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Postgraduate education and job mismatch in Italy: Does migration help?

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Abstract

Doctoral graduates represent the pinnacle of education. While the importance of increasing their number has been recognised by the Italian government and there has been a huge increase in the number of publicly funded PhD scholarships, doctoral graduates still struggle in the labour market to find employment commensurate with their skills and competencies. It is against this backdrop that the role of migration becomes crucial. Exploiting Italian microdata at the census level, this study aims to investigate how human capital migration, occurring at different 'times' of individual's life and across different regions, could mitigate the potential education–job mismatch, which is measured here from a multidimensional perspective by looking at overeducation, overskilling and satisfaction. Our findings reveal some positive effects of migration on reducing this mismatch. Moreover, the study highlights two relevant gaps, the first between domestic and foreign workers and the second between genders.

KEYWORDS

education–job mismatch, human capital migration, Italian regions, PhD

1 | INTRODUCTION

The number of PhD holders has increased substantially in Italy over the last few years (ISTAT, 2018). This trend has been supported by national and regional governments, recognise the role that doctoral studies play in knowledge creation and innovation (OECD, 2019). However, this recent increase has not yet resulted in a sizable increase in R&D expenditures (both public and private) and/or innovation (ISTAT, 2018; OECD, 2017). This suggests a lack of exploitation of the full capabilities of these very highly skilled individuals due to a substantial education–job mismatch (Gaeta, 2015). Recent studies show indeed that PhD holders face remarkable obstacles in finding nonacademic jobs (both in the private and public sectors) matching their competencies (Di Paolo & Mañé, 2016; Gaeta et al., 2017). In light of the expected rapid increase in the number of PhD scholarships funded by the government through the *National Recovery and Resilience Plan*, it is crucial to consider the employment prospects of doctoral students and whether relocation (via migration) could help them to find better opportunities, thus allowing for better education–job matching.

Although this seems like an obvious issue, the role of 'space' (in this case through migration decisions) has often been neglected or, at best, under considered. This occurs even though it is clearly recognised that education–job matching depends on the geographical locations of PhD holders, both their 'origins' (where they live and/or study) and 'destinations' (where they migrate to). Indeed, as shown in the human capital migration literature (Sjaastad, 1962), migration is an investment people make with the aim of improving their social and economic status.

In fact, voluntary migration—particularly of the youngest and brightest people—is often motivated by the search for better employment opportunities that match their educational level (Docquier et al., 2014; Greenwood, 1975, 1985; Williams et al., 2018), resulting in higher job satisfaction (Abreu et al., 2015) and higher salaries (Jewell & Faggian, 2014). While a number of studies have considered the impact of spatial mobility on the education–job match of university graduates (Dolton & Silles, 2008; Iammarino & Marinelli, 2015), the literature on PhD holders is still in its infancy (Alfano, D'Uva, et al., 2019; Alfano et al., 2021; Di Cintio & Grassi, 2017; Ghosh & Grassi, 2020). Nonetheless, studying the role of spatial mobility on the education–job match of PhD graduates has important policy implications, especially as doctoral degrees are expanding, and better knowledge of the role of mobility would make it possible to devise more effective policies to fully exploit the potential of highly skilled individuals to support local economic growth. Indeed, previous studies have shown that the match between jobs and educational level—as well as migration—plays a key role in determining regional economic performance in Europe (Rodríguez-Pose & Vilalta-Bufí, 2005).

Therefore, we contribute to the literature by specifically investigating the role of migration in the education–job match (or mismatch) of PhD graduates. To this end, we define matching as a multidimensional phenomenon (Gaeta et al., 2017) involving the concepts of *overeducation*, *overskilling* and *satisfaction* and consider the impact of migration on all three dimensions. In the first stage, the decision to migrate is analysed irrespective of where it is directed to and when it happens in an individual's educational path. Subsequently, we extend our analysis in two further ways: first, by considering spatial mobility both inside and outside the macro region of origin, and second, by disentangling migration flows according to the possible stages of an individual career (i.e., high school to university, university to PhD and, finally, PhD to labour market). In short, we will try to answer the following research questions:

- RQ1: Does migration 'grease the wheels' of the education–job match for PhD holders?
- RQ2: How do different investments in migration—measured in terms of 'time' and 'space' characteristics—affect educational mismatch?

In formulating these research questions, our main hypothesis is that migration should boost and favour the education–job match of doctoral graduates by reducing overeducation and overskilling and increasing job satisfaction (RQ1). Moreover, we expect an incremental effect for people who decide to migrate earlier in their individual educational path and outside their macro region of origin (RQ2).

Our empirical analysis explores the Italian case, which is interesting for many reasons. First and foremost, in recent decades Italy has experienced a constant increase in the number of PhD programmes and graduates, and it is currently planning to expand this number even further through a large investment in PhD scholarships in the next 3 years. Thus, it is vital to understand better how the education–job match could be improved. This is needed both for the sake of the graduates as well as for the country overall, as the expansion in the number of graduates, so far, has not led to an increase in R&D and/or innovation (Di Cintio & Grassi, 2017). Their difficulties in finding employment are especially visible in the private sector, where their value is not fully understood or recognised. The structure of the Italian productive sector, with many micro- and small-sized firms in the South and the concentration of a few large-sized firms in the North, does not help. Obviously, smaller firms often offer only limited opportunities for highly skilled PhD holders. This well-known North–South divide may translate into significantly different job opportunities for doctoral graduates located in different regions, irrespective of the quality of the local higher education institutions. In this context, migration may be a way to optimise the education–job match. To explore this possibility, we use data on Italian doctoral graduates taken from the most recent 'Survey on the employability of PhD holders' (*Indagine sull'Inserimento Professionale dei Dottori di Ricerca*) by the *Italian National Institute of Statistics* (ISTAT, 2018). Using self-selection and multivariate probit models, our results show that overall migration positively influences the education–job match of PhD holders. In particular, migration flows at an early stage of an individual career (from high school to university) significantly reduce the probability of overeducation. However, this holds only if the migration is outside the macro region of origin. We also find that working abroad significantly reduces both overeducation and overskilling while increases job satisfaction. Finally, we find an alarming gender gap.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature. Section 3 presents the data and the variables. Sections 4 and 5 illustrate the empirical strategy and the results respectively. Section 6 concludes.

2 | LITERATURE BACKGROUND

The general increase in the number of doctoral graduates in recent years has not been accompanied by an increase in employment in the R&D and knowledge-intensive sectors. This suggests that the labour market structure is not able to absorb highly skilled individuals in occupations that fit their competencies and skills. This phenomenon has stimulated scholars to investigate the education–job mismatch and, in particular, the role of migration as an investment to 'reap the rewards to human capital' (Faggian et al., 2019, p. 151). Indeed, in recent years migration has involved a growing share of highly educated individuals who 'invest' in spatial mobility to improve their social and economic conditions (Faggian et al., 2017). Several studies have explored the factors affecting this migration decision, highlighting the role not only of economic and environmental determinants, such as the presence of agglomeration economies and the size of the local labour market (see, among others, Baláž et al., 2016; Berlingieri, 2019; Biagi et al., 2011; Faggian & Franklin, 2014; Ortensi & Barbiano di Belgiojoso, 2018; Williams et al., 2018), but also that of individual characteristics, such as gender (Impicciatore & Panichella, 2019; Williams et al., 2018), age (see Otrachshenko &

Popova, 2014; Van Mol, 2016) and individual personal traits, including students' quality (Faggian & Franklin, 2014) and individuals' openness to change and extroversion (Crown et al., 2020). In addition, the traditional human capital migration literature has also explored the returns of human capital migration in terms of better job opportunities (see, among others, Abreu et al., 2015; Croce & Ghignoni, 2015; Devillanova, 2013; Di Cintio & Grassi, 2013; Iammarino & Marinelli, 2015; Jewell & Faggian, 2014). Indeed, migration is an investment people make in their future to increase their chances of finding jobs that not only provide higher economic rewards but also support the matching of their knowledge, competencies and job tasks (see the seminal work by Sjaastad, 1962). Thus, this paper investigates this relationship by assuming that individuals who decide to migrate and, in particular, who choose to do so in the initial stage of their educational path and outside their macro region of origin, are more likely to have better job opportunities and hence less likely to experience education–job mismatch. Our expectations are supported by the evidence presented by Jewell and Faggian (2014) on U.K. university graduates, who found that migration in an early stage of an educational career that is repeated over time (i.e., from school to university and from university to first job) is associated with more job opportunities compared to late migration (i.e. migration for work).

Moreover, we do not look at wage premia derived from migration but rather concentrate on various dimensions of educational mismatch, specifically overeducation, overskilling and satisfaction. These dimensions have been extensively investigated in relation to Italian or U.K. university undergraduates, and several studies have reported that migration favours a good education–job match (Abreu et al., 2015; Croce & Ghignoni, 2015; Devillanova, 2013; Di Cintio & Grassi, 2013), especially when it involves a move from Southern to Northern regions (Iammarino & Marinelli, 2015). Similarly, looking at U.S. college graduates, it has been shown that migration reduces labour overeducation, especially in time of crisis (Waldorf & Do Yun, 2016), and it is more likely to occur toward geographical areas that offer employment opportunities that fit and reward graduate's competencies (Winters, 2017). Further, data on young people from Britain and Australia indicated that human capital migration, especially long-distance migration, increases job satisfaction (Perales, 2017).

Recently, scholars have begun to focus their attention on doctoral graduates. However, most studies mainly seem to look at the determinants of educational mismatch in entering the labour market and its impact on earnings or at the impact of the sector of activity on job satisfaction (see, among others, Alfano et al., 2021; Di Paolo & Mañé, 2016; Gaeta et al., 2017; Gaeta, 2015),[1] without explicitly considering the role of space. The role of migration is still under-investigated. For example, looking at U.S. PhD holders, Davis and Patterson (2000) observed that doctoral economists are more likely to switch regions for academic employment than for private-sector jobs. Similarly, Grogger and Hanson (2015) showed that economic conditions are the most important factor determining the mobility of U.S. PhD students in the field of science and engineering. Jewell and Kazakis (2020) analysed a sample of European doctoral holders and migration. However, only a handful of studies have considered the Italian case. In fact, to the best of our knowledge, there are only three Italian studies (Alfano, D'Uva, et al., 2019; Di Cintio & Grassi, 2017; Ghosh & Grassi, 2020). These studies mainly concentrated on international or interregional migration as an investment people realise in the final stage of their educational path (i.e., from PhD studies to the job market). For instance, Alfano, D'Uva, et al. (2019) studied the effect of interregional mobility on easing the education–job match but did not compare national and international markets or consider when migration occurs in an individual's life. Specifically, using data from two cohorts of Italian PhD holders (2008 and 2010), the authors found that only mobility within the Central and Northern regions has a positive effect on the education–job match, although most of the flows occur from Southern to Central-Northern regions. This is probably a consequence of lower job-search costs when moving within Northern regions. From another perspective, Di Cintio and Grassi (2017) and Ghosh and Grassi (2020) focussed on the impact of international migration on inbound PhD holders in the labour market. Di Cintio and Grassi (2017), using data on the population of Italian PhD holders from 2004 to 2006, provided evidence of a wage premia induced by international mobility. Similar results were reported by Ghosh and Grassi (2020), who explored the role of international migration on overeducation and overskilling with four cohorts of Italian PhD graduates (2004, 2006, 2008 and 2010). They found that investments in international spatial mobility are very effective in reducing the likelihood of education–job mismatch.

Building on this framework, we present our main hypothesis that migration should improve the education–job match of PhD holders. In doing so, we contribute to the existing literature in several ways. First, our analysis is based on the last wave of the Italian survey at the census level (ISTAT, 2018), which considers the whole population of students who graduated from doctoral programmes in 2012 and 2014. To the best of our knowledge, no other studies still explored this data set. Second, unlike the studies mentioned above, we analyse both the role of regional and international migration and extend the investigation to migration in different stages of an individual's educational path. The main hypothesis is that PhD holders who decide to migrate earlier in their educational path and outside their macro region of origin are less likely to experience education–job mismatch. Finally, we model the mismatch not only considering overeducation and overskilling, as usually done in literature, but also satisfaction. As suggested by Gaeta et al. (2017), satisfaction provides a different lens for exploring the phenomenon of overskilling than that typically used in the literature.

[1]For instance, Gaeta (2015) investigated the factors associated with the likelihood of being overeducated and overskilled, showing that family background, being self-employed and having a permanent job position play a major role. Similar results were reported by Di Paolo and Mañé (2016), who found a remarkable wage penalty for Spanish PhD holders who are both overeducated and overskilled. Gaeta et al. (2017) presented slightly different results. They analysed the wage penalty associated with overeducation, overskilling and dissatisfaction using data on Italian PhD holders and showed that while overeducation and dissatisfaction are associated with a considerable wage penalty, overskilling is not.

The next section includes a description of the data set and the variables employed in the analysis.

3 | DATA AND VARIABLES

The data set used in our analysis comes from ISTAT and includes information on the employment status of PhD holders in 2018, 4 (2014) and 6 (2012) years after graduation. The data set includes information on 22,098 PhD holders (11,459 in 2012 and 10,639 in 2014). The response rate was very high, with approximately 72% of interviewees providing answers to the questionnaire. However, the questions on educational mismatch were only asked of respondents who started their current job after the end of their doctoral studies. Of course, respondents who started their current job before concluding their doctoral studies (about 27%) are, by default, subject to some degree of educational mismatch. Respondents who had not obtained a job at the time of the interview were also excluded by the data set (about 6% of the population). Therefore, the. final data set we explored included approximately 10,500 PhD holders, representing about 50% of the population. This is a large share of the population, which ensures the reliability of our analysis. Table 1 reports the list of all variables employed in this study, while Tables 2 and 3 present some main descriptive statistics.

Table 2 shows that 19% of PhD holders report experiencing overeducation, 50% report overskilling and more than 73% are satisfied with the use of their competencies. We note that females are slightly more penalised than males (53% and 47% respectively), 43% of the respondents are married and 32% have children. Most of the respondents have both parents employed (53%) and 80% have at least one parent with a degree or who completed a higher level of education. In addition, 28% of the respondents work in universities, while only 5.49% work in R&D departments of private institutions. A large share had teaching experience during their PhD programmes (70.88%), while slightly less than 50% travelled abroad. Almost 19% of the respondents work abroad (see the *Labour Market* variable), while about 22% work in the North-West, 16% in the North-East, 23% in the Centre and 20% in the South and Islands.

In this study, we focus on the Italian macro regions (NUTS1 level[2]): North-West, North-East, Centre, South and Islands. While this spatial level of aggregation may appear unsuitable for a migration study, it is appropriate in our case, as the population includes PhD holders. In Italy, this population amounts to about 10,000 people a year, and this specific group of people usually moves in specialised

[2]The NUTS classification (*Nomenclature of Territorial Units for Statistics*) is a geocoded standard that divides European countries for statistical and policy purposes. It consists of three different NUTS levels, moving from larger to smaller territorial units (e.g., one NUTS1 area typically contains several NUTS2 areas, and one NUTS2 area typically contains several NUTS3 areas). Above NUTS1 is the national level of the Member State. In Italy, there are five NUTS1 regions: North-West, North-East, Centre, South and Islands. For the purposes of this study, we combine the Islands with the South due to the low number of observations for the Islands and the structural homogeneity between the two regions. Thus, our geographical classification for Italy includes four NUTS1 areas, to which we add the foreign market to account for the PhD choice of working abroad.

TABLE 1 List of variables.

Dependent variables	
Migration	Dummy variable equal to 1 if the individual migrates at least once in his life and 0 otherwise.
Overeducation	Dummy variable equal to 1 if the PhD title was not a requirement to get the job and 0 otherwise.
Overskilling	Dummy variable equal to 1 if the PhD title was not useful or needed to carry out the job and 0 otherwise.
Satisfaction	Dummy variable equal to 1 if the respondent is satisfied with the use of PhD skills in carrying out the job and 0 otherwise.
Individual-level variables (X)	
Age	Categorical variable indicating the age of the PhD holders: 1 = age ≤ 28 (*reference*); 2 = 29 ≤ age ≤ 30; 3 = 31 ≤ age ≤ 34; 4 = age ≥ 35 years.
Female	Dummy equal to 1 if the respondent is a female and 0 otherwise.
Married	Dummy equal to 1 if the respondent is married and 0 otherwise.
Children	Dummy equal to 1 if the respondent has at least 1 child and 0 otherwise.
Parents' Education	Dummy variable equal to 1 if parents' educational level is high school, degree or more and 0 otherwise.
Parents' Occupation	Dummy variable equal to 1 if both parents are employed and 0 otherwise.
Individual-level variables (X)	
Job contract	Categorical variable indicating the type of job contract 1 = permanent contract (*reference*); 2 = fixed-term contract; 3 = atypical contract (occasional employment, self-employed, research grant).
Experience	Categorical variable indicating the years of experience in the job. 0 year = 2018–2018 (*reference*); 1 year = 2018–2017; 2 years = 2018–2016; 3 years = 2018–2015; 4 years = 2018–2014; 5 years = 2018–2013; 6 years = 2018–2012.
Sector of activity	Categorical variable indicating the sector of activity: 1 = R&D in public administrations (*reference*); 2 = R&D in private institution; 3 = Industry; 4 = University; 5 = Non-academic education; 6 = Agriculture and other services.

TABLE 1 (Continued)

Education-related variables (T)	
Specialisation	Categorical variable indicating the PhD specialisation: 1 = LS: Science and medicine (*reference*) 2 = PE: Physics and engineering; 3 = SH: Social sciences.
Year of PhD	Dummy variable equal to 1 if the PhD was completed in 2012 and 0 otherwise.
Scholarship	Dummy variable equal to 1 if benefitted from a scholarship during the PhD and 0 otherwise.
Degree grade	Categorical variable indicating the degree grade: 1 = grade ≤ 104 (*reference*); 2 = 105 ≤ grade ≤ 109; 3 = grade ≥ 110.
Teaching	Dummy variable equal to 1 if the respondent did some teaching activity during the PhD and 0 otherwise.
Visiting	Dummy variable equal to 1 if the respondents spent a research period abroad during the PhD and 0 otherwise.
In time	Dummy variable assuming equal to 1 if PhD was finished in time.
Migration-related variables	
High school to university	Categorical variable indicating migration from high school to degree 1 = no migration (*reference*); 2 = inside the macro region; 3 = outside the macro region.
University to PhD	Categorical variable indicating migration from university to PhD: 1 = no migration (*reference*); 2 = inside the macro region; 3 = outside the macro region.
PhD to labour market	Categorical variable indicating migration from PhD to labour market: 1 = no migration (*reference*); 2 = inside the macro region; 3 = outside the macro region; 4 = migration abroad.
Regional labour market (R)	
Labour Market Dummies	Dummies indicating where the respondent works: Foreign labour market (*reference*) and macro regions (North-West; North-East, Centre; South and Islands).
Inverse Mill's ratio (IMR)	
IMR	Inverse Mill's ratio from Equation (1) (migration decision)

environments and over longer distances. In other words, the physical distance should be less important in this case, while the socio-economic distance across regions should matter more. As suggested by Biagi et al. (2022) and Di Berardino et al. (2019), PhD holders do not move from one poor region to another; rather, they move from poorer regions (South in Italy) to richer regions (North-West and North-East in Italy). In terms of socio-economic conditions, the Italian macro regions are quite homogeneous within their territorial borders, while they are heterogeneous if compared to each other (Bonifazi et al., 2021), and thus were suitable for use in this study.

Moreover, it is quite likely that people may choose to be commuters rather than migrants within the same macro region. However, our estimates also control for migration flows inside each macro region (i.e., *intra-regional migration*). Finally, we consider an additional category (*foreign labour market*) to account for migration flows directed toward more prosperous labour markets abroad.

Table 3 reports a breakdown of migration flows by stage of the educational path. We can see that 77.64% of PhD holders had no migration experience from high school to university, 75.07% from university to PhD, and 56.64% from PhD to the labour market. Most of migration flows occur from PhD to the labour market and outside the macro region (36.86%). The flows from high school to university and from university to PhD are non-negligible in the case of migration outside the macro region (17.85% and 18.32%, respectively). Irrespective of the stage of the educational path, the flows inside the macro region are the lowest.

4 | EMPIRICAL STRATEGY

Our first research question (*RQ1*) aims to assess the impact of migration in general on the education–job mismatch. In this stage, we do not focus on the heterogeneity in the migration phenomenon but rather on a comparison between migrants and non-migrants. The idea is simply that people who have had at least a migratory experience—independently of the 'time' and 'space' characteristics of migration—benefit in terms of education–job match.

The empirical literature suggests the need to control for the potential endogeneity of migration in this type of investigation (see, among others, Alfano, D'Uva, et al., 2019; Croce & Ghignoni, 2015; Devillanova, 2013; Ghosh & Grassi, 2020). In short, the decision to migrate could be associated with unobservable individual characteristics, which in turn may also affect the education–job mismatch. Ghosh and Grassi (2020) argued that 'if migration is positively related to ambition (or ability) then migration and mismatching might be negatively correlated even in the absence of a true causal relationship' (p. 10). Accordingly, we first estimate a selection equation as follows:[3]

$$\Pr(Migration = 1) = \alpha + \vartheta X + \varphi E + u \quad (1)$$

where *Migration* is a dummy that equals 1 if the individual has migrated at least once in his life and is 0 otherwise; X is a matrix of

[3]Subscripts are omitted for simplicity.

TABLE 2 Summary statistics.

Variables	Frequency	%
Migration	5796	54.31%
Overeducation	1984	18.59%
Overskilling	5333	49.97%
Satisfaction	7814	73.21%
Age		
Age ≤ 28	2056	19.26%
29 ≤ Age ≤ 30	3611	33.83%
31 ≤ Age ≤ 34	3303	30.95%
Age ≥ 35	1703	15.96%
Female	5665	53.08%
Married	4625	43.33%
Children	3501	32.80%
Parents' Education	8542	80.52%
Parents' Occupation	5656	52.99%
Job contract		
Permanent	3834	35.92%
Fixed-term contract	2736	25.63%
Atypical contract	4103	38.44%
Experience		
0 Year	852	7.98%
1 Years	3217	30.14%
2 Years	2088	19.56%
3 Years	1783	16.71%
4 Years	1023	9.58%
5 Years	701	6.57%
6 Years	1009	9.45%
Sector of activity		
R&D in public admin.	1060	9.97%
R&D in private institution	583	5.49%
Industry	1010	9.50%
University	2975	27.99%
Non-academic education	1789	16.83%
Agriculture and other services	3211	30.21%
Specialisation		
LS (Science and Medicine)	3282	30.75%
PE (Physics and Engineering)	4070	38.13%
SH (Social Sciences)	3321	31.12%
Year of PhD		
2014	4725	44.27%
2012	5948	55.73%
Scholarship	8491	79.56%
Degree grade		
Grade ≤ 104	1225	11.48%
105 ≤ Grade ≤ 109	1383	12.96%
Grade ≥ 110	8065	75.56%
Teaching	7565	70.88%
Visiting	5186	48.59%
In time	8986	84.19%
Labour market		
Foreign	2021	18,94%
North-West	2344	21.96%
North-East	1693	15.86%
Centre	2433	22.80%
South and Islands	2182	20.44%

TABLE 3 Migration flows by stage of education path.

	High school to university	University to PhD	PhD to labour market
No migration	8287	8012	6045
	(77.64%)	(75.07%)	(56.64%)
Inside macro region	481	706	694
	(4.51%)	(6.61%)	(6.50%)
Outside macro region	1905	1955	3934
	(17.85%)	(18.32%)	(36.86%)
Total	10,673	10,673	10,673
	(100%)	(100%)	(100%)

covariates that includes some main individual characteristics (gender, parents' education and occupation); and the matrix *E* includes the exclusion restrictions, which are the *Age of Graduation* and the region of origin (*Regional Dummies*[4]). The first variable is used as a proxy of an individual's abilities (Clark & Lisowski, 2019; Labrianidis & Vogiatzis, 2013), while the second measures the role of space on the decision to migrate. As suggested by past studies, people who graduate later should be less likely to migrate (Otrachshenko & Popova, 2014; Van Mol, 2016), while those living in peripheral and/or less developed regions (e.g. the South of Italy) should be more likely to migrate (Ballarino et al., 2014; Impicciatore & Panichella, 2019).

Equation (1) allows us to control Equation (2) for the potential endogeneity effects of migration on the education–job match by including the inverse Mill's ratio (IMR) as follows:

[4]NUTS2 spatial level.

$$\begin{cases} \Pr(Overeducation = 1) = \beta_1 X + \delta_1 Z + \theta_1 T + \mu_1 R \\ \qquad\qquad + \gamma_1 Migration + \lambda_1 IMR + \varepsilon_1 \\ \Pr(Overskilling = 1) = \beta_2 X + \delta_2 Z + \theta_2 T + \mu_2 R + \gamma_2 Migration \\ \qquad\qquad + \lambda_2 IMR + \varepsilon_2 \\ \Pr(Satisfaction = 1) = \beta_3 X + \delta_3 Z + \theta_3 T + \mu_3 R + \gamma_3 Migration \\ \qquad\qquad + \lambda_3 IMR + \varepsilon_3 \end{cases} \quad (2)$$

We consider education–job match to be a multidimensional phenomenon that can be measured from the following three perspectives (see Gaeta et al., 2017):

- *Overeducation*, that is, a PhD is required to get the job;
- *Overskilling*, that is, a PhD is necessary to do the job;
- *Satisfaction*, that is, the PhD holder is satisfied with using the knowledge acquired from doctoral studies in doing the job.[5]

The first two variables are binary, while the third was originally measured by a Likert scale (0–10). However, we need to apply the same scale to all three variables if we want to model the phenomenon as multidimensional using a multivariate probit model. Thus, we transform *Satisfaction* into a binary variable as follows: 0–5 unsatisfied; 6–10 satisfied. *Satisfaction* is usually employed in literature as a more accurate measure of overskilling (Allen & van der Velden, 2001; Iammarino et al., 2011; Gaeta et al., 2017). For example, respondents might use the skills acquired during doctoral studies, so they do not report overskilling, but this use could be at a lower intensity, leading them to report being unsatisfied.

Regarding the choice of covariates, following previous studies (Croce & Ghignoni, 2015; Devillanova, 2013; Gaeta et al., 2017; Impicciatore & Panichella, 2019; Williams et al., 2018), we include individual characteristics, job and education characteristics as well as environmental determinants. The matrix X includes the following individual characteristics: *Age*, we expect that older and more experienced individuals suffer less the education–job mismatch (Devillanova, 2013; Di Paolo & Mañé, 2016); *Gender*, we expect females to be less likely to migrate and more likely to experience education–job mismatch, and similar results are expected for marital status (*Married*) and having *Children* (Gaeta et al., 2017; Ghosh & Grassi, 2020); family background, including *Parents' Education* and *Parents' Occupation*, which might influence their matching and provide them with better economic conditions, larger networks and more opportunities (Croce & Ghignoni, 2015; Di Cintio & Grassi, 2017). The matrix *Z* includes 'job-related' variables: *Job Contract*, *Experience* and *Sector of Activity*. We expect temporary contracts and R&D activities (either public or private) to be positively associated with the education–job match (see Alfano et al., 2021). The matrix T includes 'education-related' variables, such as: *Visiting* and *Teaching*, which allow PhD holders to gain experience and increase their relationship networks, thus, possibly exerting a positive impact on the education–job match (Gaeta, 2015) and field of study[6] (*Specialisation*). However, in line with previous studies, which did not find significant differences by field, we did not have strong a priori expectations regarding the field of study (Gaeta, 2015; Ghosh & Grassi, 2020). Finally, the matrix *R* includes a set of dummies for 'regional labour markets' at the NUTS1 level.

The second research question (*RQ2*) explores the impact of different migration investments on the educational–job match. We differentiate migration along two dimensions: 'time' and 'space'. Regarding 'time', following Jewell and Faggian (2014), we consider whether migration happens (i) from high school to university,[7] (iii) from university to PhD or (iii) from PhD to job market. In terms of 'space', we account for movements (i) between NUTS1 regions (*outside macro region*) and (ii) between NUTS2 regions within the same NUTS1 region (*inside macro region*). The assumption here is that people who decide to migrate at the beginning of their educational path and outside their macro region of origin invest more and hence should achieve the highest return as well as a better education–job match.

5 | EMPIRICAL RESULTS

Table 4 reports the average marginal effects from the estimation of Equation (1). We find that females have a lower propensity to migrate than males (see Ortensi & Barbiano di Belgiojoso, 2018). The probability to migrate increases for individuals whose parents have higher educational levels and are employed (Labrianidis & Vogiatzis, 2013). In line with previous studies, we find that the probability of migration is lower for people who get their degree late (Otrachshenko & Popova, 2014; Van Mol, 2016).[8] Importantly, these estimates allow us to control for endogeneity of migration in Equation (2) by including the IMR. If this is not significant, we can

[5]The questionnaire specifically asks PhDs the following questions: 'Was the doctorate expressly required to access your current job?' (Overeducation); 'In your opinion, is the doctorate necessary to carry out your current job?' (Overskilling); 'How satisfied are you in the use of the knowledge acquired during the doctorate' (Satisfaction).

[6]The data set distinguishes 14 fields of study: Mathematical and Computer Sciences; Physical Sciences; Chemical Sciences; Earth Science; Biological Science; Medical Sciences; Agricultural and Veterinary Sciences; Civil Engineering and Architecture; Industrial and Information Engineering; Sciences of Antiquity, Philological-Literary and Historical-Artistic; Historical, Philosophical, Pedagogical and Psychological Sciences; Legal Sciences; Economic and Statistical Sciences; Political and Social Sciences. However, this classification is common only in Italy. To be coherent with the European classification, the 14 fields are aggregated into three groups (Science and medicine; Physics and engineering; Social sciences), which are also those on which calls for research projects in all European countries are focussed. For these reasons and in line with previous studies (i.e., Alfano, Cicatiello, et al., 2019; Alfano, D'Uva, et al., 2019; Gaeta, 2015; Parenti et al., 2020), we adopt the European classification. However, we also ran the regressions with the 14 categories, and the main results were unchanged.

[7]We excluded in the first migration stage people who came from abroad and enroled in Italian universities. They amount to a handful of observed units. In the second migration stage, we only included people who enroled in Italian universities to attend a PhD programme.

[8]We also include regional dummies at NUTS-2 level. For the sake of brevity, we do not report the estimates. However, we find that individuals from most Southern regions (e.g., Puglia, Basilicata, Campania, Calabria and Sicily) are more likely to migrate. This corroborates the discussion provided by Impicciatore and Panichella (2019), who analysed Italian internal migration from the South to the North. Estimates are available upon request from the authors.

TABLE 4 Selection equation for migration–probit model.

Variables	Migration
Female	−0.0698***
	(0.00968)
Parents education	0.0346***
	(0.0128)
Parents occupation	0.0304***
	(0.0101)
Age graduation	
Age ≤ 24	*Reference*
25 ≤ Age ≤ 26	−0.0292**
	(0.0117)
27 ≤ Age ≤ 30	−0.0830***
	(0.0141)
Age ≥ 31	−0.164***
	(0.0241)
Regional dummies	Yes
Mcfadden	0.037
Mcfadden (adjusted)	0.034
Percentage of correctly predicted	60%
Observations	10,136

Note: The values reported are the average marginal effects. Standard Errors in Parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

conclude that the relationship between the migration decision and education–job match variable (overeducation, overskilling and satisfaction) is not affected by sample selection bias and, thus, by endogeneity issues.

Table 5 provides the results for the multivariate probit in Equation (2). Many interesting findings emerge in relation to individual-level variables. First, older respondents are more likely to enter the labour market but also to experience both overeducation and overskilling. Moreover, they are less likely to be satisfied with their job. Confirming past evidence (Alfano, Cicatiello, et al., 2019; Croce & Ghignoni, 2015), we find significant gender discrimination, with females having less favourable job opportunities than males. Unexpectedly, being *Married* and having *Children* do not play a role. However, we cannot be sure that individuals get married and have children before entering the labour market.[9] Regarding the family of origin, we find that the probability of being overeducated is lower if the parents are highly educated (*Parents' Education*) and employed

[9]As in Croce and Ghignoni (2015), we also tried to interact *Females* with both *Married* and *Children*, but no significant effect emerged. Therefore, gender discrimination seems to exist independently of a woman's family status. These results are not reported here for brevity, but they should be interpreted with caution for the reasons mentioned above.

TABLE 5 Education–job mismatch—multivariate probit model.

Variables	Overeducation (1)	Overskilling (2)	Satisfaction (3)
Age			
Age ≤ 28	*Reference*	*Reference*	*Reference*
29 ≤ Age ≤ 30	0.178***	0.102**	−0.0973**
	(0.0517)	(0.0446)	(0.0420)
31 ≤ Age ≤ 34	0.293***	0.218***	−0.193***
	(0.0538)	(0.0477)	(0.0445)
Age ≥ 35	0.303***	0.141**	−0.164***
	(0.0645)	(0.0601)	(0.0552)
Female	0.184***	0.145***	−0.122***
	(0.0361)	(0.0333)	(0.0310)
Married	−0.0292	0.0546	0.0177
	(0.0386)	(0.0361)	(0.0334)
Children	0.00208	−0.0410	0.0157
	(0.0409)	(0.0388)	(0.0357)
Parents' Education	−0.0810*	0.00580	−0.0442
	(0.0417)	(0.0396)	(0.0366)
Parents' Occupation	−0.0715**	0.00817	0.0586**
	(0.0342)	(0.0317)	(0.0294)
Job Contract			
Permanent Contract	*Reference*	*Reference*	*Reference*
Fixed-Term Contract	−0.0834*	−0.196***	−0.0575
	(0.0451)	(0.0418)	(0.0385)
Atypical Contract	−0.0425	−0.312***	−0.0338
	(0.0414)	(0.0395)	(0.0368)
Experience			
0 Year	*Reference*	*Reference*	*Reference*
1 Year	0.0538	0.0409	−0.120**
	(0.0695)	(0.0612)	(0.0582)
2 Years	0.168**	0.00897	−0.147**
	(0.0721)	(0.0642)	(0.0610)
3 Years	0.149**	0.0566	−0.119*
	(0.0733)	(0.0657)	(0.0623)
4 Years	0.126	0.0862	0.00392
	(0.0797)	(0.0732)	(0.0693)
5 Years	0.263***	0.114	−0.0228
	(0.0879)	(0.0815)	(0.0773)
6 Years	0.183**	0.203***	−0.118*
	(0.0821)	(0.0751)	(0.0708)

TABLE 5 (Continued)

Variables	Overeducation (1)	Overskilling (2)	Satisfaction (3)
Sector of Activity			
R&D In Public Administration	*Reference*	*Reference*	*Reference*
R&D In Private Institution	0.262**	0.574***	−0.243***
	(0.126)	(0.0777)	(0.0845)
Industry	1.361***	1.615***	−0.917***
	(0.0998)	(0.0728)	(0.0725)
University	−0.0551	−0.170***	0.0371
	(0.0999)	(0.0635)	(0.0638)
Nonacademic Education	0.787***	1.858***	−0.929***
	(0.0968)	(0.0684)	(0.0672)
Agriculture And Other Services	1.518***	1.849***	−1.050***
	(0.0899)	(0.0608)	(0.0610)
Specialisation			
LS	*Reference*	*Reference*	*Reference*
PE	−0.0107	0.0514	−0.0539
	(0.0424)	(0.0387)	(0.0360)
SH	0.130***	0.0457	−0.0286
	(0.0429)	(0.0407)	(0.0373)
Year of PhD	0.0449	−0.00243	−0.0579*
	(0.0364)	(0.0335)	(0.0310)
Scholarship	−0.0788**	−0.0316	0.102***
	(0.0395)	(0.0380)	(0.0347)
Degree Grade			
Grade ≤ 104	*Reference*	*Reference*	*Reference*
105 ≤ Grade ≤ 109	−0.0537	−0.108*	0.00934
	(0.0643)	(0.0622)	(0.0576)
Grade ≥ 110	−0.102*	−0.0874*	−0.00654
	(0.0538)	(0.0519)	(0.0481)
Teaching	−0.0186	0.000158	0.0817***
	(0.0367)	(0.0340)	(0.0313)
Visiting	−0.147***	−0.0874***	0.0711**
	(0.0347)	(0.0320)	(0.0297)
In Time	−0.0854*	−0.0248	−0.00636
	(0.0449)	(0.0433)	(0.0398)
Labour Market			
Foreign	*Reference*	*Reference*	*Reference*
North-West	0.351***	0.390***	−0.133**
	(0.0669)	(0.0549)	(0.0523)
North-East	0.452***	0.405***	−0.145***
	(0.0701)	(0.0584)	(0.0556)
Centre	0.385***	0.366***	−0.176***
	(0.0668)	(0.0552)	(0.0523)
South and Islands	0.384***	0.312***	−0.141**
	(0.0731)	(0.0621)	(0.0585)
Migration	−0.0761**	−0.115***	0.0275
	(0.0373)	(0.0354)	(0.0327)
IMR	−0.145	−0.0161	−0.0837
	(0.115)	(0.107)	(0.0986)
Constant	−2.005***	−1.278***	1.586***
	(0.199)	(0.172)	(0.161)
Correlation of Error Terms	0.520***	−0.545***	−0.618***
	(0.0229)	(0.0198)	(0.0211)
Observations	10,094	10,094	10,094

Note: Estimate Coefficients by Multivariate Probit. Standard Errors In Parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

(*Parents' Occupation*), while satisfaction only depends on having both parents employed.

Looking at the job-related variables, we find that individuals with fixed-term or atypical contracts are less likely to report overskilling (see Gaeta, 2015). This result points to a potential trade-off between finding a permanent job or finding one that 'fits' their education and skills. *Experience* does not reduce the education–job mismatch, pointing to some long-term 'lock-in' effect. However, this result could be affected by the economic cycle, as more years of experience (e.g. 4, 5 and 6 years) correspond to periods of intense economic depression (i.e. 2014, 2013, 2012). The results related to the variable *Sector of Activity* are interesting. Lower probabilities of educational mismatching, in terms of all three measures, are found for people who hold public R&D or academic positions, while alarming results emerge for private R&D, where individuals are more likely to experience education–job mismatching. This clearly points to a potential underutilisation of employees' competencies and skills, as also highlighted by Di Paolo and Mañé (2016).

Regarding the set of education-related variables, doctors specialised in social sciences (SH) are more likely to suffer from overeducation (in line with Di Paolo & Mañé, 2016). Moreover, we find a positive influence of *Scholarship* on both overeducation and

satisfaction, while *Degree Grade* reduces the probability of being overeducated and overskilled. Students who decided to spend a period abroad during their PhD studies (*Visiting*) are less likely to report overeducation and overskilling and more likely to be satisfied with their job (see Gaeta, 2015). In line with Ghosh and Grassi (2020), we find that having completed the PhD on time has a negative and statistically significant effect, but only on overeducation.

Finally, we control for regional labour markets. We find worse occupational conditions (higher probabilities of overeducation and overskilling and a lower probability of satisfaction) in all Italian macro regions in comparison with the international labour market, which is used as a reference category. This result is in line with that of Ghosh and Grassi (2020), who found a positive impact of international mobility on the educational–job match. Consistent with our expectations, we find that migration improves the education–job match of PhD holders by significantly reducing the probability of both overeducation and overskilling. We do not find evidence of sample selection bias, as the IMR is never statistically significant. This could be explained by the fact that we use population data and, moreover, that such endogeneity issues do not seem to affect the migration of PhD graduates. Rather, it only affects individuals with lower education levels, as highly educated individuals constitute a very homogeneous group (Ghosh & Grassi, 2020; McGuinness & Sloane, 2011). Instead, the correlation of error terms is significant, confirming the choice of a multivariate model to investigate overeducation, overskilling and satisfaction in relation to the education–job match.

The results in Table 6 split migration by time and space. The results for individual-level variables, job-related variables and education-related variables are all in line with those presented in Table 5. Combining the results of the two tables, we can conclude that spatial mobility is a way to reduce the education–job mismatch, but not all migrations have the same effect. PhD holders who decide to migrate in the first stage of their educational path (from high school to university) and outside their macro region of origin are better off. In other words, independently of the market in which people work, the larger the migration investment in terms of both time and space, the lower the probability of being overeducated for a job. The same applies when the decision to migrate outside the macro region occurs in the final stage, that is, from PhD to the labour market.

We note that interregional migration effects may be hidden by the sizable gap between domestic and foreign labour markets. For this reason, in the next section, we will replicate the analysis, isolating the sub-population of people who work in the domestic market. In addition, other robustness checks are provided.

6 | ROBUSTNESS CHECKS

In this section, we provide some robustness checks by excluding specific categories of respondents that may influence the results described above. First, as suggested by Ghosh and Grassi (2020), individuals who obtain academic positions should be less exposed to

TABLE 6 Education–Job Mismatch and Migration Flows – Multivariate Probit Model.

Variables	*Overeducation* (1)	*Overskilling* (2)	*Satisfaction* (3)
Age			
Age ≤ 28	*Reference*	*Reference*	*Reference*
29 ≤ Age ≤ 30	0.179***	0.103**	−0.0976**
	(0.0517)	(0.0446)	(0.0420)
31 ≤ Age ≤ 34	0.295***	0.217***	−0.194***
	(0.0539)	(0.0478)	(0.0446)
Age ≥ 35	0.303***	0.139**	−0.164***
	(0.0647)	(0.0603)	(0.0553)
Female	0.188***	0.143***	−0.119***
	(0.0363)	(0.0335)	(0.0311)
Married	−0.0310	0.0546	0.0176
	(0.0386)	(0.0361)	(0.0334)
Children	0.00265	−0.0397	0.0149
	(0.0409)	(0.0388)	(0.0357)
Parents' Education	−0.0831**	0.00728	−0.0469
	(0.0418)	(0.0397)	(0.0367)
Parents' Occupation	−0.0710**	0.00792	0.0577**
	(0.0342)	(0.0318)	(0.0294)
Job contract			
Permanent contract	*Reference*	*Reference*	*Reference*
Fixed-term contract	−0.0848*	−0.193***	−0.0587
	(0.0452)	(0.0418)	(0.0385)
Atypical contract	−0.0432	−0.309***	−0.0346
	(0.0414)	(0.0395)	(0.0368)
Experience			
0 Year	*Reference*	*Reference*	*Reference*
1 Year	0.0575	0.0425	−0.120**
	(0.0696)	(0.0612)	(0.0582)
2 Years	0.171**	0.00991	−0.145**
	(0.0722)	(0.0641)	(0.0610)
3 Years	0.152**	0.0559	−0.118*
	(0.0734)	(0.0657)	(0.0623)
4 Years	0.130	0.0867	0.00543
	(0.0798)	(0.0732)	(0.0693)
5 Years	0.267***	0.116	−0.0227
	(0.0880)	(0.0815)	(0.0773)
6 Years	0.186**	0.205***	−0.117*
	(0.0822)	(0.0751)	(0.0708)
Sector of activity			
R&D in public administration	*Reference*	*Reference*	*Reference*

TABLE 6 (Continued)

Variables	*Overeducation* (1)	*Overskilling* (2)	*Satisfaction* (3)
R&D in private institution	0.262**	0.575***	−0.246***
	(0.126)	(0.0777)	(0.0845)
Industry	1.366***	1.620***	−0.917***
	(0.0999)	(0.0728)	(0.0725)
University	−0.0553	−0.168***	0.0367
	(0.100)	(0.0635)	(0.0639)
Non-academic education	0.788***	1.866***	−0.930***
	(0.0969)	(0.0684)	(0.0673)
Agriculture and other services	1.525***	1.854***	−1.052***
	(0.0900)	(0.0608)	(0.0610)
Specialisation			
LS	*Reference*	*Reference*	*Reference*
PE	−0.0101	0.0508	−0.0538
	(0.0424)	(0.0387)	(0.0360)
SH	0.124***	0.0501	−0.0320
	(0.0431)	(0.0409)	(0.0375)
Year of PhD	0.0409	−0.00177	−0.0593*
	(0.0364)	(0.0335)	(0.0310)
Scholarship	−0.0799**	−0.0328	0.102***
	(0.0396)	(0.0381)	(0.0347)
Degree grade			
Grade ≤ 104	*Reference*	*Reference*	*Reference*
105 ≤ Grade ≤ 109	−0.0524	−0.108*	0.0104
	(0.0644)	(0.0622)	(0.0577)
Grade ≥ 110	−0.100*	−0.0872*	−0.00642
	(0.0539)	(0.0519)	(0.0481)
Teaching	−0.0191	−0.00162	0.0860***
	(0.0368)	(0.0341)	(0.0314)
Visiting	−0.146***	−0.0870***	0.0704**
	(0.0348)	(0.0320)	(0.0297)
In time	−0.0845*	−0.0230	−0.00623
	(0.0450)	(0.0434)	(0.0399)
Migration: high school to university			
No migration	*Reference*	*Reference*	*Reference*
Migration inside macro region	−0.00569	−0.0560	0.0491
	(0.0781)	(0.0745)	(0.0692)
Migration outside macro region	−0.106**	−0.0245	−0.00970
	(0.0517)	(0.0469)	(0.0436)
Migration: University to PhD			
No migration	*Reference*	*Reference*	*Reference*
Migration inside macro region	0.157**	−0.0990	−0.0108
	(0.0741)	(0.0688)	(0.0644)
Migration outside macro region	0.0189	−0.0287	0.0655
	(0.0535)	(0.0480)	(0.0453)
Migration: PhD to labour market			
No migration	*Reference*	*Reference*	*Reference*
Migration inside macro region	−0.0237	−0.0110	0.0539
	(0.0729)	(0.0689)	(0.0644)
Migration outside macro region	−0.0828*	−0.103**	−0.00257
	(0.0484)	(0.0450)	(0.0418)
Labour market			
Foreign	*Reference*	*Reference*	*Reference*
North-West	0.413***	0.475***	−0.146***
	(0.0680)	(0.0552)	(0.0527)
North-East	0.501***	0.485***	−0.161***
	(0.0699)	(0.0581)	(0.0552)
Centre	0.444***	0.445***	−0.190***
	(0.0666)	(0.0547)	(0.0517)
South and Islands	0.441***	0.402***	−0.160***
	(0.0690)	(0.0574)	(0.0540)
IMR	−0.148	0.00466	−0.0982
	(0.117)	(0.108)	(0.100)
Constant	−2.077***	−1.394***	1.613***
	(0.193)	(0.166)	(0.155)
Correlation of error terms	0.522***	−0.546***	−0.618***
	(0.0230)	(0.0198)	(0.0212)
Observations	10,094	10,094	10,094

Note: Estimate coefficients by multivariate probit. Standard errors in parentheses.

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

mismatching. This may be true if we look at overeducation, but it is not as obvious if we look at overskilling and satisfaction and requires further investigation. A second issue to investigate further is the difference between domestic and foreign labour markets. Alfano, D'Uva, et al. (2019) suggested excluding people who get a job abroad

to better explore the impact of regional flows of migration on education–job matching.

Therefore, we compare estimates of our model in Table 6 with those obtained by excluding all respondents who obtain an academic job and/or get a job abroad (Supporting Information: Tables A1 and A2). The empirical results appear to be very stable. Unfortunately, gender discrimination is robust in all of the estimated models. Another notable result relates to the type of job contract. When we exclude people who obtain an academic job and/or a job abroad, we find that a fixed-term contract significantly reduces the probability that they will be satisfied. This means that people may be satisfied with fixed-term contracts when balancing them with other conditions, such as working in an academic context or in an international market. Regarding migration, we still find a positive effect on education–job match, especially when migration occurs early in the individual's educational path and outside their macro region of origin. Unexpectedly, Supporting Information: Table A2 does not reveal a North–South divide. Using the North-West region for reference, we do not find any significant differences across the macro regions. The only exception is the probability of over-education, which is higher in the North-East.

7 | CONCLUSION

This paper contributes to the existing literature on the role of migration in the education–job mismatch of PhD graduates. Modelling matching as a multidimensional phenomenon involving overeducation, overskilling and satisfaction, we explore whether investing in migration in earlier stages of an individual's life and moving outside the macro region of origin reduce overeducation and overskilling while increasing individual satisfaction. To the best of our knowledge, the few studies on PhD holders' education–job mismatch have not considered all these aspects simultaneously. Using the most recent wave of the Italian survey on the employability of PhD holders (ISTAT, 2018), we evaluate the role of different types of migration on overeducation, overskilling and job satisfaction. Italy is a perfect case study because education–job mismatch is a real issue, as the number of R&D employees in both the public and private sectors remains very low compared to the other European countries, despite the efforts made by the government to increase the number of PhD graduates (and the plans to increase them sensibly in the near future).

The empirical results confirm our main hypothesis. Indeed, we find a positive role of spatial mobility on the education–job match, especially migration in the early stage of the educational path (i.e. from high school to university) and outside the macro region of origin. While, unexpectedly, we do not find evidence of the well-known Italian North–South divide, we find a significant gap between the Italian and foreign labour markets in all three mismatch dimensions (i.e., overeducation, overskilling and satisfaction). People investing in international migration are more likely to reap the rewards in terms of a better education–job match. This is alarming for policymakers. In fact, international mobility of Italian doctoral students is an integral part of their courses to increase their human capital, with the intent of exploiting the newly acquired skills and knowledge to help the country grow and progress. However, this golden opportunity for growth seems fatally lost for Italy, as retention of graduates is difficult, given the non-attractiveness of the Italian labour market especially for high-skilled individuals whose skills are not adequately recognised and rewarded (worse matching). This seems to occur in Italy, differently than in other foreign countries—for example, the United States, Germany and the United Kingdom—where the education–job mismatch is lower (OECD, 2019).

Our evidence points to another alarming signal for policymakers. In fact, in line with previous work, we observe a significant gender gap in the education–job match, with women being penalised irrespective of marital status or having children. This result is dramatically robust in our study. Despite the presence of women among doctoral graduates has increased over time, they still suffer from high unemployment rates and are disproportionally allocated to part-time occupations or temporary contracts. Past evidence suggests that in Italy, there are still strong cultural ties that see women mostly devoted to childcare and household. For example, they often decide to migrate in response to their partners' movements rather than to search for better job opportunities (Impicciatore & Panichella, 2019).

In conclusion, our results emphasise the urgent need in Italy to support the creation of job opportunities that fit the knowledge, competencies and skills of PhD holders, filling international and gender gaps. This issue has been partially addressed by the *National Recovery and Resilience Plan*, that has set out extraordinary investments aimed at creating new job positions in academia, and in particular for women. However, the low competitiveness of Italian wages compared to international ones remains an unsolved problem, especially in a period of dramatic reduction in household purchasing power due to rising inflation. Finally, there is still a lack of understanding of the importance of doctoral skills and competencies in the private sector, notwithstanding policymakers favouring stronger research collaboration between doctoral students and companies (e.g., the so-called 'industrial doctoral studies'). A clear change of mentality is needed on this and this will require time and a constant effort.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data used in this paper are available upon request to the Italian National Institute of Statistics (ISTAT) at the following link: https://www.istat.it/it/archivio/87536.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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