

# **Short-term and long-term international scientific mobility of Italian PhDs: An analysis by gender**

Valentina Tocchioni, Alessandra Petrucci, Alessandra Minello

## **1. Introduction**

Internationalization and globalization recently led to a large increase in high-educated and high-skilled international mobility. The increase in high-skilled mobility is also a consequence of the weakening of research and university systems of sending countries (the “brain drain” process), and the increase in skilled demand and improvements in higher education of host countries (the “brain gain” process; Boeri et al., 2012). At the micro-level, academic mobility has positive consequences on occupational prospects and careers of researchers, both in the short- and long- run (Ermini et al., 2019). For European researchers, experiencing scientific mobility is a way to advance their careers (Ackers, 2005; Mahroum, 2000; Morano-Foadi, 2005), but only a few studies focused on gender differences in opportunities for international scientific mobility (Deitch and Sanderson, 1987; Rosenfeld and Jones 1987; Mason et al., 2013; Cohen et al., 2019).

The literature suggests that women in academia tend to travel less (e.g., He et al., 2019), and especially those who are not in the humanities (Jöns, 2011). Family constraints, especially those related to childbearing and childrearing, have a stronger effect in reducing women’s mobility than men’s (Shauman and Xie, 1996). Due to the work-family conflict, women must be strongly determined and able to balance their professional and private lives for traveling during their academic careers (González -Ramos and Bosch, 2012). Moreover, for women in STEM (Science, Technology, Engineering and Mathematics), where the share of women is lower than in other fields of study, their performances (and hence, possibly, the chances of travelling) are much more hindered by personal events – mainly children (Ginther and Kahn, 2009). The conflict might be exacerbated in Italy, since the care responsibilities for women compared to men are higher than elsewhere in Europe: Italy is the European country (together with Romania) with the highest gender-gap in hours devoted to care during the day (Eurostat data, 2019), and it is below the European mean for the indicators of care in the European Gender Equality index (Eige, 2020). Despite it, the literature on Italy is missing on this topic.

Moving from these premises, our paper studies gender differences in short- and long-term international scientific mobility among a cohort of Italian PhDs. Moreover, we test whether these differences are diversely pronounced in female- or male- dominated fields of study, comparing the probability of moving for short- and long- periods abroad in humanities, soft- or hard- STEM (Bliglan, 1973a, 1973b).

Using Italian data on occupational conditions of PhDs collected in 2018 by Istat and modelling multinomial logistic regression analyses, we intend to deal with two research objectives. First, we aim to verify if female PhDs are associated with a lower scientific mobility irrespective their field of study. Second, we want to investigate the extent to which gender interacts differently in the humanities, soft- and hard-STEM in affecting the propensity of moving abroad after PhD qualification. We expect that women in STEM will be more penalized than women in the humanities with respect to men in the same fields. Also, the distinction between long-term and short-term mobility, which has been mainly neglected in the literature concentrating on longer stays, has taken into account across the two research objectives. In this respect, short-term mobility is a potentially high-value investment that may be pursued also by those researchers and scientists who cannot move for longer periods, such as women with caring

Valentina Tocchioni, University of Florence, Italy, valentina.tocchioni@unifi.it, 0000-0002-0793-6122  
Alessandra Petrucci, University of Florence, Italy, alessandra.petrucci@unifi.it, 0000-0001-9952-0396  
Alessandra Minello, University of Florence, Italy, alessandra.minello@unifi.it, 0000-0002-0018-5442

FUP Best Practice in Scholarly Publishing (DOI 10.36253/fup\_best\_practice)

Valentina Tocchioni, Alessandra Petrucci, Alessandra Minello, *Short-term and long-term international scientific mobility of Italian PhDs: An analysis by gender*, pp. 35-40, © 2021 Author(s), CC BY 4.0 International, DOI 10.36253/978-88-5518-304-8.08, in Bruno Bertaccini, Luigi Fabbris, Alessandra Petrucci, *ASA 2021 Statistics and Information Systems for Policy Evaluation. Book of short papers of the opening conference*, © 2021 Author(s), content CC BY 4.0 International, metadata CC0 1.0 Universal, published by Firenze University Press ([www.fupress.com](http://www.fupress.com)), ISSN 2704-5846 (online), ISBN 978-88-5518-304-8 (PDF), DOI 10.36253/978-88-5518-304-8

responsibilities (Henderson, 2019). For this reason, we expect a lower gender gap in mobility among short-term stays in comparison with long-term stays and (potential) international relocations.

In the literature, it is acknowledged that an experience abroad during early career may have positive effects on future occupational prospects. With our work, we intend to shed light on potential disparities on moving abroad that may exist among researchers in their early career by gender, and which could contribute to leave women behind in academia.

## 2. Data and methods

Our sample was drawn from the Istat Survey on occupational conditions of Italian PhD holders, conducted in 2018 by contacting all PhD holders who had obtained their qualification from an Italian academic institute in 2012 and 2014. After excluding foreign PhD holders (625) and those who declared to have moved abroad because of personal or familiar reasons, our final sample was formed by 15,216 observations<sup>1</sup>. Among them, 3,313 (21.8%) spent a period of at least three months abroad after their PhD dissertation: 799 PhDs (5.3% of PhD holders) stayed less than one year (short-term stays); 1,016 (6.7%) moved for one year or more (long-term stays); 1,498 (9.8%) were still abroad at the interview date<sup>2</sup> (potential international relocations); and 11,903 (78.2%) did not move.

To investigate our two research objectives, we estimated two multinomial logistic regression models, with standard errors clustered at the field of study. The response variable was a nominal variable that indicated whether the researcher remained in Italy after doctoral studies (1), or if they went, whether they moved for less than one year (2), for one year or more (3), or if they were still abroad at the interview date (4). The two key explanatory variables were student gender and the field of study, with three categories: Hard STEM; Soft STEM; and Humanities<sup>3,4</sup>.

In our first step, in order to verify if female researchers are associated with a lower mobility irrespective their field of study, Model 1 estimated the probability of going abroad in one of the three different situations or remaining in Italy according to gender, field of study and some control covariates: parental education<sup>5</sup> (the highest educational level between parents, assuming the following categories: primary or lower; lower secondary; upper secondary; tertiary or post-tertiary), mother's economic activity (employed/self-employed; homemaker; retired; other condition), father's social class, classified according to EGP-class typology aggregated in a five-category classification (Goldthorpe & Erikson, 1992: higher grade professionals; lower grade professionals; routine non-manual labourers; self-employed; working class - skilled/unskilled; and a residual sixth category for those whose social class was unknown); if the researcher completed his/her PhD studies at a university outside his/her region of residence;

<sup>1</sup> PhD holders who completed the interview in 2018 were 16,057 (72.7% of all 22,099 PhD holders who defended in 2012 and 2014, which were contacted by Istat for the interview).

<sup>2</sup> Unfortunately, we don't know when PhDs moved during the years intercurred between the defence and the interview (this period lasted four years for those who defended in 2014, and six years for those who defended in 2012). For this reason, we opted for keeping them separated from the other two categories of short-term and long-term stays, which were defined on the basis of a specific amount of time. Moreover, we referred to this kind of mobility as "potential international relocation", because researchers could be abroad at the interview date only for a fixed amount of time.

<sup>3</sup> Hard STEM comprises Maths and Computer Science; Physics; Chemistry; Civil Engineering and Architecture; Industrial and Information Engineering; Soft STEM includes Earth Science; Biology; Medicine; Agricultural and Veterinary Science; Economics and Statistics; and Humanities comprises Antiquity, Philology, Literary Studies, Art History; History, Philosophy, Pedagogy, Psychology; Law; Political and Social Sciences.

<sup>4</sup> The percentage of women was 37.7% in the Hard-STEM, 60.1% in the Soft-STEM, and 59.9% in the Humanities.

<sup>5</sup> The three covariates related to the family of origin (parental education, mother's economic activity and father's social class) referred to when the researcher enrolled to the university for the first time.

the calendar year of PhD dissertation (2012 or 2014); if the researcher spent an international visiting period during PhD studies.

In the second step, Model 2 included also an interaction term between gender and field of study, for verifying if and how the field of study moderates the relationship between gender and international mobility.

### 3. Results

We estimated predicted probabilities of researchers' international mobility and present them graphically (full model results are available upon request to the authors). Figure 1 shows predicted probabilities of moving/not moving abroad after PhD studies according to gender and length of the stay from Model 1. Predicted probabilities show how female researchers' propensity to move is always significantly lower than their male counterparts, irrespective the length of stay. Overall, the difference between male and female researchers' propensity to mobility is about 7.8% (see Figure 1d). Looking at the three types of move, the highest propensity is of those who moved up to the interview date for both men and women, with 10.4% and 6.6%, respectively (see Figure 1c). As expected, the gender gap in the propensity towards international mobility is positively associated with the length of stay: whilst the difference in the predicted probability of moving abroad is only 1.2% between men and women for short-term stays, it raises to 2.8% for long-term stays and 3.8% for potential international relocations.

**Figure 1:** Results from Model 1: Predicted probabilities of moving/not moving abroad after PhD studies according to gender. CI 83%.

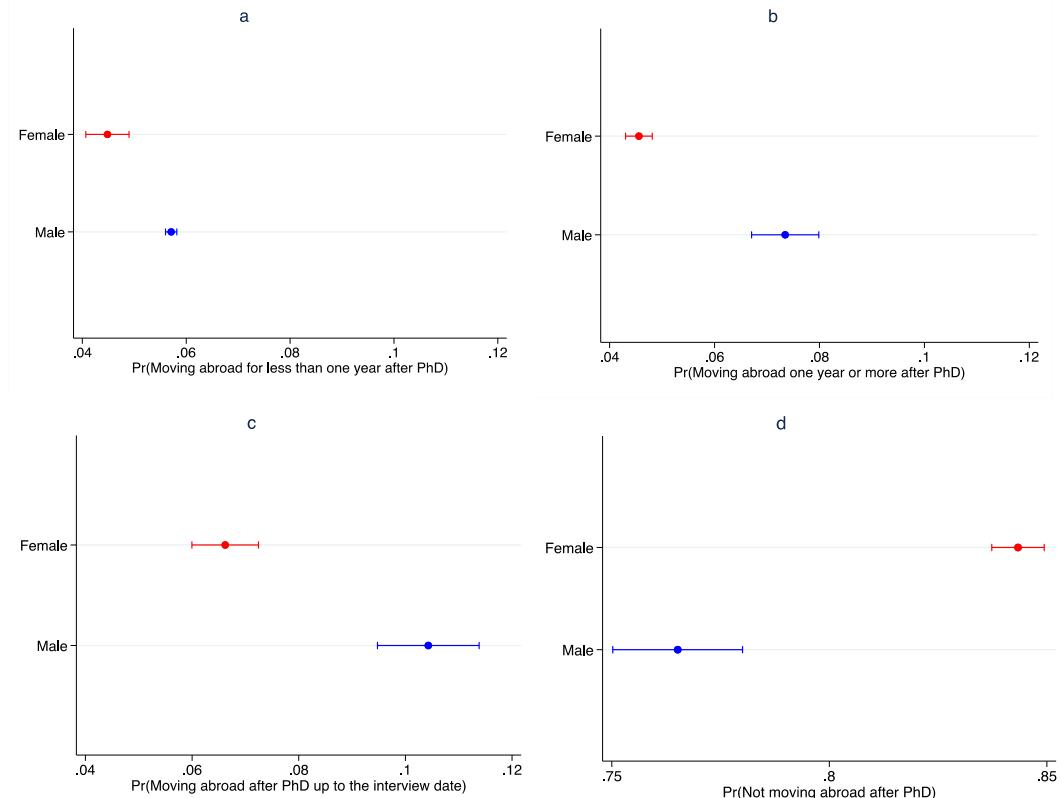
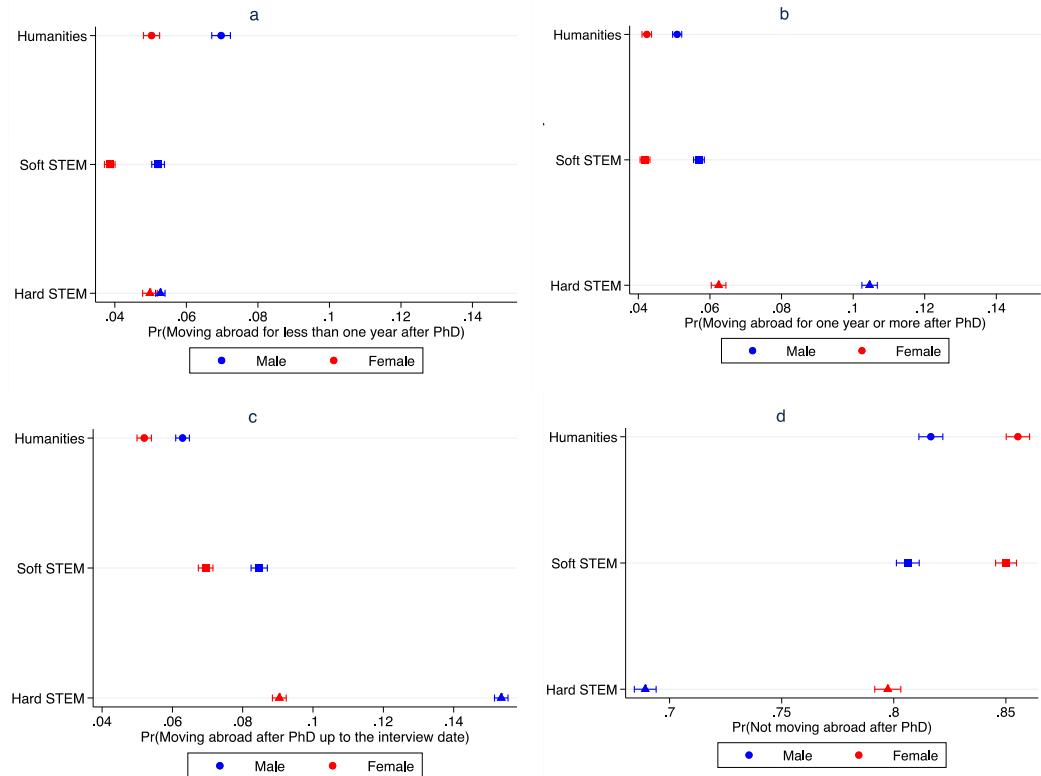


Figure 2 shows predicted probabilities of moving/not moving abroad after PhD studies according to gender and field of study from Model 2. Overall, male researchers' propensity to move is still higher than female researchers' propensity in all fields of study, and the highest gap is among those researchers who have a PhD in the Hard STEM: in this field of study, men who move abroad are 10.8% more than women, whereas this difference shrinks to 3.8% for those in the Humanities (see Figure 2d for complementary percentages). Moreover, researchers in the Hard STEM are also the ones with the highest mobility: whilst male and female researchers who moved were 31.3% and 20.3% in this field of study, respectively, these percentages decrease to 18.3% and 14.5% among researchers in the Humanities.

According to the three types of move, confidence intervals of predicted probabilities show how male researchers' propensity to move is still higher than female researchers' propensity in all combinations of field of study and length of stay, except for researchers in the Hard STEM who moved for short-term periods with the two confidence intervals overlapping (see Figure 2a). Nevertheless, researchers in the Hard STEM have a higher propensity for longer stays (both long-term stays and potential international relocations), and the gender gap in mobility is significant and the highest across all fields of study: 4.2% for and 6.3%, respectively (see Figure 2b and 2c). On the other hand, researchers in the Humanities have a higher propensity for short-term stays abroad (see Figure 2a), whereas researchers in the Soft STEM show similar percentages, with only a slightly higher propensity for potential international relocations. Differences in gender gap are very low both in the Humanities - from 0.8% to 1.9% in the different types of move - and in the Soft STEM – where the gender gap is around 1.4%-1.5% across all types of move (see Figure 2a-c).

**Figure 2:** Results from Model 2: Predicted probabilities of moving/not moving abroad after PhD studies according to gender and field of study. CI 83%.



## 4. Conclusions

International mobility of high-educated people and researchers has positive consequences on their occupational prospects and careers, both in the short- and long- run (Ermini et al., 2019). Despite it, women in academia have a lower mobility with respect to their male counterparts, experiencing more often work-family conflicts that tend to limit their traveling during their academic careers (González -Ramos and Bosch, 2012; Jöns, 2011). In this paper, we concentrated on gender differences in short- and long-term international scientific mobility among a cohort of Italian PhDs, and the potential role of moderator played by the field of study in the relationship between gender and international mobility.

Our analyses show how women with a PhD qualification have a lower propensity to mobility compared with their male counterparts. As expected, a lower gender gap in mobility emerges among short-term stays in comparison with long-term stays and potential international relocations. In this respect, it is acknowledged that short-term mobility is presumably an investment that may be pursued also by those researchers who cannot move for longer periods, which are more often women (e.g. Henderson, 2019). Concentrating on the field of study, as expected the highest gender gap in international mobility is among women and men in hard-STEM, whereas the lowest among those researchers in the Humanities. As identified for other aspects in previous literature, to bridge the gap in hard-STEM is more difficult than in other fields of study, where the presence of women is much more pronounced (e.g., Ginther and Kahn, 2009). Nevertheless, a remark should be made. International mobility of female researchers in hard-STEM seems to be the highest among the three fields of study. Thus, a higher gender gap in international mobility in the hard-STEM could depend - at least partly - from the higher overall mobility of those researchers, and in particular that of men. In this respect, hard-STEM appears as the field of study where international mobility is more widespread, at least in Italy, and it could reveal a greater difficulty in accessing scientific research and academia positions for Italian researchers in this field of study.

Gender disparities in academia can be found in several outputs such as publications (namely, men publish more papers than women, on average: West et al. 2013), career advancement, with women having slower and more complex pattern of career (Gaiaschi and Musumeci 2020) and, as we demonstrated, in the chances to experience international short- and long- term mobility. For this final output, more than for the others there might be a direct effect of the family-work conflict. Women might be less likely to travel due to the difficulties to balance their career and their family duties. This aspect deserves further investigation. Moreover, we demonstrated that international mobility is another way to leave women behind. The direct effect of this gap on careers of women in the Italian academia should be the focus of future research.

## References

- Ackers, L. (2005). Moving people and knowledge: Scientific mobility in the European Union. *International migration*, **43**(5), pp. 99–131.
- Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology*, **57**, pp. 195-203.
- Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology*, **57**, pp. 204-213.
- Deitch, C.H., Sanderson, S.W. (1987). Geographic constraints on married women's careers. *Work and Occupations*, **14**(4), pp. 616–634.
- Boeri, T., Brücker, H., Docquier, F., Rapoport, H. (2012). *Brain drain and brain gain: The global competition to attract high-skilled migrants*. Oxford University Press, Oxford, (UK).
- Cohen, S., Hanna, P., Higham, J., Hopkins, D., Orchiston, C. (2020). Gender discourses in academic mobility. *Gender, Work & Organization*, **27**(2), pp. 149-165.

- Eige (2020). Gender Equality Index: Italy. Retrieved here: <https://eige.europa.eu/publications/gender-equality-index-2020-italy>
- Ermini, B., Papi, L., Scaturro, F. (2019). Wage returns to interregional mobility among Ph.D graduates: Do occupations matter?. *Papers in Regional Science*, **98**(2), pp. 995–1025.
- Eurostat (2019). How do women and men use their time. Retrieved here: [https://ec.europa.eu/eurostat/statistics-explained/index.php/How\\_do\\_women\\_and\\_men\\_use\\_their\\_time\\_-\\_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php/How_do_women_and_men_use_their_time_-_statistics)
- Gaiaschi, C., Musumeci, R. (2020). Just a matter of time? Women's career advancement in neo-liberal academia. An analysis of recruitment trends in Italian Universities. *Social Sciences*, **9**(9), p.163.
- Ginther, D. K., Kahn, S. (2009). Does science promote women? Evidence from Academia 1973-2001, in *Science and engineering careers in the United States*, eds. R.B. Freeman, D.F. Goroff, University of Chicago Press, Chicago, (IL), pp. 163–194.
- Goldthorpe, J., Erikson, R. (1992). *The constant flux: a study of class mobility in industrial societies*. Clarendon Press, Oxford (UK).
- González Ramos, A.M., Bosch N.V. (2013). International mobility of women in science and technology careers: shaping plans for personal and professional purposes. *Gender, Place & Culture*, **20**(5), pp. 613-629.
- He, Z., Zhen, N., Wu, C. (2019). Measuring and exploring the geographic mobility of American professors from graduating institutions: Differences across disciplines, academic ranks, and genders. *Journal of Informetrics*, **13**(3), pp. 771-784.
- Henderson, E. F. (2019). A PhD In motion: Advancing a critical academic mobilities approach (CAMA) to researching short-term mobility schemes for doctoral students. *Teaching in Higher Education*, **24**(5), pp. 678–693.
- Jöns, H. (2011). Transnational academic mobility and gender. *Globalisation, Societies and Education*, **9**(2), pp. 183-209.
- Loeb, J.W. (2006). The status of female faculty in the U.S.: thirty-five years with equal opportunity legislation. *Management Revue*, **17**(2), pp. 157-180.
- Mahroum, S. (2000). Scientists and global spaces. *Technology in Society*, **22**(4), pp. 513–523.
- Mason, M.A., Wolfinger, N.H., Goulden, M. (2013). *Do babies matter? Gender and family in the ivory tower*. Rutgers University Press, New Brunswick, (NJ), and London (UK).
- Morano-Foadi, S. (2005). Scientific mobility, career progression, and excellence in the european research area. *International Migration*, **43**(5), pp. 133–162.
- Rosenfeld, R., Jones, J. (1987). Patterns and Effects of Geographic Mobility for Academic Women and Men. *The Journal of Higher Education*, **58**(5), pp. 493-515.
- Shauman, K. A., Xie, Y. (1996). Geographic Mobility of Scientists: Sex Differences and Family Constraints. *Demography*, **33**(4), pp. 455-468.
- West, J. D., Jacquet, J., King, M., Correll, S. J., Bergstrom, C. T. (2013). The Role of Gender in Scholarly Authorship. *PLoS ONE*, **8**(7), pp. e66212.