



# Exploring the effects of mobility and foreign nationality on internal career progression in universities

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Accepted: 19 May 2022 / Published online: 3 June 2022  
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## Abstract

This article explores how organizational mobility and foreign nationality affect a researcher's chances of an internal career promotion in university systems that do not have rules preventing inbreeding and where teaching occurs mostly not in English but a local language. As a case study, we have examined the Flemish university system, the Dutch speaking part of Belgium, and developed expectations on the chances of promotion for mobile and foreign researchers compared to non-mobile and nationals. We use data for all post-doctoral and professorial staff between 1991 and 2017, for a total of 14,135 scientists. We calculated the chances of promotion with a competing risk model to take time into account and to disentangle the probability of two mutually exclusive risk events: promotion and leaving the university. The results show that international mobility and foreign nationality reduced the chances of promotion in the same university, and that mobile and foreign scientists were also more likely to leave any given university. These effects were particularly strong at an early stage: in the study period, 21.9% of non-mobile national postdocs became professor compared to just 1.2% of internationally mobile foreigners. These results would suggest that internationally mobile and foreign scientists struggle to advance in universities that lack rules preventing inbreeding and with little opportunity to teach in English.

**Keywords** Scientific mobility · Academic careers · European Research Area · Internationalization · Brain drain · Competing risk model

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## Introduction

In many countries, a large share of *junior* academic staff, namely, PhD students and Post-docs, is made up of foreign and organizationally mobile scientists, namely, those that changed their institutional affiliation — either from a university within the same national system or from abroad. However, the proportion of foreign and mobile researchers in *senior* positions tends to be much smaller. For example, in 2019, foreigners in the United Kingdom accounted for 50% of PhD students but only 22% of the *senior* academic staff, in Spain; in 2016, this figure was, respectively, 25% and less than 3%; and in France, in 2009, 41% and 7%.<sup>1,2</sup> In Flemish universities, the share of foreign postdocs has grown eightfold over the last three decades, from 5 to 42%, whereas the share of foreign professors has grown considerably less, from 4 to 12% (source: Human Resources in Research Flanders 1991–2017).

In a similar vein, several studies found that non-mobile scientists — i.e., scientists who never changed institutional affiliation — constitute the great majority of the professorial body in systems as diverse as France, Mexico, and Sweden (Godechot & Louvet, 2008; Horta et al., 2010; Lundgren et al., 2018). Scholarly research has repeatedly shown the downsides of academic inbreeding, namely, the practice of hiring a university's own graduates, and the positive effects of organizational mobility on individual and institutional research performance, knowledge exchange, and creativity (e.g., Horta et al., 2010; Horta, 2013; Jacob & Meek, 2013; Franzoni, Scellato and Stephan 2014; Petersen, 2018; Payumo et al., 2018).

The mechanisms leading to a smaller number of mobile and foreign scientists at the professorial level have been seldom investigated so far. Indeed, several studies have explored what factors predict academic career progression, but only a minority considered the impact of mobility (e.g., Cruz-Castro & Sanz-Menéndez, 2010; Jonkers, 2011) or foreign nationality (e.g., Corley & Sabharwal, 2007; Hayter & Parker, 2018) and to our knowledge, only one study considered the effects of mobility and foreign nationality simultaneously (Lawson & Shibayama, 2015). As such, given that foreign scientists are more often mobile than national scientists, we have little insight into whether foreign mobile scientists have fewer chances of obtaining a senior position due to a negative effect of foreign nationality, mobility, or both of them — or other factors.

The goal of this article is to widen our understanding of how organizational mobility — namely, mobility which implies a change of institutional affiliation — and foreign nationality affect the chances of internal university career progression and any possible underlying mechanisms. We examined the case of Flanders, which is exemplary of systems that do not have rules or norms preventing academic inbreeding and where teaching occurs to a large extent in a local language that is not English, two features that can obstacle the career progression of mobile and foreign researchers<sup>3</sup> (Afonso, 2016;

<sup>1</sup> The degree of internationalization of junior staff in different countries is also affected by the size and structure of doctoral programs.

<sup>2</sup> Sources: UK: HESA (UK's Higher Education Statistics Agency — <https://www.hesa.ac.uk/news/19-01-2021/sb259-higher-education-staff-statistics>); Spain: ETER (European Tertiary Education Register); France: Eumida (European Micro Data).

<sup>3</sup> The term researcher encompasses both senior (i.e., professors) and junior researchers (i.e., postdoc, PhD), tenured and untenured scientific staff.

Marimon et al., 2009; Musselin, 2005, 2010; Luxon & Peelo, 2009; Pudelko & Tenzer, 2019; Seeber and Mampeay 2021).

Academic career progression depends on the performance in the most important domains of academic activity, namely, the “holy trinity” (Baruch, 2013) of research, teaching, and administrative/management tasks (Blaxter et al., 1998). The way academic tasks are carried out is partly affected by the specific national and organizational contexts in which they take place. In most cases, professors must teach in the official language of the country or region where the university is located. They must conform to expectations about research standards and outcomes, which are influenced by national evaluation processes and institutional traditions. They must coordinate and create coalitions with their colleagues to effectively participate in the management and the decision-making process.

Hence, starting from the assumptions that the way teaching, research, and management tasks must be carried out is partly affected by the context, we have developed expectations on the impact of organizational mobility and foreign nationality on *internal* career progression in a Flemish university. We explored these expectations employing data from the Human Resources in Research Flanders (HRRF) dataset, which keeps track of all academic staff of the five Flemish universities from 1991 to 2017. Due to confidentiality rules, we could not retrieve information on individual scientific productivity. Systematic differences in scientific productivity between mobile and non-mobile researchers, and foreign and national researchers, are explored in the “Robustness tests” section.

In the following section we have reviewed the literature, exploring the relationships between academic career and mobility. We then discuss how organizational mobility and foreign nationality probably affect internal career progression in a Flemish university and develop expectations accordingly. In the “Data and methods” section we present the data, variables, and methods, and in the “Empirical analysis” section we present the analysis and the results. We conclude by discussing the findings, the implications for individual careers and the European Research Area (ERA), and directions for future research.

## Factors affecting internal career progression in Flemish universities

### Organizational mobility and academic career

Academic mobility in some cases consists of a short-term period, while in other cases it implies a change of organizational affiliation, namely, a new position and employment contract in a different university: organizational mobility (from now onward “mobility”). The decision to move and where to move to are affected by necessity and desire to obtain better working and life conditions, as well as for professional and cognitive development. The factors that affect mobility decisions vary by career stage and research fields (Cañibano et al. 2008; Laudel & Bielick, 2019; Cañibano et al., 2020).

Researchers are often motivated by a lack of opportunities at home (i.e., “forced mobility”) as well as greater opportunities and pay elsewhere (Ackers, 2008). European universities’ capability to attract foreign researchers mostly depends on the attractiveness of the country in which they are located, given by its wealth, the investment, and opportunities in research, and only to a secondary extent by the universities’ specific traits, such as research intensity and reputation (Lepori et al., 2015). Postdocs are attracted to highly reputed and prestigious places, available facilities, and financial support (Musselin, 2004; Stephan et al., 2015). In some disciplines and national systems there are also strong expectations

that early career researchers (ECR — Early Career Researcher<sup>4</sup>) should be mobile (e.g., Cantwell, 2011; Gaughan & Robin, 2004; Jöns, 2007; Musselin, 2005), among others because of the importance for knowledge flow (Laudel, 2005; Zubieta, 2009; Fontes et al., 2013) and the transmission of tacit knowledge (e.g., Cambrosio & Keating, 1988; Collins, 1974, 2001).

Gläser and Laudel (2015, p. 13) conceptualize the academic career as the intertwining of three types of careers: (i) a *cognitive career*, which gradually extends a researcher's knowledge via a sequence of thematically connected problem-solving processes; (ii) a *community career*, namely, a sequence of positions within a scientific community with different status, reputation, and expectations; and (iii) an *organizational career*, related to a progression of organizational positions with specific expectations regarding research and resources for doing research. Accordingly, decisions of mobility (or non-mobility) are determined by and intertwined with researchers' efforts to develop the three kinds of interrelated careers. Laudel and Bielick (2019) explored how mobility patterns of German ECR depend on field-specific scripts and the interaction between organizational, cognitive, and community careers. They found, for example, that in two fields in the natural sciences, the PhD phase is commonly followed by a continuation in the same research group to complete a step in their cognitive career. This is because the common duration of PhD positions in these fields is based on unrealistic assumptions about the duration of research projects and an orientation phase is necessary after the completion. After such an orientation period, international mobility frequently occurs because the development of cognitive career requires specific and diffuse learning that cannot be obtained in the same research group. As a consequence, mobility of ECR in the natural sciences tends to occur after a (short) postdoctoral period, whereas in the humanities (i.e., modern history) they found the chances of mobility to be more evenly spread after the conclusion of the PhD and during the postdoc.

By looking at the existing literature through the lenses of Gläser and Laudel' framework, it emerges that most studies found a beneficial effect of mobility for a cognitive career, scientific achievement, and productivity (e.g., Franzoni et al. 2015; Lu and Zhang 2015; Gibson and McKenzie 2014; Moed et al. 2013; Asknes et al. 2013; Veugelers and van Bouwel 2015), while the impact on community and organizational career is variable. Youtie et al. (2013) found that the organizational and institutional contexts have very important consequences for researchers' career paths and any chance to be recognized as a creative scientist (i.e., community career). They found that the implications of mobility for recognition vary between the USA and Europe. US scientists benefit from being mobile in the labor market, also across disciplines and sectors, while in Europe work relationships are more hierarchical and recognition is associated with remaining in one single disciplinary context and affiliation to a university or research institute the entire career (Youtie et al., 2013). They argue that the academic labor market in the USA offers a more open arena for developing scientific reputation, in which both native- and foreign-born scientists can engage, because universalistic criteria of merit and individual performance receive strong institutional support.

Research findings on the impact of mobility on career advancement are also quite mixed. Lawson and Shibayama (2015) found that periods abroad for Japanese academics in the biosciences, while holding a stable (tenured) position in Japan, were positively associated with a reduced time to promotion upon return, yet international postdoctoral

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<sup>4</sup> An ECR is determined on the length of time since the completion of the PhD. There is no one single definition of the length, which typically ranges between 3 and 8 years.

appointments had no lasting effect on career advance (Lawson & Shibayama, 2015). Marinelli et al. (2014) examined a sample of researchers from ten European countries and found that non-mobile and returnee researchers were more likely to achieve a tenured position when compared to migrants.

### Internal career progression in Flanders

The difference in the share of mobile and foreign staff at junior and professorial level may be partly due to a generational effect. Namely, the internationalization of junior staff has grown over time, so the gap might decrease as soon as the new generation of scientists achieve senior positions. However, this generational effect may not be the only underlying mechanism explaining demographic differences. It is also possible that mobile and foreign scientists may be less likely than non-mobile and national scientists to benefit from internal career progression. This may either occur because it is more difficult for them to be promoted and/or because they have a stronger propensity to leave the university to pursue job opportunities elsewhere. Here, we theorize and explore some mechanisms that may account for the smaller share of mobile and foreign professors in Flemish universities.

The “Promotion: language of teaching, criteria of research quality, and homophily” section discusses how the system and organizational contexts affect teaching, research, and management tasks, and develops expectations regarding the chances of foreign and mobile scientists to be promoted in Flemish universities. The “Propensity to leave” section explores the factors increasing the propensity of mobile and foreign scientists to leave a Flemish university compared to non-mobile and national scientists, either to start a new position in a different university or to begin a non-academic career.

### Promotion: language of teaching, criteria of research quality, and homophily

This section explores how language barriers, criteria defining research quality, and homophily mechanism affect the performance and expected performance in teaching, research, and management duties. We develop five hypotheses regarding the chances of internal promotion in Flemish universities of mobile and foreign researchers. It is important to note that the empirical analysis creates controls for both traits, and therefore disentangles the respective impact of being a native speaker or not, of mobility and foreign nationality.

### Language of teaching

Pudelko and Tenzer (2019) argued that language barriers — namely, not mastering the local language — have a negative impact on all academic duties. This obstacle is arguably stronger when it comes to teaching, to the extent that even accent-based stereotyping may negatively affect evaluations of teachers delivering classes in a foreign language (e.g., Śliwa & Johansson, 2014; Boyd 2003; Luxon & Peelo, 2009). Indeed, in most university systems, teaching is performed in the local language, either because teaching in a foreign language is forbidden or limited by national laws, and/or because local students are not proficient in a foreign language, typically English (Seeber and Mampeay, 2021). This is also the case for Flanders, where there are strict regulations to safeguard Dutch as a language of instruction in third-level education against an increasing influence of English as an academic *lingua franca*. For example, in 2013, the percentage of non-Dutch courses at Bachelor level which can be accredited in Flanders was capped at 6% and 35% at Master level (Flemish

Government 2013). A bachelor's degree is defined as non-Dutch from the moment 18.3% of its course components are taught in other languages, and a Master's degree from 50% of other-language course components. For each of these, a Dutch-language equivalent must be available at one of the Flemish universities. The law also introduced the obligation for non-native speakers involved in teaching to obtain an accredited C1-level certificate in the language of instruction. This applies to Flemish academic teaching in English as much as to foreign academic teaching in English or in Dutch. In addition, academics receiving tenure (i.e., a civil servant status with permanency) must hold a language certificate of Dutch at level B2 if they are not Dutch native speakers.<sup>5</sup>

Therefore, while local language proficiency has a limited impact on research-only positions like postdocs, it is important in professorial positions, given that professors in Flemish universities — as in most university systems — have extensive teaching duties. Hence, hiring committees will likely take into consideration the fact that anyone not proficient in the local language will face more challenges to teach, thus discouraging the appointment of foreigners that are not native speakers to professorial position. Hence, we expect the following in Flemish universities that due to the teaching duties of professorial positions and the prominence of Dutch as a language of instruction:

**Hypothesis (1):** *Foreign non-Dutch postdocs have fewer chances to progress to an assistant professor position in their university of affiliation compared to Dutch and nationals — other conditions being equal.*

### Criteria defining research quality

The scientific norm of universalism prescribes that the scientific community's assessment of the contribution to scientific knowledge should be based on impersonal criteria (Merton, 1973). Several studies explored whether this norm also drives academic recognition in the form of career progression. These studies found a positive association or positive effect of scientific productivity on career progression in certain countries (e.g., in the USA, Ginther and Hayes 2004; Hesli et al., 2012; Weisshaar, 2017; in Taiwan, Tien 2007), but also that mobile scientists are more research productive than non-mobile peers according to standard measure of scientific productivity (Mamiseishvili & Rosser, 2010; Inanc & Tuncer, 2011; Franzoni, Scellato and Stephan 2014; Payumo et al., 2018), but they are rarer at higher rank (Corley & Sabharwal, 2007).

As a matter of fact, the criteria defining what is a contribution to knowledge and the quality of research are affected both by national and organizational evaluation practices and traditions (Musselin, 2004). For example, Lutter and Schroeder (2016) found that to become a professor in Sociology in Germany, only certain kinds of publications are considered, namely, refereed journal article and monographs, while other kinds of publications have a marginal or even negative effect. Several European countries require a national *habilitation* or accreditation to access professorial positions, which specifies the type of productivity measures that matter (Musselin, 2004; Afonso, 2016; Donina et al., 2017; Seeber and Mampeay 2021).

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<sup>5</sup> There is no similar obligation for administrative staff, which can obtain permanent civil service status without any knowledge of Dutch.

Even when no *habilitation* is required, national research evaluation processes and funding allocation models emphasize different criteria, such as writing monographs or articles, the number of citations received, or publications in highly reputable journals. Such criteria tend to trickle down and affect evaluation of individual scholars during regular assessment and in hiring and promotion processes (Aagard 2015). In Flanders, bibliometric indicators were for the first time included in the formula to allocate funding to universities in 2003, taking only publications and citations indexed in the Web of Science (Debackere & Glänzel, 2004), thus pushing all scholars, including those in the social sciences and humanities, towards the WoS (e.g., Ossenblok et al., 2012). In 2008, the formula was revised, including publications in the Flemish Academic Bibliographic Database for the Social Sciences and Humanities (VABB-SHW) and specifying the publication types to be included in the VABB-SHW, and assigning weights to each publication type, e.g., the weight of a monograph eight times higher than for a proceedings paper (Verleysen & Engels, 2018). Comparing performance-based research funding in ten European countries, Luwel (2021) reveals that the bibliometric indicators used vary across systems, taking into account local and disciplinary publication cultures and there are also large differences in the impact on the allocation of public research funding.

Therefore, because of the relevance of national criteria affecting the definition of research quality, we expect that — *ceteris paribus* — postdocs and professors coming from other systems will be disadvantaged compared to academic staff from within the system, namely, non-mobile and nationally mobile:

***Hypothesis (2a):*** *Internationally mobile postdocs and professors have fewer chances of promotion compared to their nationally mobile and non-mobile peers — other conditions being equal.*

An additional important factor in judging a candidate's scientific performance is the extent to which it is aligned with the objective and profile of the recruiting department — a criterion which is also frequently mentioned in job calls (Pitt & Mewburn, 2016). Someone who is nurtured within a given context (non-mobile), is more likely to develop a scientific production that is aligned to such contextual understandings of scientific quality, while someone coming from another system (internationally mobile), or university (nationally mobile), is nurtured with a partly different understanding and — *ceteris paribus* — is likely to be disadvantaged.

Therefore, given this idiosyncratic element of research performance connected to the specific institution, we expect that nationally mobile staff will be disadvantaged compared to staff who have always been in the same institution:

***Hypothesis (2b):*** *Nationally mobile postdocs and professors have fewer chances of promotion compared, respectively, to their non-mobile peers — other conditions being equal.*

## Homophily and managerial tasks

The capability to collaborate with colleagues is a key criterion for promotion and hiring (Pitt & Mewburn, 2016). However, the choice of current and future collaborators is also affected by a person's preference to collaborate with others perceived to be similar

— a mechanism known as *homophily*, which can hinder the career progression of members from minority groups.

The homophily mechanism is expected to be particularly relevant to reach the most powerful academic positions, for two main reasons. First, oligarchies tend to perpetuate themselves by appointing new members based on value congruity and social similarities (Enz, 1988; Kanter, 1977; Westphal & Zajac, 1995). Second, while senior academics are relatively autonomous in research and teaching activities, a high degree of coordination is required for the management of an academic unit, including decisions about the distribution of resources, and retrieving resources through bargaining at the central university level. In this respect, collaboration, cohesion, and aligning of interests among group members are particularly important, and an institution's own PhD graduates can be perceived as loyal to the institution, thus sustaining institutional stability (Gokturk & Yildirim-Tasti, 2020).

In the Flemish university system, professors — and *especially full professors* — have the greatest responsibility in management, decision-making, hiring, and promotion, and they are to a large extent Flemish and non-mobile. Hence, we expect that the homophily mechanism will reduce the chances of promotion of *mobile and foreign* postdocs and professors, because these are more likely to display different values, language, cultural, and social traits when compared to the existing body of full professors. This effect, as previously mentioned, is likely to be particularly strong when regulating access to the most senior academic positions of full professors, leading to the expectation that:

***Hypothesis (3):*** *Foreign and mobile postdocs and professors have fewer chances of promotion in their university of affiliation than their national and non-mobile peers, especially to the rank of full professor — other conditions being equal.*

For the same homophily principle, we expect that foreign postdocs and professors have more chances of promotion when the body of full professors in the discipline of the university in which they work includes a greater proportion of foreigners.

***Hypothesis (4a):*** *The chances of promotion of foreign postdocs and professors are positively affected by the percentage of foreign full professors in the discipline of the university of affiliation — other conditions being equal.*

We can expect a similar process for mobile postdocs and professors.

***Hypothesis (4b):*** *The chances of promotion of mobile postdocs and professors are positively affected by the percentage of mobile full professors in the discipline of the university of affiliation — other conditions being equal.*

Finally, the more time a researcher has been employed in the university, the more s/he is expected to be embedded within the social context and to conform to local values, norms, criteria of performance, and ways of working. Given the importance of the fit with the local context, we expect that the amount of time being employed in a university has a positive effect on the chances of promotion both because of socialization (i.e., via homophily) and functional reasons, e.g., learning the language and adapting to local criteria of performance.



**Table 1** Summary of mechanisms and hypotheses.

	Postdoc to Assistant Professor	Assistant Prof. to Associate Professor	Associate Prof. to Full Professor	Affected Group	Moderators	Hypotheses
Language of teaching	xxx			Foreign Non-Dutch	*	Hypothesis 1) Foreign non-Dutch postdocs have fewer chances to progress to an assistant professor position in their university of affiliation compared to Dutch and nationals
National and Local research criteria	x	x	x	Mobile	*	Hypothesis 2a) Internationally mobile postdocs and professors have fewer chances of promotion compared to their nationally mobile and non-mobile peers Hypothesis 2b) Nationally mobile postdocs and professors have fewer chances of promotion compared respectively to non-mobile postdocs and professors
Homophily and management	x	x	xxx	Foreign and Mobile	% foreign/mobile Full Professors time the in university	Hypothesis 3) Foreign and mobile postdocs and professors have fewer chances of promotion in their university of affiliation than national and non-mobile peers, especially to the rank of full professor Hypothesis 4a/b) The chances of promotion of foreign (mobile) postdocs and professors are positively affected by the percentage of foreign (mobile) full professors in the discipline of the university of affiliation Hypothesis 5) The amount of time being employed in a university increases the chances of promotion in the university of affiliation

\*Partially moderated by the time of employment in university (learning language, fit to research criteria)

**Hypothesis (5):** *The amount of time a scientist has been employed in a university increases the chances of promotion in the university of affiliation — other conditions being equal.*

Table 1 illustrates and summarize the connection between mechanisms, career steps and affected groups, and related hypothesis.

### Propensity to leave

As previously mentioned, mobile and foreign scientists may be less likely than non-mobile and national scientists to make any internal career progression because of a higher propensity to leave the university of affiliation. Leaving a university may relate to the decision to leave the academic career to start a non-academic job (i.e., professional turnover)<sup>6</sup> and/or to move to continue the academic career in another university or system.

On the one hand, it might be easier for national and non-mobile scientists to establish or preserve their network in the local non-academic environment, and therefore to find interesting job opportunities in the local non-academic job market. On the other hand, foreign and mobile scientists have different opportunity costs than natives and non-mobile scientists when it comes to the decision to move to another university. Moving implies leaving friends and families, eventually adapting to a new culture and (quite often) learning a new language. Arguably, moving for the first time or abroad implies higher costs; hence, on average, mobile and foreign scientists might be less averse than non-mobile and nationals to move once more — which might eventually imply a return to their country of origin. Mobility also widens scientists’ networks (Geuna & Shibayama, 2015), increasing the probability of being informed about job opportunities elsewhere and hence to leave the system. Language requirements can also incentivize international academics to pursue

<sup>6</sup> As specified in the “Data and methods” section, the inferential analysis focused on scientists born after 1 January 1965. Hence, factors affecting retirement are not relevant.

a career elsewhere, as pursuing an academic career would require dividing their time between investing in a strong academic record fit for tenure and investing in learning the local language. In Flanders, a B2-level<sup>7</sup> Dutch language certificate is necessary for being appointed a tenured position, and a C1-level certificate to contribute to the Dutch-language curriculum.<sup>8</sup>

While we do not formulate an explicit hypothesis in this regard, our empirical design will control for and consider that leaving a university is an alternative route to staying or getting promoted.

## Data and methods

### Context of analysis

The analysis focuses on the Flemish university system, which includes five institutions (Table 2). Flanders is the Dutch-speaking part of Belgium. The governance and funding of education in Belgium is decentralized and assigned to the communities, in this case the Flemish community, which is constituted by the Flemish Region and part of the Brussels-Capital Region, where, respectively, 58% and 11% of the country population lives. Given the level of expenditure on higher education, scientific reputation, and wealth, Flanders is very attractive to foreign scientists (Lepori, Seeber and Bonaccorsi 2015).

The analysis employs data from the Human Resources in Research Flanders (HRRF) dataset, which keeps track of all registrations and appointments of the entire pool of scientific staff (PhD students, postdoctoral researchers, professors) of the five Flemish universities from 1 October 1990 to 30 September 2017. We focus on postdoctoral researchers and professors, and on those which were born after 1 January 1965 (total of 14,135 scientists), since this sample includes complete information about their careers in the Flemish universities.<sup>9</sup> Compared to previous analyses of academic careers — which mostly relied on surveys, a sample of institutions or disciplines, or data on a single year — the HRRF dataset contains the full population of researchers in Flanders for a 27-year time span.

### Methods and analysis

The empirical analysis combines descriptive and inferential statistics.

First, we provide figures on the evolution in the composition of postdoctoral researchers and senior academic staff along the variables of mobility and foreign nationality. Second, we provide statistics on the career outcomes for postdoctoral researchers and senior ranks along their nationality and mobility status. Third, we run three sets of “baseline” regression models to explore what factors predict the chances of postdocs, assistant professors, and associate professors to be promoted to the next career level or to leave the university.

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<sup>7</sup> Common European Framework of Reference (CEFR).

<sup>8</sup> From 2021 to 2022, academics without B2 level Dutch language are no longer allowed to teach at all, neither in Dutch nor in English.

<sup>9</sup> In the Flemish system professorial positions can range from 10 to 100% appointment. In this analysis we only consider appointments above 50%, which in 88% of the cases are full-time (100%).

**Table 2** Universities in Flanders

Name	Foundation year	Under-graduate students	Junior researchers	Postdoctoral researchers	Professorial staff	Budget (million euros)
Katholieke Universiteit Leuven	1425	45,091	3953	1815	1992	1001
Ghent University	1817	35,599	3169	1295	1341	638
University of Antwerp	1965	17,417	1293	459	736	273
Vrije Universiteit Brussel	1834	11,708	1009	443	720	231
Hasselt University	1973	5141	407	194	242	89

VLIR staff statistics, year 2017. Statistical annual report of Higher Education department, year 2016–2017. <http://onderwijs.vlaanderen.be/nl/statistisch-jaarboek>. Report on the financial situation and the evolution of the staff

Finally, the “**Robustness tests**” section presents robust tests and additional analyses to explore systematic differences in research quality between mobile and non-mobile and foreign and national researchers, to control for temporary stays, to explore the importance of return mobility and disciplinary differences.

To estimate the chances of promotion for different categories of scientists, it is not sufficient to count how many were promoted and how many have left, but it is also necessary to take time into account. Indeed, let us suppose — hypothetically — that 6 years is the average time to progress from a postdoc position to an assistant professor position and that, if not already promoted, an average mobile scientist leaves the university after 4 years while a non-mobile scientist leaves after 8 years. We can then infer that a gap in career progression between mobile and non-mobile scientists is partly due to mobile scientists’ higher propensity to leave. Therefore, the inferential analysis relies on competing risks models — which are precisely suitable to disentangle the two mechanisms.

Specifically, our results were estimated by the proportional hazard model for sub-distribution of Fine and Gray (1999), which constitutes a tool for the analysis of survival data when the latter is right-censored (i.e., outcomes for some individuals are not yet observed at the time the data are collected) and more than one type of risk event can take place. The Fine and Gray (1999) competing risks model allows us to estimate the impact of model covariates on the hazard of a given outcome A, while considering not only the time-at-risk, but also that the occurrence of a different competing (i.e., mutually exclusive) outcome, B, can prevent us from observing A at a future moment. In our analyses we distinguish between two mutually exclusive risk events: promotion and leaving the university. As all models are fitted through maximum likelihood estimation, the typical fit statistic is log likelihood.<sup>10</sup>

## Dependent variables

The academic career structure in the Flemish university system entails two steps at the junior level, namely, PhD student and postdoctoral researcher,<sup>11</sup> and four steps are at the senior level: (i) assistant, (ii) associate, (iii) full, and (iv) senior full professor. Access to senior positions requires a PhD degree, whereas no *habilitation* is required.

Selection for senior positions is carried out under the authority of the faculty or the department, with a final approval by the university board. Assistant professor (*Docent*) positions used to be tenured, but since 2009 this position has become predominantly a 5-year tenure-track, with specific academic objectives regarding teaching and research and a guarantee for tenure if these objectives are met. Since 2013, the requirement includes a language certificate of Dutch with formal accreditation at level B2. After 5 years, a negative evaluation implies exit, while a positive evaluation leads to a tenured position of associate professor (*Hoofddocent*). Each university is autonomous in organizing its subsequent promotional track, but generally two options co-exist: associate professors can be promoted to full professorship (*Hoogleraar*) and to senior full professor (*Gewoon hoogleraar*) through a seniority-based process with positive evaluation, or through a competitive fast

<sup>10</sup> A Wald-Chi test can be calculated to assess the significance of the full specification. All Chi tests calculated in our analysis report significance at less than 1%.

<sup>11</sup> Postdoc positions are commonly defined as “full-time research or scholarship, preparing the person for a full-time academic and/or research career, requiring supervision of a senior scholar or a department/laboratory, and providing freedom and support with regard to publishing the research results” (Åkerlind 2005).

**Table 3** Career paths and mobility categories.

path	PhD	Postdoc	Postdoc mobility category	path	PhD	Postdoc	Senior Position	Senior position mobility category
1	A	A	No mobility	1	A	A	A	No mobility
2	B	A	National*	2	A	(no postdoc) <sup>1</sup>	A	
3	OUT	A	International	3	B	B	A	
* i.e. between universities of the Flemish university system				4	A	B	A	National*
5	B	A	National*	5	B	A	A	
6	B	A	National*	6	B	C	A	
7	B	A	National*	7	B	(no postdoc) <sup>1</sup>	A	
8	A	OUT	International	8	A	OUT	A	International
9	B	OUT	International	9	B	OUT	A	
10	OUT	A	International	10	OUT	A	A	
11	OUT	B	International	11	OUT	B	A	
12	OUT	OUT	International	12	OUT	OUT	A	

A, B, C = any Flemish university

OUT > 12 months absence from the Flemish system, or no previous record

<sup>1</sup> or OUT < 12 months absence from the Flemish system, or no previous record

track procedure. Since 2013, professors being directly appointed at tenured level who did not get their schooling in Dutch must also provide a B2 language certificate within 3 years of appointment.

To test our hypotheses and calculate the chances of promotion of foreign and/or mobile postdocs and/or professors, we considered four dependent variables examining the competing risks for (i) postdocs, (ii) assistant professors, and (iii) associate professors to be promoted to the higher career rank in the university or to leave the university while considering the time-at-risk, namely, the time elapsed before a certain event takes place. No test was run for progression from full professor to the senior full professor position because this promotion is often related to seniority.

### Variables predicting career outcomes

#### Mobility

We considered organizational mobility, namely, mobility implying a change in organizational affiliation and longer than 12 months. Mobility while remaining affiliated to one’s original institution is not considered.

Postdocs’ mobility is here defined according to where the researchers obtained their PhD, leading to three possible tracks: (i) no mobility: postdoc in the same institution as the PhD qualification; (ii) national mobility: PhD from a Flemish university different from the one of current employment; and (iii) international mobility: PhD from a non-Flemish university.<sup>12</sup>

The mobility status for senior positions considers the university of the PhD qualification and the university of the postdoc, leading to 12 possible paths and three categories: (i) no mobility: PhD and postdoc in the same institution as the senior position; (ii) national mobility: PhD and/or postdoc in another Flemish university; and (iii) international mobility: PhD and/or postdoc outside the Flemish university system or at least 1 year of absence

<sup>12</sup> This category includes students from the French speaking region of Wallonia, which are not international *stricto sensu*, but they do come from another university system.

from the HRRF database between the PhD and the senior position. Table 3 illustrates the possible combinations and corresponding category of mobility (Table 3).

### Foreign nationality

We developed a foreign nationality variable that distinguishes (i) Belgian nationality, i.e., “nationals” (to a large extent Dutch native speakers)<sup>13</sup>; (ii) Foreign non-Dutch; and (iii) Foreign with Dutch nationality (“Foreign Dutch”). In Flemish universities, Dutch is the almost exclusive language for teaching at bachelor level and the language used in most master courses. Accordingly, we are able to disentangle quite well the effect of a foreign nationality and of proficiency in the local language on the chances of being promoted.

It is important to note that, while mobility and foreign nationality often occur together, in our sample the overlap was not extreme. For example, in the sample of 13,299 postdocs, 40.05% were foreign, 43.72% were mobile (either national or international), and the percentage of foreign and mobile was 33.24%. This implies that 17% of foreign were not mobile, and 24% of mobile were not foreign.

### Foreign full prof ratio

The percentage of foreign full professors employed in the discipline of the university in which the researcher works, measured in the year the researcher started a position at a given rank.

### Mobile full prof ratio

The percentage of mobile full professors employed in the discipline of the university in which the researcher works, measured in the year the researcher started a position at a given rank.

### Time in the university

The variable measures for how many years a scientist has been employed in the university, when starting a given position. This variable was computed and tested for assistant and associate professors; we could not perform the test for postdocs, because the variable considers time in the university when starting the position, so mobile postdocs’ time in the university would always be zero.

### Control variables

#### Gender

A variable identified male and female scientists.

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<sup>13</sup> French-speaking Belgians cannot be distinguished through the nationality variable. Since this group is very small in Flemish universities, it had a marginal effect on the result.

## Funding type

The kind of funding supporting a postdoc often relates to different duties and level of prestige, which may have had an impact on career outcomes. We considered the following categories of postdoc funding support: (i) *competitive fellowships*, namely, from the Flemish Research Council (FWO) supports basic research (~25–30% success rate), the Agency for Innovation and Entrepreneurship (VLAIO) supports strategic basic research (~30% success rate), and the Special Research Fund (BOF) supports basic research, it is funded and managed by each university with a variable success rate; (ii) *teaching assistants*, who receive their salaries from universities and combine teaching duties with research; and (iii) *project fellowships* and research staff, paid from externally funded projects.

## Scientist's age

We considered the scientists' age, since younger/older candidates may have had a higher propensity to leave and/or be promoted. The variable considered the age of the scientist when starting either the postdoc, assistant professor, or associate professor position — depending on the test.

## Scientific discipline

The chances of becoming professor may differ across disciplinary areas. For example, departments in field A may employ a higher proportion of postdoctoral researchers compared to senior staff than in field B, thus lowering the chances to obtain a professorial position. A categorical variable identifies five disciplinary groups: (i) Medicine, (ii) Humanities, (iii) Social sciences, (iv) Engineering, and (v) Natural sciences.

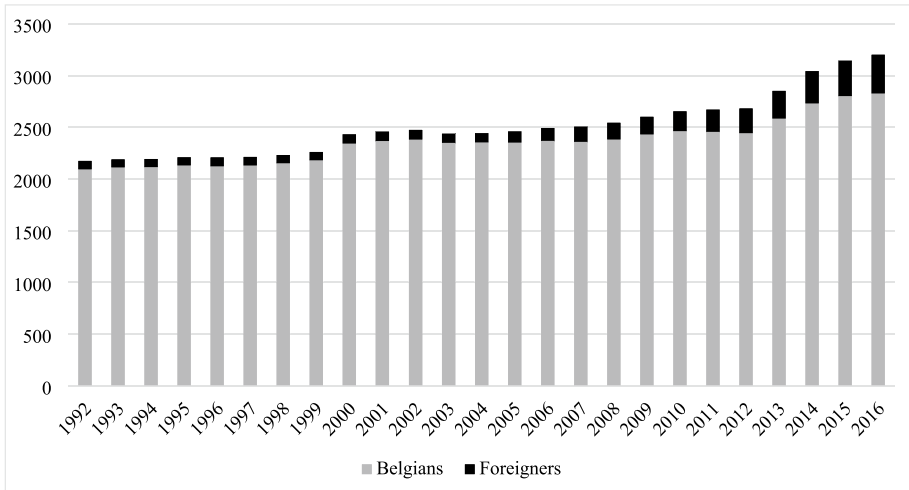
## University

The universities in our sample may have grown at different speeds during the period considered. To control for such differences, a categorical variable identified the university in which the position is held.

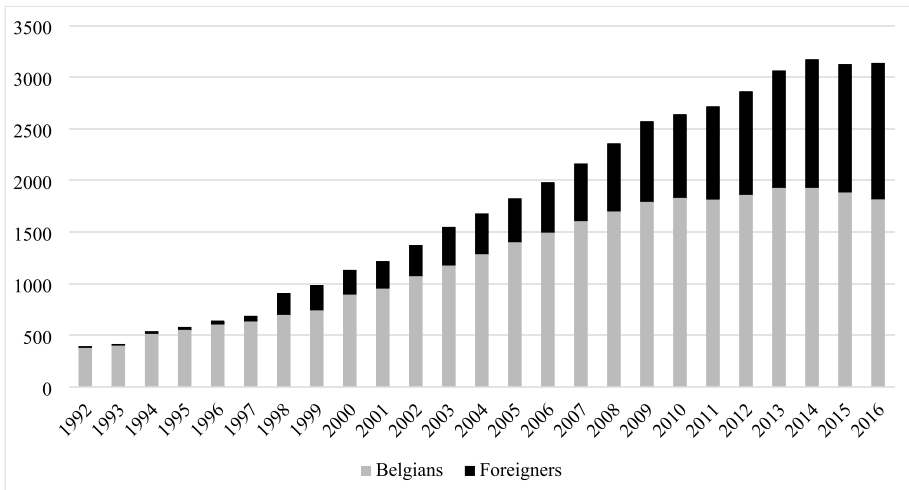
## Time trend

In recent decades, the number of junior and senior positions has grown at different rates, thus affecting the likelihood of career outcomes. We included a variable of the year when either the postdoc, assistant professor, or associate professor position started — depending on the test.

Additional variables were considered in the robustness tests and described in the corresponding sections. Among others, due to confidentiality rules it was not possible to retrieve information on individual scientific productivity; hence, the “**Robustness tests**” section explores the possibility of a systematic productivity gap between mobile and non-mobile, and between foreign and national scientists.



**Fig. 1** Belgian and foreign professors at Flemish universities 1993–2017. *Source:* Human Resources in Research Flanders (HRRF); full time equivalent (FTE), born before and after 1965



**Fig. 2** Belgian and foreign postdocs at Flemish universities 1993–2017. *Source:* Human Resources in Research Flanders (HRRF); full time equivalent (FTE), born before and after 1965

## Empirical analysis

### Descriptive statistics

Figure 1 and Fig. 2 illustrate the evolution in the number of Belgian and foreign professors and postdocs in Flemish universities from 1993 to 2017. In a quarter of a century, the composition of the academic staff has changed drastically. The number of professors (full time



**Table 4** Career outcomes of PhD students and postdocs along their gender, nationality, and mobility status (1991–2017 — born since 1 January 1965)

		Postdocs			
		<i>n</i>	Promoted	Left	Still postdoc
Nationality	National (Belgian)	7966	19.92%	44.77%	35.31%
	Foreign	5329	1.67%	69.24%	29.09%
Mobility	None	7481	19.68%	45.07%	35.25%
	National*	645	15.04%	39.69%	45.27%
	International	5169	2.07%	70.19%	27.74%

Human Resources in Research Flanders (HRRF)

\*For example, between universities of the Flemish university system

equivalent (FTE)) grew from 2185 to 3204 in 2017 (+46%), while postdocs have grown almost eight-fold, and since 2010 they are numerically equivalent to professors. The share of foreign professors was stable around 3.5% until 2004, and later grew to 11.7% in 2017 (Fig. 1), and the share of foreign postdocs grew from 5% in 1993 to 42.1% in 2017 (Fig. 2).

Table 4 presents the career outcomes for postdocs and senior staff along their nationality and mobility category: 19.9% of the national postdocs became professors in a Flemish university (approximately 1 out of 5), compared to 1.7% of the foreign postdocs (~ 1 out of 60). In a similar vein, a greater proportion of non-mobile and nationally mobile postdocs became professors at a Flemish university than internationally mobile postdocs. Combining nationality and mobility status, a very large gap emerges between the two largest categories: only 1 in 80 foreign internationally mobile postdocs became professors (56 in 4503, or 1.2%), compared to 1 in 4.6 of national non-mobile (1457 in 6659, or 21.9%), roughly 17.6 times more frequently.

## Regression analysis

Table 5 presents three competing-risk analyses exploring senior career steps.

In line with *Hypothesis 1* and the argument that proficiency of the local language is an important factor for access to professorial positions with teaching duties, we observed that a foreign nationality — non-native speaker — predicts fewer chances of a postdoc to progress to an assistant professor position (−67%),<sup>14</sup> whereas the difference between Dutch and nationals is not significant. It may be argued that other factors than language may concur or explain this result, for example — geographical proximity and cultural traits. However, while the Dutch and the Flemish speak the same language, they differ remarkably when it comes to cultural dimensions that are relevant for work organization, such as distance to power and uncertainty avoidance (both very low for Dutch and both very

<sup>14</sup> When the effect is expressed in percentages, we intend the difference in the probability to be promoted within 5 years according to the punctual estimates of the competing risk models.

**Table 5** Career outcomes of postdocs and professors

	Postdoc to promotion	Postdoc to leave	Assistant Professor to promotion	Assistant Professor to leave	Associate Professor to promotion	Associate Professor to leave
Foreign non-Dutch vs. National	-1.125*** (0.148)	0.335*** (0.042)	-0.251 (0.174)	0.559* (0.299)	-0.523** (0.218)	0.941*** (0.290)
Foreign Dutch vs. National	-0.284 (0.204)	0.256*** (0.071)	-0.008 (0.271)	0.164 (0.570)	-1.090** (0.432)	1.396*** (0.382)
National mobility vs. no mobility	-0.523*** (0.135)	0.263*** (0.076)	-0.007 (0.092)	-0.217 (0.406)	-0.323** (0.140)	0.017 (0.597)
International mobility vs. no mobility	-1.022*** (0.133)	0.289*** (0.042)	-0.431*** (0.125)	1.078*** (0.311)	-0.644*** (0.131)	0.894** (0.348)
Time trend	-0.064*** (0.005)	-0.090*** (0.004)	-0.014 (0.009)	0.004 (0.026)	-0.037*** (0.011)	-0.026 (0.033)
Gender: female vs. male	-0.412*** (0.061)	0.180*** (0.025)	-0.138* (0.071)	-0.032 (0.207)	-0.107 (0.093)	-0.327 (0.283)
Age years	0.050*** (0.010)	-0.017*** (0.003)	0.028** (0.011)	-0.032 (0.032)	-0.026* (0.015)	-0.001 (0.040)
Funds: postdoc assistant vs. project	1.357*** (0.088)	-0.809*** (0.060)	-0.008 (0.106)	-0.025 (0.372)	-0.003 (0.140)	-0.283 (0.506)
Funds: competitive vs. project	1.362*** (0.075)	-1.127*** (0.053)	0.303*** (0.095)	0.182 (0.276)	0.095 (0.104)	-0.081 (0.306)
Humanities vs. Medicine	-0.034 (0.087)	-0.018 (0.050)	-0.145 (0.103)	0.048 (0.299)	-0.009 (0.127)	0.159 (0.340)
Social Sciences vs. Medicine	0.254*** (0.086)	-0.149*** (0.053)	-0.045 (0.103)	-0.016 (0.294)	0.062 (0.126)	-0.027 (0.335)
Engineering vs. Medicine	-0.237*** (0.080)	0.163*** (0.036)	0.051 (0.116)	-0.080 (0.375)	-0.019 (0.119)	-0.040 (0.331)
Natural Science vs. Medicine	-0.717***	0.288***	0.098	-0.171	-0.072	-0.306

**Table 5** (continued)

	Postdoc to promotion	Postdoc to leave	Assistant Professor to promotion	Assistant Professor to leave	Associate Professor to promotion	Associate Professor to leave
University 2 vs. 1	(0.086) 0.362*** (0.064)	(0.036) -0.159*** (0.031)	(0.115) -0.102 (0.093)	(0.317) -0.145 (0.343)	(0.119) -0.455*** (0.109)	(0.348) 0.434 (0.328)
University 3 vs. 1	-0.070 (0.104)	-0.062 (0.041)	-0.118 (0.138)	0.232 (0.384)	-0.271* (0.142)	0.181 (0.473)
University 4 vs. 1	0.145 (0.101)	-0.104** (0.042)	-0.396*** (0.145)	0.728* (0.405)	-0.386** (0.188)	0.861 (0.551)
University 5 vs. 1	0.717*** (0.157)	-0.454*** (0.098)	0.361 (0.262)	0.362 (0.606)	0.644*** (0.265)	-16.137*** (0.419)
Observations	13,299	13,299	1584	1584	1575	1575
Log likelihood	-11,456	-62,010	-5353	-606.9	-3625	-337.5
Chi-squared	1572	1532	67.97	58.39	152	2585
Prob> Chi	0	0	4.81e-08	1.93e-06	0	0

The coefficients denote the relative change in the rate of the occurrence (“incidence”) of the events (e.g., promotion) for subjects who have not yet experienced the event of interest, but who are also exposed to the other type of risk (i.e., leave). In other words, each coefficient refers to outcome\_1 vs. all other outcomes

Robust standard errors in parentheses

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

high for Flemish) (Hofstede et al., 2010). The Dutch have also significantly higher chances of promotion to assistant professorship when compared to Germans and French, who are also geographically close and display similar cultural traits to the Flemish<sup>15</sup> (Appendix — Table 9).

On the one hand, the fact that Dutch postdocs, as well as Dutch and Foreign non-Dutch assistant professors, have similar chances of promotion as nationals downplays the importance of the homophily mechanism for promotion to assistant and associate professor positions. On the other hand, both Dutch and foreign nationality (−41% and −66%) and international and national mobility (−28% and −48%) reduced the chances of promotion to full professor positions, which is consistent with *Hypothesis 3*, and the argument that a homophily mechanism plays a strong role in regulating access to the highest ranked positions.

International and national mobility also strongly reduced the chances of promotion from postdoc to assistant professor positions (−64% and −41%), which is consistent with *Hypothesis 2*. The effect was however smaller or null for promotion to associate professor, which might be due to two reasons. Scientists not aligned with local criteria of quality are less likely to become assistant professor in the first place, and second, mobile scientists reaching a senior level have been in the system for a longer period and arguably adapted to the local criteria of quality.

In summary, the observations suggest that barriers for mobile and non-national scientists depend on a contextual definition of performance (e.g., performing the teaching function implies proficiency of the local language) and on homophily mechanisms. This is partly consistent with a mechanism of statistical discrimination (Phelps, 1972), which occurs when information on the applicants' performance is imperfect (for example, in terms of the future capability to collaborate in the decision process), and hence, information on the group they belong to is used to infer performance. At the same time, the results would suggest that so-called “taste” discrimination, namely, a general prejudice against a minority (Becker, 1971), is of lesser importance in this context, as it would imply an ever present and rather homogenous barrier at all career steps.

Foreign, Dutch, and mobile scientists were also more likely than nationals and non-mobile peers to leave the system.

Considering the control variables, female postdocs were significantly more likely to leave and less likely to be promoted than their male peers, while there are smaller or non-significant differences at later career stages. Researchers with competitive bursaries or with teaching duties were less likely to leave and more likely to climb; competitive bursaries also had a positive effect at later career stages. Differences by disciplines were only observed at an early stage. There are some minor differences between universities in the chances of career progression, which, however, cannot be explained by differences in prestige nor age. While results regarding the control variables are interesting, an in-depth analysis lies beyond the scope of this article.

The regression models run separately for each university provide very similar results.<sup>16</sup>

<sup>15</sup> For example, when considering the four main indicators from Hofstede et al. (2015), the cultural distance between Dutch and Flemish is 98 points, which decreases to 92 for Germans and only 25 for French. Moreover, the Netherlands is traditionally a protestant country, while Flanders is Catholic, like France, and Germany is mixed. In the Appendix, we reported the regression model predicting postdoc promotion or leave, including dummy variables for German, French, Dutch, and other foreigners vs. Nationals. Germans and French displayed significantly fewer chances of promotion compared to nationals.

<sup>16</sup> The results are available upon request.

**Table 6** Homophily test: composition of the hiring committee and chances of promotion of mobile and foreign postdocs and professors

	Postdoc to promotion	Postdoc to leave	Assistant Professor to promotion	Assistant Professor to leave	Associate Professor to promotion	Associate Professor to leave
Foreign non-Dutch vs. National	-0.979*** (0.168)	0.261*** (0.040)	-0.240 (0.190)	0.598* (0.318)	-0.259 (0.226)	0.499 (0.308)
Foreign full prof ratio	1.108** (0.469)	-1.346* (0.806)	-0.767*** (0.270)	-0.360 (0.111)	0.513* (0.289)	-0.711 (0.308)
<b>Foreign non-Dutch × foreign full prof ratio</b>	4.998*** (1.713)	1.021 (-4.342)	-0.076 (-1.634)	-1.224 (-2.320)	-1.974 (-2.740)	5.046 (-6.682)
Foreign Dutch vs. National	-0.201 (0.296)	0.193*** (0.068)	0.007 (0.271)	0.150 (0.568)	-1.094*** (0.380)	1.128*** (0.385)
Mobile full prof ratio	2.753*** (0.092)	-2.534*** (0.135)	0.383*** (0.125)	-0.507 (0.429)	1.073*** (0.136)	-1.382** (0.589)
National mobility vs. no mobility	-0.656*** (0.178)	0.172** (0.079)	0.119 (0.159)	0.096 (0.552)	-0.323 (0.215)	-0.267 (0.777)
<b>National mobility × mobile full prof ratio</b>	0.429 (0.327)	1.118*** (0.414)	-0.222 (0.227)	-0.840 (-1.061)	0.271 (0.307)	0.273 (-1.727)
International mobility vs. no mobility	-1.380*** (0.178)	0.229*** (0.042)	-0.209 (0.181)	0.790* (0.437)	-1.078*** (0.194)	0.987** (0.434)
<b>International mobility × mobile full prof ratio</b>	1.637*** (0.400)	-0.171 (0.471)	-0.383 (0.242)	0.526 (0.547)	1.066*** (0.244)	-0.649 (0.802)
Time trend	-0.051*** (0.007)	-0.089*** (0.004)	-0.026** (0.010)	0.023 (0.029)	-0.048*** (0.012)	-0.011 (0.028)
Gender: female vs. male	-0.352*** (0.067)	0.168*** (0.026)	-0.109 (0.071)	-0.027 (0.210)	-0.074 (0.090)	-0.249 (0.303)
Age years	0.066*** (0.011)	-0.018*** (0.003)	0.029** (0.012)	-0.036 (0.032)	-0.028*** (0.014)	-0.027 (0.039)
Funds: postdoc assistant vs. project	0.897***	-0.638***	-0.041	0.042	-0.122	-0.126

**Table 6** (continued)

	Postdoc to promotion	Postdoc to leave	Assistant Professor to promotion	Assistant Professor to leave	Associate Professor to promotion	Associate Professor to leave
Funds: competitive vs. project	(0.093) 0.883*** (0.083)	(0.065) -0.994*** (0.056)	(0.107) 0.286*** (0.097)	(0.368) 0.251 (0.279)	(0.142) 0.018 (0.103)	(0.505) -0.170 (0.334)
Humanities vs. Medicine	-0.484*** (0.102)	0.082 (0.051)	-0.146 (0.103)	0.025 (0.300)	-0.391*** (0.132)	0.434 (0.367)
Social Sciences vs. Medicine	-0.094 (0.104)	-0.026 (0.054)	-0.088 (0.105)	0.025 (0.299)	-0.069 (0.128)	0.016 (0.359)
Engineering vs. Medicine	-0.433*** (0.087)	0.183*** (0.037)	0.061 (0.122)	-0.002 (0.372)	-0.416*** (0.124)	0.310 (0.325)
Natural Science vs. Medicine	-0.595*** (0.091)	0.262*** (0.037)	0.123 (0.117)	-0.199 (0.322)	-0.302*** (0.119)	-0.172 (0.320)
University 2 vs. 1	0.393*** (0.074)	-0.171*** (0.032)	-0.097 (0.094)	-0.187 (0.345)	-0.314*** (0.111)	0.280 (0.316)
University 3 vs. 1	0.263** (0.130)	-0.122*** (0.044)	-0.063 (0.141)	0.045 (0.416)	0.072 (0.149)	-0.263 (0.467)
University 4 vs. 1	0.277** (0.110)	-0.087** (0.043)	-0.336** (0.145)	0.583 (0.417)	-0.166 (0.199)	0.607 (0.670)
University 5 vs. 1	0.917*** (0.163)	-0.444*** (0.107)	0.461* (0.275)	0.211 (0.650)	1.071*** (0.250)	-18.814*** (0.521)
Observations	13,299	13,299	1584	1584	1575	1575

Robust standard errors in parentheses

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

## Further exploration of the homophily effect

We tested whether the gap in the promotion probability between foreign vs. nationals and mobile vs. non-mobile is moderated, respectively, by the share of foreign and mobile full professors in each university and discipline.<sup>17</sup> We considered the share of full professors, as they are those that in the Flemish system have the greatest influence on career progression and promotion decisions.

Table 6 presents three competing-risk analyses exploring senior career steps.

The results largely corroborate *Hypotheses 4a and 4b*. The interaction terms reveal that the chances of progression of foreign non-Dutch postdocs were positively affected by the percentage of foreign full professors in the discipline of the university of affiliation. In a similar vein, internationally mobile postdocs as well as associate professors had more chances of progression/promotion, the larger the proportion of mobile full professors in the discipline of the university of affiliation.

## Time of employment in a university

Given the importance of the fit with the local context — both for homophily and functional mechanisms — we tested whether the number of years being employed in a university increases the chances of promotion in the university of affiliation, because over time a researcher is gradually socialized into the local values, norms, criteria of performance, and the way of working.

Table 7 presents two competing-risk analyses for assistant professors and associate professors, exploring the effect of the variable time of employment in the university. In line with *Hypothesis 5*, the amount time employed in the university increased the chances of promotion of assistant professors and associate professors, while also reducing the propensity to leave of assistant professors.

It is also interesting to examine the effect of mobility and foreign nationality when the time spent into the university is taken into consideration (Table 7), with the effect in the main model (Table 5).

The effect of national mobility on promotion changes from null to positive for assistant professors and from negative to non-significant for associate professors. The effect of international mobility changes from negative to null for assistant professors, whereas the effect on the chances of associate professors to become full professors is still negative. On the one hand, this pattern suggests that the effect of mobility on the promotion of assistant professor is not per se negative, but due to mobile researchers having less time to become accustomed into the local context; on the other hand, international mobility had a negative effect on the chances to become full professors.

When time is taken into consideration, the effect of foreign and Dutch nationality on the chances of promotion of assistant professors does not change. For associate professors the negative effect of foreign nationality is reduced, whereas it is still strongly negative for Dutch nationals. In other words, the gap in promotion of foreign associate professors was partly due to having spent less time at the university, whereas for Dutch it was rather time-independent, and seemingly due to traits that hardly ever change over years of employment

<sup>17</sup> The ratio of the year in which the potential candidate entered at a given career stage is considered.

**Table 7** Time of employment in the university, effect on chances of promotion, and leaving

	Assistant Profes- sor to promotion	Assistant Professor to leave	Associate Professor to promotion	Associate Professor to leave
<b>Time in the university</b>	0.064*** (0.013)	-0.100** (0.049)	0.024*** (0.008)	0.013 (0.037)
Foreign non-Dutch vs. National	-0.178 (0.176)	0.406 (0.287)	-0.385* (0.225)	0.940*** (0.314)
Foreign Dutch vs. National	0.242 (0.241)	-0.256 (0.606)	-1.027** (0.450)	1.235*** (0.400)
National mobility vs. no mobility	0.398*** (0.140)	-0.860 (0.599)	-0.207 (0.158)	-0.149 (0.642)
International mobility vs. no mobility	-0.038 (0.158)	0.572 (0.427)	-0.568*** (0.147)	0.963** (0.413)
Time trend	-0.024** (0.010)	0.034 (0.028)	-0.045*** (0.013)	-0.016 (0.036)
Gender: female vs. male	-0.105 (0.074)	-0.010 (0.220)	-0.157 (0.100)	-0.339 (0.302)
Age years	0.005 (0.013)	-0.006 (0.033)	-0.035** (0.016)	-0.005 (0.043)
Funds: postdoc assistant vs. project	-0.114 (0.110)	0.263 (0.414)	-0.035 (0.151)	-0.242 (0.570)
Funds: competitive vs. project	0.235** (0.098)	0.182 (0.334)	0.119 (0.111)	-0.399 (0.337)
Humanities vs. Medicine	-0.143 (0.105)	-0.023 (0.324)	-0.038 (0.129)	0.129 (0.365)
Social Sciences vs. Medicine	-0.023 (0.105)	-0.093 (0.316)	0.025 (0.135)	0.195 (0.338)
Engineering vs. Medicine	-0.006 (0.119)	-0.020 (0.389)	-0.102 (0.128)	0.143 (0.344)
Natural Science vs. Medicine	0.066 (0.116)	-0.187 (0.337)	-0.071 (0.124)	-0.122 (0.359)
University 2 vs. 1	-0.153 (0.094)	-0.077 (0.401)	-0.463*** (0.118)	0.454 (0.356)
University 3 vs. 1	-0.145 (0.147)	0.453 (0.413)	-0.349** (0.157)	0.412 (0.473)
University 4 vs. 1	-0.505*** (0.156)	0.922** (0.446)	-0.344* (0.203)	0.825 (0.647)
University 5 vs. 1	0.252 (0.275)	0.686 (0.625)	0.663*** (0.247)	-20.110*** (0.437)
Observations	1512	1512	1458	1458
Log likelihood	-4949	-547.2	-3219	-294.1
Chi-squared	97.64	61.06	155.7	3328

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$



in a university, such as the aforementioned different cultural traits or a different Dutch accent.

## Robustness tests

### Scientific quality of foreign vs. national and mobile vs. non-mobile researchers

Due to confidentiality rules, data concerning the scientific productivity of individual researchers could not be retrieved and included in the analysis. Since scientific productivity can be an important predictor of promotion, the reason why mobile and foreign researchers have fewer chances of promotion might be due to lower scientific performance. To control for this possibility and partially address one limitation of the research design, this paragraph presents data that can inform us about the quality of mobile and foreign researchers compared to non-mobile and national researchers.

**Attractiveness to foreign researchers** Junior researchers are attracted by highly reputed places able to provide good financial support (Musselin, 2004; Stephan et al., 2015), for higher remunerations and opportunities (Ackers, 2008). Flemish universities have a very good reputation; according to various rankings, the universities of Ghent and Leuven are among the top 100 in the world, and all five display a similar performance when considering indicators of productivity normalized by size (source: ARWU and Leiden Ranking). A net monthly salary is around 2000 euros for a PhD and 2500–3200 euros for postdocs, which are among the highest in Europe (European Commission 2013 — Table 18). Belgium is also a very attractive destination for scientists also according to living standards and investment in research (Lepori et al., 2015).

**Quality of PhD candidates** To explore Flemish universities' capability to attract talented junior staff, we first focused on PhD candidates. We explored the difference in the quality of foreign vs. non-foreign PhD candidates, considering the chances to graduate or quit the program with a competing risk model (Appendix — Table 10). The results show that foreign PhD candidates were more likely to graduate and do so faster, and less likely to abandon compared to national PhD candidates. No difference was observed between Dutch and nationals.

**Success of research proposals** Proposals to the Research Foundation Flanders (FWO) of Flemish PhD students and postdocs are slightly more successful (~25%) than those of foreign PhD students and postdocs (~20%) (source: FWO yearly reports, 2005–2015).

**Scientific productivity of mobile and non-mobile researchers** We considered a sample of junior scientists to analyze their productivity, namely, scientists in the field of *Medicine* affiliated to a Flemish university in 2010 and who authored their first publication in 2005 ( $n = 170$ ) (source: Scopus). The median, mean, and 75th percentile number of co-authored articles are very similar for internationally mobile<sup>18</sup> (11; 12.6; 18), nationally mobile (10.5; 11.2; 14), and non-mobile (12; 14.1; 18); a Kruskal–Wallis non-parametric test retains the

<sup>18</sup> In this analysis, researchers in 2010 were affiliated to a Flemish university; they were classified as non-mobile if the affiliation of the first publication is the same university, nationally mobile if it was another Flemish university, and internationally mobile if it is a non-Flemish university.

null hypothesis that the distribution of the number of articles is the same across the categories. We repeated the analysis for scientists in *Chemistry* with the same selection criteria ( $n=92$ ), and also found very similar median, mean, and 75th percentile productivity for internationally mobile (12.5; 15.95; 20.50), nationally mobile (12; 14; 24), and non-mobile (12; 14.9; 19), and no significant differences between groups.

Overall, this additional information does not suggest the existence of a systematic quality gap between nationals and foreigners, non-mobile and mobile.

### Excluding temporary stays

Some mobile researchers who only stayed in Flanders for a short period of time might have never considered a career progression in Flanders as the objective of their move, and their mobility had other purposes (e.g., networking, or community or cognitive career). We therefore ran an additional test (for postdocs) considering only researchers with a stay of at least 1 year. The results are very similar to the main test (Appendix — Table 11).<sup>19</sup>

### Return mobility

Return mobility to the country of PhD could be a mechanism for promotion (Cañibano et al., 2020; Musselin, 2004) and part of the “career script” in certain disciplines (Laudel & Bielick, 2019). We developed several tests to explore the frequency of the return mobility track and whether mobility had a different impact if someone was previously affiliated with the university.

Table 8 presents descriptive statistics of the likelihood of different career tracks after Ph.D. graduation, in total and for each disciplinary area, from 1991 to 2016.

Among PhD graduates who became professors at the same university, 83.5% followed an internal career path and 16.5% a return mobility path.<sup>20</sup> Among those who left the university after graduation (62%), only one in 67 later returned as professor, whereas among those who remained in a postdoc position (38.5%), one in five was later appointed as professor. Mobility can also occur after a period as postdoc; however, among the postdocs who left the system, only 4% returned later as professor. There were some variations between disciplines. The internal career progression after a mobility period is more common in the natural sciences (20.3%). Among the “returnee professors” in medicine and the social sciences one in two had its mobility phase after the PhD and one in two after the Postdoc, whereas in the other disciplines returnees had the mobility phase predominantly after the postdoc.

To explore whether return mobility becomes an advantage at senior career stages, we explored whether internationally mobile professors, who had already worked in the Flemish system at some stage (“returnees”) have more chances being promoted compared to professors who entered for the first time in the system (“non-returnees”) and compared to non-mobile professors (Appendix — Table 12). At all stages, the first are more likely to

<sup>19</sup> Excluding these researchers implies censoring the dependent variable, which is not fully appropriate from a methodological standpoint. Nonetheless, the test is useful to control for the possibility that this group has a different decision-making process.

<sup>20</sup> Via consider a returnee someone who spent at least 12 months out of the system and obtained an appointment at least at 50%.

**Table 8** Career paths of PhD graduates of Flemish universities 1991–2016

	Total	Medicine	Humanities and Arts	Social Sciences	Engineering	Natural Sciences
No internal career	60.1%	57.7%	58.1%	49.6%	63.3%	64.9%
1. PhD – leave						
2. PhD – postdoc – leave	19.4%	16.3%	17.3%	20.0%	20.7%	21.6%
3. PhD – postdoc (still postdoc)	10.8%	17.9%	9.7%	11.7%	8.8%	7.1%
Internal career	0.4%	0.4%	0.7%	1.6%	0.1%	0.2%
4. PhD – professor						
5. PhD – postdoc – professor	7.6%	6.5%	11.6%	13.9%	6.2%	4.9%
Return mobility	0.9%	0.9%	1.4%	2.0%	0.4%	0.6%
6. PhD – leave – professor						
7. PhD – postdoc – leave – professor	0.7%	0.2%	1.3%	1.2%	0.5%	0.7%
PhD graduates becoming professors	9.6%	8.0%	15.0%	18.7%	7.2%	6.4%
of which: via return mobility	16.5%	14.5%	18.1%	17.2%	13.0%	20.3%
Among PhD graduates that left: % that returned as professors	1.5%	1.6%	2.4%	4.0%	0.7%	1.0%
Among postdocs that left: % that returned as professors	3.4%	1.5%	7.0%	5.6%	2.4%	3.0%
N	24,751	5394	3238	2884	7216	5933

\*Leave: at least 12-month absence from the Flemish system.

\*\*Professor: appointment at least 50%

be promoted than the second, but both have significantly fewer chances of promotion than non-mobile professors.

In sum, return mobility was a rare event for PhD graduates of Flemish universities and riskier than the internal path for a career within the alma mater.

### Disciplinary differences

We explored disciplinary differences with regression models for postdoctoral researchers in the five disciplinary areas (Appendix — Table 13). The results are similar, with few exceptions. First, the gap in promotion of foreign vs. national was smaller for the natural sciences, which may be due to a more common use of English as a language of instruction in this discipline, as observed — for example — in Germany and Italy (Seeber and Mampeay, 2021). Second, internationally mobile in the natural sciences display a similar propensity to leave as non-mobile, whereas in the other disciplines, internationally mobile postdoc had a greater propensity to leave. Indeed, in the natural sciences, a PhD is often followed by short postdoc extension, followed by a mobility as soon as an opportunity emerges (Lauedel and Bielick 2019); this increases the propensity to leave among non-mobile postdocs to a level comparable to mobile postdoc.

### Discussion and conclusions

This article explored how organizational mobility and foreign nationality affect the chances of internal career progression in Flemish universities. We argued that the way in which academic tasks should be carried out — i.e., teaching, research, and management — is partly affected by the national and organizational contexts in which they take place, and that such *idiosyncratic aspects* of academic tasks may reduce the chances of internal career promotion of mobile and foreign scientists compared to non-mobile and nationals. We explored five hypotheses in the Flemish university system by employing data on postdoctoral researchers and professorial staff employed from 1990 to 2017, for a total of 14,135 scientists. The results show that international mobility and foreign nationality reduce the chances to be promoted to assistant, associate, and full professor positions in the university of affiliation, while increasing the chances to leave it. Foreign postdocs who are Dutch native speakers have similar chances to nationals to be promoted to an assistant professor position. A greater share of foreign and mobile full professors in the discipline of the university of affiliation increases the chances of progression, respectively, of foreign and mobile postdocs.

The combined effects of more difficulty to be promoted and a higher propensity to leave the university for internationally mobile and foreign scientists were very strong, particularly at an early stage, so that in the considered period, 1457 in 6659 of non-mobile national postdocs became professor in their university of affiliation (21.9%) compared to just 56 in 4503 internationally mobile foreigners (1.2%), or –94%. These results suggest that mobile and foreign scientists struggle to advance in universities that lack rules preventing inbreeding and with few opportunities to teach in English.

This study presents several novel aspects. It explores the mechanisms underpinning the effect of organizational mobility and foreign nationality on internal career progression. Second, while research so far has focused on factors predicting access to tenured position and either on mobility or foreign nationality, this work examines several career steps and

disentangles the effects, respectively, of national mobility, international mobility, and foreign nationality, on internal career progression at each career step, as well as the composition effect of the body of full professors' and the effect of the time a researcher has been employed in any given university.

Some research choices and limitations should be discussed.

First, the results are valid for the Flemish university system. To some extent, they can be generalized to other systems that lack rules preventing academic inbreeding, where the language of education is a local language and not English, and where a large majority of the academic staff is non-mobile and national. Several European countries possess one or more of these traits (Macháček et al., 2021; Seeber and Mampeay 2021). In systems where rules and norms prevent or discourage internal careers, like Germany, the USA, and Switzerland, the results are likely to be different. At the same time, insiders can still enjoy certain advantages. For example, studies on Germany found that network connections and having a highly respected mentor are important predictors of appointment at professorial positions, giving a competitive-edge to nationals and home-grown scientists (Plümper & Schimmelfennig, 2007; Jungbauer-Gans & Gross, 2013; Lutter and Schroeder 2016). While Pudielko and Tenzer (2019) argued that language barriers have a negative impact on all academic duties, our results suggest that the language barrier is particularly strong to access positions with teaching duties, which in Flanders occurs in the progression from postdoc to assistant professor positions. The results may be different in systems where English or other “world” languages are used for education.

Our study explored how mobility and foreign nationality affect career progression, by controlling for some important personal and contextual traits. Due to confidentiality rules, we could not retrieve information about individual scientific productivity; the “[Robustness tests](#)” section explored the possibility of a systematic productivity gap between mobile and non-mobile, foreign and national researchers, and found little support in this respect. Other relevant factors, such as personal ties (e.g., Fisman et al., 2018; Hadlock & Pierce, 2021) or institutional prestige and ties (Burris, 2004), were not explored. Moreover, future research needs to shed more light on differences within the group of mobile and foreign scientists, based, for instance, on the prestige of institution of origin and the strength of scientific relationships between two countries, as well as explore more in depth the reasons underpinning the effect of important variables such as gender, and type of funding support, which are beyond the scope of this study.

Finally, fewer chances for internal career progression do not exclude the possibility that those who left have been promoted elsewhere. This outcome, however, should not be taken for granted. The chances of mobile, foreign, and external candidates to obtain a tenured position are low in many university systems (e.g., in USA, Corley & Sabharwal, 2007; Spain, Cruz-Castro & Sanz-Menéndez, 2010; in 14 EU countries, Marinelli 2014). In Sweden, more than 60% of academics work at their doctoral alma mater and 73% of the new positions are obtained by internal candidates (Lundgren et al., 2018). In France, local applicants to professorial positions are 18 times more likely to be hired than external applicants (Godechot & Louvet, 2008). Challenges are also faced by return scientists who move abroad and later try to come back to their institution of origin (Lawson & Shibayama, 2015; Musselin, 2004).<sup>21</sup>

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<sup>21</sup> Nor those who left appear to have been promoted in another Flemish university. We run a competing risk analysis at system level, and we obtained barely the same findings as to the internal career test. The results are available upon request.

The results have important implications. Gläser and Laudel (2015) highlighted the value of conceptually separating three career scripts — the cognitive, community, and organizational careers — and studying their interactions, as they mediate institutional conditions of research and diachronic structures of knowledge production (see also Laudel & Bielick, 2019). Along this line, our results suggest that misalignment between these three career scripts and between the career scripts in different systems may be dysfunctional. For example, while mobility is beneficial for “diffuse learning” and “specific learning,” and hence for the development of cognitive careers, it can be detrimental for an organizational career. Or, in other cases, if the organizational career script requires mobility in some systems but not in others, this may end up penalizing early career researchers coming from systems favoring mobility.

In turn, while several studies and policy statements highlight and promote the positive effects of mobility for what Gläser and Laudel define “cognitive” and “community” careers (e.g., Horta et al., 2010; European Commission, 2012; Council of Europe 2014; Franzoni, Scellato and Stephan 2014; UNESCO 2017; Petersen, 2018; Laudel & Bielick, 2019), our results suggest that taking on an appointment in another country can imply greater challenges for career progression, particularly for junior scientists and when the local language is compulsory for teaching. In order to avoid the potential negative effects of mobility in terms of career progression, scientists are recommended to preserve linkage in their home country (Baruffaldi & Landoni, 2012) or ensure that their mobility period is undertaken with the promise to return to their original institution, ascertain whether mobility is an asset for career progression in the host country and institution, become proficient in the local language, align with local evaluation criteria, and if possible, move only to tenured positions. For institutions aiming to hire and promote on the basis of scientific merit, awareness of the systemic bias of internal career progression could help identify mechanisms which are more inclusive: for example, providing language courses for international postdocs, communicating performance criteria more transparently to aspiring academics, and introducing norms or rules that limit academic inbreeding and incentives to stimulate mobility.

Since Europe includes systems with very different rules regarding inbreeding, very different compositions in terms of mobile and non-mobile, and the role that mobility plays for career progression (Macháček et al., 2021; Seeber and Mampeay 2021), this has important implications also for the development of a European Research Area (ERA). The European Commission (EC) recognizes that, despite the progress made, academic recruitment in Europe is still characterized by many national and institutional specificities and barriers, which may hinder fair and equal treatment (EC 2020a,b). In this respect, our results can inform the implementation of EC’s declared objective to deepen the ERA towards deeper integration between national policies, as a precondition to attract and retain talent. Instead, promoting mobility without considering — and harmonizing — key aspects regulating academic careers in different systems, may endanger the career prospects of mobile researchers, researchers from less affluent countries and from countries which discourage internal career progression, with a significant loss of scientific talent.

## Appendix

**Table 9** Career outcomes of postdocs, including dummy variables for Dutch, German, and French nationality

Variables	Postdoc to promotion	Postdoc to leave
Foreign non-Dutch vs. National	− 1.176*** (0.161)	0.328*** (0.042)
Foreign Dutch vs. National	− 0.289 (0.204)	0.258*** (0.071)
German vs. National	− 0.560* (0.303)	0.256*** (0.073)
French vs. National	− 1.794*** (0.596)	0.484*** (0.059)
National mobility vs. no mobility	− 0.522*** (0.135)	0.262*** (0.076)
International mobility vs. no mobility	− 1.006*** (0.133)	0.281*** (0.042)
Time trend	− 0.064*** (0.005)	− 0.090*** (0.004)
Gender: female vs. male	− 0.412*** (0.061)	0.181*** (0.025)
Age years	0.049*** (0.010)	− 0.015*** (0.003)
Funds: postdoc assistant vs. project	1.353*** (0.088)	− 0.809*** (0.060)
Funds: competitive vs. project	1.356*** (0.075)	− 1.123*** (0.052)
Humanities vs. Medicine	− 0.036 (0.087)	− 0.016 (0.050)
Social Sciences vs. Medicine	0.248*** (0.086)	− 0.145*** (0.053)
Engineering vs. Medicine	− 0.238*** (0.080)	0.166*** (0.036)
Natural Science vs. Medicine	− 0.719*** (0.086)	0.291*** (0.036)
University 2 vs. 1	0.364*** (0.064)	− 0.158*** (0.031)
University 3 vs. 1	− 0.068 (0.104)	− 0.061 (0.041)
University 4 vs. 1	0.150 (0.101)	− 0.109*** (0.042)
University 5 vs. 1	0.720*** (0.157)	− 0.458*** (0.098)
Observations	13,299	13,299
Log likelihood	− 11,453	− 62,005
Chi-squared	1555	1624

Robust standard errors in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

**Table 10** PhD candidates' propensity to graduate or leave the PhD program

	PhD (1)		PhD (2)	
	Graduate	Leave	Graduate	Leave
Foreign non-Dutch vs. National	0.397*** (0.022)	-0.212*** (0.023)	0.448*** (0.022)	-0.309*** (0.023)
Foreign Dutch vs. National	-0.001 (0.053)	0.055 (0.047)	-0.007 (0.053)	0.032 (0.047)
Gender: female vs. male	-0.178*** (0.015)	0.211*** (0.017)	-0.176*** (0.015)	0.197*** (0.017)
Time trend	0.017*** (0.001)	-0.044*** (0.002)	0.016*** (0.001)	-0.053*** (0.002)
Age (year)	-0.092*** (0.003)	0.065*** (0.002)	-0.082*** (0.003)	0.058*** (0.002)
Funding: assistant vs. project			-0.028 (0.019)	-0.332*** (0.027)
Funding: competitive vs. project			0.926*** (0.021)	-1.595*** (0.048)
Humanities vs. Medicine	-0.314*** (0.025)	0.257*** (0.027)	-0.352*** (0.025)	0.334*** (0.027)
Social Sciences vs. Medicine	-0.451*** (0.024)	0.456*** (0.025)	-0.410*** (0.024)	0.447*** (0.025)
Engineering vs. Medicine	0.050** (0.020)	-0.063** (0.025)	0.096*** (0.021)	-0.137*** (0.026)
Natural Science vs. Medicine	0.172*** (0.022)	-0.225*** (0.028)	0.177*** (0.022)	-0.265*** (0.029)
Constant (binomial regression)				
Observations	42,507	42,507	42,507	42,507
Log likelihood	-208,282	-154,259	-207,423	-153,327

Robust standard errors in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$



**Table 11** Career outcomes of postdocs: all sample, compared to sample excluding temporary stays (< 1 year)

	All sample		Excluding stays < 1 year	
	Postdoc to promotion	Postdoc to leave	Postdoc to promotion	Postdoc to leave
Foreign non-Dutch vs. National	-1.125*** (0.148)	0.335*** (0.042)	-0.967*** (0.150)	0.254*** (0.048)
Foreign Dutch vs. National	-0.284 (0.204)	0.256*** (0.071)	-0.249 (0.205)	0.214*** (0.076)
National mobility vs. no mobility	-0.523*** (0.135)	0.263*** (0.076)	-0.530*** (0.138)	0.336*** (0.075)
International mobility vs. no mobility	-1.022*** (0.133)	0.289*** (0.042)	-0.960*** (0.135)	0.337*** (0.049)
Time trend	-0.064*** (0.005)	-0.090*** (0.004)	-0.061*** (0.005)	-0.069*** (0.004)
Gender: female vs. male	-0.412*** (0.061)	0.180*** (0.025)	-0.434*** (0.063)	0.195*** (0.029)
Age years	0.050*** (0.010)	-0.017*** (0.003)	0.050*** (0.010)	-0.021*** (0.004)
Funds: postdoc assistant vs. project	1.357*** (0.088)	-0.809*** (0.060)	1.257*** (0.089)	-0.628*** (0.060)
Funds: competitive vs. project	1.362*** (0.075)	-1.127*** (0.053)	1.220*** (0.076)	-0.872*** (0.049)
Humanities vs. Medicine	-0.034 (0.087)	-0.018 (0.050)	-0.093 (0.089)	0.003 (0.056)
Social Sciences vs. Medicine	0.254*** (0.086)	-0.149*** (0.053)	0.186** (0.088)	-0.123** (0.057)
Engineering vs. Medicine	-0.237*** (0.080)	0.163*** (0.036)	-0.170** (0.081)	0.149*** (0.040)
Natural Science vs. Medicine	-0.717***	0.288***	-0.674***	0.301***

Table 11 (continued)

	All sample		Excluding stays < 1 year	
	Postdoc to promotion	Postdoc to leave	Postdoc to promotion	Postdoc to leave
University 2 vs. 1	(0.086) 0.362***	(0.036) -0.159***	(0.088) 0.357***	(0.039) -0.198***
University 3 vs. 1	(0.064) -0.070	(0.031) -0.062	(0.066) -0.076	(0.035) -0.084*
University 4 vs. 1	(0.104) 0.145	(0.041) -0.104**	(0.106) 0.132	(0.047) -0.141***
University 5 vs. 1	(0.101) 0.717***	(0.042) -0.454***	(0.103) 0.728***	(0.047) -0.469***
Observations	(0.157) 13,299	(0.098) 13,299	(0.159) 1091	(0.097) 1091
Log likelihood	-11,456	-62,010	-10,733	-41,684
Chi-squared	1572	1532	1191	1125

Robust standard errors in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

**Table 12** Career outcomes of professors: effect of international mobility for “returnees” and “non-returnees”

	Assistant Professor to promotion	Assistant Professor to leave	Associate Professor to promotion	Associate Professor to leave
International mobility “non-returnees” vs. non-mobile	−0.412** (0.185)	1.124*** (0.433)	−0.815*** (0.214)	0.862 (0.529)
International mobility “returnees” vs. non-mobile	−0.327** (0.132)	0.694* (0.360)	−0.582*** (0.135)	0.883** (0.410)

The coefficients are computed replacing the variable “international mobile” with the new ones in the regression models in Table 4

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

**Table 13** Career outcomes of postdocs by disciplinary area

Variables	Medicine promotion	Medicine leave	Humanities promotion	Humanities leave	Social Sciences promotion	Social Sciences leave	Engineering promotion	Engineering leave	Natural Sciences promotion	Natural Sciences leave
Foreign non-Dutch vs. National	-1.339*** (0.310)	0.276*** (0.091)	-1.162*** (0.403)	0.293** (0.122)	-1.000*** (0.331)	0.373*** (0.101)	-1.226*** (0.332)	0.330*** (0.075)	-0.624* (0.336)	0.392*** (0.097)
Foreign Dutch vs. National	-0.229 (0.304)	0.234* (0.138)	-0.567 (0.514)	0.282 (0.172)	-0.389 (0.449)	0.137 (0.140)	-0.468 (0.739)	0.101 (0.183)	-0.044 (0.535)	0.291* (0.172)
National mobility vs. no mobility	-0.613*** (0.234)	0.176 (0.145)	-0.178 (0.325)	0.338* (0.199)	-0.222 (0.258)	0.160 (0.185)	-0.800** (0.378)	0.390*** (0.149)	-0.774* (0.465)	0.170 (0.183)
Internat. mobility vs. no mobility	-1.151*** (0.279)	0.413*** (0.085)	-0.931*** (0.327)	0.264** (0.117)	-0.686*** (0.249)	0.321*** (0.105)	-1.154*** (0.350)	0.323*** (0.065)	-0.979*** (0.345)	0.135 (0.109)
Time trend	-0.057*** (0.011)	-0.080*** (0.007)	-0.082*** (0.014)	-0.045*** (0.008)	-0.061*** (0.012)	-0.033*** (0.009)	-0.065*** (0.011)	-0.101*** (0.008)	-0.069*** (0.011)	-0.120*** (0.008)
Gender: female vs. male	-0.635*** (0.116)	0.211*** (0.055)	-0.408*** (0.147)	0.260*** (0.073)	-0.324** (0.131)	0.162** (0.072)	-0.239* (0.141)	0.122** (0.050)	-0.438*** (0.165)	0.166*** (0.053)
Age (year)	0.094*** (0.016)	-0.030*** (0.006)	0.033 (0.023)	-0.002 (0.008)	-0.011 (0.023)	-0.017** (0.008)	0.063*** (0.022)	-0.017*** (0.005)	0.000 (0.030)	-0.008 (0.006)
Funds: postdoc assistant vs. project	1.833*** (0.116)	-0.988*** (0.055)	1.127*** (0.147)	-0.734*** (0.073)	0.783*** (0.131)	-0.480*** (0.072)	1.471*** (0.141)	-0.809*** (0.050)	1.541*** (0.165)	-0.823*** (0.053)

**Table 13** (continued)

Variables	Medicine promotion	Medicine leave	Humanities promotion	Humanities leave	Social Sciences promotion	Social Sciences leave	Engineering promotion	Engineering leave	Natural Sciences promotion	Natural Sciences leave
Funding: competitive vs. project	(0.180) 1.663***	(0.127) -1.245***	(0.220) 0.695***	(0.134) -0.704***	(0.167) 0.762***	(0.110) -0.533***	(0.180) 1.601***	(0.129) -1.392***	(0.275) 1.588***	(0.156) -1.261***
University 2 vs. 1	(0.147) 0.241*	(0.100) -0.062	(0.203) 0.097	(0.115) -0.032	(0.164) 0.230	(0.119) 0.024	(0.149) 0.527***	(0.127) -0.288***	(0.195) 0.562***	(0.118) -0.259***
University 3 vs. 1	(0.129) -0.061	(0.066) -0.029	(0.157) -0.737***	(0.084) 0.178*	(0.161) -0.046	(0.084) -0.002	(0.137) 0.720	(0.054) -0.247	(0.163) 0.261	(0.073) -0.139**
University 4 vs. 1	(0.197) 0.180	(0.104) -0.012	(0.280) 0.228	(0.107) -0.175	(0.215) 0.597***	(0.108) -0.367**	(0.676) -0.079	(0.259) -0.015	(0.205) 0.039	(0.058) -0.161**
University 5 vs. 1	(0.208) 0.045	(0.120) -0.218	(0.250) 0.932	(0.163) -0.218	(0.225) 0.810***	(0.152) -0.665***	(0.203) 0.654	(0.080) -0.587*	(0.279) 1.142***	(0.070) -0.600***
Observations	(0.411) 2972	(0.210) 2972	(0.850) 1447	(0.445) 1447	(0.255) 1590	(0.249) 1590	(0.451) 3337	(0.321) 3337	(0.288) 3814	(0.161) 3814
Log likelihood	-2329	-10,666	-1412	-4010	-1775	-3974	-2061	-13,553	-1578	-17,969
Chi-squared	454	380.7	165.8	154.4	184	131.6	399.1	420.4	336.7	427.3

Robust standard errors in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

**Acknowledgements** We are grateful to the reviewers for their insightful comments. We are also grateful to the ECOOM consortium of Flemish universities for having made the data for this study available. Previous draft versions of the article were presented at STI and AIIG conferences in 2018, DZHW workshop on research governance; we warmly thank participants for their feedback and comments. We would like to thank Michele Seeber for retrieving data on researchers' productivity; Mattia Cattaneo, Jeroen Huisman, and members of the evaluation unit of the University of Zürich for their useful comments; and Robert Coates from the University of Edinburgh for carefully proofreading the article.

**Funding** Open access funding provided by University of Agder. This work was supported by Fonds Voor Wetenschappelijk Onderzoek Vlaanderen (grant number G.OC42.13 N).

## Declarations

**Conflict of interest** The authors declare no competing interests.

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