respectively). Additionally, we report in each column the result of the Wald test to determine the difference between the two coefficients of *PD_Abroad (Home Linkages)* (above vs. below the TH). The results, which are reported only for the CEM sample (but are similar in the full sample), indicate that collaborating primarily with co-authors from the home country reduces the time to entry for internationally mobile researchers when the percentage of Italian co-authors is "extreme", meaning above the third quartile The hazard ratio in this case is 1.278 and significantly different from the complementary hazard of 0.718.

Table 6 – Risk of entry in t, additional results (CEM sample)

	(1) TH: Q1	(2) TH: Q2	(3) TH: Q3
PD_Abroad (Home Linkages>TH)	0.722***	0.800***	1.236*
	(0.035)	(0.057)	(0.152)
PD_Abroad_Ita (Home Linkages<TH)	0.890	0.723***	0.718***
	(0.105)	(0.037)	(0.034)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-10426.8	-10427.6	-10423.3
Chi-squared	1105.7	1278.0	1315.6
Prob.	0.089	0.178	0.000

Notes: The coefficients reported in the table are hazard ratios. SE in parenthesis; * p<0.1 ** p<0.5 *** p<0.01.

The results of the estimations may reveal two distinct modes of scientific workforce management in Italy. On the one hand, PD appointments abroad 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 PD the researcher continues working manly with Italian academics, she has a higher probability of getting sooner an assistant professor position.

We find weak evidence of a positive effect on time-to-entry for those researchers who do not move internationally and that seek their first academic position in their *alma mater*, however the effect is not significant in the CEM sample estimation.[9] On the other hand, we do not find a statistically significant difference in the effect for researchers that spent a PD period abroad and then returned to their *alma mater*, with respect to those who got hired by a different university. We also find that maintaining a strong connection with the home country network pays in term of speed of entry for the internationally mobiles, and that postdocs abroad with a predominant network of Italian co-authors obtain an assistant professor position before than their peers.

As in previous literature, control variables provide evidence for a positive productivity effect in terms of publications and citations, especially for publications before the end of the PhD (*Precocity*). Age has an "inverted-U" shape tendency and women researchers take longer to get to the assistant professor position.

[9] In an unreported result, available upon request, we utilized the complete sample of 18,039 researchers and conducted CEM with "being research active during the PD" as the treatment variable, instead of *PD_Abroad* as in the main analysis. This process resulted in a CEM sample of 3,483 researchers. Subsequently, we employed the same regression model as presented in column 3 of Table 5. Our observations indicate a notably stronger and statistically significant effect of inbreeding. Specifically, the results demonstrate that the hazard ratio of *Inbred_Entry* is 1.216 with a p-value < 0.01. This implies that researchers who did not publish during the PD and secured their first Assistant Professor position at the University of their PhD exhibit a higher hazard rate of entry. For the inbred, the average time-to-entry is estimated to be 0.37 years less, which corresponds to a significant decrease of 11% relative to non-inbred. The result holds also for the full sample of 18,039 researchers. This underscores the influential role of inbreeding on entry of researchers-that have not been publishing before entry (non-research active).

6.2 Time-to-promotion

To provide a first impression of the survival process for the time-to-promotion analysis, Figure 4 depicts the Kaplan-Meier survival estimate (left) and the hazard curve (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 PD period abroad. We can observe that this latter group exhibits a steeper survival curve (left panel), which means that the survival probability (i.e., the probability of not being promoted) decreases faster with respect to researchers without international experience, and a higher hazard of being tenured at all times, with a peak at 13 years after their first appointment (right panel).

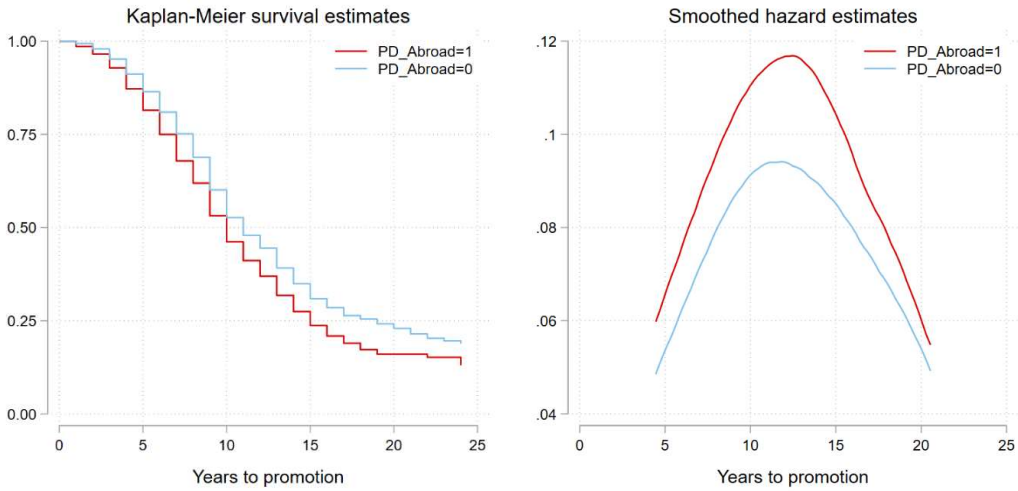


Figure 4 – Kaplan-Meier survival estimate (left) and hazard curve (right)

Table 7 shows the results of the Cox model estimations for being promoted from assistant professor to associate or full professor positions (the latter case is rarer), investigating the effect of having spent a PD period in a foreign institution. The baseline Cox results (column 1) show that international PD appointments have a significant and positive effect, indicating that academics benefit from their research experience abroad in terms of career advancement: they are promoted faster with respect to their peers without such experience. The estimated average time-to-promotion for all non-

internationally mobile postdocs is 12.3 years. With a PD appointment abroad, the average time-to-promotion is estimated to be 1.2 years less, which corresponds to a significant decrease of 10% relative to the previous case (15% for the CEM sample).

In column 2 we split international PD positions into appointments to the USA, which are assumed to be the most valuable due to the global recognition of their institutions, Europe and rest of the world. We find that PD appointments to the USA increase the likelihood of being promoted more than visits elsewhere.

Table 7 – Risk of being promoted in t, baseline results

	(1)	(2)	(3)
PD_Abroad	1.211***		1.236***
	(0.045)		(0.071)
PD_Abroad_USA		1.276***	
		(0.063)	
PD_Abroad_EUR		1.151***	
		(0.059)	
PD_Abroad_OTH		1.186	
		(0.133)	
Inbred_Entry	0.926**	0.925**	0.933*
	(0.033)	(0.033)	(0.037)
PD_Abroad × Inbred_Entry			1.195***
			(0.056)
Log_Pubs_Prom	4.069***	4.083***	4.069***
	(0.335)	(0.337)	(0.335)
Log_Cits_Prom	1.201***	1.195***	1.201***
	(0.054)	(0.054)	(0.054)
Precocity	1.093**	1.091**	1.093**
	(0.040)	(0.040)	(0.040)
Female	0.825***	0.826***	0.825***
	(0.027)	(0.027)	(0.027)
Age_PhD	0.941	0.939	0.942
	(0.111)	(0.111)	(0.111)
Age_PhD^2	1.001	1.001	1.001
	(0.002)	(0.002)	(0.002)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	9912	9912	9912
Log likelihood	-40369.7	-40368.4	-40369.6
Chi-squared	2528.5	2531.0	2528.7

Notes: The coefficients reported in the table are hazard ratios. SE in parenthesis; * p<0.1 ** p<0.5 *** p<0.01.

In column 3, we analyze the relationship between inbreeding (obtaining the first academic position at one's PhD institution) and international PD appointments. We anticipate inbred academics to benefit more from PD appointments due to their institutional connections, but we find a negative main effect on time-to-promotion for inbred academics without international experience. This aligns with US-based research but contradicts previous studies in Italian academia. While the interaction effect between international PD mobility and inbreeding is positive, it is not significantly different for non-inbred international mobile academics. Hence, localism does not significantly impact researchers' career paths with international PD experience.

Looking at the control variables, *Age* has a significant negative impact on the scientists' velocity to tenure, indicating an important role for seniority in the process of selection. *Female* has an important negative impact in all the specifications considered, female scientists have about 30% lower hazard rate of being promoted. Scientific productivity, measured by average number of publications and citations by year, have a positive impact on being promoted, while estimates of the dummy variable *Precocity* suggest that having published during the PhD has still an impact (lower than on the entry stage) on the hazard of obtaining a promotion.

Table 8 shows the previous results replicated for the restricted sample of CEM matched academics. All main results hold also for the restricted matched sample.

Finally, we divided PD_Abroad into two variables in Table 9 based on the proportion of coauthors who are acquaintances from the doctoral/postdoctoral period. We tested our hypothesis on the persistence of collaboration with these acquaintances and its importance. As already discussed when commenting Table 6, we set the three quartiles of this proportion as the threshold (TH). The results reported in columns 1 to 3 refer to the CEM sample, and we performed the Wald test on the difference of the two coefficients. The findings indicate that maintaining an active scientific collaboration with acquaintances from the postdoctoral period increases the promotion velocity of researchers who spent time in a PD period abroad (see column 3). The difference in the two coefficients is significant based on the Wald test.

Table 8 – Risk of being promoted in t, baseline results (CEM sample)

	(1)	(2)	(3)
PD_Abroad	1.198**		1.191
	(0.096)		(0.153)
PD_Abroad_USA		1.334***	
		(0.134)	
PD_Abroad_EUR		1.066	
		(0.122)	
PD_Abroad_OTH		1.223	
		(0.269)	
Inbred_Entry	0.830	0.828	0.828
	(0.103)	(0.103)	(0.119)
PD_Abroad × Inbred_Entry			1.201*
			(0.120)
Log_Pubs_Prom	7.140***	7.285***	7.139***
	(1.771)	(1.791)	(1.772)
Log_Cits_Prom	0.992	0.976	0.993
	(0.122)	(0.120)	(0.122)
Precocity	0.961	0.945	0.961
	(0.091)	(0.090)	(0.091)
Female	0.750**	0.756**	0.750**
	(0.089)	(0.090)	(0.089)
Age_PhD	0.623	0.633	0.622
	(0.401)	(0.409)	(0.401)
Age_PhD^2	1.007	1.007	1.007
	(0.011)	(0.011)	(0.011)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-5533.8	-5532.3	-5533.8
Chi-squared	35727.8	1378.6	1361.8

Notes: The coefficients reported in the table are hazard ratios. SE in parenthesis; * p<0.1 ** p<0.5 *** p<0.01.

Table 9 – Risk of being promoted in t, additional results (CEM sample)

	(1)	(2)	(3)
	TH: Q1	TH: Q3	TH: Q3
PD_Abroad (Old Network>TH)	1.187*	1.243**	1.933***
	(0.109)	(0.118)	(0.246)
PD_Abroad (Old Network<TH)	1.221	1.143	1.023
	(0.155)	(0.129)	(0.091)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-5535.0	-5534.8	-5524.7
Chi-squared	1366.7	1361.9	1381.4
Prob.	0.844	0.523	0.000

Notes: The coefficients reported in the table are hazard ratios. SE in parenthesis; * p<0.1 ** p<0.5 *** p<0.01.

7 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-promotion. We have assembled data on affiliations, productivity and careers of researchers active in Italian academia in between 1986 and 2015. We focused on international PD 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. Our baseline results show that internationally mobile postdocs experience a 17% longer time-to-entry (0.64 years more) in Italian academia and a 10-15% lower time-to-promotion (1.2 years less) with respect to their peers.

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 evidence that PD positions abroad slow down the entry in the Italian academic system. In this career phase, however, maintaining scientific collaboration with the home country makes the re-entry much quicker compared to peers that work with foreign authors during their international PD appointments.

On the other hand, we found that nurturing the collaboration ties created during the PD period abroad accelerates academic careers in Italy. In particular, the ability of

maintaining the scientific network in universities and research labs, obtained by moving across different institutions, is a relevant form of social capital a valuable in the long term. We found that maintaining connections to Italian academia while being abroad is beneficial in terms of time-to-entry, but it has no effect on time-to-promotion for internationally mobile postdocs. 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 (but they have an advantage compared to non-internationally mobile inbred academics). We used CEM 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

	Career stage	
	Entry	Promotion
Localism	No direct effect Weak undirect (–)	No direct effect Weak undirect (+)
Home country linkages	Strong (+) if TH>Q3	/
Persistence in the composition of the co-author network	/	Strong (+) if TH>Q3

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.

References

Abbott, A. (2006). Saving Italian science. *Nature*, *440*(7082), 264–265. https://doi.org/10.1038/440264a

Abbott, A. (2018). Italian election leaves science out in the cold. *Nature*, *554*(7693), 411–412. https://doi.org/10.1038/d41586-018-02223-7

Ackers, L. (2005). Moving People and Knowledge: Scientific Mobility in the European Union1. *International Migration*, *43*(5), 99–131. https://doi.org/10.1111/j.1468-2435.2005.00343.x

Allison, P. D., & Long, J. S. (1990). Departmental Effects on Scientific Productivity. *American Sociological Review*, *55*(4), 469–478. https://doi.org/10.2307/2095801

Aman, V. (2018). Does the Scopus author ID suffice to track scientific international mobility? A case study based on Leibniz laureates. *Scientometrics*, *117*(2), 705–720. https://doi.org/10.1007/s11192-018-2895-3

Becher, T., & Trowler, P. (2001). *Academic tribes and territories: Intellectual enquiry and the culture of disciplines* (2nd ed). Open University Press.

Bozeman, B., Dietz, J. S., & Gaughan, M. (2001). Scientific and technical human capital: An alternative model for research evaluation. *International Journal of Technology Management*, *22*(7/8), 716. https://doi.org/10.1504/IJTM.2001.002988

Cañibano, C., D'Este, P., Otamendi, F. J., & Woolley, R. (2020). Scientific careers and the mobility of European researchers: An analysis of international mobility by career stage. *Higher Education*, *80*(6), 1175–1193. https://doi.org/10.1007/s10734-020-00536-z

Cañibano, C., & Woolley, R. (2015). Towards a Socio-Economics of the Brain Drain and Distributed Human Capital. *International Migration*, *53*(1), 115–130. https://doi.org/10.1111/imig.12020

Carriero, R., Coda Zabetta, M., Geuna, A., & Tomatis, F. (2023). Investigating PhDs' early career occupational outcomes in Italy: Individual motivations, role of supervisor and gender differences. *Higher Education*. https://doi.org/10.1007/s10734-023-01068-y

Coda Zabetta, M., & Geuna, A. (2020). *Italian Doctorate Holders and Academic Career Progression in the Period 1986-2015* (Carlo Alberto Notebooks 629). Collegio Carlo Alberto.

Conchi, S., & Michels, C. (2014). *Scientific mobility: An analysis of Germany, Austria, France and Great Britain*. https://api.semanticscholar.org/CorpusID:150661856

Cruz-Castro, L., & Sanz-Menéndez, L. (2010). Mobility versus job stability: Assessing tenure and productivity outcomes. *Research Policy*, *39*(1), 27–38. https://doi.org/10.1016/j.respol.2009.11.008

Durante, R., Labartino, G., & Perotti, R. (2011). *Academic Dynasties: Decentralization and Familism in the Italian Academia* (w17572; p. w17572). National Bureau of Economic Research. https://doi.org/10.3386/w17572

Fernández-Zubieta, A., Geuna, A., & Lawson, C. (2015). What Do We Know of the Mobility of Research Scientists and Impact on Scientific Production. In *Global Mobility of Research Scientists* (pp. 1–33). Elsevier. https://doi.org/10.1016/B978-0-12-801396-0.00001-6

Franzoni, C., Scellato, G., & Stephan, P. (2012). Foreign-born scientists: Mobility patterns for 16 countries. *Nature Biotechnology*, *30*(12), 1250–1253. https://doi.org/10.1038/nbt.2449

Gill, B. (2005). Homeward bound? The experience of return mobility for Italian scientists. *Innovation: The European Journal of Social Science Research*, *18*(3), 319–341. https://doi.org/10.1080/13511610500186698

Godechot, O. (2016). The chance of influence: A natural experiment on the role of social capital in faculty recruitment. *Social Networks*, *46*, 60–75. https://doi.org/10.1016/j.socnet.2016.02.002

Gonzalez-Brambila, C. N., Veloso, F. M., & Krackhardt, D. (2008). Social Capital and the Creation of Knowledge. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1120977

Hargens, L. L., & Farr, G. M. (1973). An Examination of Recent Hypotheses About Institutional Inbreeding. *American Journal of Sociology*, *78*(6), 1381–1402. https://doi.org/10.1086/225470

Heining, J., Jerger, J., & Lingens, J. (2007). *Success in the Academic Labour Market for Economics—The German Experience* (University of Regensburg Working Papers in Business, Economics and Management Information Systems 422). University of Regensburg, Department of Economics. https://EconPapers.repec.org/RePEc:bay:rdwiwi:803

Hunter, R. S., Oswald, A. J., & Charlton, B. G. (2009). The Elite Brain Drain. *The Economic Journal*, *119*(538), F231–F251. https://doi.org/10.1111/j.1468-0297.2009.02274.x

Iacus, S. M., King, G., & Porro, G. (2012). Causal Inference without Balance Checking: Coarsened Exact Matching. *Political Analysis*, *20*(1), 1–24. https://doi.org/10.1093/pan/mpr013

Jonkers, K. (2011). Mobility, productivity, gender and career development of Argentinean life scientists. *Research Evaluation*, *20*(5), 411–421. https://doi.org/10.3152/095820211X13176484436177

Jöns, H. (2007). Transnational mobility and the spaces of knowledge production: A comparison of global patterns, motivations and collaborations in different academic fields. *Social Geography*, *2*(2), 97–114. https://doi.org/10.5194/sg-2-97-2007

Kawashima, H., & Tomizawa, H. (2015). Accuracy evaluation of Scopus Author ID based on the largest funding database in Japan. *Scientometrics*, *103*(3), 1061–1071. https://doi.org/10.1007/s11192-015-1580-z

Kotsemir, M., Dyachenko, E., & Nefedova, A. (2022). Mobile young researchers and their non-mobile 'twins': Who is winning the academic race? *Scientometrics*, *127*(12), 7307–7332. https://doi.org/10.1007/s11192-022-04488-2

Laudel, G. (2003). Studying the brain drain: Can bibliometric methods help? *Scientometrics*, *57*(2), 215–237. https://doi.org/10.1023/A:1024137718393

Lawson, C., & Shibayama, S. (2015). International research visits and careers: An analysis of bioscience academics in Japan. *Science and Public Policy*, *42*(5), 690–710. https://doi.org/10.1093/scipol/scu084

Liu, M., & Hu, X. (2022). Movers' advantages: The effect of mobility on scientists' productivity and collaboration. *Journal of Informetrics*, *16*(3), 101311. https://doi.org/10.1016/j.joi.2022.101311

Long, J. S., Allison, P. D., & McGinnis, R. (1993). Rank Advancement in Academic Careers: Sex Differences and the Effects of Productivity. *American Sociological Review*, *58*(5), 703–722. https://doi.org/10.2307/2096282

Lutter, M., & Schröder, M. (2016). Who becomes a tenured professor, and why? Panel data evidence from German sociology, 1980–2013. *Research Policy*, *45*(5), 999–1013. https://doi.org/10.1016/j.respol.2016.01.019

Mahroum, S. (2000). Scientific Mobility: An Agent of Scientific Expansion and Institutional Empowerment. *Science Communication*, *21*(4), 367–378. https://doi.org/10.1177/1075547000021004003

Mahroum, S. (2001). Europe and the Immigration of Highly Skilled Labour. *International Migration*, *39*(5), 27–43. https://doi.org/10.1111/1468-2435.00170

Melin, G. (2005). The dark side of mobility: Negative experiences of doing a postdoc period abroad. *Research Evaluation*, *14*(3), 229–237. https://doi.org/10.3152/147154405781776102

Moed, H. F., & Halevi, G. (2014). A bibliometric approach to tracking international scientific migration. *Scientometrics*, *101*(3), 1987–2001. https://doi.org/10.1007/s11192-014-1307-6

Morano-Foadi, S. (2005). Scientific Mobility, Career Progression, and Excellence in the European Research Area1. *International Migration*, *43*(5), 133–162. https://doi.org/10.1111/j.1468-2435.2005.00344.x

Musselin, C. (2004). Towards a European Academic Labour Market? Some Lessons Drawn from Empirical Studies on Academic Mobility. *Higher Education*, *48*(1), 55–78. https://doi.org/10.1023/B:HIGH.0000033770.24848.41

Netz, N., Hampel, S., & Aman, V. (2020). What effects does international mobility have on scientists' careers? A systematic review. *Research Evaluation*, *29*(3), 327–351. https://doi.org/10.1093/reseval/rvaa007

OECD. (2017). *OECD Science, Technology and Industry Scoreboard 2017: The digital transformation*. OECD. https://doi.org/10.1787/9789264268821-en

Sanz-Menéndez, L., Cruz-Castro, L., & Alva, K. (2013). Time to Tenure in Spanish Universities: An Event History Analysis. *PLoS ONE*, *8*(10), e77028. https://doi.org/10.1371/journal.pone.0077028

Saxenian, A. (2005). From Brain Drain to Brain Circulation: Transnational Communities and Regional Upgrading in India and China. *Studies in Comparative International Development*, *40*(2), 35–61. https://doi.org/10.1007/BF02686293

Scellato, G., Franzoni, C., & Stephan, P. (2012). *Mobile Scientists and International Networks* (w18613; p. w18613). National Bureau of Economic Research. https://doi.org/10.3386/w18613

Stephan, P. E. (2015). *How economics shapes science* (First Harvard University Press paperback edition). Harvard Univ. Press.

Tartari, V., Di Lorenzo, F., & Campbell, B. A. (2020). "Another roof, another proof": The impact of mobility on individual productivity in science. *The Journal of Technology Transfer*, *45*(1), 276–303. https://doi.org/10.1007/s10961-018-9681-5

Zhao, X., Aref, S., Zagheni, E., & Stecklov, G. (2022). Return migration of German-affiliated researchers: Analyzing departure and return by gender, cohort, and discipline using Scopus bibliometric data 1996–2020. *Scientometrics*. https://doi.org/10.1007/s11192-022-04351-4

Appendices

A : Retrieving publications data

To retrieve publication information for the 18,039 researchers in our sample, we followed a specific procedure. We utilized the Scopus API to conduct a query using the researchers' full names along with their last affiliation, sourced from MIUR data. This operation yielded 34,419 results, corresponding to 15,968 unique combinations of researcher names and affiliations.

Each result includes a Scopus Author ID (AU-ID), which means that the same researcher may be associated with multiple AU-IDs. Additionally, for each result Scopus provides a list of scientific fields (or "subject areas"[10]) along with the corresponding number of articles published in journals within each field. Using this information, we filtered out observations that were likely incorrect. This involved verifying whether the scientific field of the researcher and the subject area of the corresponding author profile aligned.

In order to attribute comparable disciplinary categories for authors and individuals, we aggregate disciplines defined by MIUR and Scopus subject 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.

After this step, we identified 10,582 AU-IDs that were linked to a unique researcher profile, and we retained them. The remaining researchers were linked to two or more AU-IDs. For these cases, we selected a single AU-ID, prioritizing the one with the highest number of registered publications. At the end of this process, we obtained 15,385 researcher–AU-ID pairs.

[10] Scopus subject areas are: Agricultural and Biological Sciences-AGRI; Arts and Humanities-ARTS; Biochemistry, Genetics and Molecular Biology-BIOC; Business, Management and Accounting-BUSI; Chemical Engineering-CENG; Chemistry-CHEM; Computer Science-COMP; Decision Sciences-DECI; Earth and Planetary Sciences-EART; Economics, Econometrics and Finance-ECON; Energy-ENER; Engineering-ENGI; Environmental Science-ENVI; Immunology and Microbiology-IMMU; Materials Science-MATE; Mathematics-MATH; Medicine-MEDI; Neuroscience-NEUR; Nursing-NURS; Pharmacology, Toxicology and Pharmaceutics-PHAR; Physics and Astronomy-PHYS; Psychology-PSYC; Social Sciences-SOCI; Veterinary-VETE; Dentistry-DENT; Health Professions-HEAL and Multidisciplinary-MULT.

B : Coarsened Exact Matching

We employ Coarsened Exact Matching (CEM) to identify suitable matches for each academic. Matching is based on observable characteristics assessed prior to the international research visit, ensuring:

- Similar levels of number of publications and citations prior to PhD.
- Comparable birth year and PhD year distributions.
- Identical university of PhD and scientific field.

The desired outcome of this process is a balanced sample of treated and control subjects. In this instance, we identified 582 treated academics, each paired with at least one coarsened exact match from the pool of all possible pairs (see Table B1).

The matching process yielded two groups that exhibit no statistical differences across any of the matching criteria. Descriptive statistics of pre-treatment variables for academics who participated in research visits and those who did not are presented in Table B2. The test of means in Table B3 demonstrates a significant difference in time to entry and promotion.

Iacus et al., (2012) propose a measure of imbalance (*L1*) as the semi-sum of the absolute differences between relative frequencies of treated and control groups within each identified stratum. In our case, the overall *L1* for the population is 0.98, indicating a highly unbalanced distribution of treated and control subjects. This implies that a significant number of cells in the multidimensional matrix have either zero controls or zero treated cases.

Comparing the *L1* of the matched population with the original population provides evidence of improved balance resulting from CEM. After CEM, *L1* is reduced to 0.87, indicating a higher degree of balance between treated and control groups.

Table B1. Treated and control units by CEM group.

	Treated	Controls
All	1944	7968
Matched	582	1033
Un-matched	1362	6935

Table B2. Descriptives of matched units by treated and controls

	Controls				Treated			
	Mean	SD	Min	Max	Mean	SD	Min	Max
# Pubs during PhD	1.76	2.30	0	24	2.34	2.54	0	23
# Cits during PhD	50.46	105.78	0	1881	73.07	127.51	0	1842
Woman	0.30	0.46	0	1	0.32	0.47	0	1
Year of birth	1970.28	4.73	1957	1980	1969.70	4.95	1957	1980
Year of PhD	2000.15	4.21	1989	2007	1999.59	4.38	1988	2007
Observations	1033				582			

Table B3. T-test; international PD positions

	Controls		Treated		Diff.	
	Mean	SD	Mean	SD	b	t
Time-to-Entry	3.41	2.36	4.11	2.47	-0.70***	(-5.53)
Promoted	0.55	0.50	0.59	0.49	-0.04	(-1.51)
Time-to-Promotion	8.06	3.60	7.52	3.57	0.55*	(2.23)
Observations	1033		582		1615	

C : Robustness check: alternative parametric survival models

Table 11 – Time-to-entry, baseline results (Weibull distrib.)

	(1)	(2)	(3)
PD_Abroad	0.698***		0.756***
	(0.040)		(0.070)
PD_Abroad_USA		0.698***	
		(0.054)	
PD_Abroad_EUR		0.727***	
		(0.052)	
PD_Abroad_OTH		0.551***	
		(0.099)	
Inbred_Entry			1.084
			(0.087)
PD_Abroad × Inbred_Entry			0.669***
			(0.048)
Log_Pubs_Entry	5.803***	5.867***	5.816***
	(0.828)	(0.840)	(0.832)
Log_Cits_Entry	0.749***	0.750***	0.746***
	(0.062)	(0.063)	(0.062)
Precocity	1.255***	1.250***	1.253***
	(0.087)	(0.087)	(0.086)
Female	0.933	0.928	0.931
	(0.072)	(0.071)	(0.071)
Age_PhD	1.227	1.167	1.191
	(0.577)	(0.555)	(0.552)
Age_PhD^2	0.997	0.998	0.997
	(0.008)	(0.008)	(0.008)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1481.2	-1479.9	-1480.5
Chi-squared	1915.3	1898.3	1731.9

Table 12 – Time-to-entry, additional results (Weibull distr.)

	(1)	(2)	(3)
	TH: Q1	TH: Q2	TH: Q3
PD_Abroad (Home Linkages>TH)	0.656***	0.737***	1.452**
	(0.039)	(0.066)	(0.250)
PD_Abroad_Ita (Home Linkages<TH)	0.919	0.684***	0.666***
	(0.112)	(0.043)	(0.039)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1476.7	-1481.0	-1472.2
Chi-squared	975.8	1861.5	1838.4
Prob.	0.007	0.432	0.000

Table 13 – Time-to-promotion, baseline results (Weibull distrib.)

	(1)	(2)	(3)
PD_Abroad	1.218**		1.204
	(0.105)		(0.168)
PD_Abroad_USA		1.362***	
		(0.148)	
PD_Abroad_EUR		1.072	
		(0.133)	
PD_Abroad_OTH		1.282	
		(0.295)	
Inbred_Entry			0.808
			(0.124)
PD_Abroad × Inbred_Entry			1.224*
			(0.131)
Log_Pubs_Prom	8.777***	8.969***	8.864***
	(2.391)	(2.422)	(2.405)
Log_Cits_Prom	0.952	0.936	0.956
	(0.126)	(0.125)	(0.127)
Precocity	0.966	0.948	0.968
	(0.098)	(0.097)	(0.098)
Female	0.725**	0.732**	0.730**
	(0.093)	(0.094)	(0.093)
Age_PhD	0.484	0.491	0.489
	(0.329)	(0.335)	(0.333)
Age_PhD^2	1.011	1.011	1.011
	(0.011)	(0.011)	(0.011)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-954.9	-953.2	-953.4

Table 14 - Time-to-promotion, additional results (Weibull distr.)

	(1) TH: Q1	(2) TH: Q3	(3) TH: Q3
PD_Abroad (Old Network>TH)	1.211*	1.311***	2.241***
	(0.120)	(0.134)	(0.296)
PD_Abroad (Old Network<TH)	1.233	1.102	0.998
	(0.170)	(0.134)	(0.098)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-954.8	-954.0	-938.7
Prob.	0.906	0.219	0.000

Table 15 – Time-to-entry, baseline results (Exponential distr.)

	(1)	(2)	(3)
PD_Abroad	0.808***		0.833***
	(0.026)		(0.044)
PD_Abroad_USA		0.806***	
		(0.034)	
PD_Abroad_EUR		0.823***	
		(0.033)	
PD_Abroad_OTH		0.740***	
		(0.069)	
Inbred_Entry			1.029
			(0.048)
PD_Abroad × Inbred_Entry			0.796***
			(0.031)
Log_Pubs_Entry	2.547***	2.552***	2.547***
	(0.178)	(0.178)	(0.178)
Log_Cits_Entry	0.864***	0.864***	0.863***
	(0.037)	(0.037)	(0.037)
Precocity	1.137***	1.136***	1.137***
	(0.044)	(0.045)	(0.044)
Female	0.977	0.976	0.977
	(0.042)	(0.042)	(0.042)
Age_PhD	1.074	1.059	1.065
	(0.286)	(0.282)	(0.281)
Age_PhD^2	0.999	0.999	0.999
	(0.004)	(0.004)	(0.004)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1890.6	-1890.4	-1890.5
Chi-squared	7220.0	6374.7	10645.1

Table 16 – Time-to-entry, additional results (Exponential distr.)

	(1)	(2)	(3)
	TH: Q1	TH: Q2	TH: Q3
PD_Abroad (Home Linkages>TH)	0.769***	0.817***	1.176*
	(0.025)	(0.040)	(0.103)
PD_Abroad_Ita (Home Linkages<TH)	0.997	0.805***	0.788***
	(0.068)	(0.028)	(0.025)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1887.8	-1890.6	-1887.9
Chi-squared	1343.6	6672.7	4816.4
Prob.	0.000	0.772	0.000

Table 17 – Time-to-promotion, baseline results (Exponential distr.)

	(1)	(2)	(3)
PD_Abroad	1.148**		1.145
	(0.065)		(0.101)
PD_Abroad_USA		1.192**	
		(0.083)	
PD_Abroad_EUR		1.099	
		(0.089)	
PD_Abroad_OTH		1.180	
		(0.187)	
Inbred_Entry			0.892
			(0.095)
PD_Abroad × Inbred_Entry			1.149*
			(0.082)
Log_Pubs_Prom	3.082***	3.101***	3.085***
	(0.481)	(0.483)	(0.479)
Log_Cits_Prom	1.166*	1.159*	1.169*
	(0.094)	(0.094)	(0.094)
Precocity	0.968	0.964	0.970
	(0.066)	(0.066)	(0.067)
Female	0.781***	0.783***	0.783***
	(0.069)	(0.070)	(0.069)
Age_PhD	1.015	1.026	1.022
	(0.505)	(0.511)	(0.508)
Age_PhD^2	0.999	0.999	0.999
	(0.008)	(0.008)	(0.008)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1365.9	-1365.7	-1365.5

Table 18 - Time-to-promotion, additional results (Exponential distr.)

	(1)	(2)	(3)
	TH: Q1	TH: Q3	TH: Q3
PD_Abroad (Old Network>TH)	1.142**	1.190***	1.515***
	(0.074)	(0.079)	(0.129)
PD_Abroad (Old Network<TH)	1.163*	1.091	1.036
	(0.102)	(0.085)	(0.066)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1365.9	-1365.7	-1361.9
Prob.	0.851	0.329	0.000

Table 19 – Time-to-entry, baseline results (Gompertz distr.)

	(1)	(2)	(3)
PD_Abroad	0.703***		0.785***
	(0.040)		(0.072)
PD_Abroad_USA		0.697***	
		(0.054)	
PD_Abroad_EUR		0.742***	
		(0.053)	
PD_Abroad_OTH		0.545***	
		(0.103)	
Inbred_Entry			1.110
			(0.089)
PD_Abroad × Inbred_Entry			0.663***
			(0.047)
Log_Pubs_Entry	4.912***	4.964***	4.939***
	(0.628)	(0.637)	(0.633)
Log_Cits_Entry	0.770***	0.772***	0.767***
	(0.059)	(0.060)	(0.059)
Precocity	1.256***	1.254***	1.253***
	(0.088)	(0.088)	(0.087)
Female	0.921	0.916	0.920
	(0.071)	(0.071)	(0.071)
Age_PhD	1.381	1.298	1.329
	(0.677)	(0.645)	(0.638)
Age_PhD^2	0.995	0.996	0.995
	(0.008)	(0.008)	(0.008)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1546.1	-1544.4	-1544.8
Chi-squared	2173.0	1979.9	2082.8

Table 20 - Time-to-entry, additional results (Gompertz distr.)

	(1)	(2)	(3)
	TH: Q1	TH: Q2	TH: Q3
PD_Abroad (Home Linkages>TH)	0.667***	0.749***	1.364**
	(0.039)	(0.066)	(0.203)
PD_Abroad_Ita (Home Linkages<TH)	0.885	0.687***	0.674***
	(0.106)	(0.043)	(0.039)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1542.9	-1545.8	-1538.6
Chi-squared	1207.8	1911.6	1894.2
Prob.	0.023	0.358	0.000

Table 21 - Time-to-promotion, baseline results (Gompertz distr.)

	(1)	(2)	(3)
PD_Abroad	1.228**		1.200
	(0.104)		(0.160)
PD_Abroad_USA		1.344***	
		(0.142)	
PD_Abroad_EUR		1.100	
		(0.133)	
PD_Abroad_OTH		1.324	
		(0.289)	
Inbred_Entry			0.800
			(0.120)
PD_Abroad × Inbred_Entry			1.241**
			(0.132)
Log_Pubs_Prom	7.694***	7.835***	7.781***
	(1.935)	(1.964)	(1.941)
Log_Cits_Prom	0.992	0.979	0.995
	(0.124)	(0.123)	(0.124)
Precocity	0.971	0.958	0.973
	(0.098)	(0.097)	(0.098)
Female	0.712***	0.719***	0.717***
	(0.090)	(0.091)	(0.091)
Age_PhD	0.442	0.451	0.444
	(0.296)	(0.302)	(0.297)
Age_PhD^2	1.013	1.012	1.012
	(0.011)	(0.011)	(0.011)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1043.4	-1042.1	-1041.9

Table 22 – Time-to-promotion, additional results (Gompertz distr.)

	(1)	(2)	(3)
	TH: Q1	TH: Q3	TH: Q3
PD_Abroad (Old Network>TH)	1.221**	1.322***	2.129***
	(0.119)	(0.132)	(0.262)
PD_Abroad (Old Network<TH)	1.242	1.112	1.022
	(0.166)	(0.132)	(0.099)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1615	1615	1615
Log likelihood	-1043.4	-1042.5	-1029.9
Prob.	0.912	0.205	9.14e-08

D : Robustness checks: STEMM subsample

Table 23 – Time-to-entry, baseline results (STEMM subsample)

	(1)	(2)	(3)
PD_Abroad	0.755***		0.831**
	(0.037)		(0.070)
PD_Abroad_USA		0.739***	
		(0.048)	
PD_Abroad_EUR		0.795***	
		(0.049)	
PD_Abroad_OTH		0.635***	
		(0.101)	
Inbred_Entry			1.086
			(0.077)
PD_Abroad × Inbred_Entry			0.722***
			(0.043)
Log_Pubs_Entry	3.572***	3.589***	3.586***
	(0.386)	(0.388)	(0.389)
Log_Cits_Entry	0.797***	0.800***	0.794***
	(0.052)	(0.053)	(0.052)
Precocity	1.225***	1.224***	1.220***
	(0.073)	(0.073)	(0.072)
Female	0.951	0.947	0.951
	(0.065)	(0.065)	(0.065)
Age_PhD	1.482	1.461	1.428
	(0.665)	(0.658)	(0.632)
Age_PhD^2	0.993	0.994	0.994
	(0.007)	(0.007)	(0.007)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1506	1506	1506
Log likelihood	-9545.0	-9544.1	-9544.2
Chi-squared	1259.4	1184.5	1325.2

Table 24 – Time-to-entry, additional results (STEMM subsample)

	(1)	(2)	(3)
	TH: Q1	TH: Q2	TH: Q3
PD_Abroad (Home Linkages>TH)	0.720***	0.817***	1.289**
	(0.036)	(0.061)	(0.160)
PD_Abroad_Ita (Home Linkages<TH)	0.949	0.734***	0.727***
	(0.103)	(0.039)	(0.036)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1506	1506	1506
Log likelihood	-9542.3	-9544.5	-9539.9
Chi-squared	950.2	1149.9	1176.0
Prob.	0.013	0.173	0.000

Table 25 – Time-to-promotion, baseline results (STEMM subsample)

	(1)	(2)	(3)
PD_Abroad	1.151*		
	(0.097)		
PD_Abroad_USA		1.311***	
		(0.137)	
PD_Abroad_EUR		0.964	
		(0.122)	
PD_Abroad_OTH		1.376	
		(0.324)	
Inbred_Entry			0.864
			(0.131)
PD_Abroad × Inbred_Entry			1.183
			(0.122)
Log_Pubs_Prom	7.048***	7.308***	7.069***
	(1.793)	(1.848)	(1.791)
Log_Cits_Prom	1.007	0.978	1.008
	(0.128)	(0.125)	(0.128)
Precocity	0.969	0.948	0.970
	(0.096)	(0.095)	(0.096)
Female	0.800*	0.815	0.802*
	(0.101)	(0.103)	(0.101)
Age_PhD	0.653	0.697	0.663
	(0.508)	(0.543)	(0.516)
Age_PhD^2	1.006	1.005	1.006
	(0.013)	(0.013)	(0.013)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1506	1506	1506
Log likelihood	-4964.9	-4962.1	-4964.3
Chi-squared	1352.0	1383.4	18180.5

Table 26 – Time-to-promotion, additional results (STEMM subsample)

	(1)	(2)	(3)
	TH: Q1	TH: Q3	TH: Q3
PD_Abroad (Old Network>TH)	1.157	1.252**	1.983***
	(0.111)	(0.124)	(0.260)
PD_Abroad (Old Network<TH)	1.137	1.015	0.955
	(0.164)	(0.125)	(0.092)
PhD Year, Area & Uni FE	Yes	Yes	Yes
Observations	1506	1506	1506
Log likelihood	-4964.8	-4963.7	-4953.0
Chi-squared	1354.2	23579.2	17436.4
Prob.	0.915	0.141	0.000