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Describing and Projecting the Age and Spatial Structures of Interregional Migration in Italy

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ABSTRACT

A multiplicative component model is applied in this paper to present a simple, yet powerful, framework for analyzing and projecting internal migration flows. The multiplicative components are useful for identifying important underlying structures in the migration patterns. To demonstrate, seven periods of age-specific interregional migration in Italy (1970-1971 to 2000-2001) are analyzed. This information is then used to project the age and spatial structures forward to the 2010-2011 period. The projection model focuses on the underlying structures, which allows both the stable and changing aspects of the migration patterns to be included.

Key words: internal migration, migration analysis, migration estimation, migration projection, Italy, categorical data analysis

DESCRIBING AND PROJECTING THE AGE AND SPATIAL STRUCTURES OF INTERREGIONAL MIGRATION IN ITALY

1. INTRODUCTION

A basic understanding of the underlying age and spatial structures found in past patterns of interregional migration flows is important for accurately projecting future patterns of interregional migration. A simple framework for this is set out in this paper. We use the multiplicative component model for decomposing age-specific interregional migration flows in Italy from 1970 to 2001. The goals are to demonstrate how the multiplicative components can be used to identify and compare age and spatial structures of migration over time and how they can be altered to estimate future patterns of migration.

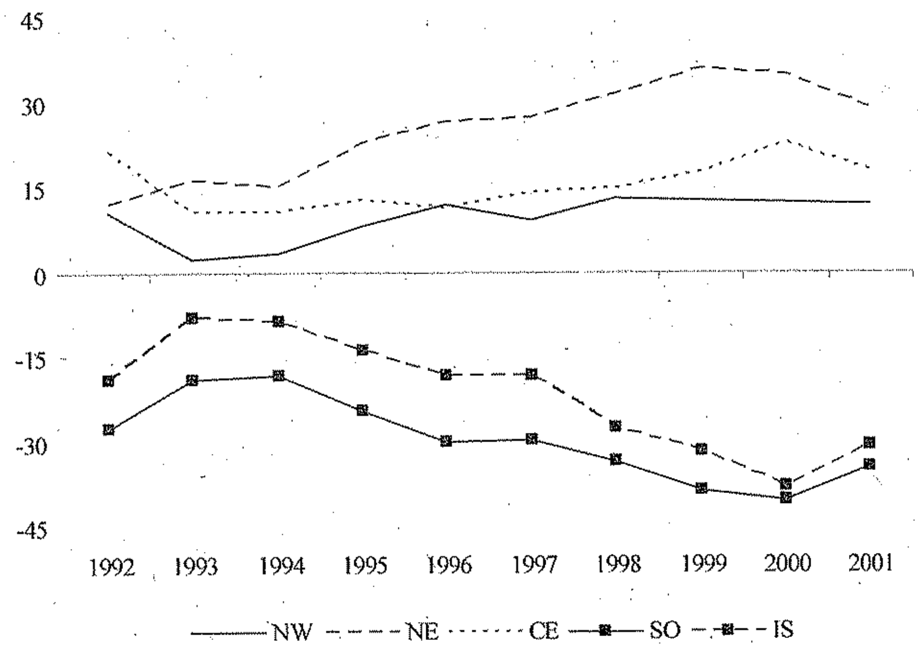
Rogers et al. (2002) modeled age and spatial patterns of interregional migration in the United States using the categorical logit model. They focused on particular descriptions of the generation and distribution components of age-specific interregional migration in the United States. This paper extends this research in two ways. First, a multiplicative component model, with direct relations to the log-linear (and related logit) model, is used to describe interregional migration flows in Italy. Here, an intuitive parameter coding scheme proposed by Raymer (2006) is applied and extended to include age. Second, a method for projecting interregional migration patterns is set out. This method focuses on making assumptions about specific model components.

1.1 Interregional migration in Italy

A usual and effective way to describe the patterns of internal migration in Italy is to divide the country into five macro-regions (King 1987:173-202). The regions include the industrialized *Northwest*, the recently industrialized *Northeast*, the small-to-medium-scale industrialized *Centre*, the social and economically disadvantaged *South*, and the peripheral *Islands*.

Long term analyses of internal migration in Italy can be found in Bonifazi, Chieppa and Heins (1999) and Bonifazi and Heins (2000). In the first two decades after the war, the largest interregional migration flows were from the South, Islands, and Northeast to the Northwest. Latium (Rome) in the Centre also received substantial flows from the South and Islands. During the 1970s, migration efficiency (i.e., ratio of net migration to the gross flows) and long distance (interregional) migration started to decline. More recently, in the 1990s, the level of interregional migration has increased with the Northeast now the most attractive region to migrants (see Figure 1), gaining population in its exchange with all other regions including the Northwest and Centre. The largest flows still originated in the South and Islands regions, which has continued their traditional role of being "sending areas". The Northwest still gained population from the South and Islands, albeit to a lesser extent, but lost population in the exchanges with the Northeast and Centre. These changes in the spatial patterns of interregional migration have been attributed to the regional economic and social transformations in Italy. Many provinces of Northeastern Italy are now among the wealthiest in the entire European Union, while many parts of the South and Islands are still the poorest and most disadvantaged.

Figure 1. Net migration rates (per 10,000) for the five Italian macro-regions, 1992-1991 to 2001-2002



Source: Istat (2003).

The migration from the South to the Northwest lessened in the mid-1970s. Econometric analysis has demonstrated the importance of social and economic differences behind the relatively large flows during the first couple of decades after World War II (Barsotti 1985; Bonaguidi 1985; Salvatore 1977, 1980). The smaller migration flows in the 1970s and 1980s are not explained by a reduction in the social and economic differences between the two regions, which persisted or grew larger (Bonaguidi and Abrami 1996). Other factors (i.e., demographic, social, political, cultural, and psychological) are considered responsible for the decrease in the migration patterns (Livi-Bacci et al. 1996). However, one should note that when age is considered, the young adult interregional migration patterns have remained relatively stable since the 1950s (Bisogno 1999; Bonaguidi 1987; De Santis 1991).

More recently, there has been a rise in levels of interregional migration, which are interpreted to be a result of more efficient human resources reallocation and the restoration of the traditional push and pull factors related to regional social and economic differences. As a result, there is currently much interest in identifying and explaining the current internal migration patterns in Italy, as well as predicting future patterns.

1.2 The Migration Flow Data

The statistical data on migration in Italy can be obtained both from the population registers and censuses, but the registration data have traditionally been largely privileged. The availability of yearly registration data has led to the census data being neglected. This has implications in terms of approach, measures, and methods of analysis of the migration patterns (Morrison, Bryan and Swanson 2004; Willekens 1999).

There are several important differences between registration and survey (or census) migration data. Registration data tends to include all moves recorded within a period of one year. Migration data obtained from surveys, on the other hand, typically represents current residence by residence at a point earlier in time (usually one year or five years). With survey data, the numbers of moves within the period are not captured. Also, the length of the interval can have substantial implications for analyses of migration patterns (Long and Boertlein 1990; Rogers, Raymer and Newbold 2003; Rogerson 1990). Registration data are generally considered to be more accurate than survey data. However, these data may not contain all of the moves. For example, some citizens may not declare (or declare with delay) their change of residence or they may declare fictitious moves.

Registration data in Italy come from the municipal population registers. Each municipality (or comune) sends to the National Institute of Statistics (ISTAT) one record of summary data reporting the annual demographic flows affecting its particular population register. As described in ISTAT (1998), the components include the population at the beginning of the year, registrations (i.e., live births, in-migrants, immigrants, and "other reasons"), de-registrations (i.e., deaths, out-migrants, emigrants, and "other reasons"), and the population at the end of the year. For the most part, de-registrations for "other reasons" are post-censual adjustments, persons who failed to register previously, or corrections of persons double-counted. Note our analysis does not include deregulations for "other reasons" because estimated migration flow tables are not provided by Istat with these adjustments included. The adjustments are attributed to net migration levels only and not to the specific flows.

2. DESCRIBING THE AGE AND SPATIAL STRUCTURES OF MIGRATION

The multiplicative component model, with a particular reference coding scheme, is put forward in this section for the purpose of describing the age and spatial structures of migration patterns in Italy for seven time periods between 1970 and 2001. This model is analogous to the saturated log-linear model described in texts on categorical data analysis (e.g., Agresti 1996; Bishop, Fienberg and Holland 1975; Knoke and Burke 1980).

2.1 The Multiplicative Component Model and The Log-Linear Model for Descriptive Analysis of Migration Age and Spatial Structures

The analytical and modeling framework set out in this paper focus on migration flows between origins i and destinations j at age x. These flows are denoted $n_{ij}(x)$. Note migrants within the same region, i.e., $n_{ii}(x)$, are not included. The aggregate number of age-specific migrants originating from a particular place is denoted $n_{i+}(x)$ and the aggregate number of age-specific migrants choosing a particular destination is denoted $n_{+j}(x)$.

Place-to-place migration flows (without age) are often set out in two-way (origin by destination) contingency tables. For analysis purposes, these "migration flow tables" can be disaggregated into separate components (Rogers et al. 2002): an *overall* component representing the level of migration, an *origin* component representing the relative "pushes" from each region, a *destination* component representing the relative "pulls" to each region, and a two-way *origin-destination interaction* component representing the physical or social distance between places not explained by the overall and main effects. This disaggregation is multiplicative, such that

$$n_{ij} = T * O_i * D_j * OD_{ij} \qquad (1)$$

where T is the total number of migrants (n_{++}), O_i is the proportion of all persons migrating from region i, and D_j is the proportion of all persons moving to region j. The interaction component OD_{ij} is defined as $n_{ij}/(T * O_i * D_j)$ or the ratio of an observed flow to an expected flow (for the case of no interaction). The motivation for this paper comes from this approach to examining migration flows.

The observed migration flows between the five Italian macro-regions during the 1970-1971 time period set out in Panel A of Table 1. During this period, there were 467 thousand interregional migrants. The South region sent the most persons (i.e., 166 thousand). The Northwest region received the most persons (i.e, 202 thousand). And, in terms of origin-destination-specific flows, the South to Northwest flow of 102 thousand persons was the largest, followed by the Islands to Northwest and South to Centre flows of 52 thousand and 40 thousand persons, respectively.

Table 1. Italian interregional migration, 1970-1971: Observed flows and multiplicative components

	Region of destination					
Origin	Northwest	Northeast	Centre	South	Islands	Total
A. Observed flows						
Northwest	0	27,345	20,553	35,061	21,169	104,128
Northeast	27,757	0	13,048	8,093	4,147	53,045
Centre	20,880	13,300	0	19,868	7,964	62,012
South	101,517	17,640	39,988	0	6,789	165,934
Islands	51,851	7,478	15,208	7,023	0	81,560
Total	202,005	65,763	88,797	70,045	40,069	466,679
B. Multiplicative components						
Northwest	0.000	1.864	1.037	2.243	2.368	0.223
Northeast	1.209	0.000	1.293	1.016	0.911	0.114
Centre	0.778	1.522	0.000	2.135	1.496	0.133
South	1.413	0.754	1.267	0.000	0.477	0.356
Islands	1.469	0.651	0.980	0.574	0.000	0.175
Total	0.433	0.141	0.190	0.150	0.086	466,679

The multiplicative components corresponding to the migration flows set out in Panel A above are set out in Panel B (of Table 1). The overall component (T) is placed in the total sum (i.e., n_{++}) location of the table, the origin components (O_i) are placed in the row-sum locations (i.e., n_{i+}), the destination components (D_j) are placed in the column-sum locations (i.e., n_{+j}), and the origin-destination interaction components (OD_{ij}) are placed in the cells inside of the marginal totals (i.e., n_{ij}).

To illustrate the multiplicative component model, consider the 21,169 persons that moved from the Northwest region to the Islands region. This number can be disaggregated into four multiplicative components:

$$n_{15}(+) = TO_1D_5OD_{15} = 466{,}679 * 0.223 * 0.086 * 2.368 = 21{,}169,$$

where the subscripts denote the regions (1 = Northwest and 5 = Islands). The interpretations of these components are relatively simple. The overall component is the level of the interregional migration system at that time; there were 467 thousand interregional migrants in Italy during the 1970-1971 period. The origin component represents the proportion of all persons in the system migrating from a particular region; 22 percent of all migrants left from the Northwest region. The destination component represents the proportion of all persons migrating to a particular region; 9 percent of all migrants went to the Islands region. And, finally the interaction component represents the ratio of observed to expected flows; there were roughly 24 observed migrants for every 10 expected migrants (based on the marginal total information, i.e., $T*O_1*D_5$). This last component captures the "connectedness" or association between regions. For this example, the Northwest and Islands were more connected than otherwise expected. Ratios much greater than one signify that there is a strong association between places, whereas ratios much less than one indicate the opposite. For example, the South to

Islands flows was observed to be about 50 percent less than expected. This notion of observed to expected flows is the essence of the spatial interaction (or association) in migration flow tables.

The multiplicative component model can also be expressed as a log-linear (additive) model:

$$\ln(n_{ij}) = \lambda + \lambda_i^O + \lambda_j^D + \lambda_{ij}^{OD} \tag{2}$$

or in its multiplicative form:

$$n_{ij} = \tau\tau_i^O\tau_j^D\tau_{ij}^{OD} \tag{3}$$

where the parameters of the model (λs or τs) have superscripts O and D denoting origin i and destination j, respectively. The log-linear model has a standard set of statistical techniques associated with categorical data analysis (see e.g., Agresti 1996) and is an option in commonly-used statistical packages (e.g., SPSS, Stata, or SAS).

For the (multiplicative) log-linear model parameters to have the same interpretation as the components in the model set out in Equation 1, the overall effect parameter (or component) must equal to $\tau = \sum_{ij} n_{ij}$, the main effect parameters (or components) must equal to $\tau_i^O = \sum_j n_{ij} / \tau$ and $\tau_j^D = \sum_i n_{ij} / \tau$, and the interaction effect parameters (or components) must equal to $\tau_{ij}^{OD} = n_{ij} / \tau\tau_i^O\tau_j^D$. The constraints of these parameters are: $\tau = \sum_{ij} n_{ij}$, $\sum_i \tau_i^O = \sum_j \tau_j^D = 1$ and $\left(\sum_i \tau_i^O \sum_j \tau_{ij}^{OD}\right)/m$ = $\left(\sum_j \tau_j^D \sum_i \tau_{ij}^{OD}\right)/m = 1$, where m is the number of regions.

Two-way migration flow tables (e.g., Table 1) can be expanded to include an age dimension. The multiplicative log-linear model for this flow table is specified as:

$$n_{ij}(x) = \tau\tau_i^O\tau_j^D\tau^A(x)\tau_{ij}^{OD}\tau_i^{OA}(x)\tau_j^{DA}(x)\tau_{ij}^{ODA}(x) \qquad (4)$$

where the superscript A denotes age and x denotes a five-year age group. The age groups for the Italian migration data start with 0-4 years and end with 95+ years. This model is more complicated because there are now three two-way interaction components and one three-way interaction component between the variables origin, destination, and age. However, the interpretations of the parameters are still relatively simple. The interpretation of the overall effect (τ), the origin and destination main effects (τ_i^O and τ_j^D, respectively), and the origin-destination interaction effects (τ_{ij}^{OD}) remain the same: $\tau = \sum_{ijx} n_{ij}(x)$, $\tau_i^O = \sum_{jx} n_{ij}(x)/\tau$, $\tau_j^D = \sum_{ix} n_{ij}(x)/\tau$, and $\tau_{ij}^{OD} = \sum_x n_{ij}(x)/\tau\tau_i^O\tau_j^D$. The calculations for the age effect parameters are: $\tau^A(x) = \sum_{ij} n_{ij}(x)/\tau$, $\tau_i^{OA}(x)$ = $\sum_j n_{ij}(x)/\tau\tau_i^O\tau^A(x)$, and $\tau_j^{DA}(x)$ = $\sum_i n_{ij}(x)/\tau\tau_j^D\tau^A(x)$. And, finally, the calculation for the origin-destination-age interaction is $\tau_{ij}^{ODA}(x) = n_{ij}(x)/\tau\tau_i^O\tau_j^D\tau^A(x)\tau_{ij}^{OD}\tau_i^{OA}(x)\tau_j^{DA}(x)$.

The constraints of the model for the origin and destination parameters remain the same. The constraints for the parameters that include age are $\sum_x \tau^A(x) = 1$ for the age main effect parameters and $\left[\sum_x \left(\tau^A(x)\sum_i \tau_i^{OA}(x)\right)\right]/m = \left[\sum_i \left(\tau_i^O \sum_x \tau_i^{OA}(x)\right)\right]/k = \left[\sum_x \left(\tau^A(x)\sum_j \tau_j^{DA}(x)\right)\right]/m = \left[\sum_j \left(\tau_j^D \sum_x \tau_j^{DA}(x)\right)\right]/k = 1$ for the two-way interaction effect parameters with age, where m is the number of regions and k the number of age groups.

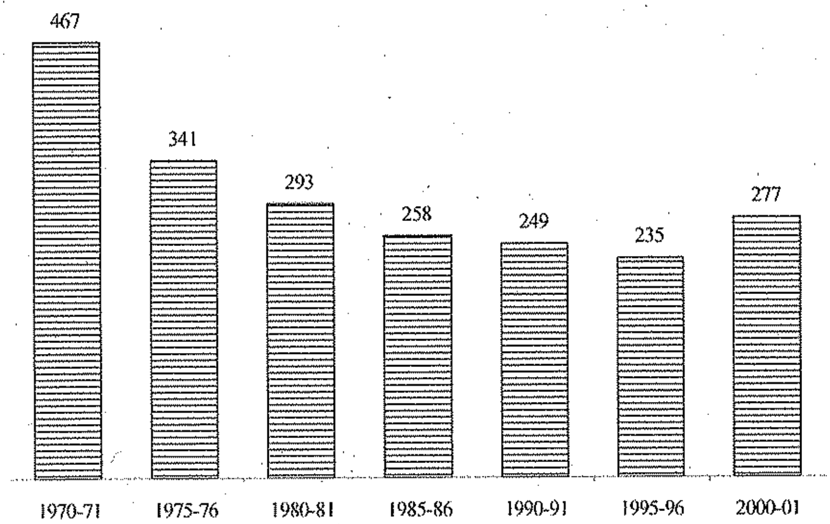
The multiplicative component modeling framework presented in detail above is useful for describing migration flow tables and also, as is demonstrated in the next section of this paper, for estimating a set of future migration patterns. The main disadvantage of the total sum reference category coding scheme is that it is not an option in standard statistical packages, so one is forced to translate between different coding schemes. However, the results produced from the total reference category coding scheme are the same as the results produced by either geometric mean or cornered-effect coding schemes (Raymer 2006); the difference lies in the interpretation of the parameters and in finding a logical way to estimate migration flows based on the information available.

2.2 The Migration Age and Spatial Structures in Italy, 1970-1971 to 2000-2001

The underlying age and spatial structures of interregional migration in Italy are described over time in this sub-section using the multiplicative components described above. Seven migration periods have been collected. These consist of the 1970-1971 to 2000-2001 periods, spaced out every five years. Note, the analysis of the multiplicative components follows a hierarchical format starting with the overall level component and ending with the two-way interaction components. For the purposes of this paper, we ignore the three-way interactions between origin, destination, and age for two reasons. The first is that most of the structure found in the migration patterns is captured by the overall, main, and two-way interaction effects. The second reason is, while there are often patterns found in the three-way interactions, it is tedious to incorporate these into the modelling process and their interpretation is more difficult. Therefore, we just focus on the more simple aspects of the model. In the next section, projections of the multiplicative components are carried out to estimate future age-specific migration flows in Italy. These projections are based on the historical trends found in each of the multiplicative components discussed in this section.

The overall level components of interregional migration in Italy for the seven time periods are set out in Figure 2. The levels declined over time from 467 thousand in 1970-1971 to 235 thousand in 1995-1996. In the most recent period, there exhibited an increase to 277 thousand.

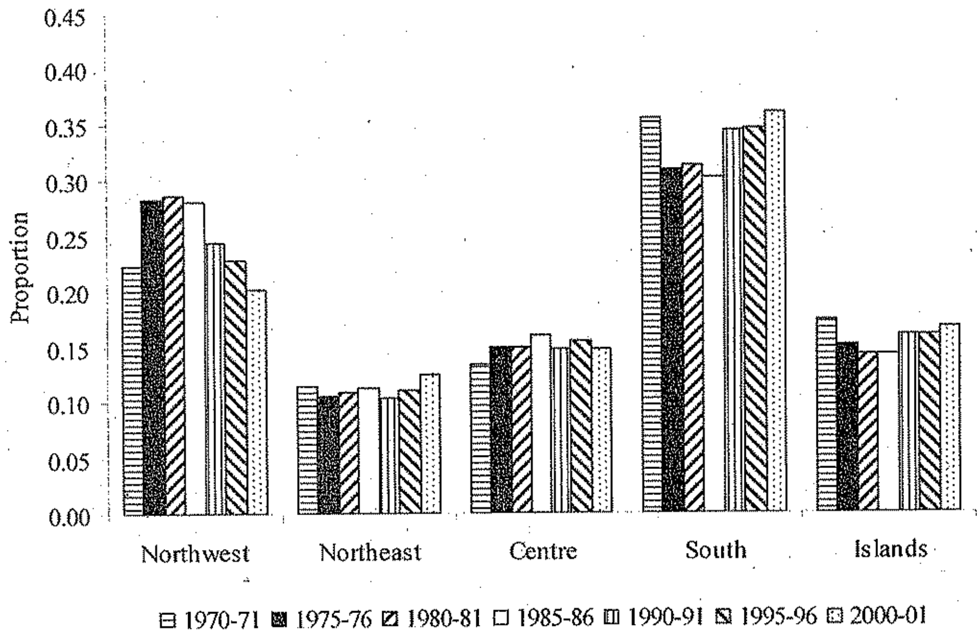
Figure 2. The overall level components (in thousands) of interregional migrants in Italy: 1970-1971 to 2000-2001



2.2.1 *Analysis of the Main Effect Components*

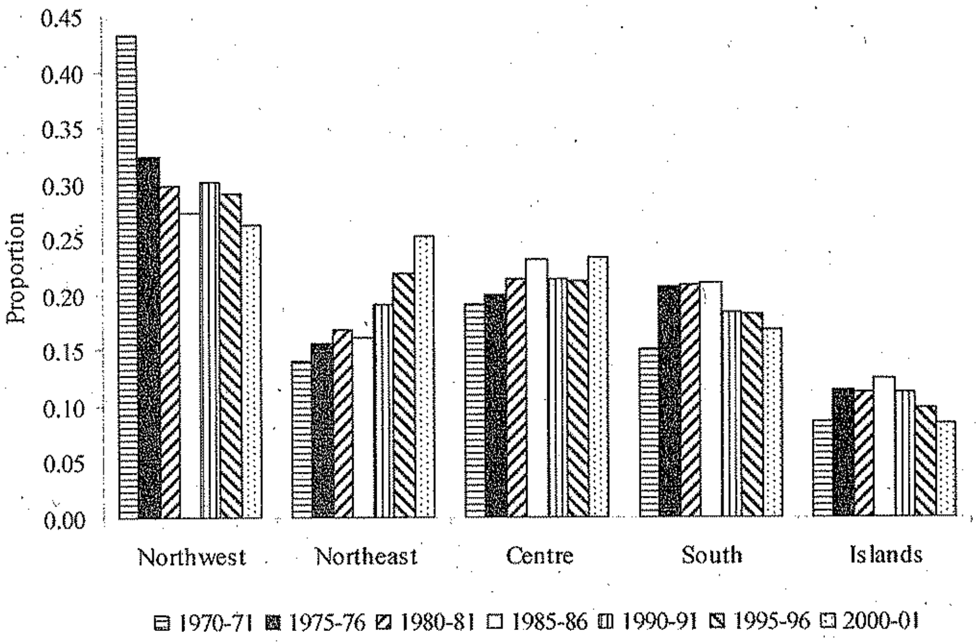
The origin main effect components are set out for the seven time periods in Figure 3. The patterns show relatively stable shares of out-migration from the Northeast, Centre, and Islands regions, averaging 11 percent, 15 percent, and 16 percent, respectively. For the Northwest region, the shares of out-migration increased from 22 percent in 1970-1971 to 28 percent in 1975-1976, where it remained stable for three periods and then steadily declined to 20 percent in 2000-2001. The shares of out-migration from the South over time mirrored the patterns found in the Northwest. During the 1975-1976, 1980-1981, and 1985-1986 periods, the Northwest and South regions exhibited roughly the same shares of out-migration (28 percent and 31 percent, respectively). Before and after these periods, the South sent the largest share of the migrants (around 35 percent).

Figure 3. The origin components of interregional migrants in Italy: 1970-1971 to 2000-2001



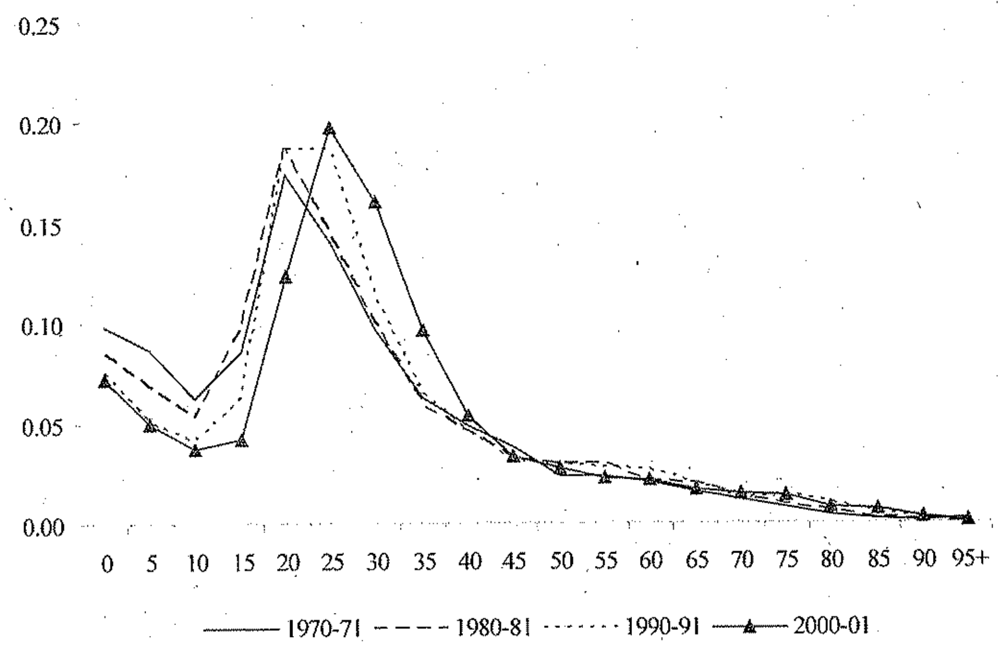
The destination main effect components of interregional migration are set out over time in Figure 4. These patterns are different than those found with the origin components. The Northwest region experienced substantial declines in its share of in-migrants over time from 43 percent to 26 percent. The Northeast region, however, exhibited steady increases in its shares over time from 14 percent to 25 percent. The Centre region also exhibited increases, albeit to a lesser extent. The South and Islands regions exhibited increasing shares between 1970-1971 and 1985-1986 (with most of the increase between the first two periods) and then declined back to around the same level found in the 1970-1971 period.

Figure 4. The destination components of interregional migrants in Italy: 1970-1971 to 2000-2001



The age main effect components (i.e., proportions of all migrants by age) for the 1970-1971, 1980-1981, 1990-1991, and 2000-2001 periods are set out in Figure 5. When examining the patterns over time, three interesting findings come out. First, the shares of migrants in the young age groups (i.e., 0-14) steadily declined between 1970 and 1991. Second, the position of labor force peak has shifted five years to the right. During the first four periods of this study, the largest share of migrants was in the 20-24 age group. In 1995-1996, the largest share of migrants was in the 25-29 age group and remained there for the subsequent period. The transition occurred in the 1990-1991 period, where roughly 19 percent of migrants were in the 20-24 age group and 19 percent in the 25-29 age group. Third, during all seven periods, the shares in the 40+ age groups remained relatively low and constant.

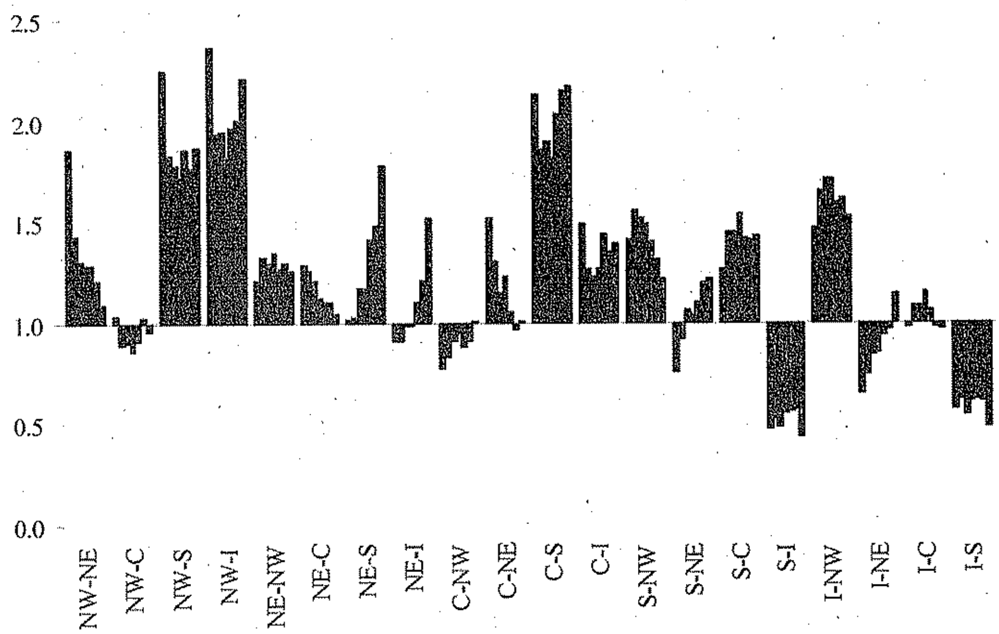
Figure 5. The age components of interregional migrants in Italy: 1970-1971, 1980-1981, 1990-1991, and 2000-2001



2.2.2 *Analysis of the Two-Way Interaction Components*

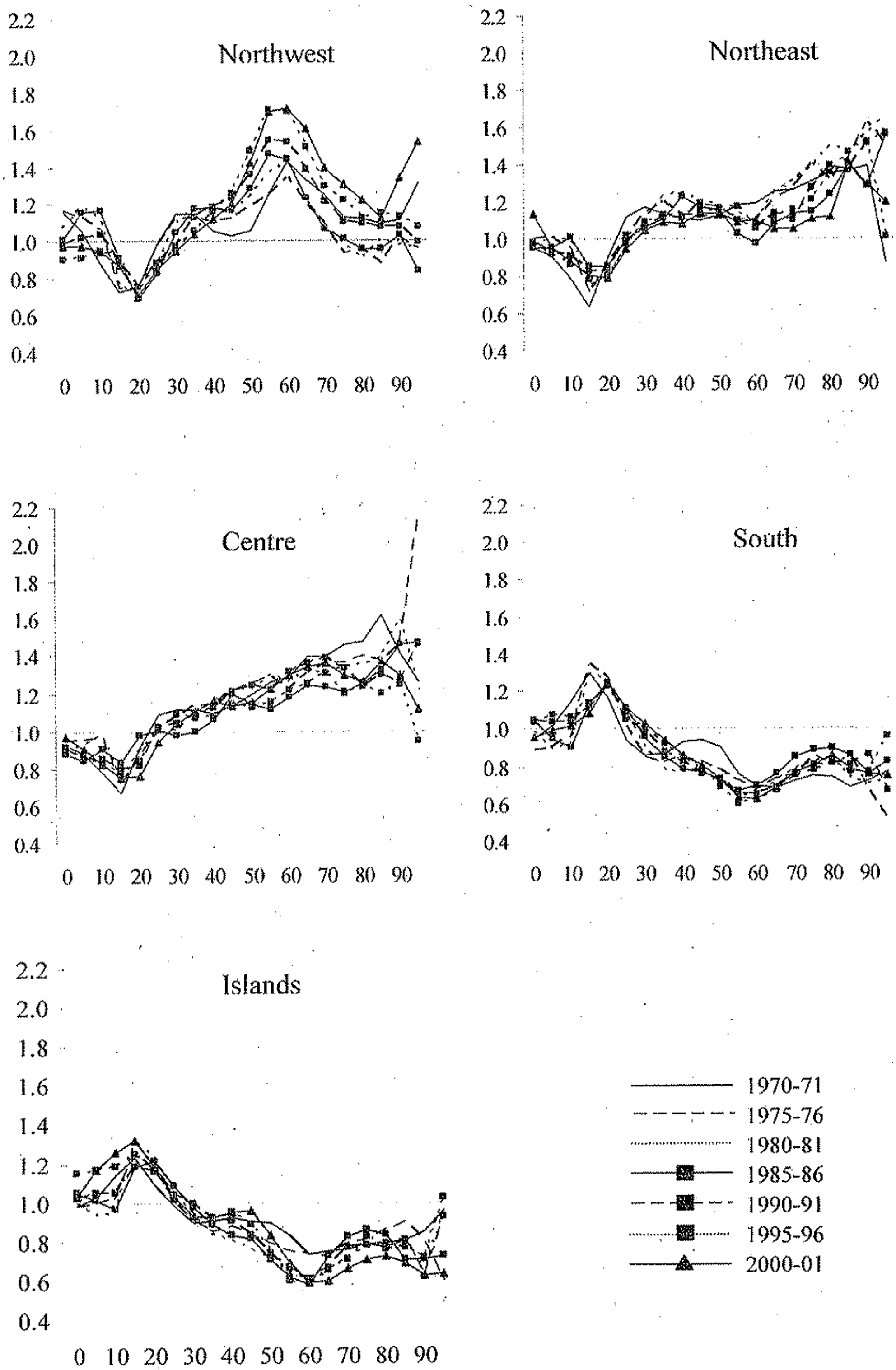
Thus far, the analysis has focused on the main effects of the multiplicative component model, which are interpreted as proportional shares. The two-way interaction components represent deviations from the overall proportions represented by the main effects. The origin-destination interaction components are set out in Figure 6. They show that there were relatively stable patterns over time. In particular, the interaction components remained *high* (i.e., average ratios above 1.6) for migration from the Northwest to the South and Islands, from Centre to South, and from Islands to Northwest. The interaction components remained *moderate* (i.e., average ratios between 1.3 and 1.4) for migration from Northeast to Northwest and from South to Centre. The interaction components remained *weak* (i.e., ratios close to unity) for migration from Northwest and Islands to Centre. And, the interaction components remained low (i.e., ratios averaging below 0.6) for migration between South and Islands. The remainder of the interaction components (9 out of 20) exhibited either increasing or decreasing patterns. Interestingly, the associations between Northeast and South and Northeast and Islands substantially and steadily increased, whereas the associations between Northeast and Centre, and the association representing the flow from Northwest to Northeast, steadily decreased.

Figure 6. The origin-destination interaction components of interregional migration in Italy: 1970-1971 to 2000-2001



The interactions between origin and age have also remained relatively stable over time, as demonstrated in Figure 7. In reference to the overall age schedules of interregional migration (see Figure 5), retirement age groups are more likely to migrate out of the Northwest and less likely to leave the South and Islands. For young adult age groups, the patterns are the opposite. And for the Northeast and Centre regions, migrants are more likely to leave in the young adult and older age groups. Over time, the most striking pattern is that the retirement peak exhibited by the Northwest has become more pronounced.

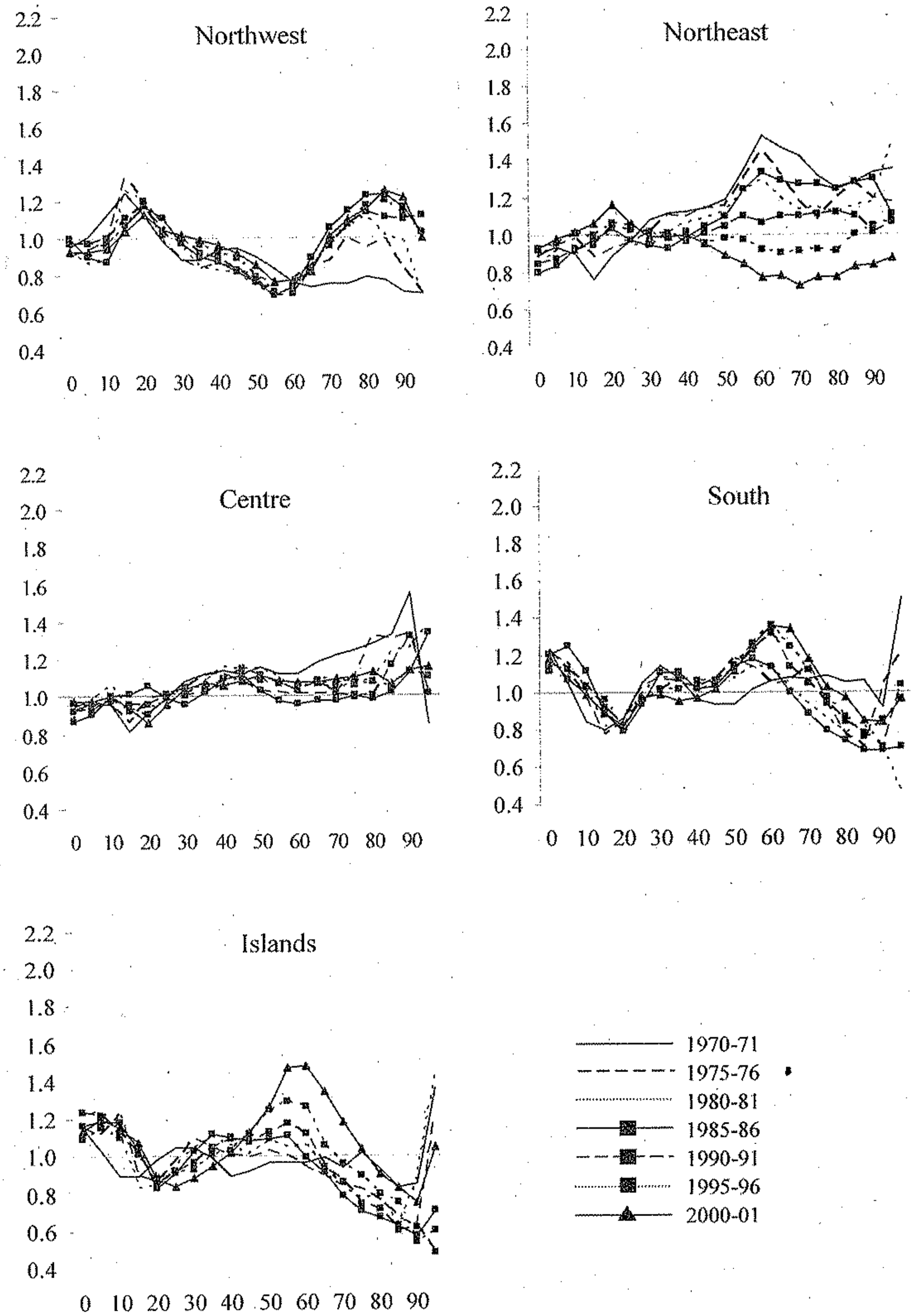
Figure 7. The origin-age interaction components of interregional migration in Italy: 1970-1971 to 2000-2001



A different set of patterns emerges when the associations between destination and age are examined (Figure 8). First, there was great stability up to around age 60 exhibited in the Northwest and Centre regions. The Northwest region attracted migrants in the 15-29 ages (i.e., labor force years) and 70+ ages (i.e., late elderly years), with the latter representing more recent trends. The relatively flat profiles of the destination-age associations in the Centre region demonstrate that the age-specific in-migration profiles to this region were similar to the overall age-specific profile of migration. The other three regions exhibited stable patterns over time until the about the 45-49 age group. At this point the patterns exhibited increasing ratios in the South and Islands regions and decreasing ratios in the Northeast region. For the South and Islands regions, this implies that retirement in-migration has become more important over time. For the Northeast region, it has become much less important.

In comparing the origin-age and the destination-age interactions, we find some interesting differences. For example, consider the South region where the origin-age interactions show that most of the out-migrants from this region were in their labor force years. The destination-age interactions, on the other hand, show that many of the in-migrants to this region were elderly retirees. Young adults were particularly not attracted to this region. For another example, consider the Centre region. In the destination-age interactions, there were few deviations from the overall shape of the migration age profile (see Figure 6), whereas in the origin-age interactions there were increasing levels found in the age groups after 30 years.

Figure 8. The destination-age interaction components of interregional migration in Italy: 1970-1971 to 2000-2001



To summarize, the structures found in the age and spatial patterns of migration show that there appears to have been some substantial shifts in the interregional migration patterns since 1970. The overall levels have declined. The shares of in-migration have increased in the Northeast and declined in the Northwest. The labor force peak of age-specific migration has shifted five years to the right. The Islands region has become more connected with the rest of Italy. And, finally, retirement migration from the Northwest and to the South and Islands (in particular) has become more important.

2.3 Comparing the Multiplicative Components Using Ratios

The disaggregation of migration flows between origins i, destinations j, and ages x into separate components allows us to measure the contribution of each to the variation of this flow in a given period of time. Consider the saturated log-linear model set out in Equation 4. The ratio between a specific migration flow in two different points of time (time 0 and 1) can be specified as product of the ratios of each component, that is:

$$\frac{{}^{1}n_{ij}(x)}{{}^{1}n_{ij}(x)} = {}_{0}^{1}\lambda = {}_{0}^{1}\lambda_{\tau} * {}_{0}^{1}\lambda_{i}^{O} * {}_{0}^{1}\lambda_{j}^{D} * {}_{0}^{1}\lambda^{A}(x) * {}_{0}^{1}\lambda_{ij}^{OD} * {}_{0}^{1}\lambda_{i}^{OA}(x) * {}_{0}^{1}\lambda_{j}^{DA}(x) * {}_{0}^{1}\lambda_{ij}^{ODA}(x) \quad (5)$$

where ${}_{0}^{1}\lambda_{\tau} = \frac{{}_{1}\tau}{{}_{0}\tau}$ represents the relative contribution of the overall component, ${}_{0}^{1}\lambda_{i}^{O} = \frac{{}_{1}\tau_{i}^{O}}{{}_{0}\tau_{i}^{O}}$ the relative contribution of the origin component, and so on. As an example, let us consider the number of migrations of persons aged 20-24 from the South to the Northeast in four points of time: 1970-1971, 1975-1976, 1995-1996, and 2000-2001. The multiplicative components for these periods and the ratios of the components are set out in Table 2.

Table 2. The observed flows and multiplicative components of South to Northeast migration, age 20-24 years: 1970-1971, 1975-1976, 1995-1996, and 2000-2001

	1970-71	1975-76	Ratio	1995-96	2000-01	Ratio
Observed flow	3,757	3,450	0.918	4,185	5,586	1.335
Component						
Overall	466,674	340,410	0.729	235,014	277,336	1.180
Origin	0.356	0.309	0.870	0.346	0.360	1.038
Destination	0.141	0.155	1.101	0.218	0.253	1.157
Age	0.174	0.185	1.059	0.151	0.124	0.821
Origin-destination	0.754	0.917	1.216	1.204	1.223	1.016
Origin-age	1.045	0.985	0.943	1.056	1.175	1.112
Destination-age	1.373	1.352	0.984	1.221	1.257	1.030
Origin-destination-age	0.851	0.936	1.101	1.004	0.990	0.986

The ratios between the observed flows can be expressed in terms of ratios between the multiplicative components:

$$ {}^{1975-76}_{1970-71}\lambda_{S,SE}(20-24) = (0.729)(0.870)(1.101)(1,059)(1.216)(0.943)(0.984)(1.101) $$
$$ = 0.918 $$

$$ {}^{2000-01}_{1995-96}\lambda_{S,SE}(20-24) = (1.180)(1.038)(1.157)(0.821)(1.016)(1.112)(1.030)(0.986) $$
$$ = 1.1335 $$

The results are interesting. In the first half of seventies (i.e., 1970-1971 to 1975-1976), the overall level of interregional migration declined by 27%, but the specific flow of persons aged 20-24 from the South to the Northeast declined by only 8%, thanks to the positive contributions of the destination (+10%), the origin-destination (+22%), and the origin-destination-age (+10%) components. In the most recent period (i.e., 1995-1996 to 2000-2001), the overall level of migration increased by 18%, but our specific flow increased by 34%, thanks to the positive contributions of the destination (+16%) and the origin-age interaction (+11%) components. This was in despite of the negative influence of the age component (-18%).

In other words, the "keeping" of the migration flows of the young adult age groups from the South to the Northeast in the period of an intense decline of the overall level of internal migration is mainly due to a stronger interaction between the two areas, while the particularly high increase of the South to Northeast migration in the recent period is due to a rises in the destination component and the origin-age component.

3. PROJECTING FORWARD THE AGE AND SPATIAL PATTERNS OF MIGRATION

This section focuses on projecting the interregional migration patterns in Italy forward to 2010-2011 using the patterns found in the multiplicative components described in the previous section. The multiplicative components are first projected forward using simple linear extrapolation techniques and then systematically incorporated into the multiplicative component model to produce initial estimates of future migration flows. In order to satisfy the model constraints set out in Section 2.1 of this paper, the initial estimates are then "corrected" using a log-linear-with-offset model.

3.1 Projection of the Main Effect Components

If the levels observed from 1970-1971 to 2000-2001 were extrapolated linearly to 2010-2011, the projected level would be 155,993 migrants --- 121 thousand less migrants than reported during the 2000-2001 period. However, if the linear projection was based just on the more recent patterns (i.e., 1990-91, 1995-96, and 2000-01), then the projected level would be 296,297 --- 19 thousand more migrants. Clearly, projecting the overall level has great impact on the interregional migration patterns.

All of the projections carried out in this paper maintain the overall level found in the 2000-2001 period (i.e., 277 thousand). The emphasis is instead placed on projecting the origin, destination, and age structures and the two-way interactions between them. This allows one to identify the direct consequences due to changes in main effect and interaction structures. The modeling approach, of course, allows the researcher to do both. Also, the projection of the multiplicative components is kept simple for the purpose of illustration. Extrapolation of past trends is a commonly-used option but, ideally, one would project each of the multiplicative components forward using covariates or expert judgments specific to each component.

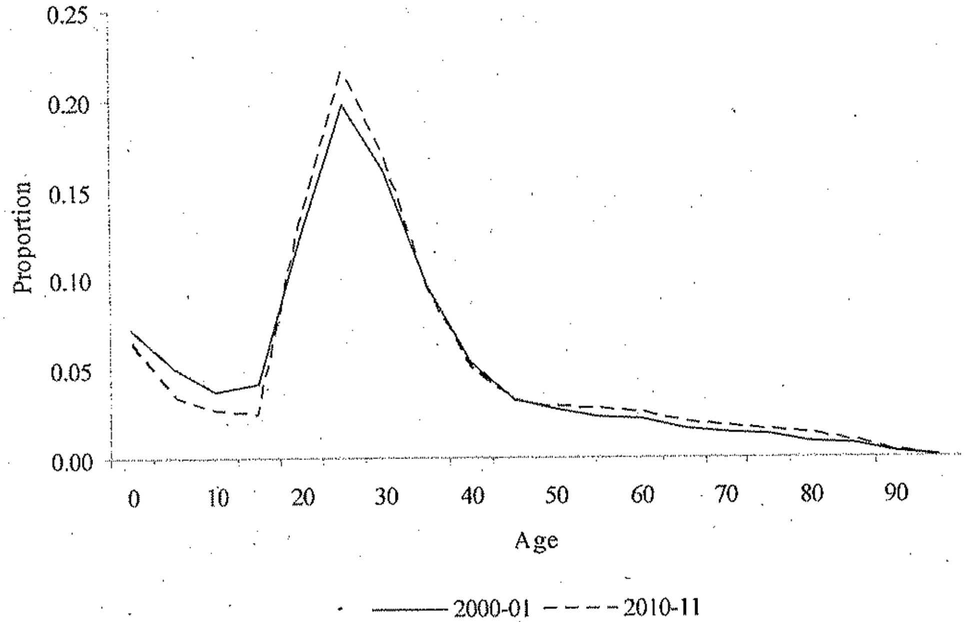
To start, consider the 2010-2011 projected origin and destination main effect components (i.e., O_i and D_j, respectively) set out in Table 3. These projected values (standardized to unit area) are based on a linear projection using the 1970-1971 to 2000-2001 proportions as inputs. For the origin main effect components, the proportional shares of out-migration are projected to decline for the Northeast, South and Islands regions and increase for the Northwest and Centre regions. In each case, the increase or decrease is about 1 percent. For the destination main effect components, the changes are more substantial. The proportional shares of migration to the Northwest are projected to decrease by about 5 percent. The shares for other four regions are projected to increase with the Northeast and South increasing about 3 percent combined.

Table 3. The origin and destination main effects of Italian interregional migration: 1970-1971 to 2010-2011 (projected)

Region	Observed 1970-71	1980-81	1990-91	2000-01	Projected 2010-11
Origin main effects					
Northwest	0.2231	0.2857	0.2443	0.2018	0.2115
Northeast	0.1137	0.1096	0.1036	0.1246	0.1177
Centre	0.1329	0.1497	0.1479	0.1477	0.1587
South	0.3555	0.3123	0.3441	0.3595	0.3539
Islands	0.1748	0.1427	0.1602	0.1663	0.1583
Destination main effects					
Northwest	0.4328	0.2984	0.3014	0.2628	0.2089
Northeast	0.1409	0.1688	0.1906	0.2525	0.2700
Centre	0.1903	0.2136	0.2134	0.2331	0.2403
South	0.1501	0.2078	0.1831	0.1679	0.1833
Islands	0.0859	0.1115	0.1115	0.0837	0.0974

The main effect parameters for age $\tau^{A}(x)$ were also projected forward (standardized to unit area) and are set out in Figure 9. Here we see that the overall age profile of migration for Italy is projected to include more persons in the labor force years. The age-specific proportions after age 40 are about the same as found in the earlier periods, whereas the age-specific proportions are substantially lower for migrants 0-19 years old.

Figure 9. The age main effect components of interregional migration in Italy: 2000-2001 and 2010-2011 (projected)



3.2 The Log-Linear Model for Projecting Migration Age and Spatial Structures

Auxiliary information may be used to predict migration flows (Rogers, Willekens and Raymer 2003; Willekens 1982). Let $n^*_{ij}(x)$ denote a hypothetical migration flow table. The migration flow table for a future period may be predicted on the basis of, for example, an estimated level of the migration system, estimated proportions of migrants originating from regions i, and some additional (e.g., current) information represented by $n^*_{ij}(x)$. This particular model is specified as:

$$\hat{n}_{ij}(x) = n^*_{ij}(x)\nu\nu^O_i . \tag{5}$$

where the v's denote the parameters of the log-linear-with-offset model (Rogers, Willekens and Raymer 2003:60-61). The result is a migration flow table that exhibits the estimated level of overall migration and proportions of migrants originating from regions i, but incorporates the remaining structure found in the *offset*, $n^*_{ij}(x)$.

The offset in this paper represents the initial estimates obtained by multiplying each of the multiplicative (projected and observed) together. To demonstrate, consider the multiplicative components for the reported flow of migration between the Northwest and South during the 2000-2001 period for persons aged 65-69 years:

$$
\begin{aligned}
n_{14}(65) &= T * O_1 * D_4 * A(65) * OD_{14} * OA_1(65) * DA_4(65) * ODA_{14}(65) \\
&= (277{,}436)(0.2018)(0.1679)(0.0168)(1.8674)(1.6018)(1.3451)(0.7290) \\
&= 462
\end{aligned}
$$

Now consider the outcome if the projected 2010-2010 proportions for O_1, D_4, and A(65) replaced the ones above:

$$
\begin{aligned}
\hat{n}_{14}(65) &= (277{,}436)(\mathit{0.2115})(\mathit{0.1833})(\mathit{0.0196})(1.8674)(1.6018)(1.3451)(0.7290) \\
&= 618
\end{aligned}
$$

The set of estimated flows that are produced by altering the main effects of origin, destination, and age add up to 277,892, which differs from the specified overall level of 277,436 by 456. The reason for this (small) difference has to do with the constraints of the multiplicative components not being met. To obtain flows that coincide with the model constraints, a log-linear-with-offset model can be applied (Equation 5).[4] The multiplicative components calculated from the predicted values obtained from the log-linear-with-offset model for the above example are:

$$\hat{n}_{14}(65) = (277{,}436)(0.2115)(0.1817)(0.0198)(1.7257)(1.5712)(1.3338)(0.7401)$$

$$= 565$$

which is 53 less than the initial estimate of 618.

3.3 Future Migration Scenarios in Italy

To illustrate how the multiplicative component model can be used for projection, several scenarios are carried out in a systematic manner using the 2000-2001 interregional migration patterns as the starting point. The overall level of migration of 277,436 is kept constant for all of the projection scenarios. The first set of estimates insert the projected origin [O], destination [D], and age [A] main effect components. Age-specific net migration totals are then calculated for a comparison of the results. The second set of estimates focus on the inclusion of projected two-way interactions. These results are also compared in terms of age-specific net migration. Finally, a comparison is made between the main effects model and the two-way interactions model for particular age- and origin-destination specific migration flows.

The age-specific regional net migration levels projected for 2010-2011 obtained by adjusting the main effects singularly and collectively are set out in Figure 10. In comparison to the 2000-2001 age-specific net migration patterns, the collective main

[4] Note, in SPSS, the data were weighted to a set of flows that were obtained by resetting the origin component parameters (only). The multiplicative model maintains the overall level when only one main effect component is altered.

effects model version (i.e., [O][D][A] in Figure 9) produced aggregate net migration levels that were 16,832 fewer in the Northwest, 7,144 more in the Northeast, 1,152 less in the Center, 5,418 more in the South, and 5,423 more in the Islands. Overall, the age-specific patterns remained relatively stable. As expected from the descriptive analysis, the destination main effect component made the biggest impact on the predictions. This was particularly noticeable in the Northwest region.

For the estimates that included projections of the origin-destination [OD], origin-age [OA], and destination-age interaction [DA] components, the only noticeable differences in the net migration levels set out in Figure 9 were found in the Northwest region (set out in Figure 11). For all other regions, introducing projections of the two-way interaction parameters had little effect on the age-specific net migration levels. The net migration in the Northwest increased by 107 for the [O][D][A] model, decreased by 937 for the [OD] model, increased by 120 for the [OA] model, increased by 1,714 for the [DA] model, and increased by 690 migrants for the [OD][OA][DA] model. Interestingly, the overall age pattern between the different models does not as vary much as the aggregate results.

Figure 10. Projected 2010-2011 age-specific net migration levels in Italy by region: Various main effect models

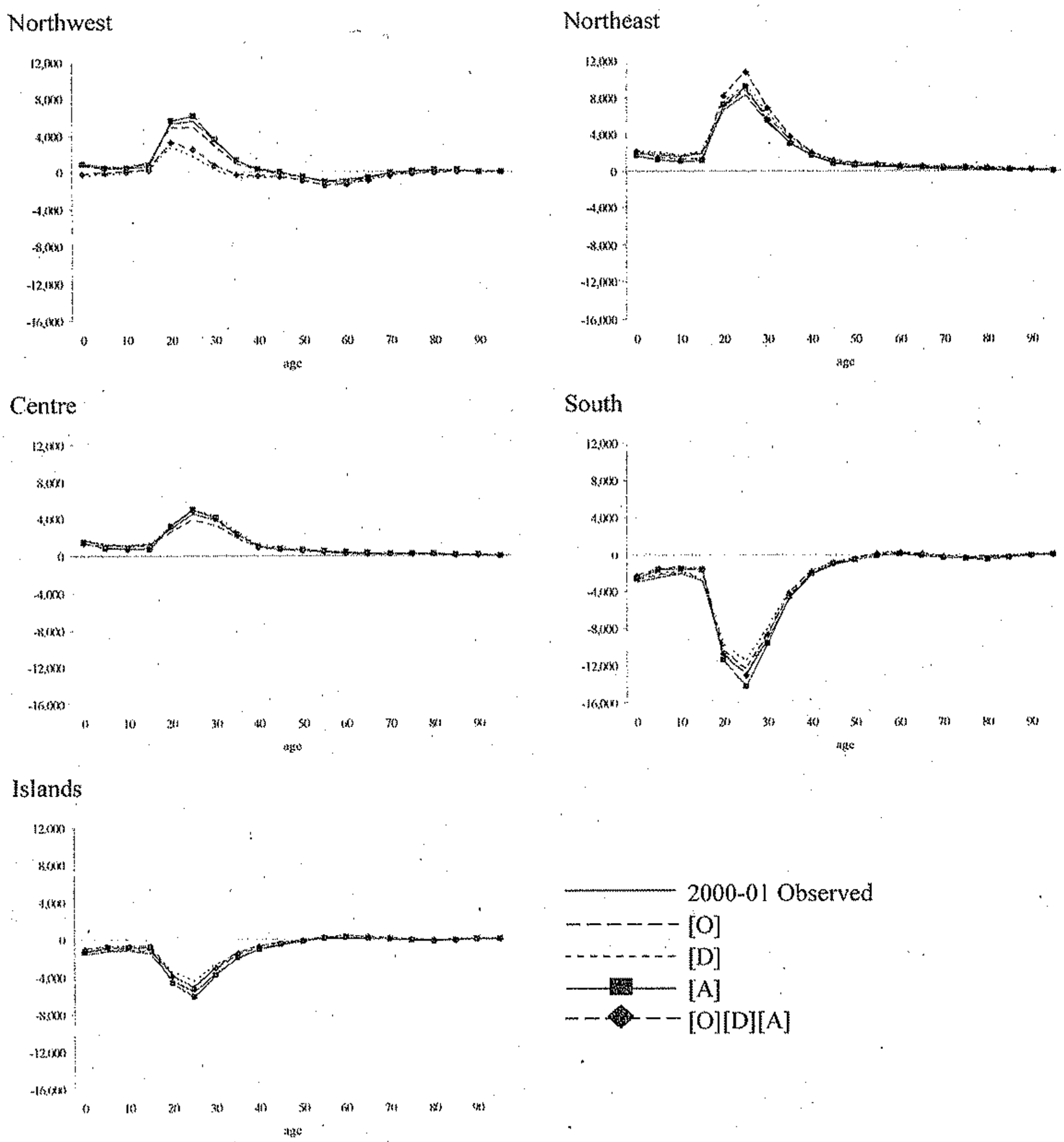
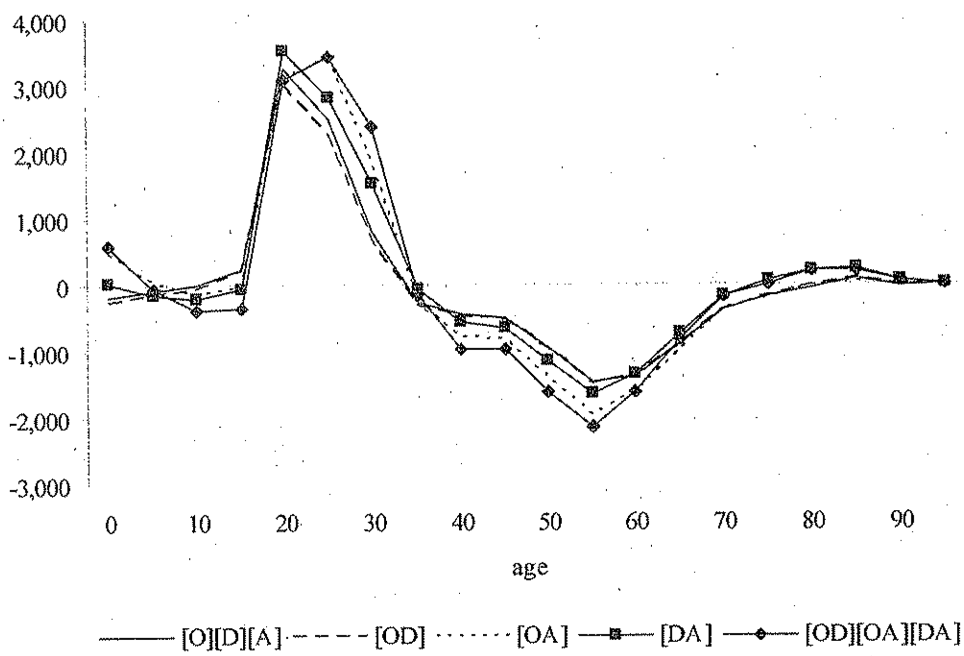
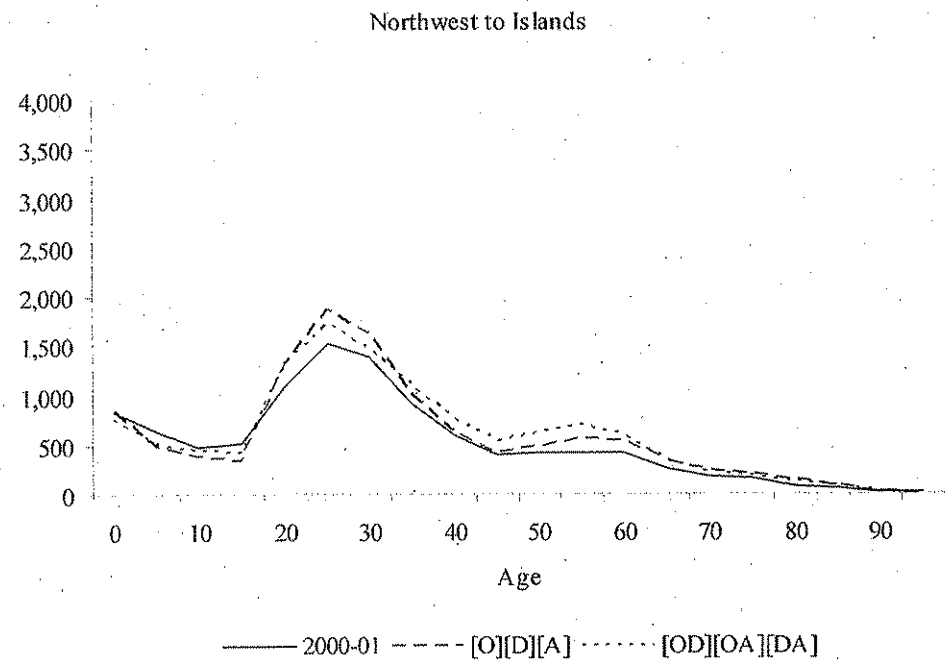


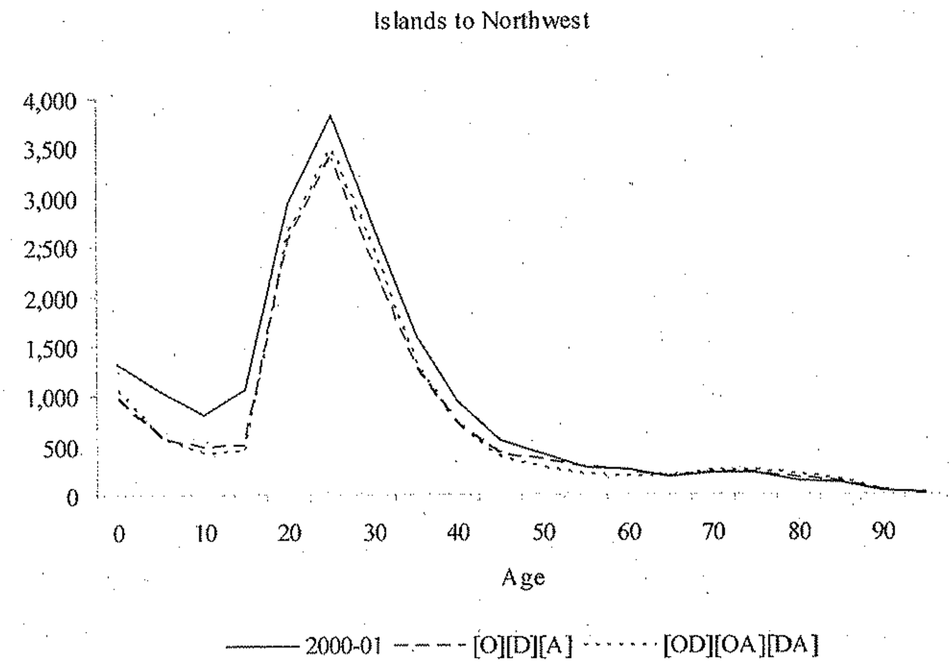
Figure 11. Projected 2010-2011 age-specific net migration levels in the Northwest region: Main effect (i.e., [O][D][A]) and two-way interaction models



The above analysis focuses on the net results of the projection. However, one can also examine the origin-destination-specific flows. For example, consider two projection results for migration between the Northwest and Islands regions, set out in Figure 12. The first projection used a main effects model (i.e., [O][D][A]) and the second projection used a two-way interactions model (i.e., [OD][OA][DA]). During the 2000-01 period, there were 10,360 migrants from the Northwest to the Islands and 18,610 migrants from the Islands to the Northwest. The [O][D][A] model predicted an increase of 1,086 migrants for the Northwest to Islands flow and a decrease of 3,752 for the opposite flow. The [OD][OA][DA] model predicted an increase of 1,491 migrants for the Northwest to Islands flow and a decrease of 3,539 for the opposite flow.

Figure 12. The observed 2000-2001 and projected 2010-2011 Northwest to Islands and Islands to Northwest migration flows in Italy: Main effects model ([O][D][A]) and two-way interactions model ([OD][OA][DA])





These projection scenarios have allowed us to assess the future implications of regional age-specific migration. The results are based on past trends found in the multiplicative components. The advantage of this method is that it focuses on the underlying structures of migration which have been shown to exhibit strong regularities over time.

4. CONCLUSION

The migration age and spatial structures analyzed over 30 years have provided some new insights into the recent patterns of migration in Italy. In the near future, the interregional migration flows are likely to reflect continued trends found in the underlying structures. These include an increasing share of migrants going to the Northeast (at the expense of the Northwest), an aging and more concentrated labor force peak in the overall age profile of migration, an increasing connectedness of migration between the Islands region and the rest of Italy, and a more distinct pattern of elderly migration from the Northern regions to the South and Islands regions.

In conclusion, there has been a recent rise in the overall level of interregional migration in Italy after a long period of a decline that started in the early part of the 1970s. This rise has been interpreted as a sign of a more efficient reallocation of human resources and a beginning of a new, more physiological, process which supports the socio-economic development of the country (Livi-Bacci et al. 1996). Future research should certainly explore the reasons behind this recent rise in the overall level of migration, as well as the factors causing increasing and decreasing associations between certain regions and the increasing role that elderly migration is playing.

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