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Individual-level determinants of international academic mobility: insights from a survey of Polish scholars

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Abstract
This study investigates the patterns and determinants of international academic mobility among Polish scholars, focusing on short- and mid-term mobility activities such as attending conferences, project meetings, and professional training, conducting research, and lecturing. Utilizing a representative random sample survey of scholars employed in research and higher education institutions in Poland, this study explores the influence of gender, childcare responsibilities, and family financial situation on mobility while controlling for age, career stage, institution type, field of science, and region. The results indicate significant disparities in mobility, with female scholars, those with young children, and those from less affluent households being less likely to engage in career-related international travel. Scholars at advanced career stages and those who perceived travel as necessary for their research exhibited higher mobility. The findings highlight the compounded impact of gender, family, and financial factors on academic mobility, underscoring the need for targeted policies to promote equitable and inclusive participation in international academic activities. This study contributes to the literature by providing evidence from a scientific semi-periphery country on the role of household economic status, reflecting a variable rarely considered in studies on academic mobility.

Keywords International academic mobility · Gender disparity · Childcare responsibilities · Financial constraints · Academic career development · Polish scholars

Introduction

The present study examines the patterns and determinants of international academic mobility among Polish scholars, focusing on short- and mid-term mobility, including attending conferences (conventions, seminars), project meetings, and professional training, conducting research, lecturing or teaching, and taking up academic internships. Specifically, it investigates how gender, childcare responsibilities, and family economic status influence academic mobility while controlling for career stage, institution type, field of science, and

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age. The contributions of this study are twofold. First, it presents the results of a representative quantitative study from a country on the scientific semi-periphery outside the scientific center (Kwiek, 2020; Olechnicka et al., 2019; Schott, 1998), whereas it should be noted that most empirical studies on the determinants and effects of scientific mobility are based on data from countries at the center of scientific research (Shen et al., 2022). Second, it includes the economic status of the respondent's household as an important factor explaining the likelihood of involvement in international mobility, as a variable that is very rarely included in studies on the topic (Bunt-Kokhuis, 1994; Kyvik et al., 1999; Netz & Jaksztat, 2014; OECD, 2001). Specifically, this study investigates whether taking into the family's economic status influences the impact of gender and the presence of young children on academic mobility.

International academic mobility, defined as the movement of scholars across national borders for work-related purposes, is essential for promoting global knowledge exchange, advancing academic careers, and enhancing research quality (Altbach & Knight, 2007; Fernández-Zubieta et al., 2016; Gureyev et al., 2020; Kim, 2009; Momeni et al., 2022; Nascia et al., 2021; Teichler, 2015). Despite the increasing emphasis on equality and inclusiveness, significant disparities exist in the extent of scholars' international mobility (Bilecen & Van Mol, 2017; Børing et al., 2015; Cañibano et al., 2011; Mihut et al., 2016; Ackers, 2008; Morley et al., 2018; Nikunen & Lempiäinen, 2020).

It might seem that in the world of instant communication enabled by global digital networks, mobility of scholars has no significant impact because it can be replaced by communication at a distance. It turns out, however, that despite the availability of communication technologies, mobility does matter, and the main factor is the benefits of personal face-to-face contact enabled by being in one place at one time (Boudreau et al., 2017; Chai & Freeman, 2019; Duede et al., 2024). Current research on contemporary academic mobility broadly discusses its multifaceted effects. Guthrie et al. (2017) identified benefits for researchers, institutions, countries, and science in general. For researchers, academic mobility can enhance professional skills, broaden international networks, increase research output and quality, and advance careers. For institutions, mobility fosters innovation and academic excellence by bringing in diverse expertise and facilitating international collaborations. At the country level, hosting international researchers plays a crucial role in fostering a dynamic research environment and significantly contributing to national scientific agendas by providing access to global talent (Fernández-Zubieta & Guy, 2010; Siekierski et al., 2018). The benefits for science as a whole arise from the exchange of ideas facilitated by international mobility, which leads to significant scientific advances (Bahar et al., 2020; Nomaler et al., 2013).

Based on a systematic literature review of 96 empirical studies, Netz et al. (2020) compiled a comprehensive typology of the individual effects of international researcher mobility. They identified eight key impact areas: international networks, scientific productivity, occupational situations, scientific impact, competencies and personality, scientific knowledge, access to research infrastructures, and symbolic capital (prestige). They found that the majority of the studies highlighted positive impacts, with relatively few reporting no impact or ambiguous results. For example, Holding et al. (2024) demonstrated that the positive effects on productivity and impact are driven by the prestige of the institutions that researchers visit. Gu et al. (2024) and Liu and Hu (2022) found a positive effect on productivity and collaboration networks but no evidence of increased impact. Baruffaldi et al. (2020) reported a positive impact on quality and collaboration but no effect on productivity and career advancement. Zhao et al., (2023a, 2023b) found no overall impact on productivity but acknowledged heterogeneous impacts among disciplines. Ploszaj et al.

(2020) showed a significant impact of the availability of air flights on research collaboration, although this effect was not uniform across institutions. Although Wynes et al. (2019) found no relationship between air travel and academic productivity, they showed that those who were more academically mobile enjoyed higher salaries. Some studies focus specifically on conferences and other scholarly meetings as short forms of international mobility, highlighting their crucial role in building global networks and collaborations, allowing researchers to share findings, and remain informed about the latest developments in their field. (Campos et al., 2018; De Leon & McQuillin, 2020; Hansen & Budtz Pedersen, 2018; Hauss, 2021).

Gender has an effect on academic mobility, with numerous studies having found that female scientists are less academically mobile than their male counterparts (Jöns, 2011; Marwell et al., 1979; Sugimoto & Larivière, 2023). In a large-scale bibliometric study, Zhao et al., (2023a, 2023b) found that although female researchers were underrepresented among internationally mobile researchers and tended to travel shorter distances, the gender gap is gradually narrowing. Some studies show that gender differences have lower than expected significance and that the main factor is family composition, especially when researchers have children or care for other family members (Leemann, 2010). Furthermore, Shauman and Xie (1996) argue that the impact of having children on the probability of academic mobility differs by gender, with women being more negatively affected. Combining these two adverse conditions creates a 'double gender-family inequality' (Moguérou, 2004) that is particularly unfavourable for early-career researchers. Børing et al. (2015) showed that scholars with children are less likely to engage in international mobility than scholars without children (by a difference of circa 15 percentage points). Henderson and Moreau (2020) contended that academic conferences can be seen as exclusionary for academics with caregiving responsibilities, with Calisi (2018) calling this phenomenon a 'child-care–conference conundrum.' (see also Knoll et al., 2019). Leemann (2010) suggests an even more complex interplay of factors causing inequalities among researchers, including gender, children, partnership status, dual-career constellations, and social class (Netz et al., 2020).

Materials and methods

Sampling and data collection

A random sample was selected from the official governmental database, POL-on, a comprehensive list of all researchers employed in higher education institutions and research institutes across Poland. Eligibility for the survey required participants to hold at least a doctoral degree. The survey was conducted in Polish. The decision was made that one language version was sufficient because there are very few foreigners working in Polish research and higher education institutions. The initial version of the survey was piloted on a small sample of purposefully selected individuals, who were subsequently asked about the survey layout, comprehensibility, and relevance of the questions. Conclusions from the pilot were used to develop the final form of the survey. The survey questions used in this analysis are provided in Polish and English in the Supplementary Information annexed to this paper. This study has been reviewed and approved by the Ethical Review Board at the Center for European Regional and Local Studies EUROREG, University of Warsaw (approval reference number: KEB-EUROREG-20-1).

Several measures were implemented to ensure a robust response rate. Personalized email invitations, including the recipient's name, surname, and institutional affiliation, were dispatched from an official University of Warsaw email address (in the @uw.edu.pl domain). The initial invitation was followed by two subsequent reminders sent to non-respondents. The survey team monitored the survey mailbox daily, and promptly responded to any inquiries from potential participants.

A random sample was selected from a population of scholars indexed in POL-on. A total of 6742 individuals were randomly selected to ensure at least 1000 responses, even with a very low anticipated response rate. The survey was hosted on the Webankieta platform, and data collection took place from May 4, 2021, to June 24, 2022. The survey yielded 2222 complete responses, and 315 incomplete surveys were discarded, which translates to a robust response rate of 33%, which is considered highly satisfactory for online surveys of scholars. This response rate places this study high compared with other national or international surveys of academics conducted in recent years.

For example, in the large international study *Changing Academic Profession* and its European sister study *The Academic Profession in Europe (EUROAC)*, response rates significantly higher than 33% were recorded only in China (86%) and Mexico (70%). In Norway (36%), Italy (35%), Argentina (34%), and Germany (32%), the response rates were similar to those of the study discussed in this article, and in the case of other countries, they were significantly lower: Finland (28%), Malaysia (28), Netherlands (26%), Brazil (25%), Australia (24%), Japan (23%), Ireland (22%), USA (21%), Canada (17%), United Kingdom (15%), Hong Kong (13%), South Korea (13%), Croatia (10%), Portugal (4%) (Teichler & Höhle, 2013; Teichler et al., 2013). It is worth emphasizing that in the EUROAC study, the response rate among Polish scientists was only 11% (Kwiek, 2018).

Other recently published scientific surveys report similar response rates, including 26% for the United Kingdom (Crespi et al., 2011), 19% for Portugal and 18% for Italy (Baruffaldi & Landoni, 2012), 30% for a survey of PhD students in the United States (Sauermann & Roach, 2014), 19% for a survey of Ukrainian scholars (De Rassenfosse et al., 2023). A response rate of 36%, slightly higher than that of the one discussed in this article, was obtained in a survey conducted in 16 countries—Australia, Belgium, Brazil, Canada, Denmark, France, Germany, India, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States—as reported by Franzoni et al. (2014). However, a recent methodologically sophisticated survey of a random sample of global scientists obtained a response rate of only 15% (Teplitskiy et al., 2022).

This last study is particularly informative in relation to our data because it provides response rates by discipline. The main finding is that response rates are lower for medical disciplines and higher in the humanities. A similar pattern is evident in the survey discussed in this article, where response rates by discipline were as follows: humanities (40.5%), natural sciences (37.9%), social sciences (35.8%), agricultural sciences (34.4%), medical and health sciences (25.9%), and engineering and technology (25.0%). It should also be noted that, in the study presented here, the difference between the disciplines with the lowest and the highest response rate is only 1.6 times, while in Teplitskiy et al. (2022) study, the difference is as high as 2.6 times. Based on this, it can be concluded that our survey achieved a more balanced sample across disciplines. Moreover, the inclusion of the discipline variable in the regression model ensured that the influence of disciplinary differences, including variation in response rates, was controlled using the ceteris paribus principle. This allowed the relationships that were the main subjects of interest in the analysis to be isolated from the possible influence of differences between disciplines and other included control variables.

Although the results of any survey study should be interpreted with caution due to the possibility of non-response bias (Stoop, 2012), it should be emphasized that the structure of the obtained sample is similar to the structure of the population in terms of variables that can be analyzed both for the sample and for the population—namely, discipline, career level and gender (see Table A1 in Supplementary Information annexed to this paper). This similarity can be interpreted as an indication of the representativeness of the survey. Moreover, it should be emphasized that the study collected a relatively large sample in absolute terms (2222 full questionnaires), and it is argued that in the case of a random sample, the larger the sample collected, the greater the probability that it will be representative (Bryman, 2016).

Sample characteristics

Gender was nearly balanced, with women constituting 50.1% and men 49.9% of the sample. Respondents were aged 29 to 88 years, with a mean age of 48.6 years (SD = 10.6), and the median age was 47. Data on household composition revealed that 45.3% of the respondents had no children living with them, 14.6% reported having children aged 0–5 years, 23.8% had children aged 6–12, and 20.4% had children aged 13–18.

Regarding academic career stage, 53.5% of the respondents held a PhD degree, 34.3% had achieved habilitation, and 12.2% were professors (including university professors and full professors). In Poland, habilitation (dr hab.) is a postdoctoral qualification akin to tenure, which confers academic independence and the ability to supervise PhD students. It requires a strong publication record, and is often a prerequisite for a professorship. The title of professor (prof.) can refer to a university professor (a title granted by institutions) or a full professor, which is awarded by the President of Poland in recognition of national-level achievements.

In terms of institutional affiliation, 85.5% of the participants were employed at public higher education institutions, 5.5% at private higher education institutions, and 9.0% at research institutes, including members of the Polish Academy of Sciences. The sample also exhibited diverse disciplinary backgrounds, classified according to the OECD field of science categories. Social sciences represented 26.4% of the sample, humanities 21.2%, natural sciences 19%, engineering and technology 17.1%, medical and health sciences 11.8%, and agricultural sciences 4.4%.

Model specification

The study employed logistic regression modeling to analyze the determinants of international academic mobility among Polish scholars, specifically focusing on the probability of undertaking at least one work-related international trip in 2019. The dependent variable in this analysis was a binary indicator, coded as 1 if the respondent undertook at least one work-related international trip in 2019 and 0 otherwise. The independent variables included a range of demographic, career-related, and contextual factors. Gender was included as a binary variable (female = 1, male = 0). The household composition variable measured the presence of children in three age groups: 0–5 years, 6–12 years, and 13–18 years (coded as three binary variables indicating the presence of children in each age group). Respondents' age was measured in years. The career stage was categorized into three levels: PhD degree (reference category), habilitation degree, and professor (including university professors and full professors). Institutional type was coded

as private higher education institutions (reference category), public higher education institutions, and research institutes. Fields of science were coded into six categories, according to OECD classification: natural sciences (reference category), engineering and technology, medical and health sciences, agricultural sciences, social sciences, and humanities. Household economic status was measured on a five-point scale (ordered variable coded from 1 to 5), capturing varying levels of financial stability. Another control variable was whether, in the respondent's opinion, their research required them to travel internationally, coded as a binary variable (yes = 1, no = 0). Finally, the regional variable accounted for the 16 voivodeships (subnational divisions) of Poland, controlling for regional variations in economic development, access to transport infrastructure, and proximity to international borders. The full specification takes the form of the following equation:

$$\begin{aligned}\text{Log}(P(\text{travel}=1)/P(\text{travel}=0)) &= \beta 0 + \beta 1(\text{Female}) \\ &+ \beta 2(\text{Children aged 0 to 5}) + \beta 3(\text{Children aged 6 to 12}) \\ &+ \beta 4(\text{Children aged 13 to 18}) + \beta 5(\text{Age}) + \beta 6(\text{Career stage}) \\ &+ \beta 7(\text{Institution type}) + \beta 8(\text{Field}) + \beta 9(\text{Households economic status}) \\ &+ \beta 10(\text{Respondents research requires foreign travel}) + \beta 11(\text{region}) + \epsilon\end{aligned}$$

where $P(\text{travel}=1)$ denotes the probability of undertaking at least one work-related international trip in 2019, and $P(\text{travel}=0)$ which represents the probability of not undertaking such a trip. The independent variables are defined as explained in the previous paragraph. The intercept is denoted by $\beta 0$, $\beta 1$ through $\beta 11$ representing the corresponding coefficients, and ϵ is the error term.

The model specification incorporated robust standard errors clustered by respondents' institutions to account for inter-institutional differences and the potential correlation of responses from the same institution. The 2222 survey respondents represented 272 institutions. The average number of respondents per institution was 8.2 (SD = 15.1), with a minimum of 1, and a maximum of 126. Differences in the representation of institutions in the research sample reflect the distribution in the overall population.

Four model specifications were estimated. The first specification included all demographic and career-related variables without considering the household economic status and the perceived necessity of travel for research. The second specification added the household economic status variable, which enabled measuring whether household financial stability increased the likelihood of the participant engaging in international travel for professional purposes. The third specification included the variable of perceived necessity of travel for research, according to the hypothesis that scholars whose research demanded international engagement would be more inclined to travel. The full specification encompassed both the household economic status and the research travel requirement variables.

Furthermore, a count outcomes regression model (Poisson regression) was utilized to ensure the robustness of the results. The outcome variable was the number of work-related international trips in 2019 (Fig. 1, Panel A). The Poisson regression model is well suited for count data as it accounts for the distributional properties of non-negative integer values and models the mean–variance relationship inherent in such data (Cameron & Trivedi, 2013; Hilbe, 2014). This model included the same independent variables and four specifications as the logistic model. The estimates of this model are presented in the Supplementary Information annexed to this paper (Table A3). The results from the Poisson regression

were remarkably similar to those obtained from the logistic regression, thereby supporting the validity of the findings.

Results

The survey revealed that a significant proportion of Polish scholars engaged in international academic mobility during 2019. Specifically, 58.2% of the respondents (95% CI, 56.2 to 60.3) reported undertaking at least one work-related trip abroad in 2019. The average number of international trips reported per participant was 1.6 (SD = 2.5). The number of trips varied from a minimum of 0 to a maximum of 50. The distribution of travel frequencies was right-skewed, indicating that few respondents engaged in numerous international travels (Fig. 1, Panel A). One trip was taken by 19.8% of the participants, 15.4% took two trips, and 10.3% took three trips. As the number of trips increased, the percentage of respondents decreased, with 5.5% traveling four times, 2.5% five times, 1.5% six times, 0.8% seven times, and 0.7% eight times. A minimal 0.2% traveled nine times, while 1.6% undertook ten or more trips. For those who traveled at least once, the average number of trips was 2.7 (SD = 2.7).

The data suggest a slightly higher prevalence of international travel among male scholars compared with their female counterparts. Among the surveyed scholars, 60.5% of men (95% CI 57.6 to 63.3) and 56% of women (95% CI 53.1 to 58.9) reported at least one work-related international travel in 2019 (Fig. 2, Panel B).

Regarding age, the findings reveal that the 40–49 age group had undertaken the highest percentage of work-related international travel, with 61.1% (95% CI, 57.8 to 64.4) reporting at least one trip abroad. This is closely followed by the under-40 age group, where 58.4% (95% CI, 53.9 to 62.9) engaged in international travel. The 45–59 age group exhibited a slightly lower percentage at 56.8% (95% CI, 52.6 to 61.1). A decline in international travel is observed with increasing age, as 54.4% (95% CI, 49.1 to 59.7) of respondents aged 60–69 and 50.8% (95% CI, 38.4 to 63.1) of those over 69 reported having undertaken work-related international travel. All told, the younger age groups appear more inclined towards international engagement, potentially reflecting their drive towards career development.

Household composition is associated with notable differences in travel frequency, particularly among scholars with young children. Only 50.3% (95% CI, 44.9 to 55.8) of

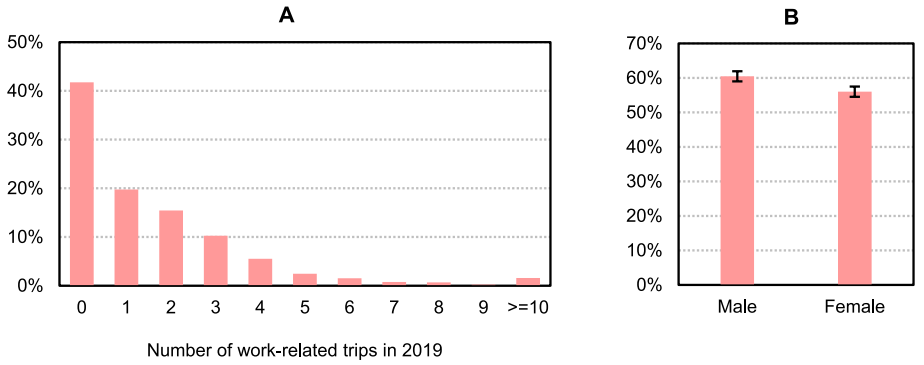

Fig. 1 Share of scholars by the number of international work-related travels in 2019 (Panel **A**) and share of scholars reporting at least one work-related international trip in 2019 by gender (Panel **B**) (error bars represent standard errors.)

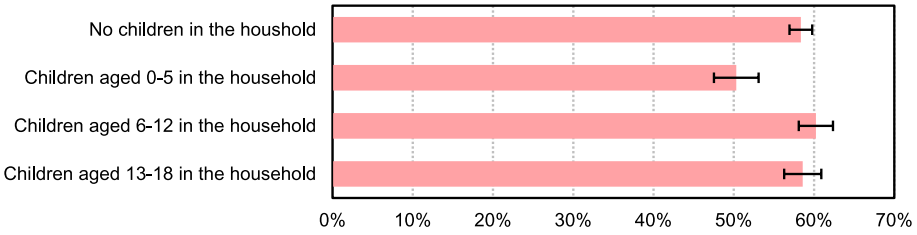

Fig. 2 Share of scholars reporting at least one work-related international trip in 2019 by the presence of children in the household (error bars represent standard errors)

scholars with children aged 0–5 years had taken work-related trips, indicating that the presence of very young children in the household may hinder international travel. In comparison, 58.4% (95% CI, 55.6 to 61.1) of scholars without children in the household reported taking trips, while those with children aged 6–12 and 13–18 years had rates comparable to families with no children, at 60.2% (95% CI, 56.1 to 64.4) and 58.6% (95% CI, 54.1 to 63.1) respectively (Fig. 2). This pattern suggests that scholars with older children might find international travel more manageable, whereas those with young children face significant challenges in balancing work-related travel and family responsibilities.

Financial stability also seems to facilitate international academic mobility. Scholars who assessed their household's financial situation as affluent exhibited the highest rate of work-related travel, with 64.0% taking at least one trip (95% CI, 53.1 to 74.9, while those experiencing financial difficulties reported taking 14% fewer trips. The data suggest a positive relationship between household economic status and the likelihood of international mobility.

International academic mobility displays significant variation by academic career stage. Professors, including full and university professors, reported the highest levels of international travel, with 68.3% (95% CI, 62.7 to 73.8) having traveled abroad for work in 2019. Those holding habilitation degrees followed at 64.5% (95% CI, 61.1 to 67.9), whereas scholars with a PhD reported the lowest level at 51.9% (95% CI, 49.1 to 54.8). These differences suggest that advanced career stages are associated with a greater opportunity or need for international engagement.

The type of institution where scholars were employed also appears to influence their travel patterns. Those at research institutes reported the highest travel rates at 67.5% (95% CI, 61 to 74). Scholars from public higher education institutions had a travel rate of 57.3% (95% CI, 55.1 to 59.6), while those from private institutions reported a rate of 56.9% (95% CI, 48.2 to 65.7). The higher mobility rate among scholars from research institutes suggests a greater emphasis on international collaboration within these institutions.

The field of study is also related to travel frequency. Scholars in social sciences and humanities reported the highest rate of international travel with 62.1% (95% CI, 58.2 to 66) and 61.4% (95% CI, 57 to 65.8), respectively, taking at least one trip, followed by those in natural sciences with 60.5% (95% CI, 55.9 to 65.2) and engineering and technology with 55.5% (95% CI, 50.5 to 60.5). Scholars in medical and health sciences and agricultural sciences reported lower travel rates, with 47.9% (95% CI, 41.9 to 53.9) and 48.0% (95% CI, 38.1 to 57.9), respectively, having taken at least one trip (Fig. 3).

Scholars' perceptions of the necessity of travel for their research seemed to influence their international mobility. A substantial 77.7% of those who believed that their research required travel reported having undertaken at least one work-related international trip. By

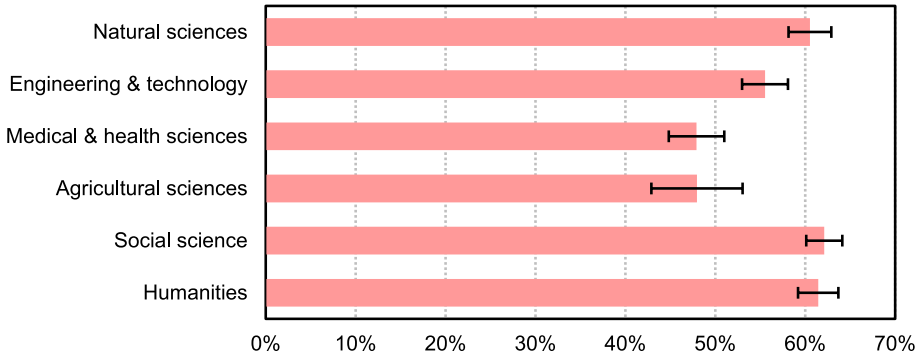

Fig. 3 Share of scholars reporting at least one work-related international trip in 2019 by field (error bars represent standard errors)

contrast, only 37.5% of those who did not view travel as necessary reported having taken such trips. This suggests a strong relationship between scholars' views on the importance academic mobility and their actual travel behavior.

The survey revealed disparities across different forms of work-related international travel (Fig. 4). Conferences, conventions, or seminars abroad were the most commonly reported, with 45.1% (95% CI, 43.1 to 47.2) of respondents engaging in such activities in 2019. Participation in project meetings abroad was lower at 18.1% (95% CI, 16.5 to 19.7) of scholars. Conducting research abroad was reported by 17.3% (95% CI, 15.8 to 18.9) of the respondents. Lecturing or teaching at a foreign institution was reported by 13.8% (95% CI, 12.3 to 15.2) of the respondents, while professional training abroad, including workshops and summer schools, was undertaken by 10.5% (95% CI, 9.3 to 11.8) of the surveyed scholars. The least frequent form of international mobility was academic internships at foreign institutions, with only 8.1% (95% CI, 7.0 to 9.2) of scholars participating in such activities. These differences among forms of international work-related travel can be partly attributed to these activities' typical length and frequency. Conferences and project meetings are usually short, lasting only a few days, and occur periodically, which allows scholars to even attend multiple events each year. By contrast, conducting research abroad and academic internships can extend over several months, making them rarer occurrences, sometimes happening only once in a scholar's career (Børing et al., 2015). Consequently, while conferences and seminars see high annual participation rates, longer-term engagements like internships are much less frequent.

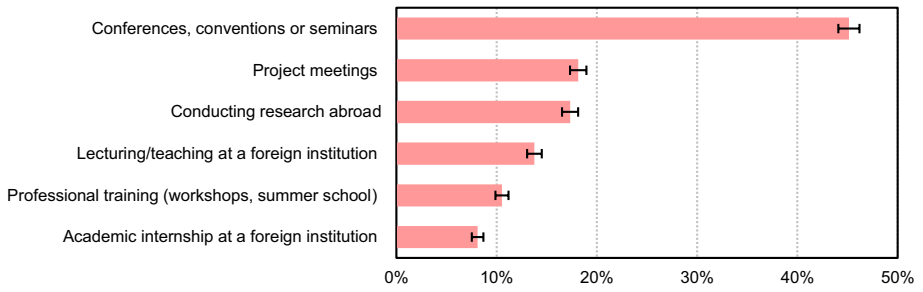

Fig. 4 Share of scholars reporting at least one work-related international trip in 2019 by form of international academic mobility (error bars represent standard errors)

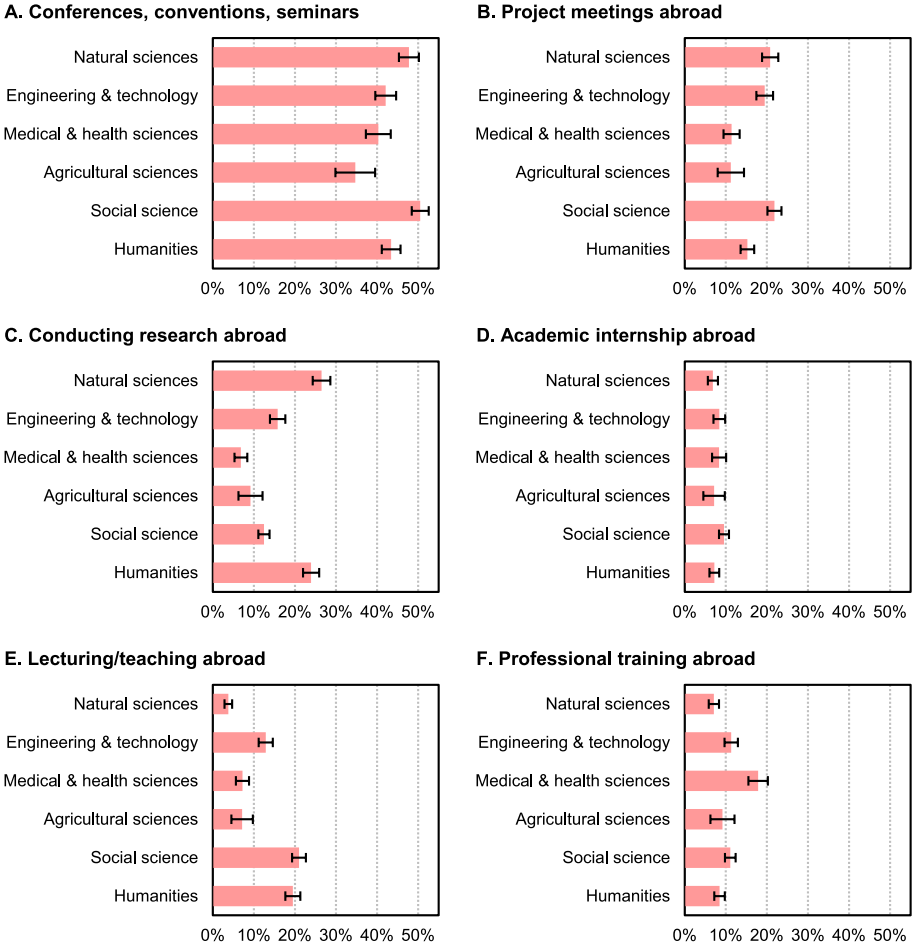

Fig. 5 Share of scholars reporting at least one work-related international trip in 2019 by form of international mobility and by field (error bars represent standard errors)

The data further reveal the differences in participation in various forms of international academic mobility across academic fields (Fig. 5). Participation in conferences, conventions, or seminars abroad was reported by 50.5% (95% CI, 46.5 to 54.6) of social sciences respondents, followed closely by 47.8% (95% CI, 43 to 52.5) of natural sciences scholars. By contrast, only 34.7% (95% CI, 25.3 to 44.1) of respondents from agricultural sciences participated in this form of mobility in 2019, marking a difference of nearly 16 percentage points between the highest and lowest fields. Project meetings abroad were attended by social sciences scholars with 21.8% (95% CI, 18.5 to 25.2), and natural science with 20.8% (95% CI, 16.9 to 24.7), while only 11.4% (95% CI, 7.6 to 15.2) of scholars from the medical and health sciences and 11.2% (95% CI, 5.0 to 17.5) of agricultural sciences respondents reported participation, indicating a span of approximately 10 percentage points. Conducting research abroad was most common among natural sciences scholars with 26.5% (95% CI, 22.3 to 30.7) and humanities scholars with 23.9% (95% CI, 20.1 to 27.8), sharply contrasting with medical and health sciences respondents with 6.8% (95% CI, 3.8 to 9.9),

reflecting a disparity of nearly 20 percentage points. Academic internships at foreign institutions in 2019 showed relatively low participation across all fields, with 9.6% (95% CI, 7.2 to 11.9) of social sciences scholars and 6.9% (95% CI, 4.4 to 9.3) of natural sciences respondents engaging in this type of international mobility. Lecturing or teaching abroad was particularly prevalent in social sciences with 21.0% (95% CI, 17.7 to 24.3) and humanities with 19.5% (95% CI, 15.9 to 23.1), compared to a mere 3.8% (95% CI, 2 to 5.6) in natural sciences, indicating a significant span of over 17 percentage points. Attending professional training abroad, including workshops and summer schools, was most reported in medical and health sciences with 17.9% (95% CI, 13.2 to 22.5), while only 8.5% (95% CI, 6.0 to 11) of humanities and 9.2% (95% CI, 3.5 to 14.9) of agricultural sciences respondents participated in this mode of international academic mobility.

The logistic regression analysis results, detailed in Table 1, underscore the significant determinants of international academic mobility among Polish scholars in 2019. Gender emerged as a significant factor influencing the likelihood of undertaking at least one work-related international trip. Female scholars were notably less likely to travel abroad than their male counterparts, with an odds ratio ranging from 0.79 to 0.82 ($p < 0.05$) across the specifications. This indicates that female scholars are 18–21% less likely to engage in at least one work-related trip in a given year than male scholars.

Scholars with young children demonstrated a markedly lower propensity for international travel, particularly those with children aged 0–5 years. The presence of children in this age group was associated with an odds ratio of 0.56 ($p < 0.01$), indicating that the odds of scholars with very young children traveling internationally are 44% lower compared to those without young children. Importantly, this effect was observed for both male and female scholars, suggesting that having young children significantly reduces the likelihood of work-related international travel irrespective of scholars' gender.

A post-estimation analysis of marginal effects (Fig. 6) further clarifies these findings. For male scholars without young children, the probability of international travel was 62.2% (95% CI, 59.5 to 64.9), whereas for male scholars with young children, this probability decreased to 51.0% (95% CI, 45.7 to 56.4). Female scholars without young children had a probability of 57.6% (95% CI, 54.7 to 60.6) of traveling internationally, while for those with young children, the probability dropped to 46.3% (95% CI, 40.6 to 51.9). The findings indicate that both men and women with young children are those least likely to engage in international work-related travel. The difference between men without children and women with young children is particularly striking, with a substantial gap of 15.9 percentage points, illustrating the compounded impact of gender and childcare responsibilities on mobility. Crucially, these results reveal that the differences related to having young children in the family are more pronounced than the gender differences alone.

Interestingly, the presence of older children, specifically those aged 6–12, and 13–18 years, did not significantly influence the likelihood of international travel. The odds ratios for these age groups were not statistically significant, suggesting that childcare responsibilities exert a more pronounced effect when children are very young. This finding underscores that there is a critical period during early childhood during which parental responsibilities may significantly curtail academic mobility, but this impact lessens as children grow older.

Other variables included in the analysis provided additional insights. Age was consistently significant across all specifications, with an odds ratio of 0.96 ($p < 0.01$). The career stage significantly influenced the probability of international travel. Specifically, habilitation degree holders had odds ratios ranging from 1.96 to 2.22 ($p < 0.01$), and professors had odds ratios ranging from 2.60 to 3.81 ($p < 0.01$), reflecting their greater international

Table 1 Regression analysis of factors influencing work-related foreign travel in 2019 (odds ratios)

Dependent variable: at least one work-related international trip in 2019				
Specifications	(1)	(2)	(3)	(4)
Female	0.82**	0.82**	0.79**	0.79**
	(0.08)	(0.08)	(0.08)	(0.08)
Children aged 0–5 in the household	0.56***	0.56***	0.56***	0.56***
	(0.08)	(0.08)	(0.09)	(0.09)
Children aged 6–12 in the household	1.04	1.04	1.12	1.12
	(0.11)	(0.11)	(0.13)	(0.13)
Children aged 13–18 in the household	0.94	0.97	0.99	1.02
	(0.11)	(0.11)	(0.12)	(0.12)
Age	0.96***	0.96***	0.96***	0.96***
	(0.01)	(0.01)	(0.01)	(0.01)
Career stage (baseline: PhD degree)				
Habilitation degree	2.22***	2.17***	2.02***	1.96***
	(0.22)	(0.22)	(0.21)	(0.21)
Professor (university or full)	3.81***	3.62***	2.81***	2.60***
	(0.64)	(0.61)	(0.50)	(0.47)
Institution type (baseline: private higher education institution)				
Public higher education institution	0.94	0.95	0.78	0.78
	(0.19)	(0.19)	(0.18)	(0.18)
Research institute	1.53*	1.55*	1.01	1.02
	(0.39)	(0.40)	(0.29)	(0.30)
Field (baseline: Natural sciences)				
Engineering and technology	0.92	0.91	1.04	1.02
	(0.14)	(0.14)	(0.18)	(0.17)
Medical and health sciences	0.65***	0.64***	0.84	0.82
	(0.10)	(0.10)	(0.15)	(0.14)
Agricultural sciences	0.63**	0.63**	0.78	0.79
	(0.14)	(0.14)	(0.21)	(0.21)
Social sciences	1.27*	1.25*	1.47**	1.44**
	(0.17)	(0.16)	(0.23)	(0.22)
Humanities	1.14	1.16	1.03	1.04
	(0.17)	(0.17)	(0.17)	(0.17)
Household's economic status		1.21**		1.30***
		(0.10)		(0.12)
Respondent's research requires foreign travel			5.66***	5.74***
			(0.58)	(0.59)
Region (voivodeship) – control dummy	✓	✓	✓	✓
Observations	2,222	2,222	2,222	2,222
Pseudo-R-squared (McFadden)	0.0516	0.0538	0.160	0.164

Robust standard errors in parentheses (clustered by institutions)

Significance levels: ***$p<0.01$, **$p<0.05$, *$p<0.1$

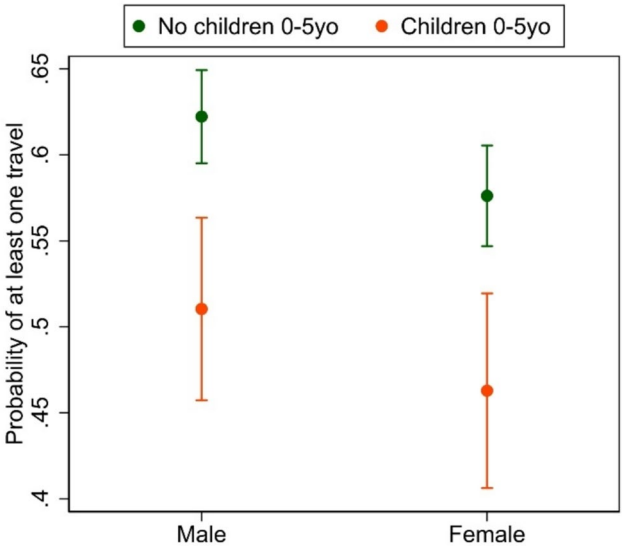

Fig. 6 Probability of at least one international work-related trip by gender and household composition (point estimates with 95% confidence intervals). The marginal effects presented were calculated based on specification 4. Specifications 1–3 produced very similar results

engagement. The institutional type variable showed mixed results, with scholars from research institutes being more likely to travel than scholars from private higher education institutions. However, this effect is only slightly significant in specifications 1–2. The impact of the field of study was mixed, with significant results for social sciences (odds ratio 1.44–1.47, $p<0.05$ in specifications 3–4), medical and health sciences (odds ratio 0.64–0.65, $p<0.01$), and agricultural sciences (odds ratio 0.63, $p<0.05$) compared to natural sciences, with lower odds of international travel.

The second specification, which included household economic status, revealed that scholars from more affluent households were more likely to engage in international travel, with an odds ratio of 1.21 ($p<0.05$). This effect was even more pronounced in the fourth specification, where the odds ratio increased to 1.3 ($p<0.01$), suggesting that financial stability is crucial in facilitating academic mobility. The third specification, which incorporated the variable indicating the perception that the respondent's research required foreign travel, demonstrated a substantial effect, with an odds ratio of 5.66 ($p<0.01$). In the full specification, both household economic status and perceived necessity for travel were included, and their effects remained robust, with odds ratios of 1.30 ($p<0.01$) and 5.74 ($p<0.01$), respectively. Notably, specifications 2 and 4, which included household economic status variables, exhibited higher pseudo-R-square values as compared to specifications 1 and 3, suggesting the importance of economic status variables in modeling factors influencing international academic mobility. Furthermore, it should be underlined that adding variables in specifications 2, 3, and 4 did not significantly change the effects associated with gender and family composition, underscoring the robustness of the presented findings.

Discussion and conclusions

This study has examined the patterns and determinants of international academic mobility among Polish scholars, focusing on gender, family composition, and family economic status. The findings reveal substantial differences in the likelihood of international work-related travel and significant factors determining these patterns. The logistic regression results showed that female scholars were approximately 18–21% less likely to take at least one international work-related trip in 2019 compared to their male counterparts, even after accounting for other variables. This finding aligns with prior research indicating that gender can influence academic mobility and career advancement in general (Ceci & Williams, 2011; Górska, 2023; Wagner et al., 2017).

Childcare responsibilities emerged as a significant factor hindering international mobility. Scholars with young children (aged 0–5 years) were significantly less likely to travel internationally compared to those with no childcare responsibilities. This pattern was observed for both male and female scholars, suggesting that young children significantly reduce the likelihood of work-related international travel irrespective of gender. The presence of children aged 6–12 and 13–18 years did not significantly influence the likelihood of international travel, highlighting that the critical period of early childhood imposes the most substantial mobility constraints. It should be emphasized that childcare responsibilities combined with gender differences results in 'double gender-family inequality' (Moguérou, 2004), meaning that female scholars with young children at home have a lower chance of international mobility not only compared to female scholars without children but also to men with young children at home.

Financial stability also played a crucial role in enabling international mobility. The logistic regression results indicated that scholars from less affluent households exhibited significantly lower travel rates, even after controlling for other factors. When combined with gender and childcare responsibilities, scholars' financial constraints create what can be termed a 'triple gender-family-resources inequality.' Female scholars with young children from less affluent families face particular challenges, with these factors significantly hindering their international mobility, and adversely affecting their long-term career prospects. This confluence of disadvantages could be particularly detrimental to the advancement of the scientific sector in Poland, as a country characterized by relatively low investment in science and higher education, which results in uncompetitive remuneration for academic professionals (Kubiczek, 2023; Magda et al., 2024).

In conclusion, this study highlights the significant impact of gender, childcare responsibilities, and household economic status on international academic mobility. Addressing these barriers through targeted policies can promote more equitable and inclusive academic mobility, ultimately enhancing both national and global research landscapes (Jacob & Meek, 2013). Possible actions include giving preference to women in programs supporting international cooperation (Larivière et al., 2013), facilitating dual careers (Tzanakou, 2017), improving institutional support for childcare (Habeeb, 2023), and promoting hybrid scientific conferences that facilitate participation for parents, caregivers, and others who find it difficult to travel (Olechnicka et al., 2024).

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Declarations

Conflict of interest The author reports there are no competing interests to declare.

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