Gender Differences in Internal and International Migration of Scholars Worldwide

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Abstract

Previous studies on gender differences in migration of scholars have focused on international migration across countries. We use bibliometric data on 28+ million publications by 8+ million scholars worldwide and extend this literature by focusing simultaneously on gender differences in internal and international migration. We found that internal migration is more gender equal than international. In more recent years, the gender gap has decreased in international migration and reversed in internal migration. In other words, female scholars became more internally mobile than males. Our results have implications for understanding gender inequality and promoting more equitable science, both at global and sub-national levels.

Introduction

Scholars contribute to innovation, creation and dissemination of ideas in knowledge economies (*1*). The migration influences the trajectory of a scholar's career, fostering the potential for groundbreaking scientific discoveries and more impactful research (*2*, *3*). While migration enhances the scholar's future career, it is also influenced by previous productivity and collaboration networks (*2*, *4*). The lack of quality data for the study of scholars' migration makes it difficult to advance our understanding of the migration patterns of this specific subgroup and how they differ from the pattern observed for the overall population (*5*). Previous studies have addressed this lack (*6*) by re-purposing bibliometric data to estimate migration based on changes in scholars' affiliation addresses (*7*–*11*).

Zhao *et al.* (*10*) has shown that between the late 1990s and 2018, there was an increase in gender equity in the overall scholars' population and the gender gap is closing faster in the international migration of scholars. It was shown that female scholars migrate over shorter distances across countries than male scholars. Although it is more common for studies to focus on the international migration of scholars or to specific countries (*11*), it is essential to analyze internal and international migration together (*12*, *13*) and investigate how they complement, substitute or precede each other (*8*, *14*). In this study, we aim to investigate whether a gender gap is also observed in sub-national migration in comparison to international migration, and how this gap has varied over time and within countries.

Materials and methods

We used 28+ million "articles" and "reviews" by 8+ million authors indexed in Elsevier's 2020 Scopus snapshot provided to us by the German Competence Network for Bibliometrics (*15*) through the Max Planck Digital Library. We used the data after a process of disambiguation and geolocation of authors' affiliation addresses at the sub-national level as described by Akbaritabar (*7*). An author's gender is previously inferred by Zhao *et al.* (*10*) using first names in different country contexts. We note that this algorithmic gender labeling, despite its scalability to large-scale data such as ours, is binary and has certain limitations in neglecting more diverse gender identities. We only considered authors with disambiguated affiliations and identified sub-national geolocations. In addition, we only considered publications between 1998 and 2017 to reduce the effects of left and right censoring (*4*) due to unobserved publications in Scopus for the case of authors whose career could have started earlier than 1996 i.e., the starting year in our data.

We used the modal region of affiliation in each year to identify migrant scholars (*9*). This strategy was found to be most suitable for analyzing the migration of scholars with bibliometric data; a description of the migration identification process can be found in Akbaritabar *et al.* (*9*, *16*).

We only considered regions with more than 20 migrant scholars in each year, since a lower limit could result in the inclusion of extreme values for gender ratios, as pointed out by Zhao *et al.* (*10*), and a higher limit would exclude a large portion of regions, especially in the initial years of the period analyzed. After excluding the regions with a smaller number than the threshold, our final data contains 560 regions located in 107 countries. We used the threshold separately for each year, consequently, the regions and countries considered are not the same for all years. For instance, if a region has fewer than 20 migrant scholars in a given year, it is excluded from the analysis in that year and if in later years it has higher than threshold migrants, it is included again in the analysis. In 1998, the year with the lowest number of regions above the threshold, we included 262 regions in 54 countries. In 2017, the last year analyzed and the one with the most countries included in the analysis, we considered 415 regions in 81 countries.

Preliminary results

Over the years, female scholars have migrated more internally than internationally, and, in more recent years, they are more internally mobile than male scholars. Fig. 1 shows that in all years, male and female scholars migrated more internally than internationally. When we compare the in- and out-migration rates between genders, we find that male scholars are more internationally mobile than females in all years (right panel). This pattern is not observed for internal migration (left panel) and the median rates for males and females are very close in all years. The median rate oscillates in years with more intense female migration and years when the median rate for men is higher. However, women are more internally mobile than men in all years after 2011.

Following Zhao *et al.* (*10*), we calculated a female-to-male gender ratio to measure the gender gap between all scholars and migrants. Fig. 2 shows that the median gender ratio among internal migrants (left panel) is higher than that of the general population, contrary to what was observed for international migration (right panel). Although internal migration is more gender equal, still the median gender ratio is close to 0.5, indicating more than half of the regions have a ratio of one female migrant scholar for two migrant males. In other words, although there is greater gender equity among internal migrants when compared to international migrants or the entire population of scholars, even this group is still under-represented by females.

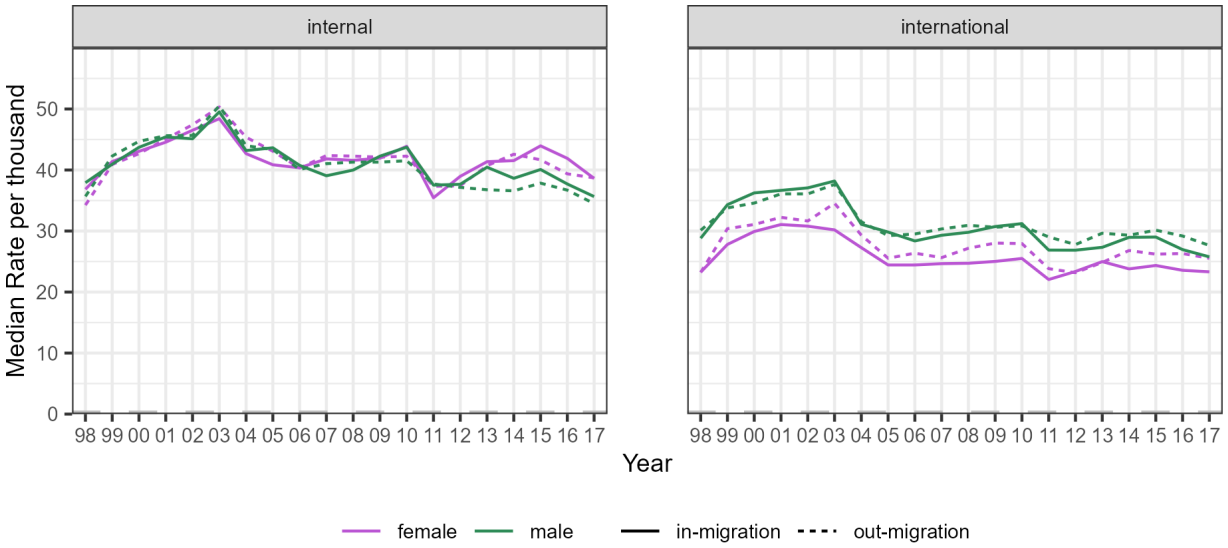

Fig. 1: Gender differences in median rates of internal (left) and international (right) in- (solid line) and out-migration (dashed line) by year.

To assess the evolution of the gender gap between migrant scholars and all scholars, we ran linear regressions of the gender ratio among migrants by the gender ratio among all scholars for each year. The gender gap is equal to one minus the estimated value by the regression when the gender ratio among all scholars is one. Fig. 3 shows that on the one hand and in the case of international migration, the gap is positive for the entire period, indicating that females are underrepresented among international migrants compared with the overall population of scholars. However, it shows a slight downward trend. Therefore, this under-representation has decreased faster than the reduction observed for all scholars. On the other hand and for internal migration, the gender gap oscillates around zero and is negative for all years after 2011. The negative gap does not mean gender equity in internal migration. Still, it does indicate that the representation of females among internal migrants is higher than that observed for the whole population of scholars.

Future steps

Our preliminary results point to greater equity in internal migration than in international migration and than in the overall population of scholars. As our future steps, we intend to compare how these results vary between continents and countries. Also, we plan to decompose the variation in the gender gap to identify if the decrease was driven by higher equity within regions in more recent years or by a change in the global distribution of scholars. Finally, we will analyze whether the results found change when considering different approaches in defining a population threshold for the sub-national region to be included in the analysis. Three possible approaches that we will explore in our next steps include 1) an overall threshold on the number of scholars' population in the region (our current approach), 2) the number of migrant male or female scholars to include (*10*), and 3) the minimum number of scholars in a region plus a minimum number of observation years (*8*).

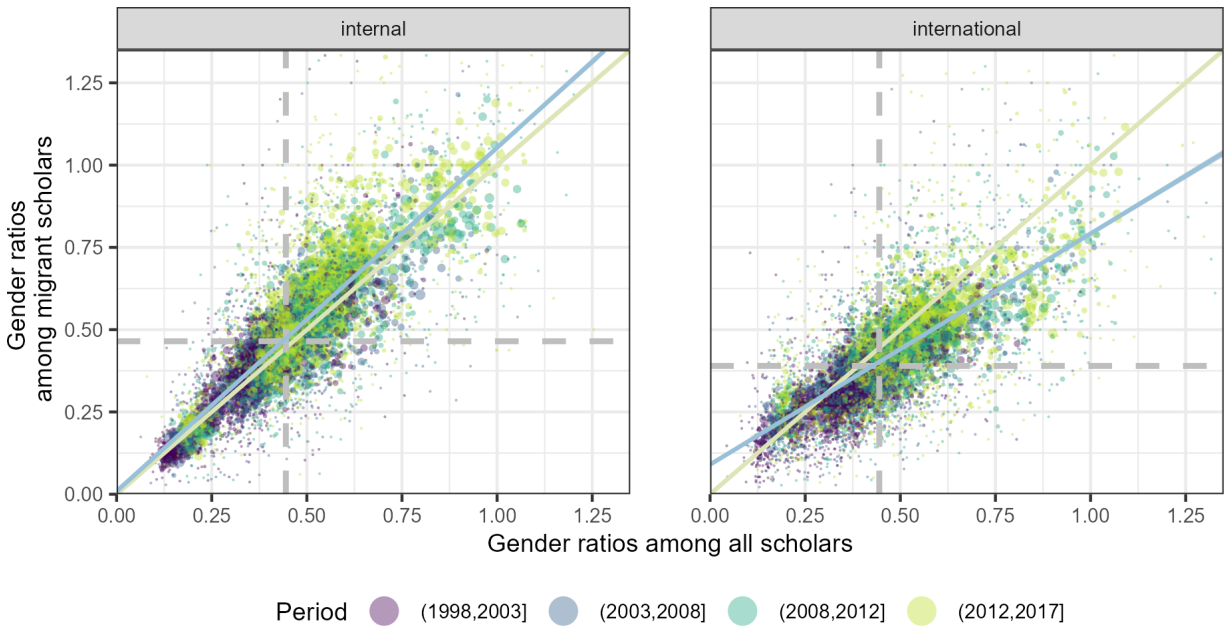

Fig. 2: Gender ratio among all published scholars (X-axis) and migrant scholars (Y-axis) for internal (left panel) and international (right panel). The size of each region's circle is proportional to the number of scholars who migrated from and to this region. Regions with less than 100 migrant scholars are set to the minimum size. The vertical and horizontal dashed gray lines indicate the median gender ratios of all scholars and mobile scholars. The 45º (yellow solid) line indicates when the gender ratio for migrants is equal for all scholars. When the gender ratio among all scholars is one, the distance between the 45º line and the fitted regression represents the gender gap between migrants and all scholars. The color of the circle indicates the year grouped in four periods.

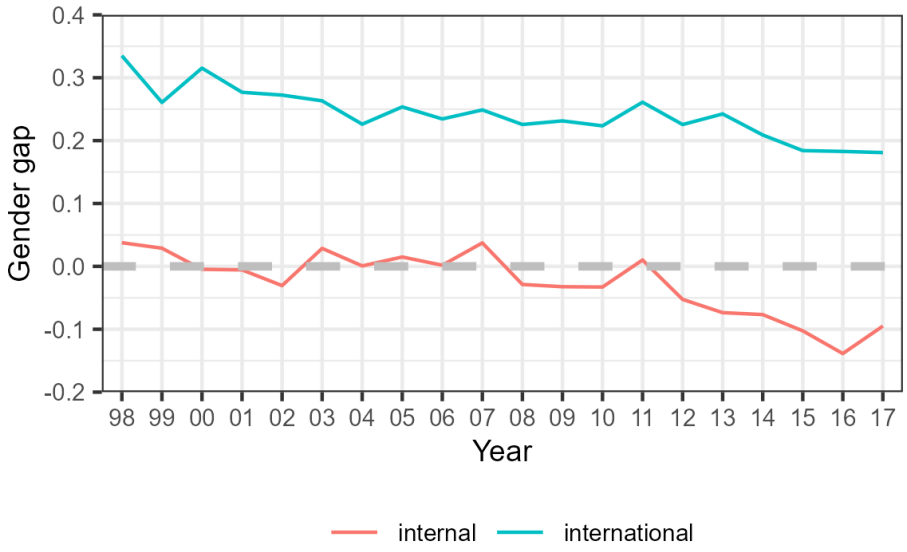

Fig. 3: Gender gap between internal (red) and international (blue) migrant scholars and all scholars by year. The dashed grey line indicates no differences between migrant scholars and all scholars

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