



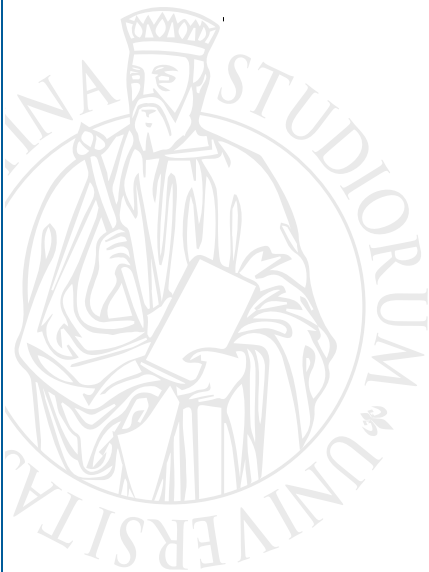
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**Italian PhD students at the borders:
The relationship between
family background
and international mobility**

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Italian PhD students at the borders: The relationship between family background and international mobility

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Abstract

Previous literature has suggested that PhD students' mobility has become a fundamental step during doctoral studies, both for training purposes and for creating transnational research networks. In recent years, there has been a significant increase in migration of highly educated and highly skilled Italians. Most studies concentrate on employment-related characteristics of researchers' and scientists' mobility, largely neglecting other topics, such as family background characteristics of those who decide to study and go abroad. Using the Istat Survey on occupational conditions of PhD holders conducted in 2014 and 2018 in Italy, along with modelling using multinomial logistic regression analyses, we aim to investigate the relationship between family background characteristics and mobility during PhD studies according to different types of international stay. Our results show that both parental education and mother's economic activity are related to the propensity for studying abroad among PhD candidates, whereas father's social class seems to have a lower impact on this decision. The gap in doctoral mobility among PhD students with respect to socio-economic status seems also to vary according to the different types of stay abroad. Overall, our findings intend to shed light on potential disparities related to studying abroad among PhD students and their links to family background, which may have future repercussions on students' occupational prospects.

Keywords: PhD students, international mobility, family background, higher education, multinomial logistic regression, Italy

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Introduction

Mobility involves the movement of people willing to improve their chances in education, occupational opportunities and quality of life (Michalos, 1997). In recent years, international academic mobility has been increasing among undergraduate, graduate and PhD students, as well as researchers and scientists around the world.

At the macro level, highly educated young people represent several short- and long-term gains for institutions and countries, which are increasingly seeking to recruit international students and retain them after graduation (Avveduto, 2012). At the micro level, empirical evidence in academic mobility has suggested that the international migration of educated and skilled people can have positive effects on their future employment prospects and careers, leading to higher salaries and better roles (Ermini, Papi, & Scaturro, 2019). As a consequence, occupational prospects and careers may differ between those who have pursued an experience abroad and those who studied only in their home country. In this respect, international mobility has become a fundamental step in curriculums for PhD students, with implied impacts on the quality of the doctoral project and significance for the long-term investment in an academic career (Avveduto, 2001; Kim, 2010, 2017).

In Italy, the number of PhDs awarded has increased more than the demand for PhD holders, because the country lacks the economic and financial resources to fully employ researchers' and scientists' skills and knowledge. The job supply for highly skilled workers is scant amid the myriad of small-scale enterprises in the private sector, for which a PhD qualification offers few – in some cases, zero – advantages. In this context, mobility of PhD holders may be even more important, given the growing competition for finding a job related to their training and acquiring access within academia (Ballarino & Colombo, 2010). Despite the rising importance of doctoral mobility, international mobility *during* PhD studies is an under-studied phenomenon, as most studies tend to concentrate on graduates' and PhD holders' mobility (Ermini et al., 2019; Panichella, 2013).

Another shortcoming in the literature concerns *family background* of those who study abroad, which is frequently overlooked among the possible characteristics that affect mobility. Nevertheless, it is well acknowledged that family background characteristics – particularly parental education – affect children's school performances and occupational prospects (Boudon, 1974; Breen & Müller, 2020; Jackson, 2013). Similarly, the expansion of PhD programmes in Italy has not been accompanied by an "equalisation", that is, by a decrease in inequalities among educational opportunities for students belonging to different social strata (Argentin, Ballarino, & Colombo, 2015). In this respect, highly educated parents, having specific educational resources to help their children with informed guidance through the education system (Boudon, 1974), may support PhD students' mobility and thus have a positive impact on their future professions.

In this paper, using data on the professional conditions of PhD holders who obtained their qualification in an Italian athenaeum from 2008 to 2014, we shed light on potential disparities in studying abroad¹ that are linked to PhD students' socio-economic status (SES) in their family of origin. Concentrating on the propensity to study abroad for a visiting period during PhD studies, we verify if parental SES, which is operationalised with parental education, mother's economic condition and father's social class, is associated with a higher or lower mobility of PhD students after

¹ We are interested in studying international mobility of Italian PhD students who obtained their qualification in an *Italian* athenaeum. For this reason, our research objectives do not cover those who decided to obtain a PhD qualification in a foreign athenaeum. Moreover, we refer to PhD students' international mobility as 'study abroad', but it includes also other activities such as research activity.

controlling for possible confounders. Furthermore, we investigate if and how the relationship between PhD students' family background characteristics and the propensity for international mobility varies according to the different types of stay planned in their PhD programmes.

Overall, our results suggest a positive relationship between parental education and PhD students' propensity to study abroad. The gap in PhD students' mobility according to PhD students' parental SES tends also to be larger when dealing with facultative and financed stays and negligible when looking at mandatory stays.

To our knowledge, scarce information is available about the relationship between PhD students' family background characteristics and their mobility; this paper intends to bridge this gap and shed light on if and how higher parental socio-economic status may favour students at the top of the higher educational system in their international mobility.

Background

Highly educated people's mobility in a globalised world

International academic mobility has grown increasingly importance in the global higher education landscape (Verbik & Lasanowski, 2007), because of its recognised positive effects both at the macro and micro level. According to human capital theory (Becker, 2009; Schultz, 1971), the prosperity of a country is strongly affected by its citizens' education and skills, as well as its quality of human resources. In light of this, an increase in skilled demand creates an incentive for improvements in higher education and, broadly speaking, for a country's economy. Following this line, governments around the world have begun to adopt specific policies to attract foreign talents while also retaining local workers. In the *brain-gain* process (Boeri, Brücker, Docquier, & Rapoport, 2012; Straubhaar, 2000), international students bring potential for several short- and long-term gains for their hosting institutions and countries. In the short term, with public funding for higher education decreasing in many countries, universities are looking to diversify their generated income, aspiring toward the revenue earned from foreign students. In the long term, and in the wider socio-economic context, developed countries are looking to attract foreign skilled labour to supplement their rapidly decreasing and ageing populations (Verbik & Lasanowski, 2007). However, some countries suffer by their scant ability to attract or retain highly educated individuals, leading to the loss of highly educated and highly skilled people (OECD, 2001; Morano-Foadi, 2005). This *brain-drain* process is even harder for sending countries with publicly funded education systems, which invest in PhD programmes with the purpose of improving human capital and promoting the economic and social development within the country.

At the micro level, the international migration of educated and skilled people can be driven by several factors, where both personal motivations and the characteristics of the economic environment of the host country play a key role. Highly educated people and students can be pushed to leave their home country to seek better career and life opportunities if there is a lack of prospects in their home country. They may aspire to higher wages, to better life conditions and quality of life, or to improve their human capital (Bartolini, Gropas, & Triandafyllidou, 2017; Solimano, 2008). As a result of their movement, PhD holders and highly skilled workers have a wage premium, especially when pursuing careers not related to R&D or academia (Di Cintio & Grassi, 2017; Ermini et al., 2019; Marini, 2019).

For doctoral students, mobility becomes part of their curriculum; it is believed to have a direct impact on the quality of the doctoral project itself. This understanding can result from technical knowledge gain, whereby mobility provides access to different or better research facilities (Ackers, Gill, & Guth, 2008; Avveduto, 2001), or from the early accrual of transnational academic capital, which includes transnational networks and modes of thinking (Kim, 2010, 2017). Funding for doctoral researchers to engage in international academic mobility is judged also to have the indirect benefit of promoting future mobility (Netz & Jaksztat, 2014; Saint-Blancat, 2018). Thus, an investment in doctoral mobility is not just an investment in the quality of the doctoral research output; it is a long-term investment in the internationalisation of research and higher education.

Family background and academic mobility in Italy

In the literature, it is acknowledged that highly educated and highly skilled people are more prone towards mobility compared to unskilled people (Fratesi & Percoco, 2014), and that they receive material and immaterial benefits from this mobility (Bartolini et al., 2017; Ermini et al., 2019). But among highly educated students, which are most likely to pursue mobility? The literature identifies both individual resources and family background as features related to students' mobility at different levels of education. Whilst individual resources are universally accepted in influencing students' mobility (Tosi, Impicciatore, & Rettaroli, 2019), agreement on the relationship between family background and students' mobility is less straightforward. Highly educated parents have specific educational resources to help their children with informed guidance through the education system (Boudon, 1974), which could suggest a positive association between parental education and mobility. Upper-class families are also well informed about university education and have access to better quality information concerning the labour market; students from these families are, therefore, in a better position to select the most rewarding educational options (Morgan, 2005; Usher, 2005). Nevertheless, in Italy, high-status students tend to overestimate economic returns in higher education to a greater extent than students from lower social groups, thus shaping different views of the profitability of a university education (Abbiati & Barone, 2017).

On the other hand, some studies posit that mobility may act as means of social upward especially for those with low family resources (Mariani, 2006; Scarlato, 2007). In the Italian context, a family's social networks are usually a resource for their children's occupational prospects, with parental education playing a decisive role in children's earnings, especially in the southern part of the country (Checchi & Peragine, 2005). As a consequence, young people with high educational attainment and strong individual resources may have greater chances to migrate from a patronage context (Mariani, 2006; Scarlato, 2007) than those young people who can count on parental resources.

Empirical studies on the topic have found that parental education plays a key role in shaping the propensity for interregional migration among high school graduates (Tosi et al., 2019), college graduates (Impicciatore & Tuorto, 2011) and PhD holders (Ruiu, Fadda, Ezza, & Esposito, 2019). Conversely, Capuano (2012) found no association between parental education and college students' mobility; she also uncovered a lower propensity toward mobility among students whose parents are highly successful while self-employed. College students with higher-grade professional parents, instead, have a higher propensity to pursue study interregional opportunities (Impicciatore & Tuorto, 2011). Additionally, social class has an impact on college graduates' interregional migration (e.g., Impicciatore & Tuorto, 2011; Panichella, 2013).

With respect to PhD students' mobility, to the best of our knowledge, no systematic study has investigated Italian doctoral students' mobility during PhD programmes, whereas a handful of empirical studies have concentrated on graduates' mobility (e.g., Assirelli, Barone, & Recchi, 2019; D'Agostino, Ghellini, & Longobardi, 2019; Panichella, 2013) and PhD holders' interregional mobility (see e.g., Ermini et al., 2019; Ruiu et al., 2019). The majority of studies deal with wage penalties and economic and financial consequences of highly educated and highly skilled people's mobility and tend to ignore family background characteristics of those who study abroad and those who remain in Italy (Ghosh & Grassi, 2020). In a recent article, Assirelli and colleagues (2019) show how graduates benefit from international mobility in terms of wages, unemployment risks, access to skilled employment and career satisfaction. In this study, it emerges that higher parental occupational class is associated with a higher mobility of graduates; nevertheless, parental class is introduced as a control variable and does not represent the main objective of this work.

Furthermore, social origin and education have been investigated deeply in Western countries, but most concentrate on other aspects of this relationship, such as students' performance, access to tertiary education, school dropout rates and fields of study (e.g., Argentin & Triventi, 2011; Triventi, Vergolini, & Zanini, 2017). In our paper, we posit that family background may have an impact on PhD students' mobility, which may in turn cause better or worse occupational prospects. In this respect, concentrating on the relationship between PhDs students' mobility and their earnings may be considered a further step. Before proceeding to analyse the association between PhDs' mobility and their incomes, the relationship between family background and PhD students' mobility should be accounted for. Nowadays, doctoral mobility is framed as an imperative for future career success. Lacking awareness of that expectation might favour social inequalities and slow intergenerational mobility among those who reach the highest level of education.

The Italian Higher Education System

In Italy, the higher educational system is mainly public; university reputation is less important in Italy than in other countries with more differentiated university systems, but it also has a few prestigious private institutions. Qualifications have the same 'legal value', regardless of the institution delivering the degree (Agasisti, 2009; Cattaneo, Malighetti, Meoli & Paleari, 2017). Since the implementation of the EU's 'Bologna process' in 2001, students attend a three-year bachelor's programme followed by a two-year master's programme, excluding a few highly technical programmes, such as pharmaceutical and medical schools, that still last five or six years. Students choose a field of study and have limited possibilities for personalising their course load. Except for private institutions, which set their own fees, tuition costs are relatively low and depend on per-capita household income with limited variation across institutions (Cattaneo et al., 2017), which is designed to favour enrolment for students from all social strata.

PhD studies were introduced in Italy in the 1980s, but they received increased incentive through the Bologna process in the 2000s, resulting in an increased number of positions and PhD programmes offered (Ballarino & Colombo, 2010). While only 4,078 PhD students defended their dissertation in 2000, the number was 9,803 in 2016, and the highest year on record was 11,459 in 2014 (Istat, 2018). However, the number of PhDs awarded has increased past the demand for PhD holders in Italy. Finding work in universities has become more difficult amid a contraction in the number of open academic positions (Di Cintio & Grassi, 2017). Both processes have produced growing competition for PhD holders to find a job related to their training and to access academia

(Ballarino & Colombo, 2010), thus incentivising both interregional and international mobility of PhD holders. Among PhD holders who defended their dissertation in 2004 or 2006, 7 percent resided abroad in 2009–2010; in 2018, this percentage increased to 17.2 percent among those who defended their dissertation in 2012 or 2014. In addition, a third of these PhD holders who defended in 2012 and 2014 had a stay abroad also before completing their PhD studies. Foreigners who chose an Italian PhD programme also increased over a similar period: 2.2 percent of PhD students who defended their dissertation in Italy in 2004 were international students, which climbed to 10.1 percent in 2014 (Istat, 2018).

Added to the scarcity of high-skilled jobs in Italy, another incentive for international mobility among PhD holders is the training experiences available during PhD studies abroad. Training abroad during the doctoral years has increasingly become a key element in both academic and professional development (Avveduto, 2001; Guth & Gill, 2008). Nowadays, the importance of international experience within PhD programmes has been explicitly recognised by the National Research Program 2015–2020 for strengthening the integration of research in the international context. In this respect, some PhD programmes consider training abroad as a mandatory experience during PhD studies; others award an additional scholarship to incentivise a study term at a foreign university. International training has been increasing over the last decade: whereas 27.9 percent of PhD students studied abroad during their PhD work among those who defended in 2004, this percentage increased to 44.6 percent a decade after. Among those who had an experience abroad and defended in 2012 or 2014, one out of five lived abroad in 2018, whereas just one out of ten lived abroad among those who did not study abroad during their PhD work (Istat, 2018).

Research questions

There is growing concern that mobility during PhD studies is a crucial and fundamental step in PhD students' education and training. In order to investigate whether and how family background characteristics and PhD students' mobility are associated, we address the following research questions. First, we ask: *Is there an association between family background characteristics and PhD students who remain in Italy?* Conscious of the fact that the association between family background characteristics and PhD students' mobility might change when accounting for other individual characteristics and features of doctoral studies, we control for a series of individual characteristics and doctoral features.

Not all PhD programmes have the same approach toward mobility during doctoral studies. Whereas a period spent abroad is mandatory in some programmes, in others it may be on a voluntary basis; in the latter case, PhD students who study abroad may receive additional funding. In this respect, it is crucial to acknowledge any association between family background characteristics and PhD students' mobility according to the type of mobility proposed by the PhD programme: mandatory, facultative and financed, or facultative and non-financed. Indeed, highly educated parents might be more concerned about the importance of having an experience abroad for future occupational prospects compared to less educated parents; thus, they could encourage their adult children to study abroad for a facultative and financed period. Greater financial resources of parents in higher social classes could be more crucial for facultative and non-financed studies abroad. Thus, we may suppose a different propensity in PhD students' mobility with respect to family background characteristics and the type of stay proposed by PhD programmes. Whilst no difference in parental educational attainment may be hypothesised among PhD students completing a mandatory period

abroad, a higher propensity to take on facultative and financed stays may be associated with PhD students who have highly educated parents or who belong to a higher social class, and this relationship may even more marked for facultative and non-financed stays. Hence, concentrating on family background characteristics as a source of guidance through the education system and the different types to stays abroad during PhD studies, our second and final research question asks: *To what extent does the relationship between family background characteristics and the probability of studying abroad differ according to the type of stay?*

Analytical strategy

Data

This study draws on retrospective micro-data. Namely, our source of information on socio-demographic characteristics and academic mobility is the Istat Survey on occupational conditions of Italian PhD holders. The first edition of these surveys was conducted in 2009–2010 by contacting all PhD holders who had obtained their qualification from an Italian academic institute in 2004 and 2006. The subsequent version of the survey contacted all PhD holders that achieved their Italian doctoral degree in 2008 and 2010. Finally, PhD holders who obtained their Italian qualification in 2012 and 2014 were surveyed in 2018. Response rates of these three surveys were around 70 percent: over a population of 18,568 PhD holders in 2004 and 2006, 69.8 percent (12,964) participated in the survey; 72.6 percent (16,322) of over 22,469 PhD holders in 2008 and 2010 responded in 2014; and among 22,099 PhD holders in 2012 and 2014, 72.7 percent (16,057) completed the interview in 2018.

Our sample included respondents who were interviewed in the two most recent editions of the survey, because the response variable about a period spent abroad during PhD studies was collected differently in the 2009–2010 edition.² Then, we excluded foreign PhD students, because they were too few to allow for a separate analysis.³ After merging the two data sources, the final sample was constituted by 31,341 PhD holders who defended their dissertation between 2008 and 2014, of which 15,934 were interviewed in 2014 and 15,407 were interviewed in 2018.⁴ Among them, 12,918 (41.2 percent) spent a period abroad during their PhD studies. This percentage increased over time, from 38.7 percent among PhD holders who defended their dissertation in 2008 to 44.0 percent among those who defended their dissertation in 2014. When considering the different types of stays, 2,845 PhD students (9.1 percent of PhD students) completed a mandatory stay abroad;⁵ 7,564 (24.1 percent) pursued a facultative and financed stay; and 2,509 (8.0 percent) went abroad for a facultative and non-financed stay. The preferred destination was the United States, where nearly 1 out of 5 PhD students spent their stay (19.9 percent), followed by the United Kingdom (16.1 percent). Overall, more than 6 out of 10 PhD students studied in a country within the European Union (65.3 percent).

Key variables and descriptive statistics

Table 1 shows descriptive statistics about the PhD students. The framework is categorised into four modalities: 1) the student did not study abroad (namely, s/he remained in Italy); 2) the

² In the 2009–2010 survey, the question about spending time abroad stipulated a minimum length of 4 weeks. In the two subsequent surveys, no temporal limitation was imposed.

³ Foreign PhD students numbered only 388 (2.4 percent) in 2014 and 625 (3.9 percent) in 2018.

⁴ We also excluded 25 PhD students who did not report their university.

⁵ The questionnaire did not specify whether the mandatory stay abroad was financed.

student spent a stay abroad because it was mandatory to their doctoral study plan; 3) the student spent a stay abroad, financed by the university; 4) the student spent a stay abroad, not financed by the university.

The key explanatory variables include three variables that describe PhD students' SES, namely, parental educational attainment, mother's economic activity and father's social class.⁶ Education is divided into four categories which represent the highest educational attainment between the two parents: primary or lower, lower secondary, upper secondary, and tertiary/post-tertiary.⁷ Most PhD students had at least one parent with a tertiary education (41.1 percent), but at least one parent with upper secondary education is also common in the sample (35.8 percent). Students whose parents were both primary educated are overrepresented among those who did not complete studies abroad (70.1 percent of students). On the other hand, PhD students whose mother and/or father was tertiary educated were more likely to spend a period abroad (overall, 43.7 percent), even if not financed (8.8 percent). Among the three possibilities of doctoral mobility, most students who studied abroad completed a facultative and financed stay. However, students whose parents were both primary educated still had this opportunity to a lower extent (16.1 percent) than other PhD students.

Mother's economic activity considers if she was an employee/self-employed, a homemaker, retired or in another condition. Most PhD students had a mother who worked (56.3 percent), or who was a homemaker (32.1 percent). Lower mobility was identified among PhD students whose mothers were homemakers (62.8 percent of them did not study abroad), whereas PhD students whose mothers worked or were retired were more prone to study abroad: a mandatory stay or a facultative and non-financed stay were more popular among PhD students with retired mothers, while facultative and financed stays were highest among PhD students with employed mothers.

Finally, father's social class is classified according to EGP-class typology aggregated in a five-category classification (Goldthorpe & Erikson, 1992): higher grade professionals, lower grade professionals, routine non-manuals, self-employed, and working class (skilled/unskilled), with a residual sixth category for those whose social class is unknown.⁸ PhD students showed high percentages among better socio-economic positions, namely, fathers who were lower-grade professionals (34 percent), self-employed (19.8 percent) and higher-grade professionals (18.7 percent). According to these findings, PhD students whose fathers were higher grade professionals had the highest probability of a facultative and non-financed stay among the four groups (9.8 percent), whereas PhD students whose fathers were routine non-manuals or working class had the highest probability of remaining in Italy (60.1 percent). The differences were modest among the various social classes (only 2.5 percent).

⁶ These variables were collected when students first enrolled in university. We opted to merge mother's and father's education into one variable because they were correlated (Spearman correlation coefficient was equal to 0.64). Correlations between the other variables were lower: correlation between parental education and father's social class (mother's economic activity) was -0.43 (-0.23), and correlation between father's social class and mother's economic activity was 0.15.

⁷ When mother's (father's) education was not reported, we categorised parental education according to the other parent's education; overall, 192 PhD students (0.61 percent of the total sample) did not report either mother's or father's education and were categorised with an unknown category.

⁸ The question about father's social class included answers from respondents whose father did not work (because of retirement, unemployment or inactivity) at the interview date.

Table 1: PhD students by their type of stay and individual and contextual characteristics. Absolute and raw percentage values.

	Remained in Italy		Study abroad				Total		
			Mandatory stay		Facultative and financed stay			Facultative and non-financed stay	
Parental education									
<i>Primary</i>	1,412	(70.1)	136	(6.8)	325	(16.1)	141	(7.0)	2,014
<i>Lower secondary</i>	3,076	(60.9)	415	(8.2)	1,166	(23.1)	391	(7.8)	5,048
<i>Upper secondary</i>	6,553	(58.4)	1,060	(9.5)	2,766	(24.7)	837	(7.5)	11,216
<i>Tertiary/post-tertiary</i>	7,242	(56.3)	1,217	(9.5)	3,283	(25.5)	1,129	(8.8)	12,871
<i>Unknown</i>	140		17		24		11		192
Mother's economic activity									
<i>Employed/self-employed</i>	9,977	(56.5)	1,700	(9.6)	4,547	(25.8)	1,426	(8.1)	17,650
<i>Homemaker</i>	6,318	(62.8)	801	(8.0)	2,180	(21.7)	769	(7.4)	10,068
<i>Retired</i>	1,363	(57.2)	233	(9.8)	578	(24.3)	209	(8.8)	2,383
<i>Other condition</i>	765	(61.7)	111	(9.0)	259	(20.9)	105	(8.5)	1,240
Father's social class									
<i>Higher-grade professional</i>	3,369	(57.6)	566	(9.7)	1,345	(23.0)	571	(9.8)	5,851
<i>Lower-grade professional</i>	6,137	(57.6)	948	(8.9)	2,729	(25.6)	836	(7.9)	10,650
<i>Routine non-manual</i>	1,229	(60.1)	190	(9.3)	488	23.9)	139	(6.8)	2,046
<i>Self-employed</i>	3,657	(59.0)	558	(9.0)	1,481	(23.9)	498	(8.0)	6,194
<i>Working class (skilled/unskilled worker)</i>	2,570	(60.1)	367	(8.6)	1,038	(24.3)	299	(7.0)	4,274
<i>Unknown social class</i>	1,461		216		483		166		2,326
Gender									
<i>Male</i>	8,286	(55.9)	1,426	(9.6)	3,870	(26.1)	1,245	(8.4)	14,827
<i>Female</i>	10,137	(61.4)	1,419	(8.6)	3,694	(22.4)	1,264	(7.7)	16,514
Scholarship									
<i>No</i>	6,887	(72.8)	462	(4.9)	920	(9.7)	1,188	(12.6)	9,457
<i>Yes</i>	11,536	(52.7)	2,383	(10.9)	6,644	(30.4)	1,321	(6.0)	21,884
Macro-area of Athenaeum									
<i>North</i>	6,906	(52.8)	1,544	(11.8)	3,628	(27.7)	1,000	(7.7)	13,078
<i>Centre</i>	5,665	(62.4)	594	(6.6)	2,020	(22.3)	794	(8.8)	9,073
<i>South</i>	5,852	(63.7)	707	(7.7)	1,916	(20.9)	715	(7.8)	9,190
Interregional move for PhD studies									
<i>No</i>	14,274	(60.3)	1,995	(8.4)	5,716	(24.2)	1,686	(7.1)	23,671
<i>Yes</i>	4,149	(54.1)	850	(11.1)	1,848	(24.1)	823	(10.7)	7,670
Year of PhD dissertation									
<i>2008</i>	4,740	(61.3)	538	(7.0)	1,865	(24.1)	593	(7.7)	7,736
<i>2010</i>	4,905	(59.8)	709	(8.7)	1,991	(24.3)	593	(7.3)	8,198
<i>2012</i>	4,587	(57.9)	745	(9.4)	1,906	(24.1)	684	(8.6)	7,922
<i>2014</i>	4,191	(56.0)	853	(11.4)	1,802	(24.1)	639	(8.5)	7,485
Field of study									
<i>Maths and Computer Science</i>	455	(45.1)	123	(12.2)	374	(37.1)	56	(5.6)	1,008
<i>Physics</i>	654	(47.0)	159	(11.4)	542	(38.9)	38	(2.7)	1,393
<i>Chemistry</i>	790	(48.4)	181	(11.1)	587	(36.0)	75	(4.6)	1,633
<i>Earth Science</i>	406	(63.9)	105	(13.7)	202	(26.3)	54	(7.0)	767

<i>Biology</i>	1,969	(63.9)	191	(6.2)	735	(23.9)	185	(6.0)	3,080
<i>Medicine</i>	3,672	(77.2)	134	(2.8)	627	(13.2)	324	(6.8)	4,757
<i>Agricultural and Veterinary Science</i>	1,002	(52.2)	265	(13.8)	520	(27.1)	132	(6.9)	1,919
<i>Civil Engineering and Architecture</i>	1,441	(62.1)	189	(8.1)	485	(20.9)	206	(8.9)	2,321
<i>Industrial and Information Engineering</i>	1,969	(53.1)	415	(11.2)	1,136	(30.6)	188	(5.1)	3,708
<i>Antiquity, Philology, Literary Studies, Art History</i>	1,587	(55.4)	270	(9.4)	645	(22.5)	365	(12.7)	2,867
<i>History, Philosophy, Pedagogy, Psychology</i>	1,546	(54.8)	297	(10.5)	638	(22.6)	339	(12.0)	2,820
<i>Law</i>	1,522	(66.9)	207	(9.1)	340	(15.0)	206	(9.1)	2,275
<i>Economics and Statistics</i>	887	(52.0)	198	(11.6)	436	(25.6)	185	(10.8)	1,706
<i>Political and Social Sciences</i>	523	(48.1)	111	(10.2)	297	(27.3)	156	(14.4)	1,087
Total	18,423	(58.8)	2,845	(9.1)	7,564	(24.1)	2,509	(8.0)	31,341

Authors' elaboration on Istat Survey on occupational conditions of PhD holders. Years 2014, 2018

Method

We studied PhD students' propensity to study abroad using a multinomial logistic regression model, with standard errors clustered at the field of study. The response variable is a nominal variable that indicates whether the student remained in Italy during doctoral studies (1), which is the reference category, or if they went, whether it was mandatory (2), facultative and financed (3) or facultative and non-financed (4).

Our first research question asks whether there is an association between the family background characteristics and the probability of remaining in Italy during PhD work, whereas our second research question investigates to what extent the relationship between family background characteristics and the probability of studying abroad differs according to the different types of stays. To answer these questions, we estimate a multinomial logistic regression model in which key covariates and controls are added through a stepwise procedure. In our first step, our model (Model 1) estimates the probability of remaining in Italy or studying abroad in one of the three different situations according to parental educational attainment; in the second step, we include mother's economic activity and father's social class in the model (Model 2); and in the third, our model (Model 3) adds all control variables, such as student gender, whether the student had a scholarship, macro-area where the athenaeum was located (North, Centre or South/Islands), if the student completed his/her PhD studies at a university outside of his/her region of residence, the calendar year of his/her PhD dissertation (2008, 2010, 2012 or 2014) and field of study (according to a categorisation in 14 fields; see Table 1 for the complete list).

Results

To aid interpretation, we estimate predicted probabilities of mobility during PhD studies and present them graphically. Full model results are presented in Appendix Table A1. Our first research question asks if there is an association between family background characteristics and PhD students who remained in Italy. In answer to this question, Figure 1 shows the predicted probability of

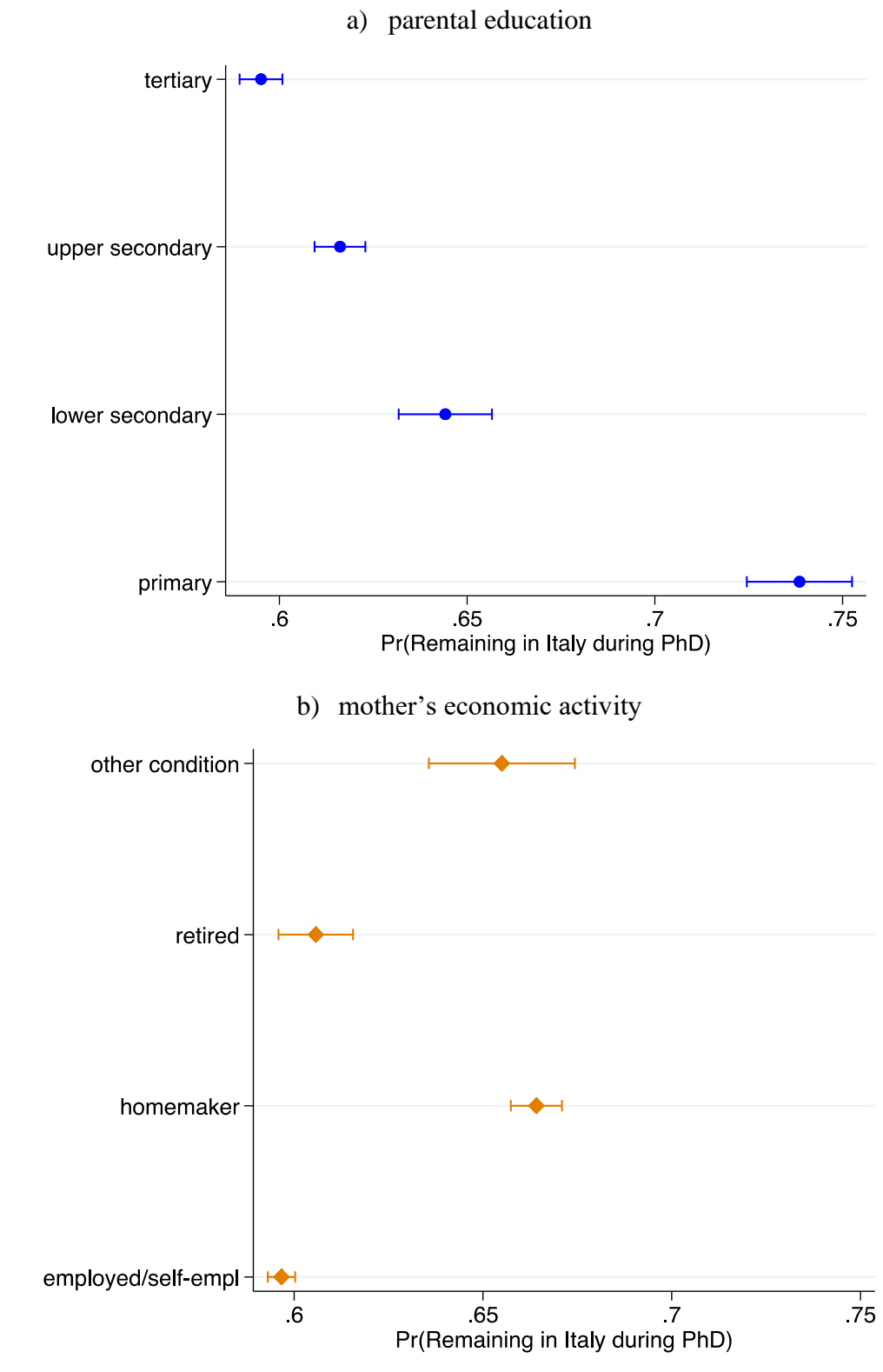
remaining in Italy during PhD studies according to family background characteristics from Model 3. Predicted probabilities of remaining in Italy decrease with parental educational attainment, and the confidence intervals do not overlap. Whilst point estimates of predicted probability of remaining in Italy is 59.5 percent for PhD students with tertiary educated parents, these estimates rise to 64.4 percent among students whose parents completed at most lower secondary education, and up to 73.9 percent among PhD students with primary educated parents. Thus, the difference in predicted probabilities of remaining in Italy between PhD candidates with tertiary educated parents and at most lower secondary educated parents is restrained (4.9 percent, statistically significant at 1%). This difference becomes very high when comparing PhD students with primary educated parents against all other PhD candidates. The difference rises to 9.4 percent when compared to students with at most lower secondary educated parents, and up to 14.3 percent for students with at least one tertiary educated parent.

According to mother's economic activity, predicted probability of remaining in Italy is lowest for students whose mother was employed or retired (59.7 percent and 60.6 percent, respectively), whereas it is highest for students whose mother was a homemaker (66.4 percent). While the difference in predicted probabilities between students with employed mother or as a homemaker is quite small (6.7 percent), it is statistically significant (at 1%), and the confidence intervals do not overlap. Instead, confidence intervals of predicted probability of remaining in Italy overlap for PhD students with employed mothers and retired mothers, as well as for PhD students with mothers who were homemakers or in another economic condition.

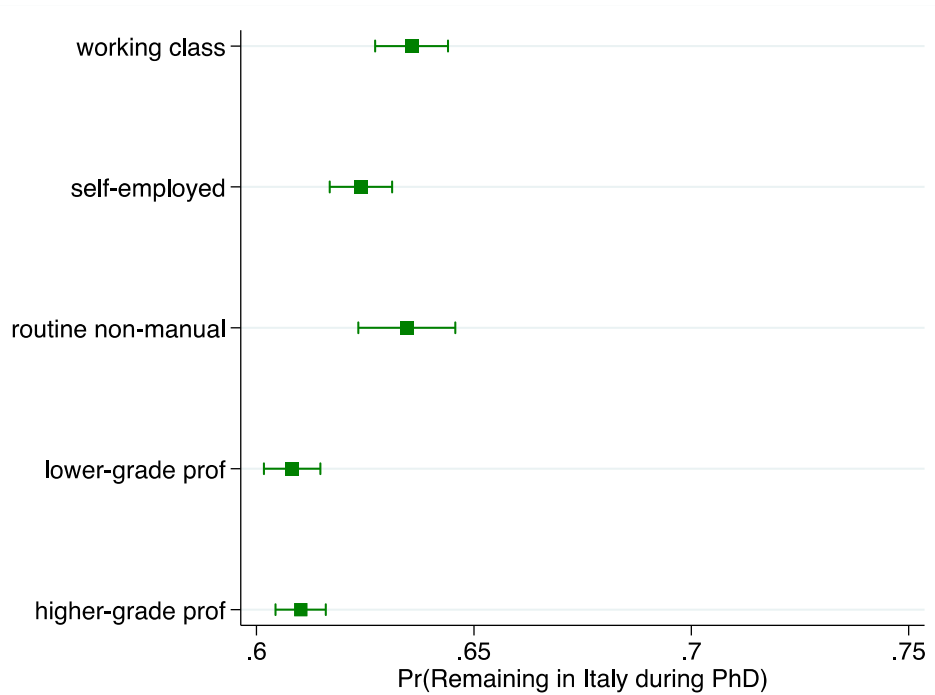
Finally, predicted probabilities of remaining in Italy vary only slightly with respect to father's social class, moving from the lowest for PhD students whose father was a lower-grade professional (60.8 percent) to the highest for those whose father belonged to the working class (63.6 percent). Overlapping confidence intervals divide the predicted probabilities of remaining in Italy for PhD students in two macro-categories of father's social class: fathers who were a higher- or a lower- grade professional and fathers who were self-employed, a routine non-manual, or working class.

In sum, both parental education and mother's economic activity indicate a relationship with the propensity not to study abroad among PhD candidates, and the highest propensities pertain to PhD candidates with low educated parents and students whose mothers were homemakers. In addition, father's social class tends to polarise the categories into two groups of PhD students with a higher or lower propensity to remain in Italy.

Figure 1: Results from Model 3: Predicted probabilities of remaining in Italy during PhD studies according to parental education, mother's economic activity, father's social class. CI 83%.



c) father's social class



Source: Istat Survey on occupational conditions of Italian PhD holders. Years 2014, 2018.

Note: To estimate predicted probabilities, the family background covariate under control is allowed to vary, whilst the remaining family background covariates, as well as controls (student gender, scholarship availability, year of PhD defence, macro-area of athenaeum, if the university is outside student's region of residence, field of study) are kept at the mean value.

Our second research question asks to what extent the relationship between family background characteristics and the probability of studying abroad differs according to type of stay. To investigate this question, we present graphically the predicted probability of studying abroad for a) a mandatory stay, b) a facultative and financed stay, or c) a facultative and non-financed stay (from Model 3) according to four profiles that emerged when considering diverse family background characteristics (see also Appendix Table A1 for full model results). The four profiles are presented in Table 2 with their numerosity.

Table 2: Profiles of PhD students by family background characteristics. Absolute and raw percentage values.

		Study abroad				Total (% over total obs)
		Remained in Italy	Mandatory stay	Financed stay	Non- financed stay	
Profile A: low SES		387 (71.0)	36 (6.6)	90 (16.5)	32 (5.9)	545 (1.7)
Parental education:	<i>primary</i>					
Mother's economic activity:	<i>homemaker</i>					
Father's social class:	<i>working class</i>					
Profile B: medium-low SES		238 (65.4)	30 (8.2)	70 (19.2)	26 (7.1)	364 (1.2)
Parental education:	<i>lower secondary</i>					
Mother's economic activity:	<i>homemaker</i>					
Father's social class:	<i>routine non-manuals</i>					
Profile C: medium-high SES		1639 (58.7)	238 (8.5)	712 (25.5)	205 (7.3)	2,794 (8.9)
Parental education:	<i>upper secondary</i>					
Mother's economic activity:	<i>employed/self-employed</i>					
Father's social class:	<i>lower-grade professional</i>					
Profile D: high SES		1706 (56.6)	303 (10.0)	715 (23.7)	291 (9.7)	3,015 (9.6)
Parental education:	<i>tertiary</i>					
Mother's economic activity:	<i>employed/self-employed</i>					
Father's social class:	<i>higher-grade professionals</i>					

Authors' elaboration on Istat Survey on occupational conditions of PhD holders. Years 2014, 2018

When looking at Figure 2, the pattern emerging from the three sub-figures is the same: predicted probabilities of studying abroad increase as the status of the PhD student increases, irrespective of their type of stay. As a consequence, the propensity to remain in Italy increases as PhD students' status decreases, in accordance with what is presented in Figure 1, which displays the probability of remaining in Italy during PhD studies according to each family background characteristic. However, some differences remain between the three types of stay.

Figure 2a shows the predicted probability of studying abroad for a mandatory stay during PhD work according to the four profiles. Predicted probabilities increase as the status of the PhD student increases, ranging from 6.1 percent to 9 percent, and confidence intervals overlap among adjacent profiles. Thus, the different profiles on family background characteristics seem to shape the propensity towards a mandatory international stay, to a limited extent.

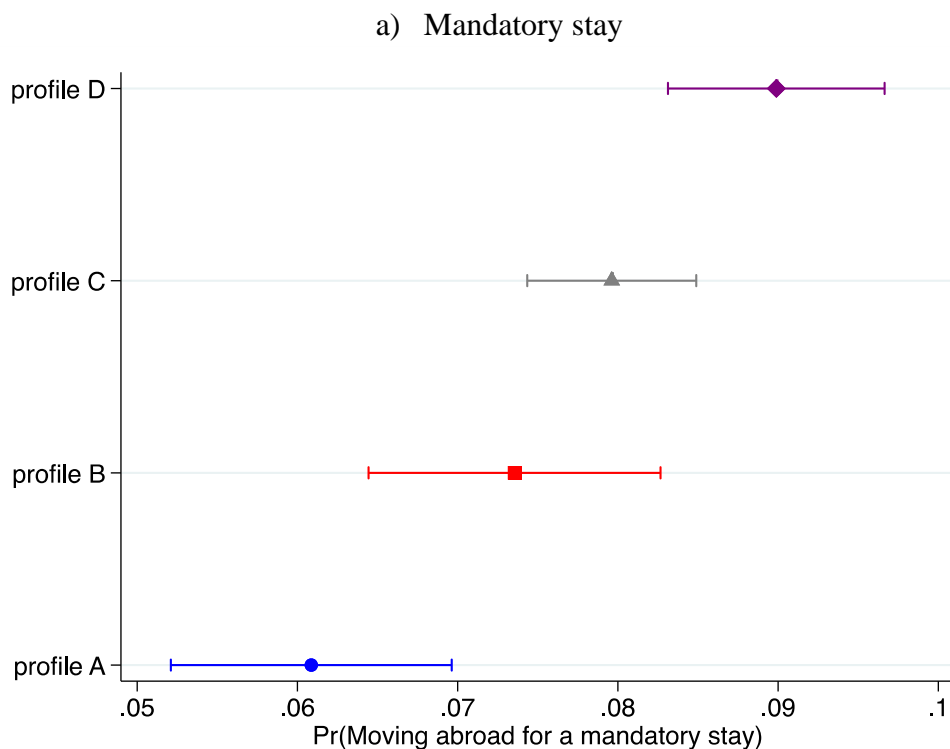
Predicted probabilities of studying abroad for a facultative and financed stay (see Figure 2b) vary from 15.9 percent to 23.4 percent, thus showing a larger gap between low-status and high-status

profiles. Apart from the two highest profiles in terms of socio-economic conditions, the confidence intervals do not overlap, marking a greater distance in their propension towards international mobility for a facultative and financed stay.

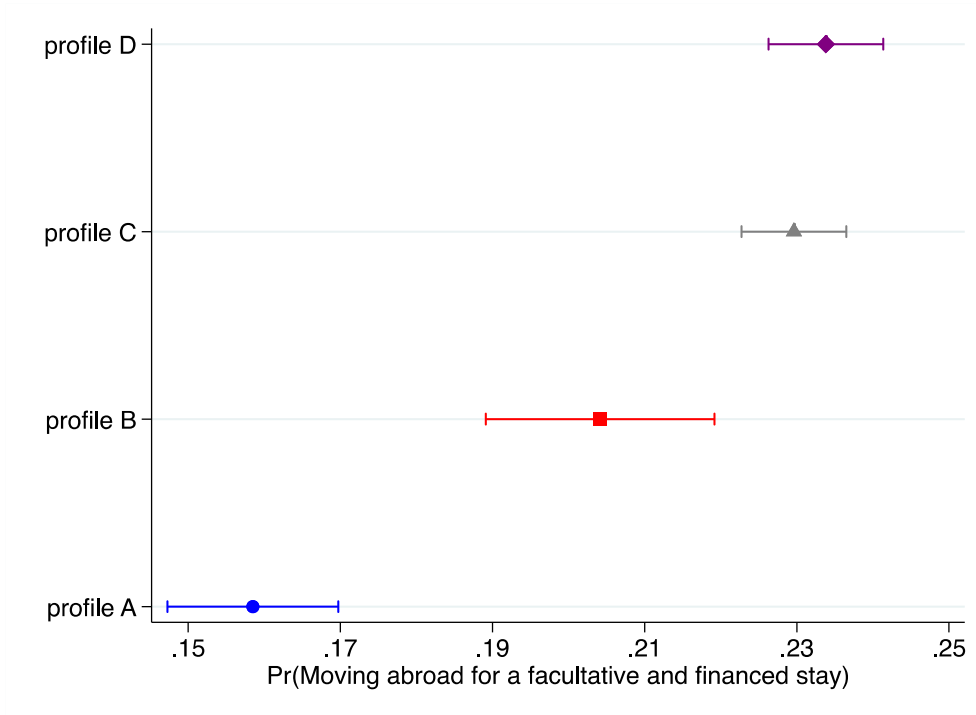
Finally, Figure 2c displays predicted probabilities of going abroad for a facultative and non-financed stay, which range from 5.9 percent among the low-status profile to 9.4 percent for the high-status profile. In this case, confidence intervals overlap between adjacent profiles in all except the highest socio-economic status, which appears isolated in the graph at over 9 percent, whereas all other socio-economic profiles remain below 7.5 percent.

In sum, the relationship between PhD students' socio-economic status and an international stay during PhD study shows slight, negligible differences for mandatory stays; substantial differences for facultative and financed stays; and polarised results for PhD candidates from families with higher socio-economic status for facultative and non-financed stays.

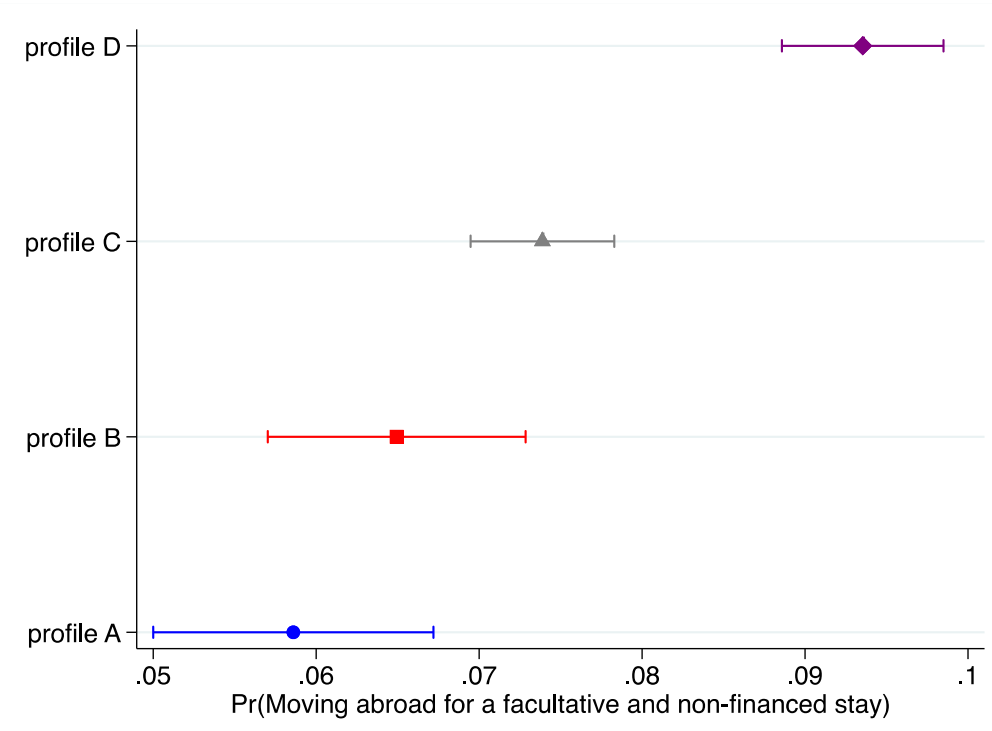
Figure 2: Results from Model 3: Predicted probabilities of studying abroad in the three types of stays during PhD studies according to four different profiles. CI 83%.



b) Facultative and financed stay



c) Facultative and non-financed stay



Source: ISTAT Survey on occupational conditions of Italian PhD holders. Years 2014, 2018.

Note: To estimate predicted probabilities, the family background covariates are kept at fixed values, whilst the controls (student gender, scholarship availability, year of PhD defence, macro-area of athenaeum, if the university is outside student's region of residence, field of study) are kept at the mean value.

All control coefficients from Model 3 (Appendix Table A1) are in line with expectations from the published literature. Male PhD students, as well as PhD candidates whose university was outside their region of residence, show a higher probability of studying abroad across the three different types

of stay. Having a scholarship increases the probability of studying abroad for a mandatory or a facultative and financed stay, whereas it decreases the propensity to pursue a facultative and non-financed stay.⁹ PhD students who completed their PhD studies at a university in the Centre or South of Italy have a lower propensity to study abroad compared to PhD students in the North; however, the estimated coefficients are not always statistically significant (see model estimates of studying abroad without funds). Coherent with the periodic trend of increasing international mobility of PhD students in Italy, predicted probabilities of studying abroad increase, on average, with year of PhD defence, but not all estimated coefficients are statistically significant. The calendar year is positively associated with a higher propensity toward studying abroad for a mandatory stay and for a facultative and non-financed stay, whereas only the most recent cohort of PhD students shows a higher propensity for a facultative and financed stay with respect to the cohort who defended in 2008. Finally, students' field of study shows greater differences in the propensity for studying abroad according to the type of stay: PhD students in earth science or agricultural and veterinary science have a higher propensity for a mandatory stay than PhD candidates in maths and computer science; when considering a facultative and financed stay, all other fields' PhD students have a lower propensity compared with PhD candidates of maths and computer science (although the estimated coefficients for physics and chemistry are very small); and for facultative and non-financed stays, the roles are reversed: PhD candidates of maths and computer science have a lower propensity compared to many other fields' candidates, like PhD students of political and social sciences.

The stepwise procedure reveals that, when comparing Models 1 and 2, estimated coefficients for parental education show the same significance in both models. The estimates differ slightly for a mandatory stay versus a facultative and financed stay, suggesting that mother's economic condition and father's social class do not mediate the relationship between parental education and the propensity toward studying abroad for a mandatory stay or a facultative and financed stay. Instead, estimated coefficients for a facultative and non-financed stay change quite substantially: the economic aspects of the family of origin (represented by mother's economic activity and father's social class) diminish the importance of parents' human capital in influence over students' propensity to study abroad without additional funds. Finally, after introducing control variables in Model 3, no substantial change occurred in the estimated coefficients.

Concluding discussion

This paper addresses the relationship between PhD students' family background characteristics and their international mobility during PhD studies, aiming to bridge the gap in the literature and shedding light on if and how higher parental socio-economic status may favour mobility for students at the top of the higher education system. International mobility is largely recognised in the literature as favourable for future employment prospects; in this respect, lower international mobility during PhD studies may negatively impact PhD holders' academic careers. Our study suggests a relationship between family background characteristics – mainly parental education and mother's economic activity – and the propensity for studying abroad. High parental education is associated with a higher propensity for studying abroad during PhD studies, whereas the opposite is true for low parental education. In particular, the gap in international mobility between PhD students with primary educated parents and other parental education is remarkable. Of note, the former group

⁹ Many PhD programmes offer additional funds to study abroad for scholarship students.

is residual among all PhD students; information barriers may still play a role in shaping their decisions on the profitability of international mobility (Morgan, 2005; Usher, 2005).

Parental economic conditions seem to play a more moderated role compared to parents' education, and they do not mediate the relationship between parental education and the propensity for studying abroad during a mandatory stay or a facultative and financed stay; thus, the family of origin's social and economic characteristics appear relevant in shaping the propensity for studying abroad (e.g., Assirelli et al., 2019).

PhD students' socio-economic profiles show that their family background has a lower impact on their mobility when the stay abroad is mandatory. When the stay is facultative and non-financed, only a few PhD students with high SES opt for the period abroad. Finally, when the stay is facultative and financed, PhD students' socio-economic profiles have a higher impact on their propensity to study abroad. In this case, we hypothesise that information barriers play a role: PhD students from upper statuses are more informed by their parents and networks about the profitability of international mobility during PhD programmes, while their lower status counterparts may not have access to similar insights from their networks (Morgan, 2005; Usher, 2005; Abbiati & Barone, 2017).

Finally, it is important to remark that PhD students are a selected group of individuals, because they have reached the highest level of education in a country. Those belonging to lower social strata have endured an even more marked process of selection in comparison with students from higher social classes (Argentin et al., 2015). PhD programmes are highly selective about access, favouring adults with high parental SES, and during students' studies, given that higher participation results in highly educational experiences such as international mobility. Nevertheless, we may posit that once the experience of studying abroad during PhD studies work has become more widespread and information barriers about the importance of studying abroad during PhD studies have reduced, this advantage of PhD students with highly educated parents could become diminished, especially for PhD students involved in PhD programmes with mandatory or facultative and financed stays abroad.

This study has some limitations, including the lack of information on life events (e.g., child's birth) during participants' PhD studies and on their family ties, which may have influenced study abroad decisions (see e.g., Henderson, 2019; Jöns, 2011). Other variables from the Istat Survey could not be used because of differences in collection methods and categories between the three surveys (e.g., the final score obtained in master's degree, age at PhD qualification). Regarding the period spent abroad, the length is unknown in the two surveys considered for this study. In the first edition of the survey, nearly 30 percent of PhD students spent at least four weeks abroad. Thus, we may suppose that at least the same percentage of PhD students spent a period of one month or a longer abroad, which would account for most of the PhD students who studied abroad in our sample. Despite this knowledge gap, even shorter study periods may be fruitful for creating international networks (Henderson, 2019; Avveduto, 2001).

Based on our work, we speculate that parental socio-economic status influences international mobility for studying abroad during PhD studies. Given that international mobility might have direct or indirect consequences on educational and occupational outcomes of those students at the highest level of education (e.g., Ermini et al., 2019), further research should investigate whether Italian PhD students' international mobility have future repercussions on their occupational prospects, and the potential mediating role of parental SES.

References

- Abbiati, G., & Barone, C. (2017). Is university education worth the investment? The expectations of upper secondary school seniors and the role of family background. *Rationality and Society*, 29(2), 113–159. <https://doi.org/10.1177/1043463116679977>
- Ackers, L., Gill, B., & Guth, J. (2008). *Doctoral Mobility in the Social Sciences. Report to the NORFACE ERA-NET*.
- Agasisti, T. (2009). Market forces and competition in university systems: theoretical reflections and empirical evidence from Italy. *International Review of applied economics*, 23(4), 463–483.
- Argentin, G., Ballarino, G., & Colombo, S. (2015). Espansione senza equalizzazione? Le disuguaglianze di accesso al dottorato di ricerca in Italia dagli anni '90 in avanti. *Sociologia Del Lavoro*, (136), 149–165. <https://doi.org/10.3280/sl2014-136008>
- Argentin, G., & Triventi, M. (2011). Social inequality in higher education and labour market in a period of institutional reforms: Italy, 1992-2007. *Higher Education*, 61(3), 309–323. <https://doi.org/10.1007/s10734-010-9379-6>
- Assirelli, G., Barone, C., & Recchi, E. (2019). “You Better Move On”: Determinants and Labor Market Outcomes of Graduate Migration from Italy. *International Migration Review*, 53(1), 4–25. <https://doi.org/10.1177/0197918318767930>
- Avveduto, S. (2001). International mobility of PhDs. In OECD (Ed.), *Innovative people: mobility of skilled personnel in national innovation system* (pp. 229–242). Paris: OECD.
- Avveduto, S. (2012). High Skilled Migration: Still a Brain Drain Problem? *Rivista Italiana Di Economia Demografia e Statistica*, LXVI(2, Aprile-Giugno), 39–56.
- Ballarino, G., & Colombo, S. (2010). Occupational outcomes of PhD graduates in Northern Italy. *Italian Journal of Sociology of Education*, 2(2), 149–171.
- Bartolini, L., Gropas, R., & Triandafyllidou, A. (2017). Drivers of highly skilled mobility from Southern Europe: escaping the crisis and emancipating oneself. *Journal of Ethnic and Migration Studies*, 43(4), 652–673. <https://doi.org/10.1080/1369183X.2016.1249048>
- Becker, G. S. (2009). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago press.
- 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.
- Boudon, R. (1974). Education, opportunity, and social inequality: Changing prospects in western society.
- Breen, R., & Müller, W. (2020). *Education and intergenerational social mobility in Europe and the United States*. Stanford University Press.
- Capuano, S. (2012). The South–North Mobility of Italian College Graduates. An Empirical Analysis. *European Sociological Review*, 28(4), 538–549. <https://doi.org/10.1093/esr/jcr023>
- Cattaneo, M., Malighetti, P., Meoli, M., & Paleari, S. (2017). University spatial competition for students: the Italian case. *Regional Studies*, 51(5), 750–764. <https://doi.org/10.1080/00343404.2015.1135240>
- Checchi, D., & Peragine, V. (2005). *Regional disparities and inequality of opportunity: the case of Italy*. IZA Discussion Paper.
- D’Agostino, A., Ghellini, G., & Longobardi, S. (2019). Exploring the determinants and trends of STEM students’ internal mobility. Some evidence from Italy. *Electronic Journal of Applied Statistical Analysis*, 12(4), 826–845. <https://doi.org/10.1285/i20705948v12n4p826>

- Di Cintio, M., & Grassi, E. (2017). International mobility and wages: an analysis of Italian Ph.D. graduates. *Annals of Regional Science*, 59(3), 759–791. <https://doi.org/10.1007/s00168-016-0749-6>
- 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), 995–1025. <https://doi.org/10.1111/pirs.12375>
- Fratesi, U., & Percoco, M. (2014). Selective Migration, Regional Growth and Convergence: Evidence from Italy. *Regional Studies*, 48(10), 1650–1668. <https://doi.org/10.1080/00343404.2013.843162>
- Ghosh, S., & Grassi, E. (2020). Overeducation and overskilling in the early careers of PhD graduates: Does international migration reduce labour market mismatch? *Papers in Regional Science*, 99(4), 915–944. <https://doi.org/10.1111/pirs.12509>
- Goldthorpe, J., & Erikson, R. (1992). *The constant flux: a study of class mobility in industrial societies*. Oxford: Clarendon Press.
- Guth, J., & Gill, B. (2008). Motivations in East–West Doctoral Mobility: Revisiting the Question of Brain Drain. *Journal of Ethnic and Migration Studies*, 34(5), 825–841.
- 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), 678–693. <https://doi.org/10.1080/13562517.2018.1552252>
- Impicciatore, R., & Tuorto, D. (2011). Mobilità interna e istruzione universitaria: risorse familiari, individuali e opportunità di ascesa sociale nell’occupazione. *Sociologia Del Lavoro*, (121), 51–78. Retrieved from http://www.francoangeli.it/Riviste/Scheda_Rivista.aspx?IDarticolo=41385
- Istat (2018). *L’inserimento professionale dei dottori di ricerca. Anno 2018*. Statistiche report. Rome: Istat.
- Jackson, M. (2013). *Determined to succeed?: performance versus choice in educational attainment*. Stanford University Press.
- Jöns, H. (2011). Transnational academic mobility and gender. *Globalisation, Societies and Education*, 9(2), 183–209. <https://doi.org/10.1080/14767724.2011.577199>
- Kim, T. (2010). Transnational academic mobility, knowledge, and identity capital. *Discourse: Studies in the Cultural Politics of Education*, 31(5), 577–591.
- Kim, T. (2017). Academic mobility, transnational identity capital, and stratification under conditions of academic capitalism. *Higher Education*, 73(6), 981–997.
- Mariani, F. (2006). Brain drain and economic development: the role of inequality and rent-seeking. *European University Institute*.
- Marini, G. (2019). A PhD in social sciences and humanities: impacts and mobility to get better salaries in an international comparison. *Studies in Higher Education*, 44(8), 1332–1343. <https://doi.org/10.1080/03075079.2018.1436537>
- Michalos, A. C. (1997). Migration and the Quality of Life: A Review Essay. *Social Indicators Research*, 39, 121–166.
- Morano-Foadi, S. (2005). Scientific mobility, career progression, and excellence in the European Research Area. *International Migration*, 43(5), 133–162. <https://doi.org/10.1111/j.1468-2435.2005.00344.x>
- Morgan, S.L. (2005). *On the Edge of Commitment: Educational Attainment and Race in the United States*. Stanford: Stanford University Press.
- Netz, N., & Jaksztat, S. (2014). Mobilised by mobility? Determinants of international mobility plans

- among doctoral candidates in Germany. *International Perspectives on Higher Education Research*, 11, 35–59.
- OECD (2001). *Innovative People. Mobility of Skilled Personnel in National Innovation Systems*. OECD Proceedings. Paris: OEC.
- Panichella, N. (2013). Migration strategies and occupational outcomes of southern Italian graduates. *Journal of Modern Italian Studies*, 18(1), 72–89. <https://doi.org/10.1080/1354571X.2013.730274>
- Ruiu, G., Fadda, N., Ezza, A., & Esposito, M. (2019). Exploring mobility of Italian Ph.Ds over the last decades. *Electronic Journal of Applied Statistical Analysis*, (December), 748–773. <https://doi.org/10.1285/i20705948v12n4p748>
- Saint-Blancat, C. (2018). Making Sense of Scientific Mobility: How Italian Scientists Look Back on Their Trajectories of Mobility in the EU. *Higher Education Policy*, 31(1), 37–54. <https://doi.org/10.1057/s41307-017-0042-z>
- Scarlato, M. (2007). Mobilità sociale e mobilità territoriale dei laureati meridionali. *Rivista economica del Mezzogiorno*, 21(2), 369–392. <https://doi.org/10.1432/25382>
- Schultz, T. W. (1971). Investment in human capital. The role of education and of research.
- Solimano, A. (2008). *The international mobility of talent: Types, causes, and development impact*. Oxford University Press on Demand.
- Straubhaar, T. (2000). *International mobility of the highly skilled: Brain gain, brain drain or brain exchange*. HWWA Discussion paper.
- Tosi, F., Impicciatore, R., & Rettaroli, R. (2019). Individual skills and student mobility in Italy: a regional perspective. *Regional Studies*, 53(8), 1099–1111. <https://doi.org/10.1080/00343404.2018.1528008>
- Triventi, M., Vergolini, L., & Zanini, N. (2017). Do individuals with high social background graduate from more rewarding fields of study? Changing patterns before and after the ‘Bologna process.’ *Research in Social Stratification and Mobility*, 51(May), 28–40. <https://doi.org/10.1016/j.rssm.2017.07.001>
- Usher, A. (2005). *A Little Knowledge Is a Dangerous Thing: How Perceptions of Costs and Benefits Affect Access to Education*. Toronto: Educational Policy Institute.
- Verbik, L., & Lasanowski, V. (2007). International Student Mobility : Patterns and Trends and former Deputy Director , The Observatory on Borderless The Observatory on Borderless Higher Education. *Higher Education*, 44(September), 1–48.

Appendix

Table A1: Model coefficients for Model 1, Model 2 and Model 3^(a).

	Model 1			Model 2			Model 3		
	Coeff.	std error	p-value	Coeff.	std error	p-value	Coeff.	std error	p-value
a) Mandatory stay									
Parental education (ref. Upper secondary)									
Primary	-0.518	0.085	0.000	-0.491	0.094	0.000	-0.324	0.083	0.000
Lower secondary	-0.181	0.071	0.011	-0.167	0.075	0.025	-0.114	0.075	0.129
Tertiary	0.038	0.058	0.514	-0.002	0.049	0.974	0.058	0.049	0.241
Unknown	-0.287	0.209	0.169	-0.285	0.227	0.211	-0.271	0.240	0.258
Mother's economic activity (ref. Employed/self-employed)									
Homemaker				-0.233	0.056	0.000	-0.151	0.059	0.011
Retired				0.014	0.096	0.886	-0.020	0.104	0.846
Other condition				-0.092	0.112	0.415	-0.080	0.128	0.534
Father's social class (ref. Lower-grade prof)									
Higher-grade professionals				0.086	0.095	0.368	0.120	0.078	0.123
Routine non-manual				0.099	0.101	0.327	0.121	0.096	0.208
Self-employed				0.082	0.063	0.191	0.076	0.059	0.194
Working class (skilled/unskilled)				0.123	0.076	0.107	0.048	0.068	0.481
Unknown social class				0.062	0.065	0.338	0.118	0.079	0.135
Gender (ref. Male)									
Female							-0.100	0.050	0.044
Scholarship (ref. No)									
Yes							1.135	0.095	0.000
Macro-area of Athenaeum (ref. North)									
Centre							-0.740	0.092	0.000
South							-0.556	0.125	0.000
Interregional move for PhD studies (ref. No)									
Yes							0.364	0.072	0.000

Year of defence (ref. 2008)									
2010							0.264	0.077	0.001
2012							0.385	0.086	0.000
2014							0.651	0.125	0.000
Field of study (ref. Maths and Computer Science)									
Physics							-0.185	0.010	0.000
Chemistry							-0.063	0.013	0.000
Earth Science							0.175	0.014	0.000
Biology							-0.909	0.015	0.000
Medicine							-1.839	0.017	0.000
Agricultural and Veterinary Science							0.206	0.016	0.000
Civil Engineering and Architecture							-0.564	0.011	0.000
Industrial and Information Engineering							-0.188	0.010	0.000
Antiquity, Philology, Literary Studies, Art History							-0.241	0.017	0.000
History, Philosophy, Pedagogy, Psychology							-0.100	0.013	0.000
Law							-0.512	0.015	0.000
Economics and Statistics							-0.024	0.010	0.017
Political and Social Sciences							-0.032	0.013	0.012
Constant	-1.822	0.169	0.000	-1.794	0.156	0.000	-2.223	0.185	0.000
b) Facultative and financed stay									
Parental education (ref. Upper secondary)									
Primary	-0.606	0.064	0.000	-0.577	0.062	0.000	-0.451	0.058	0.000
Lower secondary	-0.108	0.057	0.059	-0.097	0.058	0.094	-0.058	0.062	0.349
Tertiary	0.071	0.050	0.156	0.080	0.049	0.104	0.146	0.048	0.002
Unknown	-0.901	0.148	0.000	-0.740	0.150	0.000	-0.802	0.131	0.000
Mother's economic activity (ref. Employed/self-employed)									
Homemaker				-0.202	0.026	0.000	-0.131	0.026	0.000
Retired				-0.048	0.034	0.156	-0.073	0.037	0.047
Other condition				-0.140	0.074	0.061	-0.117	0.074	0.116
Father's social class (ref. Lower-grade prof)									
Higher-grade professionals				-0.127	0.049	0.010	-0.071	0.036	0.046
Routine non-manual				-0.002	0.056	0.970	0.007	0.059	0.901

Self-employed	0.002	0.035	0.949	0.034	0.031	0.274
Working class (skilled/unskilled)	0.120	0.040	0.003	0.053	0.046	0.248
Unknown social class	-0.151	0.059	0.011	-0.068	0.062	0.269
Gender (ref. Male)						
Female				-0.158	0.034	0.000
Scholarship (ref. No)						
Yes				1.406	0.073	0.000
Macro-area of Athenaeum (ref. North)						
Centre				-0.349	0.048	0.000
South				-0.403	0.068	0.000
Interregional move for PhD studies (ref. No)						
Yes				0.142	0.060	0.018
Year of defence (ref. 2008)						
2010				0.037	0.037	0.308
2012				0.061	0.061	0.319
2014				0.138	0.067	0.039
Field of study (ref. Maths and Computer Science)						
Physics				-0.068	0.005	0.000
Chemistry				-0.013	0.010	0.209
Earth Science				-0.261	0.013	0.000
Biology				-0.639	0.012	0.000
Medicine				-1.367	0.012	0.000
Agricultural and Veterinary Science				-0.211	0.015	0.000
Civil Engineering and Architecture				-0.709	0.011	0.000
Industrial and Information Engineering				-0.311	0.009	0.000
Antiquity, Philology, Literary Studies, Art History				-0.439	0.015	0.000
History, Philosophy, Pedagogy, Psychology				-0.392	0.015	0.000
Law				-1.099	0.014	0.000
Economics and Statistics				-0.337	0.010	0.000
Political and Social Sciences				-0.108	0.015	0.000
Constant	-0.863	0.140	0.000	-0.781	0.139	0.000

c) Facultative and non-financed stay

Parental education (ref. Upper secondary)									
Primary	-0.246	0.070	0.000	-0.199	0.066	0.003	-0.267	0.068	0.000
Lower secondary	-0.005	0.076	0.950	0.039	0.064	0.545	0.016	0.065	0.810
Tertiary	0.199	0.052	0.000	0.114	0.055	0.036	0.106	0.053	0.046
Unknown	-0.486	0.337	0.150	-0.473	0.331	0.153	-0.479	0.366	0.191
Mother's economic activity (ref. Employed/self-employed)									
Homemaker				-0.091	0.041	0.027	-0.088	0.042	0.038
Retired				0.075	0.107	0.483	-0.002	0.111	0.987
Other condition				0.102	0.100	0.306	0.090	0.107	0.400
Father's social class (ref. Lower-grade prof)									
Higher-grade professionals				0.187	0.043	0.000	0.187	0.043	0.000
Routine non-manual				-0.129	0.114	0.257	-0.121	0.110	0.273
Self-employed				0.038	0.069	0.585	0.034	0.063	0.592
Working class (skilled/unskilled)				-0.062	0.103	0.546	-0.034	0.105	0.745
Unknown social class				-0.132	0.089	0.138	-0.177	0.086	0.039
Gender (ref. Male)									
Female							-0.225	0.077	0.003
Scholarship (ref. No)									
Yes							-0.313	0.080	0.000
Macro-area of Athenaeum (ref. North)									
Centre							-0.089	0.041	0.030
South							-0.143	0.078	0.068
Interregional move for PhD studies (ref. No)									
Yes							0.375	0.053	0.000
Year of defence (ref. 2008)									
2010							-0.035	0.051	0.496
2012							0.168	0.073	0.021
2014							0.185	0.063	0.003
Field of study (ref. Maths and Computer Science)									
Physics							-0.762	0.006	0.000
Chemistry							-0.172	0.022	0.000
Earth Science							0.066	0.018	0.000

Biology							-0.210	0.027	0.000
Medicine							-0.330	0.021	0.000
Agricultural and Veterinary Science							0.083	0.020	0.000
Civil Engineering and Architecture							0.120	0.016	0.000
Industrial and Information Engineering							-0.275	0.010	0.000
Antiquity, Philology, Literary Studies, Art History							0.579	0.024	0.000
History, Philosophy, Pedagogy, Psychology							0.542	0.024	0.000
Law							-0.024	0.024	0.316
Economics and Statistics							0.501	0.012	0.000
Political and Social Sciences							0.847	0.020	0.000
Constant	-2.058	0.136	0.000	-2.033	0.132	0.000	-1.687	0.157	0.000

Note: (a) Model 1, Model 2 and Model 3 are multinomial logistic models with random errors clustered at the field of study (the response variable is about international mobility during PhD studies with four categories– where the reference category is the student who remained in Italy), and they differ only for the control variables included in the three model specifications.

