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Old but gold: The use of multiregional life tables and the place-of-birth-dependent approach for studying recent internal migration in Italy

Alessio Buonomo[1†*], Federico Benassi[1†], Oliviero Casacchia[2†], and Salvatore Strozza[1†]

[1]Department of Political Sciences, University of Naples Federico II, Naples, Italy

[2]Department of Statistical Sciences, Sapienza University of Rome, Rome, Italy

Abstract

There has been a significant shift in migratory behavior within Italy over time. The origins and destinations of the migration flows, which were previously characterized by a clear prevalence of moving from the south to the center-north, are now much more heterogeneous and complex. Despite the important progress achieved in the past 20 years, the measurement of internal migration remains a contentious topic in international research. Using data provided by the Italian National Institute of Statistics, we applied Rogers' multiregional model place-of-birth-dependent approach to assess the internal migration flows that occurred in Italy in the period 2002 – 2013. This approach provides accurate measurements of internal migration, noting in particular the years of life expectancy for each birth cohort living in each geographical Italian macroregion (northeast, northwest, center, and south). The results indicate that the northwest is the main area of destination for internal migration. The birth cohort in the south is the one that has the greatest number of years of life expectancy in other macroregions. Interestingly, this cohort is the only one characterized by a predominantly male migratory model.

Keywords: Macroregion; Multiregional model; Multiregional life table; Gender; Life expectancy; Italy; Migration

†*These authors contributed equally to this work.*

***Corresponding author:**
Alessio Buonomo
(alessio.buonomo@unina.it)

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1. Introduction

Internal migration is recognized as a complex phenomenon involving demographic, spatial, and economic aspects (Bell *et al.*, 2015; Courgeau, 2021). Although demographic indicators used for comparison and measurement have been unanimously recognized for the study of mortality and fertility, a set of measures utilized for gauging migration remains to be determined (Raymer & Willekens, 2008; United Nations, 2014). Over the past 15 years, important progress has been made in the statistical estimation of indicators for measuring international migration (Rees *et al.*, 2017). However, the measurement of internal migration, despite the significant strides made, remains a contentious topic in international research. This paper aims to make a scientific contribution to the challenge of studying internal migration through less explored methods. This challenge

is particularly important for Italy, a country significantly affected by internal migration. Before the unification of Italy (1861), the peninsula was divided into many small states that differed in language, culture, customs, and economy (Gramsci, 2012). Even today, these differences persist and have led to internal migrations with specific characteristics that have changed over time (Pipitone *et al.*, 2022). Since the mid-1990s, migratory behavior on the Italian peninsula has changed significantly (Golini & Reynaud, 2010). The origins and destinations of the flows, which were previously characterized by a clear prevalence of moving from the south to the center-north (Marini & Busetta, 2005), are now much more heterogeneous and complex (Bonifazi & Heins, 2017). The new attractiveness of the northeast and the growth of shifts between the northeast and northwest have led to an increase in non-traditional migratory trajectories (Bubbico *et al.*, 2011).

In addition to the shifting migratory flows, the characteristics of the individuals that drive such mobilization have also altered. In the past, internal migration was more concentrated among relatively young adults, but in recent years, the age profile has changed (Bonifazi *et al.*, 2012). On the one hand, the migrating population has been experiencing aging, but on the other, an increasingly important role has been played by young graduates, fueling a very lively discussion about the escape of the top talents from the south of Italy (Piras, 2007; Basile *et al.*, 2019). During the same period, the number of women engaging in internal migration increased, filling the gender gap in internal migration between Italians' geographical macroregions (northwest, northeast, center, and south), which, in the past, was dominated by men (Di Bartolomeo & Golini, 2010). In the light of these increasingly atypical, temporary (based on the growth of commuting), and widespread (due to the increasing ease of moving) shifts, the study of migration based on the duration of residence in a territorial area has become particularly important. The international literature has already shed light on a positive association between the length of residence and well-being, education, and employment of the immigrant population (Malmusi *et al.*, 2010; De Valk *et al.*, 2011). However, estimating the duration of residence is not always possible. It is generally calculated based on retrospective questions that refer to a limited number of years. Moreover, the data are not always provided (in the Italian context, it would not have been possible to reconstruct the duration of residence with retrospective questions for the period studied in this work). To overcome these limitations, we propose to study internal migration by measuring the duration of residence where each birth (hypothetical) cohort lives throughout their lives. This approach is in line with the previous studies (DeWaard & Raymer, 2012; DeWaard *et al.*, 2017) that have already shown the validity of using this type of measure based on multiregional approach (Rogers, 1995).

Although many factors (*i.e.*, economic characteristics of the area of origin and destination, quality of life, efficiency of institutions, and infrastructure) have been considered in the study of recent internal migration flows and dynamics (Greenwood, 1997; Crown *et al.*, 2020; Pipitone *et al.*, 2022), to the best of our knowledge, only a few studies have focused on the role played by the migrant's place of birth. This is quite surprising since, according to past and even more recent research, the international literature has shown that place of birth plays a relevant role in shaping migration choices both internally and abroad (Long & Hansen, 1975; Rogers & Belanger, 1990; Abel, 2013). There is no doubt that one's place of birth still constitutes a powerful background variable on the basis of which individuals shape their existence, values, and aspirations. Migration behavior is also strongly linked to this variable, especially in a country like Italy, which is characterized by deep spatial disparities and even inequalities that generate different propensities to move (Biagi *et al.*, 2011; Basile *et al.*, 2012).

Considering place of birth is of central importance in the study of internal migration. First, Italian regions are characterized by distinct cultures, economies, and even languages (Basile *et al.*, 2012; Gramsci, 2012). These characteristics are signs that the Italian context could be treated as studying international migration among countries (where the place of birth of migrants is a crucial variable). This holds significant relevance working in terms of macroareas, as proposed by Bernard & Vidal (2023). Second, place of birth is linked to the concept of identity (Tajfel, 1981; Akerlof & Kranton, 2000); in other words, it allows for identifying the sociocultural roots of those who migrate, which constitute key information about those who change residence. Third, considering the place of birth allows for distinguishing the shift of those who return to it, those who leave it and those who move between two territories that do not involve their place of birth. Therefore, knowing the place of birth enables determining the type of migration flow (Bonifazi *et al.*, 2021). Fourth, individuals' place of birth changes their propensity to migrate. Prior research shows that the risk of migration is much higher among persons returning to their place of birth, and the duration of residence is affected by this variable (Rogers, 1995; Long & Hansen, 1975; Ledent, 1980). For all these reasons, we applied Rogers' (1995) multiregional model place-of-birth-dependent approach (Ledent, 1980) to assess the internal migration flows within Italy.

Unlike studies where the multiregional life table is applied to international migrations, we used place of

birth not to identify migrants born abroad, but those born outside the macroregion considered (Ledent, 1980). Moreover, considering life expectancy offers measures for effectively characterizing internal migration behaviors, allowing for effective and robust comparisons. These behaviors have a bearing on the migratory choices in future between macroregions, which were shaped since young age (Casacchia & Strozza, 2002). This approach helps deepen our understanding of migration dynamics, facilitating formulation of informed migration policies, and addressing the challenges and opportunities associated with the migration of the population. In the case of Italy, however, contemporary research tends to preclude this variable in relevant analysis, with very few exceptions (Impicciatore & Strozza, 2016).

The fundamental idea behind our analysis is that place of birth (like in the case of the study and modeling of international migration) acts as a pivotal variable in understanding internal migration dynamics and trends and, therefore, it cannot be ignored. In other words, knowing the area of birth helps the researcher predict and interpret internal migration within a specific country under investigation. On the basis of these premises and the main international literature on the topic, we propose an approach that outlines the role played by the place of birth in internal migration within Italy from 2002 to 2013, while also considering gender and age. The model used is the multiregional model place-of-birth-dependent approach, that is, the multiregional model of Rogers (1973) taking into consideration the place of birth of whoever migrates (Ledent, 1980). Our goal is to provide accurate measurements of internal migration, noting the years of life expectancy for each birth cohort living in each geographical macroregion of Italy. Our research questions are as follows:

(i) How does internal migration differ if it is distinguished by place of birth?
(ii) Are there different migration patterns for each birth cohort?
(iii) How has the ability to absorb years of life expectancy from other birth cohorts changed in each macroregion in the past 15 years?
(iv) Are there gender differences among birth cohorts?

This paper is structured as follows: in the next section, a brief description of Italian migration between geographical macroregions is provided, and the subsequent section briefly reviews the literature on the multiregional model of the place-of-birth-dependent approach. The sources of data and research methodology are described, and the results obtained through the application of the multiregional model are presented. Finally, this work offers some discussions and conclusive remarks.

1.1. Internal migrations between geographical macroregions in Italy: A brief overview

Migration from the south to the rest of Italy became more noticeable between 1955 and 1975 (Golini, 1974; Bonifazi & Heins, 2000; Bonifazi *et al.*, 2021). Explanations for this intensity of migration included, on the one hand, the abandonment of the rural areas in favor of urban centers and, on the other, the industrial success attained in northwestern Italy, the most attractive migration destination for the south (Bubbico *et al.*, 2011). During that period, the Lazio region (particularly Rome, the capital city of Italy) became the most alluring destination of migration, attracting flows mainly from specific regions of the south such as Abruzzo, Campania, Puglia, and Sardinia. In this case, the shifts were primarily noticeable in the field of public administration and construction (Primavera, 2002).

In the 1970s and 1980s, the downsizing of economic growth and financial difficulties in Italy led to a reduction in the magnitude of migration flows between macroregions and a growing lack of interest by scholars in this field of study (Bonifazi, 1999; Bonifazi *et al.*, 2014). In the early 1990s, an economic recovery led to a non-negligible growth in industrial equipment in Italy. During this period, industrial growth was no longer focused solely on the northwest, but also on the northeast. For this reason, internal migration continued to grow again, mainly through the flows from the south (Bonifazi & Heins, 2000; 2017) and the migration of immigrants who arrived in Italy from abroad (Bonifazi *et al.*, 2012).

At the beginning of 2000, the migration flows maintained a similar increasing trend was still, reminiscent of those in the previous decade. The flows were no longer concentrated solely in the northwest. At the same time, the central macroregion continued to be an important destination, while the northeast was becoming more appealing for migrants. The growth of temporary work contracts, the enlargement of the services sector, and the rise in small businesses also led to northeast areas becoming important destinations of migration flows (Crisci & Di Tanna, 2016). In recent years, in fact, short-range shifts have increased, leading to a renewal of the migration momentum between the northwest and northeast of the country, due to the so-called housing carriers boosted by the Italian middle class (Bottai & Benassi, 2016).

In 2008 – 2009, due to the economic crisis, internal migration suffered another setback, before returning to pre-crisis levels in subsequent years (Bonifazi, 2015). In those years, the internal migration of residents in Italy was also characterized by a change in the patterns relating to age of migration. The emigration rate among young people, compared with previous years, grew intensely

(Staniscia & Benassi, 2018). In total, the number of those who abandoned the south from 1995 to 2008 was approximately 1 million people aged between 20 and 40 (Cantalini & Valentini, 2012). Yet, while in the 1990s, it was individuals between 20 and 25 years of age who had the highest propensity to migrate, in the following decade, it was those between 25 and 30 years old who were most likely to do so (Svimez, 2009).

More recent studies on the internal migration flows in Italy confirmed the persistence of a south to north migration axis (Benassi *et al.*, 2019a) and even the resurgence of the importance of metropolitan areas in attracting internal migration, especially foreign citizens residing in Italy (Strozza *et al.*, 2016; Benassi *et al.*, 2019b). Persistent and even increasing socioeconomic disparities between the different areas of the country seem to continue to play a fundamental role in defining the migration mechanism and intensities across Italy (Buonomo *et al.*, 2023). In this general framework, foreign citizens are in some way overlapping their internal migration trajectories to the ones of Italians, but with higher intensities (Casacchia *et al.*, 2022). Distinctions such as age at migration, types of trajectories, and returns to the macroregion of origin represent the core variables of the present study of internal migration in Italy.

It is important to bear in mind that the studies presented so far used the traditional approach, where migratory trajectories are generally measured through the calculation of rates or propensities distinguishing, at most, gender, age, and direction of displacement. In contrast, migration measures based on the multiregional approach enable us to obtain a much more effective vision of the process of mobility (Rogers, 2008). In particular, the place-of-birth-dependent approach presented here, which has never previously been utilized in the measurement of migration trajectories in Italy, allows for obtaining a much more effective perspective, perhaps the most useful in light of the existing methods in demography and the data available. This measurement is not affected by bias caused by the different size of the groups observed and/or their different structural characteristics (Rogers, 2015). Therefore, highly accurate measurement of migration propensity can be made. In other words, this method allows access to the field of "pure" measures in the field of demography, devoid of compositional effects that could exert a strong perturbing effect on the measurement of the true extent of internal migration (Willekens, 2016).

The information regarding the flows distinguished by age, gender, place of birth, and direction of movement is best summarized with this approach, which leads to a comparison of four typical individuals (eight if we consider that the construction of table was based on gender), for each of which we measure the intensity that the four macroregions demonstrate in attracting portions of the life expectancy at birth (e0) for each of the types. In the next section, we present how the internal migration was analyzed based on the macroregion of birth of those who change residence using Rogers' multiregional life table model (1973).

2. Data and methods

2.1. Traditional life table and multiregional life table

The traditional life table is a central concept in demography. Its use allows us to follow the survivorship of a closed group of people born at the same time. Such a cohort decreases over time until its extinction with the death of the last individual (Preston *et al.*, 2001). The key element of this instrument is the certainty of the irreversibility of the transition from surviving to deceased status (Preston *et al.*, 2001). There are extensions of the life table, in particular the multiple decrement life table, which allow for distinguishing between different causes of death (Land & Rogers, 1982). However, the traditional life table does not allow us to follow the transitions of repeatable events. In other words, it does not permit us to follow people who have moved from one state to another and to analyze their subsequent experiences (Ledent, 1980). A single-region life table shows only the life expectancy of people who remain in one specific region, and migration is completely disregarded (Rogers & Willekens, 1986). More complex tables can overcome this limitation by considering not only irreversible events but also renewable and subsequent ones, through the construction of a table characterized by a plurality of inputs and outputs (Rogers, 1973). These tables, also called increment-decrement life tables, enable us to study marriage and divorce, employment, birth, and internal migration. In the latter case, we refer to multiregional tables (Rogers, 1973), which are the subject of this study. Many different varieties of migration data have been employed as inputs for the multiregional life table, and several methods of converting these migration data and associated mortality data into the probabilities needed in the life table have been suggested (Rees & Wilson, 1975; Rogers & Ledent, 1976; Ledent, 1978). There are many applications of the multiregional model (Ledent & Rees, 1980), and the robustness of these results has been extensively demonstrated in comparison to those derived from the computation of traditional measures, including total and age-specific migration rates (Philipov & Rogers, 1981; Jozwiak, 1992; Halli & Rao, 2013).

In general, multiregional tables are based on two rigorous assumptions. On the one hand, the homogeneity

of the population and, on the other, the population follows the rules of the Markov chain model (Ledent, 1980). In other words, the transition from one state to the next, by the observed population, depends only on the immediately preceding state (in our case survivorship and migration) and no account is taken of the history that determined it. Another important element to consider is that multiregional life tables are built for contemporaries (Rogers, 1995). Indeed, a longitudinal approach would require a great deal of information with a huge number of details that are, at present, rarely (if ever) provided by the national statistical offices. Therefore, the kind of information used to construct such tables plays a crucial role. Ordinary multiregional tables, however, are characterized by a strong element of approximation; they are developed based on the place of residence of the population (and not the place of birth). In addition, the starting cohort of the traditional table is considered a birth cohort although it is created without using information on the place of birth of individuals (Willekens & Rogers, 1978; Rogers, 1995). Yet, as has been widely demonstrated, the propensity to migrate depends on the place of birth of the individuals (Long & Hansen, 1975) and, therefore, it is very important to take this variable into account.

2.2. Building multiregional life table for Italy

The multiregional table built in this study is defined as the "place-of-birth-dependent approach" (Ledent, 1980; Rogers, 2015), which creates tables distinguishable from those built through the traditional approach based only on the place of residence (the place-of-birth-independent approach). In Italy, life tables are built precisely through the traditional method based on the location of residence while neglecting the place of birth (Bertino *et al.*, 2015). This instrument is largely used to make demographic forecasts in national official statistics (Italian National Institute of Statistics [Istat], 2017). However, official Italian statistics do not provide data about the resident population classified by place of birth. It should be noted that such data are available only in the years of the census. The aim of this research is to investigate internal migration using the multiregional model of the place-of-birth-dependent approach. The multiregional life table requires the availability of stock data on the resident population and flow data, particularly births, deaths, immigration, and emigration both inside and outside the country.

In our application, the multiregional life table takes the place of birth of both the resident population and the migratory flows into account. However, as mentioned above, Istat only provides data of the population by region of birth in the census years (in our reference period, 2001 and 2011). Therefore, a preliminary allocation of the region of birth to the Italian population during the period 2002 – 2013 was necessary (for a detailed overview of the applied procedure, see: Buonomo & Strozza, 2020). The period chosen for reference ranges from January 01, 2002, to January 01, 2013. We divided this period into four triennials (2002 – 2004, 2005 – 2007, 2008 – 2010, and 2011 – 2013) and focused on macroregions (northwest, northeast, center, and south, Figure 1) with respect to both residence and place of birth. This aggregation assured us that while dividing our population and internal migration flows, apart from gender and age, even by macroregion of birth, the frequencies obtained were strong enough to ensure statistically valid results. It also confirmed that flows between macroregions were never equal to zero. We chose single years of age and decided to create an open-ended class (70 years old and more) to obtain the highest possible adherence to the data released by official Istat statistics. After obtaining the distinct population by macroregion of birth, it was possible to move to the multiregional table using Rogers' suggested formulas. In our annotations, we use "i" to indicate the macroregion of origin and "j" the macroregion of destination of the internal migration flows (we place the age in brackets on the right side of the capital letter, like in Rogers' [1995] annotations). We always refer to "origin" to indicate the macroregion where the migration flow starts; conversely, we use the locution "place of birth" to indicate where individuals are born. In other words, we never use the term "origin" to indicate the birthplace.

It is important to recall that in Rogers' (1973; 2015) multiregional model, international migrations simultaneously act as both disturbing and competing events. Therefore, in the denominators of multiregional probability formula, there are no international migrations. In other words, this approach only indirectly considers international migrants because they are included in the population considered and they can engage in internal migrations as well. According to Rogers (1973), these limits do not have a significant effect on the construction of the number of years of life expectancies in other macroregions or on in the interpretation of results.

The first operation required to calculate the multiregional table was the determination of mortality and emigration rates by age. We calculated the specific mortality rates (${}^{b}m_{i}$) for the origin of each migration flow (i), sex (s), age (x) and macroregion of birth (b), and for each of the four triennials (t). The annotation "i" represents both the macroregion of origin of the emigration and the place of residence of the population considered. In other words, we considered the macroregion of residence (r) equal to the macroregion of origin of internal emigration (i); therefore, r = i. We also measured the specific emigration rate by age (x), origin (i),

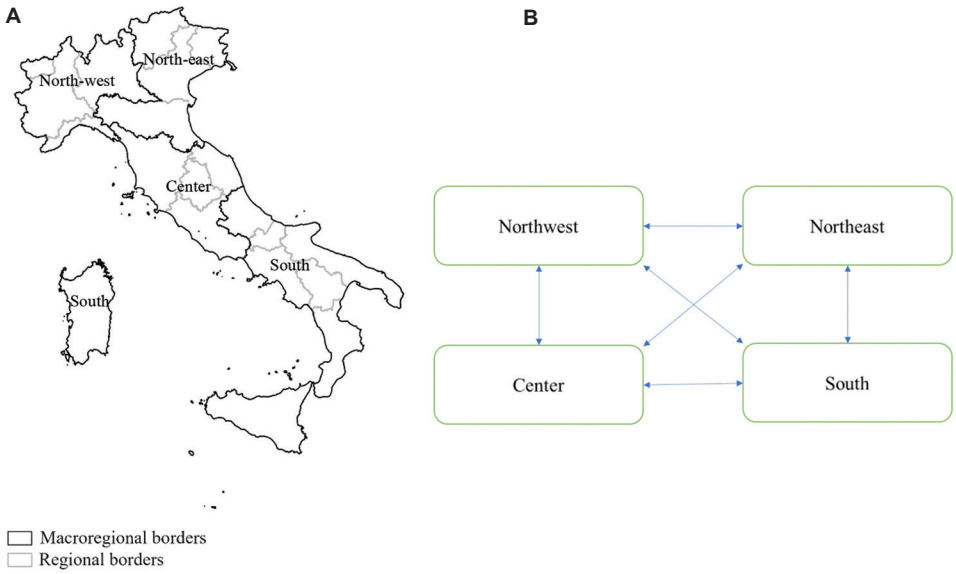

Figure 1. Regional and macroregional borders of Italy (A) and diagram of origin and destination of internal migration trajectories (B)

and destination of migration flows (j) with j ≠ i. This is the 1st time that an Italian multiregional table has been built while taking into account the macroregion of birth.

Once the rates were obtained, it was possible to apply the passage formulas to measure the probability series (death, emigration, and permanence). In our approach, consideration was also given to the probability of emigrants dying if they remained in a mentioned territory ($^{b}P_{i,i}$).

Clearly, since death is unavoidable, the matrix of probabilities has been closed by making the probability of death equal to 1 for the final open age class (70 and older years) and, of course, the remaining probabilities equal to 0 (emigration and permanence).

After these preliminary calculations, we calculated the survivors' series (l), the deaths of the table (d), the total number of years (L) lived in the macroregion j (or k) among the ages y and y+1 by individuals observed in the macroregion j (or k) at age y who lived in the macroregion i at age x applying Rogers' (1973; 2015) formulas. Therefore, "j" and "k" indicate two different macroregions of destination. The point (.) is used to signify that all the macroregions are jointly considered. This procedure, consistent with the traditional Rogers' model (2015), has assured us greater confidence of the results.

Finally, after the calculation of the total number of years lived (T) using Rogers' (1973) approach, the life expectancy (e) from the age y in the macroregion j of the cohort formed in i at x age was obtained as follows:

$$ {}^{b}_{ix}e_{j}(y) = \frac{{}^{b}_{ix}T_{j}(y)}{{}^{b}_{ix}l_{.}(y)} \quad \text{(I)} $$

$$ {}^{b}_{ix}e_{.}(y) = \frac{\sum_{j=1}^{3} {}^{b}_{ix}T_{j}(y)}{{}^{b}_{ix}l_{.}(y)} \quad \text{(II)} $$

To grasp the role played by age (x) in relation to migration between macroregions, a measurement of "temporary life expectancy" (Arriaga, 1984) has been constructed. This indicator represents the life expectancy between two age groups and can be represented with the following formula:

$$ {}^{b}_{i}e(x) = \frac{{}^{b}T(x) - {}^{b}T(x+n)}{{}^{b}l(x)} \quad \text{(III)} $$

In this case, "*n*" is a generic number of years.

The last three variables indicated represent the main measures on which the analyses proposed in this contribution will focus.

3. Results

3.1. The survivorship history of the birth cohort

The construction of the multiregional table has allowed us to follow the survivorship and the migration history of four birth cohorts in relation to the four Italian macroregions (northwest, northeast, center, and south) from 2002 to 2013 (survivors and life expectancy by age, gender, and macroregion of residence). As already stated, according to international literature, the place-of-birth-dependent approach is of higher accuracy. This approach enables

not only following the survivorship history of the various cohorts but also keeping track of their migration history from one macroregion to another. We can study their internal migration with higher accuracy to the analysis conducted using the traditional rates of emigration. Before moving on to examine life expectancy, it is interesting to explore the survivorship profiles distinctly by macroregion of birth. In a dynamic sense, all cohorts have had such a trend. In fact, survivors outside the macroregion of birth first dropped in 2005 – 2007 and in 2008 – 2010 and then reached values higher than the first 3 years (2002 – 2004) in the 2011 – 2013 periods. This evolution can be observed in all birth cohorts, for both males and females. Figure 2 depicts the survivorship of men from 2011 to 2013. On the vertical axis, the figure indicates the survivorship by macroregion (values per thousands) and on the other axis the age. As described above, the root of the table is 100,000 individuals. This figure offers a glimpse into the hypothetical history (both migratory and death-related) of the birth cohort formed by 100,000 individuals from the age of 0 to 70. In this way, for each age and for each birth cohort, the sum of survivors by macroregion of residence plus the cumulative deaths always returns to a total of 100,000. At this point, it will be clear that at age 0 there are no deaths and the whole cohort of 100,000 individuals is alive in the macroregion of birth; vice versa, after age 70 all 100,000 individuals have died.

Figure 2 shows that the males born in the northeast comprise the main cohort with the fewest individuals outside the birth area. In addition, when they leave the macroregion of birth, most of their migration flows are concentrated toward the northwest. On the other hand, the cohort of males born in the central regions and those born in the northwest show similar patterns of migration. They have a certain equal distribution in the macroregions (outside the macroregion of birth). As expected, the cohort of males born in the south is the one that has the greatest amount of survivorship outside the macroregion of birth. Compared to the other macroregions of birth, in percentage, in fact, the values are almost triple. Female survivors show similar profiles. However, there are important gender differences that should be highlighted. Figure 3 is obtained by subtracting survivorship by age of females from the corresponding males (males minus females), distinctly by birthplace in 2011 – 2013. In this way, when the values in Figure 3 are placed on the negative side of the y-axis, the values for females exceed those of the males. The opposite happens on the positive side.

In essence, the graph obtained is strongly influenced by the greater mortality of males compared to females. For this reason, for all cohorts of birth, there is a prevalence of the cumulative deaths on the positive side of the y-axis. However, based on what has been said, the cases in which survivors in other sections are predominantly male are

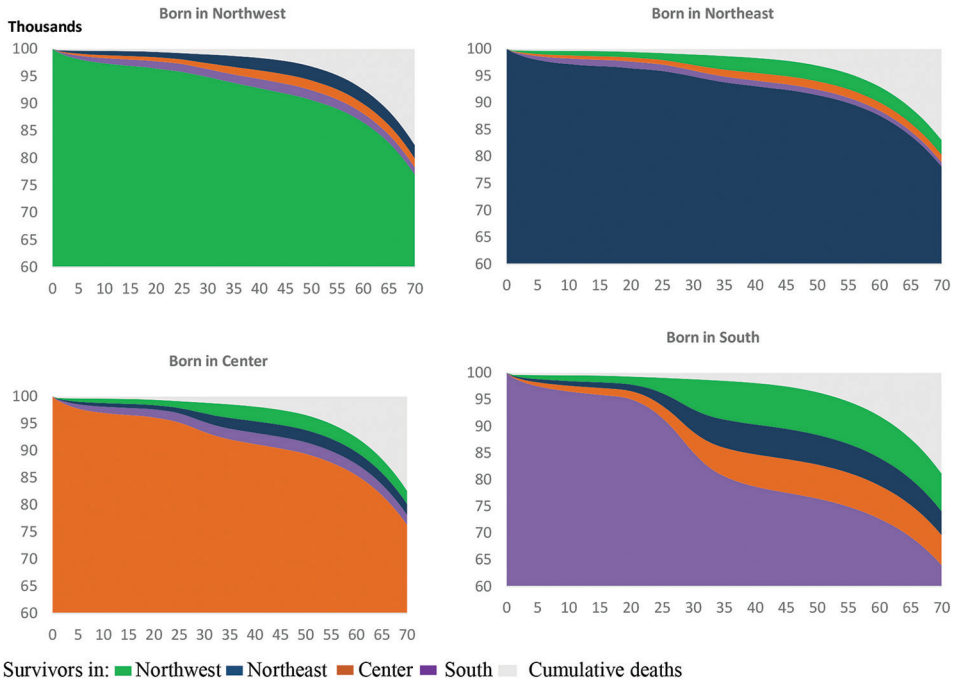

Figure 2. Survivorship of males represented by age, macroregion of residence, and macroregion of birth from 2011 to 2013. Data are expressed in values per thousands. Source: authors' elaborations based on Istat data (estimates).

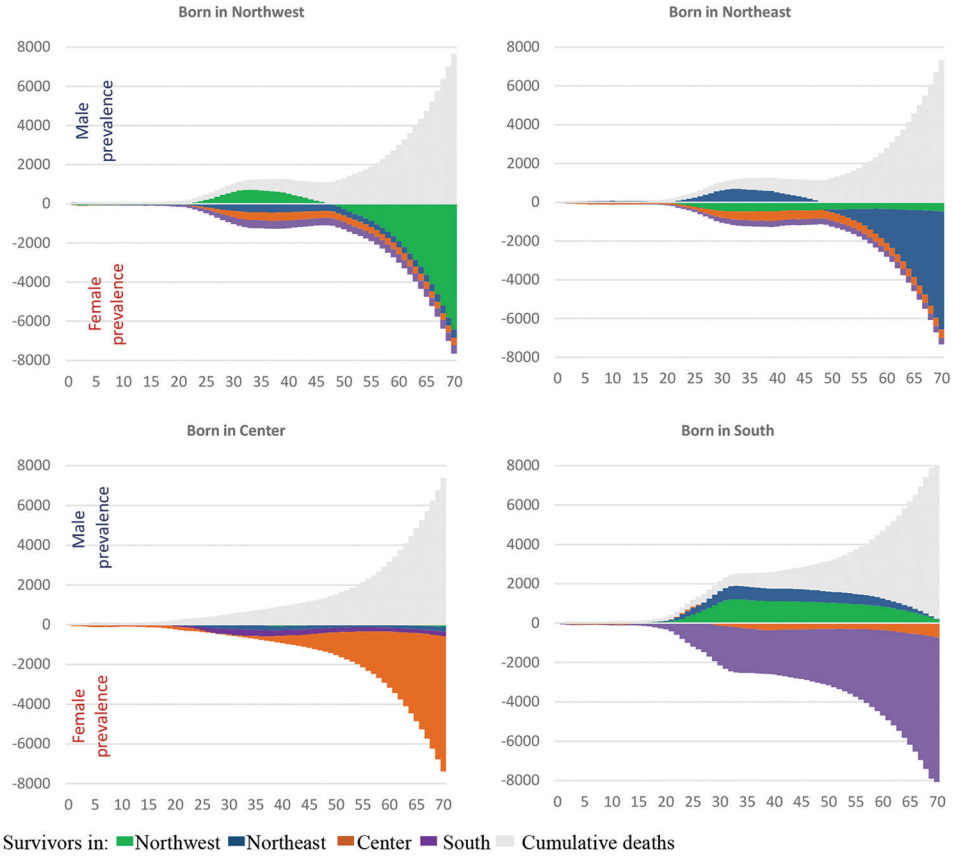

Figure 3. Gender difference (males minus females) in survivorship and cumulative deaths represented by age, macroregion of residence, and birth from 2011 to 2013. Source: authors' elaborations based on Istat data (estimates).

particularly notable. Having highlighted these important premises, we can see that in the central regions, except for a small prevalence of male survivors in the northwest up to 26 years old, the prevalence of the cumulative deaths is still predominant. In both macroregions of the north (northwest and northeast), more males than females, up to approximately 50 years of age, survive in the macroregion of birth. The birth cohort in the south stands out as following a completely different pattern. Despite the male predominance in deaths, males born in the south that survive in the northwest and northeast are prevalent in all ages considered (including the older ones). Although this is interesting, the deaths make it difficult to interpret the migration flows. The study of life expectancy allows us to go beyond what we have just outlined and to draw sounder conclusions on the migration between the macroregions of each birth cohort.

3.2. The life expectancy of each geographical macroregion by birth cohort

The construction of the multiregional table has enabled an analysis of life expectancy for each birth cohort. In Table 1, the e0 for each birth cohort is studied without distinction in which macroregions the years of life expectancy are lived (for example, the life expectancy of those born in the total northwest, without distinguishing in which macroregion such a cohort spends its years of e0). The differences between the values obtained with the multiregional model and the life expectancy data derived from the Istat tables (traditional uniregional model) are relatively small. The major differences occur in the first and last 3 years. Between 2002 and 2004, there are major differences concerning the northwest for both genders (−0.97 for males and −1.17 for females). In 2011 – 2013, however, the highest difference relates to the south, especially for females (0.50 for males and 0.84 for females). Overall, the observed variances can be considered small. In the first place, this is due to the different time intervals analyzed. In fact, the multiregional model is built on four triennials, while the Istat data relate to the past year of the corresponding 3-year period. A second element of difference is that the multiregional table is built on the basis of the macroregion of birth, whereas Istat data refer to the resident population in their respective allocations. Finally, international research has already highlighted that the variations between e0 in uniregional and multiregional

Table 1. Comparison of life expectancy at birth estimated by multiregional approach and estimated by Istat. Italian macroregions, 2002-2013

Birth cohort	Males			Females		
	Multiregional	Istat	Differences*	Multiregional	Istat	Differences*
	2002–2004	2004		2002–2004	2004	
Northwest	76.83	77.80	−0.97	82.63	83.80	−1.17
Northeast	77.48	78.26	−0.77	83.42	84.16	−0.74
Center	77.95	78.27	−0.32	83.42	83.70	−0.28
South	77.56	77.62	−0.06	82,99	82.97	0.03
	2005–2007	2007		2005–2007	2007	
Northwest	78.40	78.70	−0.30	83.59	84.17	−0.59
Northeast	78.83	79.11	−0.28	84.21	84.52	−0.30
Center	79.05	78.96	0.08	84.52	84.19	0.32
South	78.55	78.02	0.53	83.32	83.09	0.24
	2008–2010	2010		2008–2010	2010	
Northwest	79.07	79.35	−0.27	84.15	84.48	−0.32
Northeast	79.40	79.78	−0.38	84.64	84.97	−0.33
Center	79.56	79.46	0.10	84.53	84.44	0.09
South	78.88	78.70	0.17	84.10	83.62	0.48
	2011–2013	2013		2011–2013	2013	
Northwest	79.70	80.04	−0.34	84.59	84.89	−0.30
Northeast	80.12	80.36	−0.24	84.83	85.19	−0.35
Center	80.03	80.04	−0.01	84.76	84.77	−0.01
South	79.66	79.16	0.50	84.75	83.91	0.84

Notes: *Istat data minus multiregional life table birth-dependent approach data. Source: Authors' elaborations based on Istat data (estimates).

life tables are equal to the values included between −1.5 and +1.5 (Rogers, 1995). Table 1 confirms what is already known: e0 is increasing over time for both males and females and the gender differential is decreasing in all birth cohorts. What is more interesting is to investigate where each birth cohort resides over their years of life expectancy, an operation that of course can only be achieved using the multiregional life table.

Figure 4 shows, for males, the percentage of years of e0 lived outside the birth macroregion distinctly for each birth cohort. The birth cohorts are on the x-axis, while the macroregions where the years of e0 are lived are differentiated by color. As predicted, the trend of time is the one described above with respect to survivorship: for both males and for females, the trend is decreasing from the first 3 years (2002 – 2004) to the second (2005 – 2007) and then reversed in the last 3 years (2011 – 2013). Males born in the south in 2011 – 2013 live outside the birth macroregion for 14.4% of their e0 (5.8% in the northwest, 4.6% in the center and 4% in the northeast). Considering the other birth cohorts, the percentages are much lower. Central Italy is the second macroregion of birth for a life expectancy lived in another macro-area with a total of 5.7%, 8.2 percentage points less than in the south. In addition, 2.1% of e0 live in the northwest, the macroregion that is marked by the highest percentage. Second place in the ranking is the south (1.9%), which shows an important role played by distance and returns (Bonifazi & Heins, 2017). Those born in the northwest and in the northeast make up 4.7% and 4.4% of e0, respectively. If those born in the northwest comprise the main share of e0 in the northeast (2%), in the same way, the cohort born in the northeast mainly lives its e0 in the northwest (2.2%). Moreover, in all 4 time periods considered, the northeast has the lowest e0 spent in the south (1% in 2011 – 2013).

Figure 5 compares the percentage of male and female e0 in those living outside the macroregion of birth. Using percentages, it was possible to control the highest mortality of males and to make more effective gender comparisons. When the rectangle is above the x-axis, e0 in areas lived outside the macroregion of birth is higher for males. The opposite is true when the rectangle is below the x-axis. For cohorts born in the northwest and northeast, females have higher percentages of years lived outside the macroregion

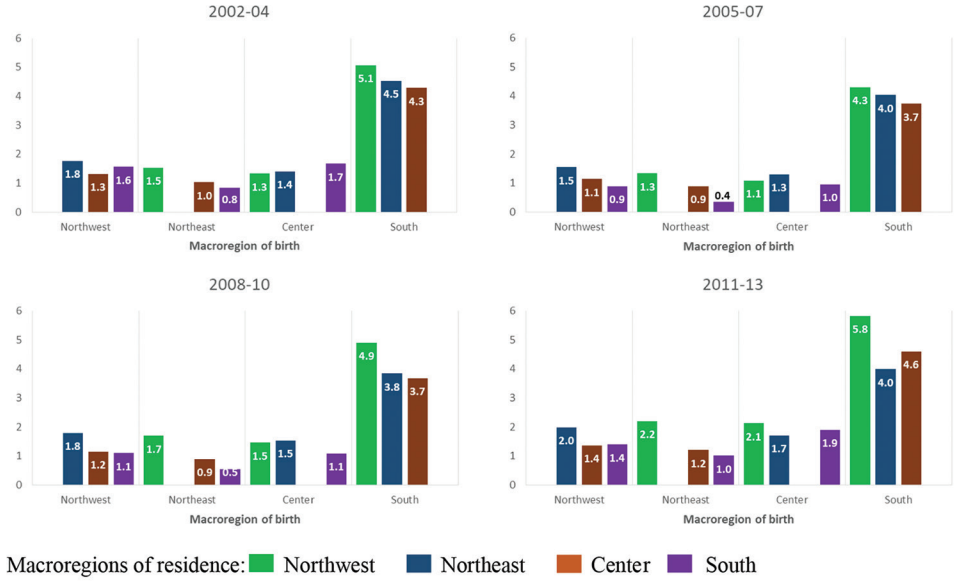

Figure 4. Percentage of life expectancy at birth of males living in a macroregion other than the macroregion of birth from 2002 to 2013. Source: authors' elaborations based on Istat data (estimates).

of birth. The gender differential for these cohorts also increases over time (from −0.5% in 2002 – 2004 to −0.7% for northwest and −0.8% for northeast in 2011 – 2013). The south is traditionally characterized by migration related to searching for a job (Bonifazi & Heins, 2017), and there is a clear male prevalence. It should be stressed, however, that in 2011 – 2013, the prevalence is higher in females than males if we consider central regions as the only destination. In addition, as shown in the graph, the gender differential in the birth cohort in the south falls from 0.7% in 2002 – 2004 to 0.5% in 2011 – 2013 (although with a fluctuating trend over time). Finally, the birth cohort in the central regions has a greater gender balance throughout the time interval.

Figure 6 shows the "temporary life expectancy" of the 3-year period 2011 – 2013 of those who live their years of life expectancy outside the macroregion of birth divided by gender. The age classes distinguish young people (0 – 19 years), adults (20 – 39 years and 40 – 59 years), and finally, those who are about to leave the labor market or have already left (60 years and older). Note that life expectancy is not expressed as a percentage in this figure. Therefore, the comparison of males and females can only be made considering the lower mortality rates of females, especially concerning the elderly (see survivorship in previous section). Individuals born in the south, in all age groups, have a temporary life expectancy that is higher than the other cohorts of birth for both males and females. The temporary life expectancy of the births in this macroregion rises as the age increases and then decreases in the final age

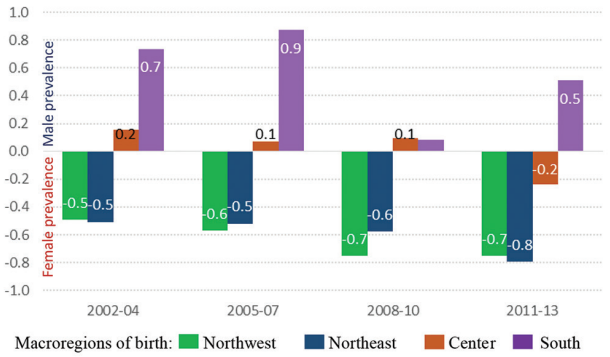

Figure 5. Gender difference (males minus females) in percentages of life expectancy at birth lived outside the macroregion of birth from 2002 to 2013. Gender difference in favor of males is evident when each chart is above the X-axis, denoting higher life expectancy at birth lived outside the macroregion of birth for males, and vice versa. Source: authors' elaborations based on Istat data (estimates).

class. Individuals born in the central regions of Italy are ranked second in all age classes with a profile that resembles (by age) that of those born in the south. The profiles of the birth cohorts in the north are more varied. Individuals born in the northeast take higher values than northwestern births in the first class (0 – 19 years). However, the northwest has a higher temporary life expectancy (compared to the northeast) after 50 years. In terms of gender differences, we immediately notice a clear split between those born in the south and center-north macroregions. In the latter macroregion, female temporary life expectancy (out of the macroregion of births) is higher than that of males.

The model of the south is different. In this birth cohort, temporary life expectancies lived outside of macroregion of birth by males are higher than those of females in all age classes, except for individuals 0 – 19 years old.

What percentage of e0 does each macroregion absorb from each birth cohort? Figure 7 answers this question with reference to the period 2011 – 2013. Unlike the previous representations of e0, in Figure 7, each of the macroregions of residence (rather than birth) are included on the x-axis. The percentages of e0 absorbed from each macroregion of birth are differentiated with different colors. As expected, it is the northwest that most attracts those born in other macroregions. However, similar to other macroregions of residence, life expectancy quotas are absorbed above all from those born in the south. The percentages of e0 absorbed from the central macro-area and from the northeast in northwest are notable (approximately 2% for both males and females). The south, on the other hand, is the least attractive macroregion in this regard. When analyzing the gender differences, we found that the second most attractive macroregion for the males is the northeast (7.4% for males and 7.6% for females), while it is the center for females (7.0% for males and 7.9% for females).

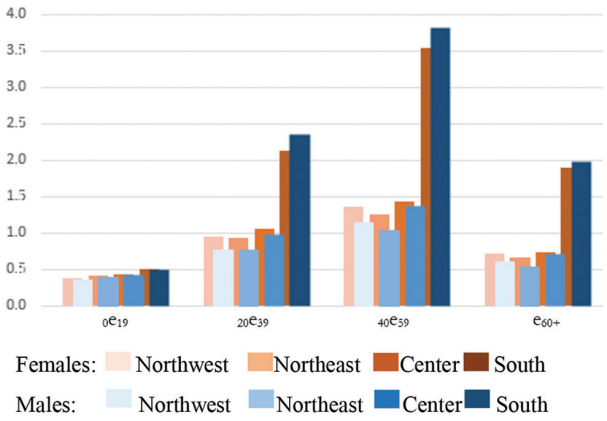

Figure 6. Temporary life expectancy (0 – 19, 20 – 39, 40 – 59, 60+) in a macroregion of residence other than macroregion of birth from 2011 to 2013. Source: authors' elaborations based on Istat data (estimates).

The most recent 3-year period considered (2011 – 2013) has both greatest highest number of out-of-region survivors outside the macroregion of birth and the highest e0 lived outside the birth macroregion values of all the 3-year periods considered. This result is probably a consequential effect of the Great Recession (Bonifazi & Heins, 2017).

4. Discussion

In the study of mobility (both internal and international migration), place of birth is widely used in analyses conducted by international scholars (Molloy *et al.*, 2011; Abel, 2013). This approach enables distinguishing whether the migrant's place of birth serves as the origin or destination of migration, thereby allowing consideration of the amount of time spent by the individual in their birth territory. The construction of the multiregional life table using the place-of-birth-dependent approach has allowed us to follow, for the 1st time in Italy, the migratory history and the survivorship of individuals born in the four Italian macroregions. The obtained results provide a perspective that enriches the one traditionally obtained using the area of residence and indicate that the use of place of birth is important for understanding internal migration.

Implementing Rogers' multiregional model place-of-birth-dependent approach allows for more precise analyses and accurate results based on standardized comparison between cohorts. These are considered more reliable in contrast to using only the place of residence. This work represents, in our view, a starting point for further research that, on the basis of the achieved results, appears necessary. Knowing how many years have been spent in each macroregion by the different populations can help policy makers in planning more specific policies and interventions in terms of taxation and inclusion, as well as preventing brain drain migration (especially from the

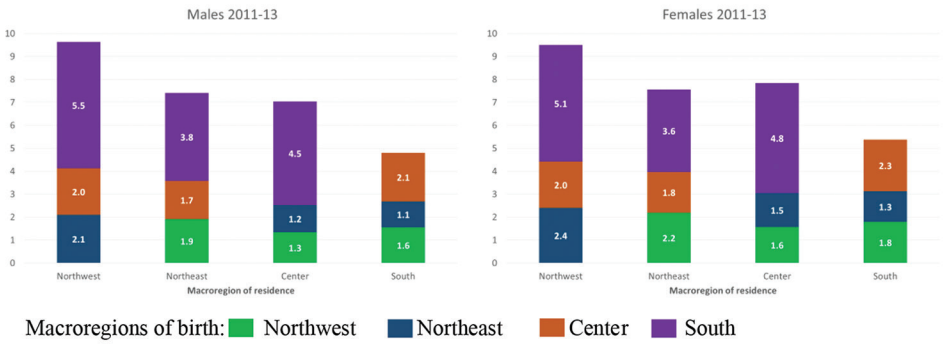

Figure 7. Life expectancy at birth from each macroregion, other than that of residence, from 2011 to 2013

south to the other Italian's macroregions). Furthermore, the results highlight the importance of collecting information on the birthplace of those migrating, as well as considering the origin and destination (residence) of migration trajectories. Since the migrant's place of birth opens up new frontiers in the analysis of internal migration, this variable should also be included in other types of analysis such as gravity models or statistical inference to explore the weight, direction, and role played by this important variable in the internal migrations of different European countries.

The results of this contribution encourage the use of an approach that is replicable by scholars and, most importantly, by statistical institutes and offices (at both the national and regional/local level) for the study of internal migration in a more accurate way, using a new perspective for analysis. This is particularly important in Italy because, to the best of our knowledge, this approach is not currently provided by Istat. This contribution does, however, have some limitations that are worth mentioning. The period considered is 2002 – 2013, due to availability of data. Istat usually does not provide information on the place of birth of the internal migration; therefore, we used *ad hoc* elaborations that are available only for this period. However, since the purpose of this paper is to test the association between internal migration and place of birth, the period considered is not a relevant limitation for our investigation. We believe that our results will encourage and motivate national (and international) statistical institutes to collect and disseminate official data about the place of birth of the population broken down by age, gender, and place of residence. Furthermore, since no previous work has adopted the same approach in Italy, we have no established reference analyses for us to compare our results with. A future development could be to incorporate age- and sex-specific rates of international out- and in-migration by making some specific assumptions to the model that we applied. This would overcome the current limitation of our approach, which is the indirect consideration of international migrants in the analysis (Rogers, 1995).

Essentially, our investigation has an explorative nature. We assumed that the multiregional life table and the place-of-birth-dependent approach were sufficiently well-established and the rigorous methods for empirically testing whether place of birth plays an important role in determining internal migration. This allowed us to distinguish specific migration patterns by highlighting that place of birth is indeed relevant to understanding migration mechanisms. It would be interesting to apply our proposed method to the study of internal migration during COVID-19 pandemic. Migrations between macroregions decreased due to the COVID-19 pandemic (Istat, 2023). The most important internal migration trajectory has remained the one originating in the south of Italy. However, compared to pre-COVID-19 years, migration from the south to the center-north decreased by approximately 17 percentage points. In other words, in Italy, as in other European countries, the pandemic had the effect of decreasing internal migration (González-Leonardo *et al.*, 2022). In the pandemic years, there was also a slight increase in internal migration from the north to the south of Italy. With our proposed approach, it would be possible to study whether the migrations to the south are returns to the migrants' place of birth. Furthermore, we expect that despite this migration dynamic, life expectancy years in the center-north are increasing during the COVID-19 pandemic and decreasing in the southern macroregion. Once the data are available, it will be interesting to answer these questions using the approach proposed in this paper.

5. Conclusion

In this study, we applied the multiregional model place-of-birth-dependent approach (Rogers 1995) to study internal migration in Italy in the period 2002 – 2013. This approach allowed us to: (i) estimate the duration of residence of migrants (which could not be estimated in any other way in Italy in the period here considered) and (ii) to focus on the migrants' place of birth, which has proved to be one of the most important determinants of internal migration (Rogers & Belanger, 1990; Abel, 2013). This approach reveals the significantly different migratory patterns for each (hypothetical) cohort of birth. International literature has pointed out that gender and distance between territories are some of the main determinants affecting the magnitude of migration flows worldwide (Abel & Muttarak, 2017). Our results indicate that in the case of Italy, those born in the northeast show the lowest levels of internal emigration compared to the other birth cohorts, with a large proportion of young people (0 – 19 years) moving to different macroregions. They are the least likely to live their years of e0 in the south. Indeed, those born in the northeast move mainly to the northwest, of which the migrants are predominantly women, against a backdrop with a rising gender differential over time. Moreover, the important role played by distance is evident, as there is a significant predilection for the neighboring macroregions. Distance is less important for those born in the south. In this case, it is probably the push factors (fewer job opportunities and a more fragile economic system) that play a crucial role. The internal migration of the northwest cohort is higher than that of the northeast cohort. Those born in the northwest concentrate their years of life expectancy in the northeast especially, but the number of years lived in the south and

in the central regions is also important. The northwest is particularly characterized as an area of attraction, showing, in 2011 – 2013, the ability to attract almost 10% of e0 of those born in other macroregions. The central macroregion stands out from the previous cohorts of birth examined, given the greater gender balance in migration to other macroregions.

This cohort is also characterized by an important presence in the south and a homogeneous distribution in all other macroregions. The birth cohort in the south, of course, is the one that has the greatest number of years of life expectancy in other macroregions. Interestingly, this cohort is the only one characterized by a male-predominant migratory model. An increasing number of migrating females, however, have reduced the gender gap over time. Compared to 2011 – 2013, most of the female migrants were of younger ages (and therefore less tied to searching for a job) and engaged with migration flows toward central Italy. However, it appears that job-seeking migration continues to be a male prerogative, although it seems that females are bridging the gap over time. The results obtained indicate that in the study of internal migration, birth cohorts play a central role and cannot be neglected. In light of these results, place of birth emerges as a crucial variable in the study of internal migration, underscoring the need to further investigate its role in future research.

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Conflict of interest

The authors report that there are no competing interests to declare.

Author contributions

Conceptualization: Alessio Buonomo, Oliviero Casacchia, Salvatore Strozza
Formal analysis: Alessio Buonomo, Oliviero Casacchia, Salvatore Strozza
Investigation: Alessio Buonomo, Federico Benassi
Methodology: Alessio Buonomo
Writing – original draft: Alessio Buonomo, Federico Benassi
Writing – review & editing: All authors

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data

Data are available from the Italian National Institute of Statistics (Istat) on official request to the Istat.

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