

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

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ABSTRACT

In this paper, we first set out a method for describing the age and spatial structures of interregional migration in Italy over time using the parameters of a saturated log-linear model. Second, we use this information and the log-linear model to project these structures forward based on a set of assumptions about the overall, main effect, and interaction parameters. These two sections of the paper demonstrate a relatively simple, yet powerful, framework for analyzing migration patterns.

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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 based on the log-linear model for categorical data analysis is set out in this paper. We use this model for decomposing a set of age- and origin-destination-specific migration flows. The goal is to demonstrate how (1) the model parameters can be used to identify and compare age and spatial structures of migration over time and (2) the model parameters can be altered to estimate future age and spatial structures of migration.

Rogers et al. (2002) modeled age and spatial patterns of migration 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, the log-linear model is used to describe interregional migration flows in Italy. Here, an alternative parameter coding scheme proposed by Raymer (2003; 2004) is applied and extended to include age. Second, a method for projecting interregional migration patterns is set out within the log-linear modeling framework. This method focuses on making assumptions about specific model parameters.

1.1 Interregional migration in Italy

This study examines the interregional migration patterns in Italy for three time periods, 1980-1981, 1990-1991, and 1999-2000⁴, to identify the changes over time that have occurred in the migration age and spatial structures. A usual and effective way to describe the patterns of internal migration in Italy is to divide the country into five macro-regions: the industrialized *Northwest*, the recently industrialized *Northeast*, the small-to-medium-scale industrialized *Centre*, the social and economically disadvantaged *South*, and the peripheral *Islands*.

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. For a long term analysis of internal

⁴ The 2000- 2001 data will be included when available

migration in Italy, refer to Bonifazi, Chieppa and Heins (1999) and Bonifazi and Heins (2000).

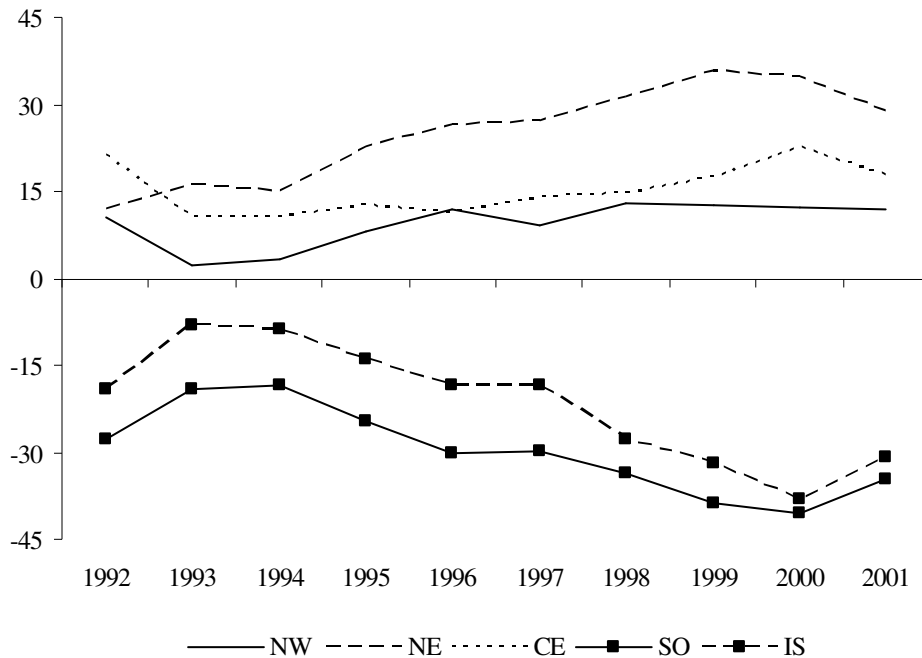


Figure 1. Net migration rates (per 10,000) for the five Italian macro-regions, 1992-91 to 2001-02

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).

There has been a more recent 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 internal migration patterns in Italy.

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.

The difference between registration data and census data, for example, in the United States is that, for the former, the patterns are obtained from population registers, whereas for the latter, they are obtained from surveys. There are several important differences between the two data collection systems. First, the registration data includes all moves. The migration data in the U.S., on the other hand, represents current residence by residence a point in time earlier. With these data, the numbers of moves within the period are not captured. Second, the time interval width of migration is different. In Italy, internal migration represents the number of interregional moves within a period of one

year, whereas the data collected during the decennial censuses in the United States, migration represents a period of five years. Five-year migration intervals typically measure more permanent migration patterns (e.g., Long and Boertlein 1990; Rogers, Raymer and Newbold 2003; Rogerson 1990). Third, just because the data come from a population register does not imply the data are perfect. Registration may not record the actual numbers of 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.

2. DESCRIBING THE AGE AND SPATIAL STRUCTURES OF MIGRATION

In this section, the log-linear model, with an alternative parameter coding scheme (Raymer 2004), is put forward for the purpose of describing the age and spatial structures of migration patterns in Italy during the 1980-81, 1990-91, and 1999-00 time periods.

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

The models set out in this paper estimate the 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 excluded from the analyses. The aggregate number of age-specific migrants originating from a particular place is denoted $n_{i+}(x)$ and the aggregate number of 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* (T) component representing the level of migration, an *origin* (O) component representing the relative “pushes” from each region, a *destination* (D) component representing the relative “pulls” to each region, and a two-way *origin-destination interaction* (OD) component representing the physical or social distance between places not explained by the overall and main effects. This disaggregation is multiplicative, such that

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

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 observed to

expected (for the case of no interaction) flows. The motivation for this paper comes from this approach to examining migration flows.

To illustrate the decomposition, consider the migration flows between the five Italian macro-regions during the 1980-1981 time period set out in Panel A of Table 1. During the 1980-81 period, there were 310 thousand migrants between the five regions. The major sources of migrants were from the Northwest and South regions. The main destinations were Northwest, Northeast, and South regions. In terms of origin-destination-specific flows, the biggest flows were Northwest-South, Northwest-Islands, South-Northwest, South-Centre, and Islands-Northwest.

Table 1. The spatial structure of Italian interregional migration, 1980-81

Origin	Destination					Total
	North-west	North-East	Centre	South	Islands	
<u>A. Observed Flows</u>						
Northwest	0	18,530	16,383	34,475	20,615	90,003
Northeast	13,225	0	8,672	9,322	4,327	35,546
Centre	12,208	8,899	0	18,208	6,819	46,134
South	42,667	17,318	29,376	0	5,543	94,904
Islands	21,432	6,660	10,057	5,272	0	43,421
Total	89,532	51,407	64,488	67,277	37,304	310,008
<u>B. Saturated Log-Linear Model Parameters</u>						
Northwest	0.000	1.242	0.875	1.765	1.903	0.290
Northeast	1.288	0.000	1.173	1.208	1.012	0.115
Centre	0.916	1.163	0.000	1.819	1.228	0.149
South	1.557	1.100	1.488	0.000	0.485	0.306
Islands	1.709	0.925	1.113	0.559	0.000	0.140
Total	0.289	0.166	0.208	0.217	0.120	310,008

The above analysis is based on the numbers of migrations. Now, consider the multiplicative decomposition of these numbers set out in Panel B of Table 1. Note that the overall component (T) is set out in the total sum (i.e., n_{++}) location of the table, the origin components (O_i) are set out in the row-sum locations (i.e., n_{i+}), the destination components (D_j) are set out in the column-sum locations (i.e., n_{+j}), and the origin-destination interaction components (OD_{ij}) are set out in the cells inside of the marginal totals (i.e., n_{ij}). This format is used throughout this paper. For example, the observed Northwest to Islands flow was 20,615 persons. This number can be disaggregated into four components listed above:

$$n_{15} = TO_1D_5OD_{15} = 310,008 * 0.290 * 0.120 * 1.903 = 20,615,$$

where the subscripts denote the regions (1 = Northwest and 5 = Islands).

The interpretations of the above components are relatively simple. The overall component is simply the level of the interregional migration system at that time; there were 310 thousand interregional migrants in Italy during the 1980-81 period. The origin component represents the proportion of all persons in the system migrating from a particular region; 29 percent of all migrants left from the Northwest region. The destination component represents the proportion of all persons migrating to a particular region; 12 percent of all migrants went to the Islands region. And, finally the interaction component represents the ratio of observed to expected flows; there were 19 observed migrants for every 10 expected migrants (based on the marginal totals). This last component captures the “connectedness” between regions. For this example, the

Northwest and Islands were more connected than otherwise expected. Ratios greater than one signify that there is a strong connection between places, whereas ratios 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 in migration flow tables.

This above model and analysis can also be expressed in terms of a log-linear (additive) model:

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

or in its multiplicative form:

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

where the parameters of the model (λ s or τ s) have superscripts O and D denoting origin i and destination j, respectively. For the (multiplicative) log-linear model parameters to have the same interpretation as the parameters of 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 $\tau_i^O = \frac{\sum_j n_{ij}}{\tau}$ and $\tau_j^D = \frac{\sum_i n_{ij}}{\tau}$, and the

interaction effect parameters (or components) must equal to $\tau_{ij}^{OD} = \frac{n_{ij}}{\tau \tau_i^O \tau_j^D}$. The

constraints of these parameters are: $\tau = \sum_{ij} n_{ij}$, $\sum_i \tau_i^O = \sum_j \tau_j^D = 1$ and $\frac{\sum_i \tau_i^O \sum_j \tau_{ij}^{OD}}{m} =$

$\frac{\sum_j \tau_j^D \sum_i \tau_{ij}^{OD}}{m} = 1$, where m is the number of regions. The log-linear model typically

assumes a Poisson probability distribution because its properties are relatively simple and well known and, like counts, the outcomes can only be positive. Finally, the parameters are estimated using maximum likelihood methods.

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:

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

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. In total, there are twenty age groups. 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: $\tau = \sum_{ijx} n_{ij}(x)$, $\tau_i^O = \frac{\sum_{jx} n_{ij}(x)}{\tau}$, $\tau_j^D = \frac{\sum_{ix} n_{ij}(x)}{\tau}$, and

$$\tau_{ij}^{OD} = \frac{\sum_x n_{ij}(x)}{\tau \tau_i^O \tau_j^D}. \text{ The calculations for the age effect parameters are: } \tau^A(x) = \frac{\sum_{ij} n_{ij}(x)}{\tau},$$

$$\tau_i^{OA}(x) = \frac{\sum_j n_{ij}(x)}{\tau \tau_i^O \tau^A(x)}, \text{ and } \tau_j^{DA}(x) = \frac{\sum_i n_{ij}(x)}{\tau \tau_j^D \tau^A(x)}. \text{ And, finally, the calculation for the}$$

$$\text{origin-destination-age interaction is } \tau_{ij}^{ODA}(x) = \frac{n_{ij}(x)}{\tau \tau_i^O \tau_j^D \tau^A(x) \tau_{ij}^{OD} \tau_i^{OA}(x) \tau_j^{DA}(x)}.$$

The constraints of the model for the origin and destination parameters remain exactly the same as set out above. The constraints for the parameters that include age are

$$\sum_x \tau^A(x) = 1 \text{ for the age main effect parameters and } \frac{\sum_x \left[\tau^A(x) \sum_i \tau_i^{OA}(x) \right]}{m} =$$

$$\frac{\sum_i \left[\tau_i^O \sum_x \tau_i^{OA}(x) \right]}{k} = \frac{\sum_x \left[\tau^A(x) \sum_j \tau_j^{DA}(x) \right]}{m} = \frac{\sum_j \tau_j^D \sum_x \tau_j^{DA}(x)}{k} = 1 \text{ for the two-way}$$

interaction effect parameters with age, where m is the number of regions and k the number of age groups.

The total reference category coding scheme for the parameterization of the log-linear model 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 2003); the difference lies in

the interpretation of the parameters and in finding a logical way to estimate migration flows based on the information available.

To better understand the interpretation of parameters under the total reference category coding scheme consider the following example. (To be continued...)

2.2 The Migration Age and Spatial Structures in Italy

The age and spatial structures of interregional migration in Italy are described in this subsection for the 1980-81, 1990-91, and 1999-00 periods to identify underlying patterns in the migration age and spatial structures over time. The multiplicative disaggregation presented in the previous subsection is the analytical mechanism for this description. Note, the analysis 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 may be patterns found in the three-way interactions, it is very 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, we use the information obtained in this section on the historical patterns to come up with a simple projection model of interregional migration in Italy.

The levels of interregional migration, i.e., τ 's, in Italy fluctuated over time from 310 thousand during the 1980-81 period, down to 244 thousand during the 1990-91 period, and up to 375 thousand during the 1999-00 period.

The proportional shares of migrants by region of origin, i.e., τ_i^0 's, are set out for the three time periods in Figure 2. The patterns show a steady and sharp decline, from 29 percent during 1980-81 to 16 percent during 1999-00 period, in the shares of migrants from the Northwest region. The Northeast and Centre regions experienced relatively small declines from 12 to 9 percent and 15 to 11 percent, respectively. In the South region, there was an increase from 31 to 35 percent between 1980-81 and 1990-91 and then a drop to 28 percent in 1999-00. The reason why the proportions changed, particularly in the latter period was the very large increase (particularly in the last period) in the proportions of migrants coming from the Islands region. During 1980-81, there were 14 percent of all migrants originating from the Islands. During 1999-00, there were 37 percent of all migrants coming from this region.

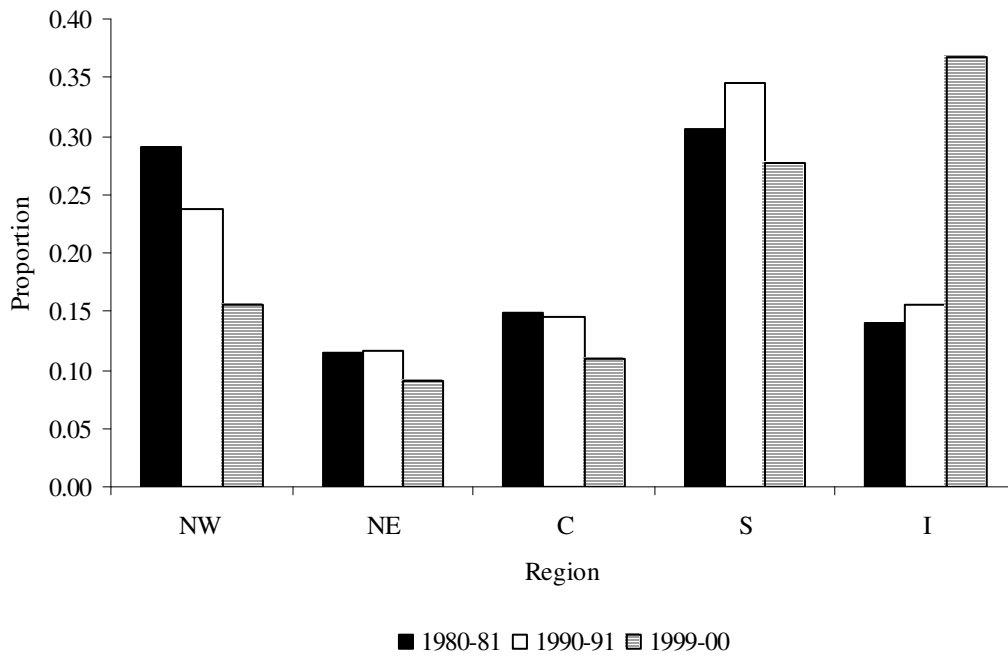


Figure 2. Proportions of interregional migrants in Italy by region of origin: 1980-81, 1990-91, and 1999-00

The proportional shares of migrants according to the five regions of destination, i.e., τ_j^D 's, are set out for the three time periods in Figure 3. These patterns show relatively stable patterns in the shares to the Northwest, increases in the shares to the Northeast, slight increases in the shares to the Centre, and declines in the shares to the South and Islands. The Northeast region experienced the largest increase from 17 percent in 1980-81 to 26 percent in 1999-00. This increase was in large part caused by the drop in the proportions going to the South and Islands from 34 percent during 1980-81 to 23 percent during 1999-00.

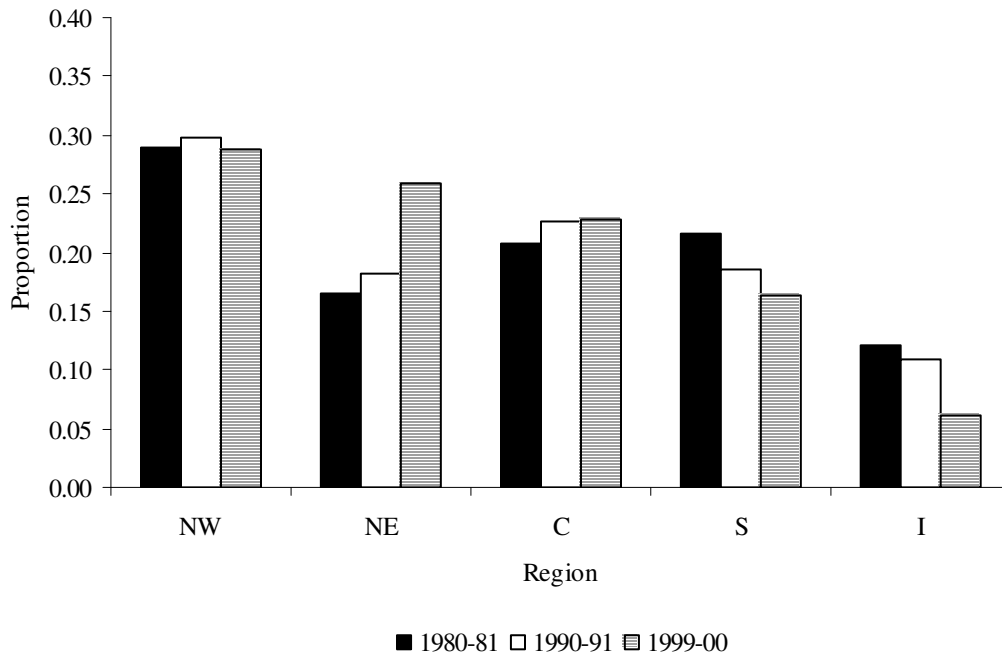


Figure 3. The destination main effect parameters of interregional migration in Italy: 1980-81, 1990-91, and 1999-00

The proportions of all migrants by age, i.e., $\tau^A(x)$'s, are set out for the three time periods in Figure 4. Here, we find that over time, the labor force peak has shifted substantially towards the right (by ten years). During the middle period, the labor force peak was broader than observed in 1980-81 and 1999-00. Finally, the proportions in the youngest age groups have declined, whereas the proportions for age groups 45+ years have remained the same.

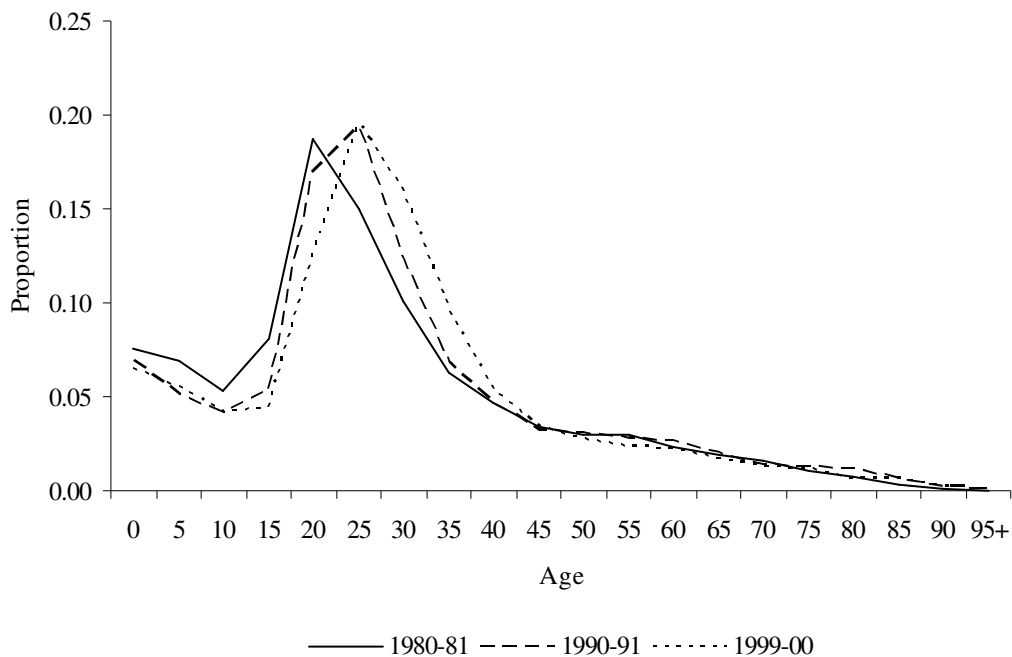


Figure 4. The age main effect parameters of interregional migration in Italy: 1980-81, 1990-91, and 1999-00

Thus far, the analysis has focused on the main effects of the log-linear decomposition (see Equation 4). These main effects were interpreted in terms of proportional shares from the five regions of origin, to the five regions of destination, or in

the twenty age groups. Next, the two-way interaction parameters are analyzed. These parameters represent deviations from the overall proportions found in the main effect parameters. The interactions between region of origin and region of destination are set out in Figure 5. They show that there were steady increases in the interactions over time between all origins and the South and Islands regions (as destinations) and in the South-Northeast, Islands-Northeast, and Northwest-Centre exchanges. The interaction for the Centre-Northeast flow increased between 1980-81 and 1999-00 but only after a decline in the interaction during the 1990-91 period. The Northwest-Northeast interaction was the only situation in which there was an increase between 1980-81 and 1990-91 but then an overall decrease by 1999-00. All of the other origin-destination interactions not mentioned experienced steady declines, with the exception of the Northeast-Centre interaction. Overall, there appears to be stability in the trends of the origin-destination interactions over time.

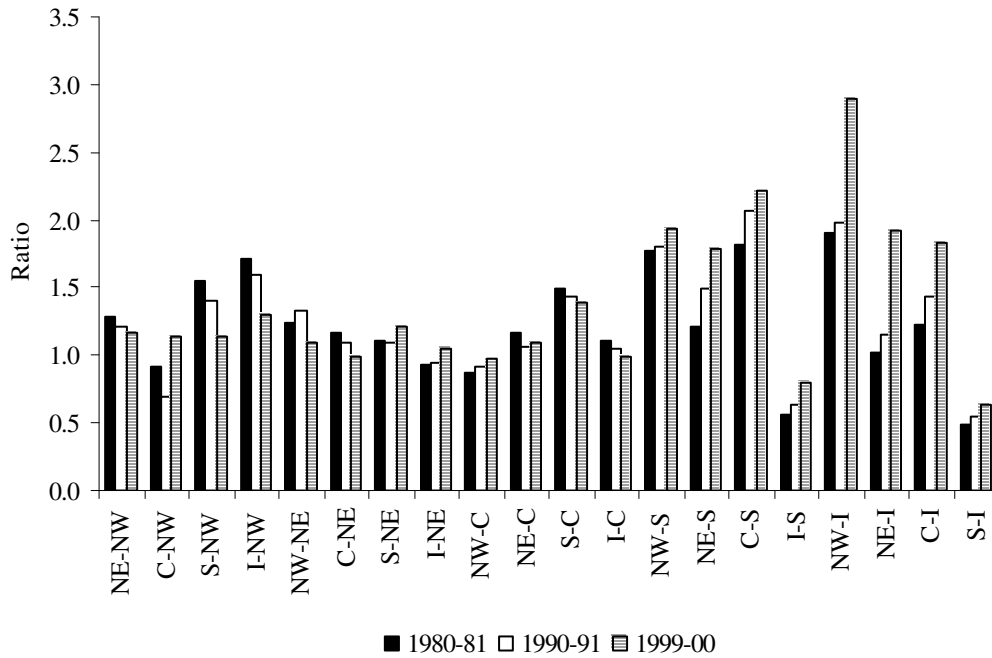


Figure 5. The origin-destination interaction effect parameters of interregional migration in Italy: 1980-81, 1990-91, and 1999-00

The interactions between origin and age are presented in Figure 6. Over time, they show that the retirement peak in the Northwest has become more pronounced and that elderly return migration has increased in the Northeast and Centre. Very different patterns were found for the South and Islands regions. Here, the values were greater than one in the young adult age groups and lower than one in the elderly age groups. Overall, the patterns appear to be following a stable trend over time, with the exceptions of the Northwest and Islands regions. In both cases, the patterns found in the older age groups (40+ years) differed substantially in the 1999-00 period from the earlier two periods.

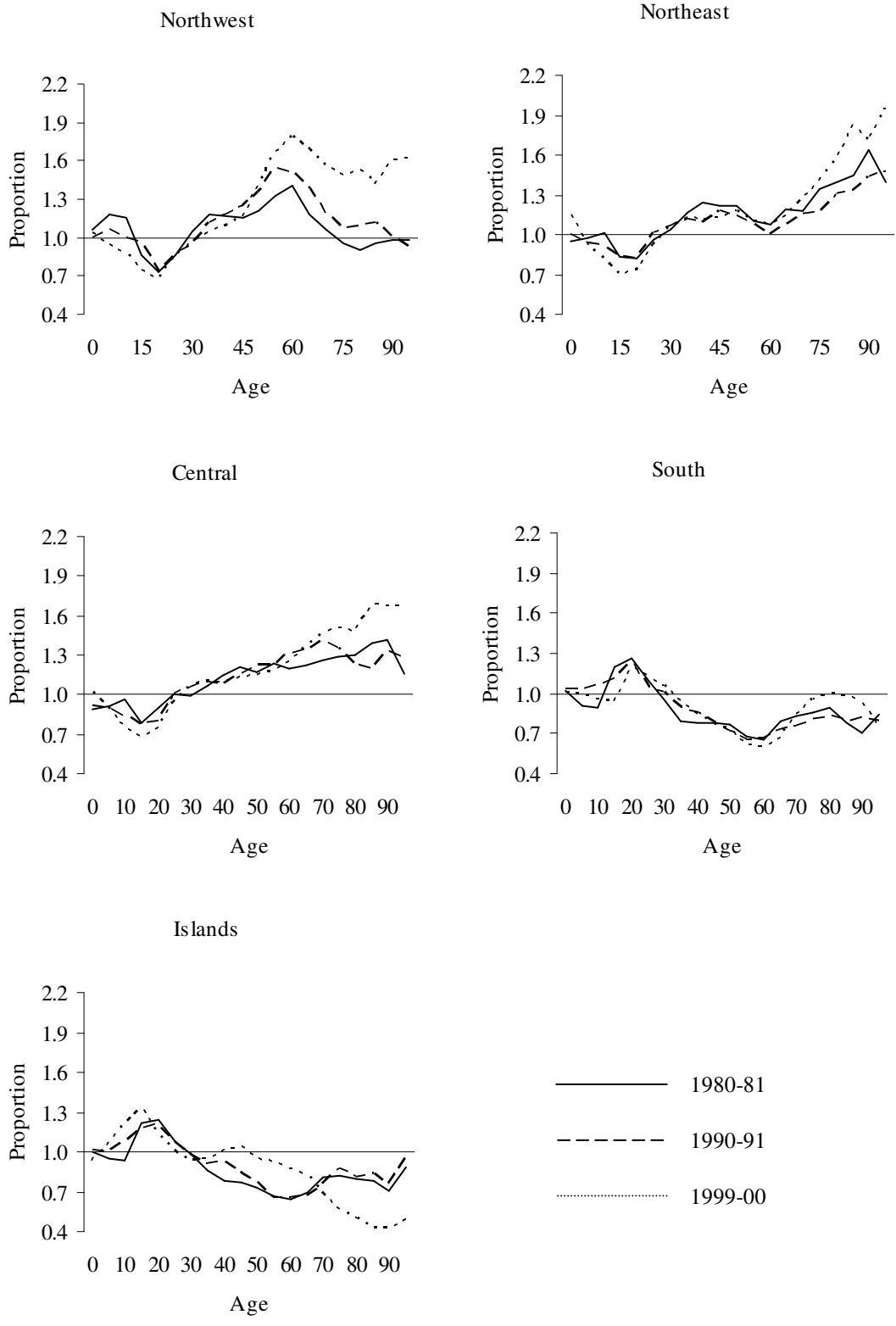


Figure 6. The origin-age interaction effect parameters of interregional migration in Italy: 1980-81, 1990-91, and 1999-00

A different pattern emerges when the interactions between destination and age are examined (Figure 7). First, there was great stability exhibited in the destination-age interactions for 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). The in-migration age profile to the Centre region was very similar to the overall age-specific proportions of migration (see Figure 4). The other three regions exhibited stable patterns until the about the 45-49 age group. Here, patterns emerged with increasing values over time found in the South and Islands and decreasing values in the Northeast. For the South and Islands regions, this suggests that retirement migration had become more important over time. For the Northeast, it became less so.

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 4), whereas in the origin-age interactions there were increasing levels found in the age groups after 30 years.

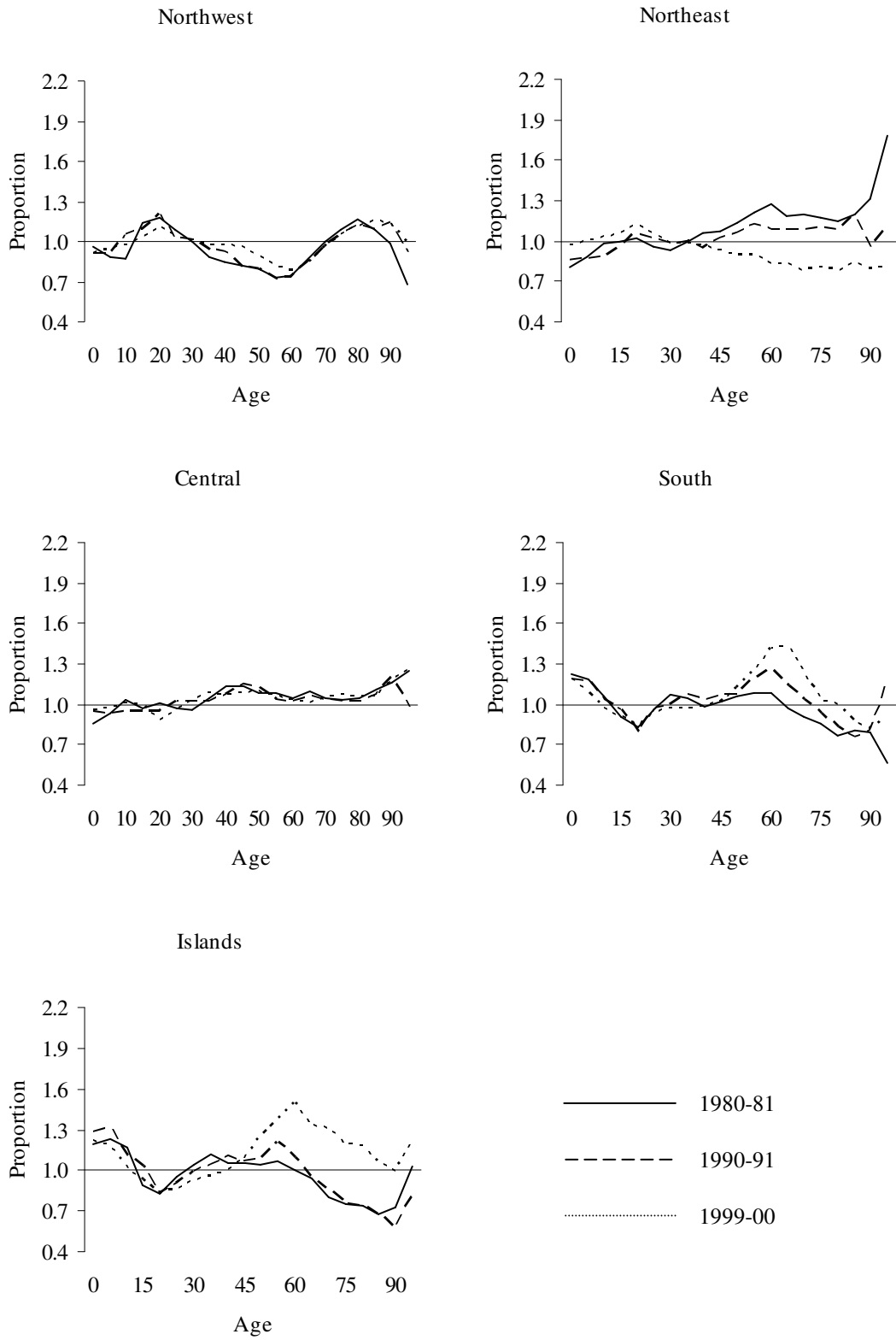


Figure 7. The destination-age interaction effect parameters of interregional migration in Italy: 1980-81, 1990-91, and 1999-00

In summary, the structures found in the age and spatial patterns of migration show that between 1980-1981 and 1999-2000, most of the change appeared to have occurred in the 1990s with relatively less migration from Northwest, Northeast, Central, and South regions, more migration to the Northeast region, and less migration to the Islands region. The interactions between all regions and the Islands region increased, in addition to increased interactions observed from Central to Northwest and South to Islands. As far as structural changes over time by age, it appears that there were differences between the aggregate patterns and ages 75+.

3. PROJECTING FORWARD THE AGE AND SPATIAL PATTERNS OF MIGRATION

This section focuses on predicting the 2010-11 interregional migration patterns in Italy based on historical information found in the 1980-81, 1990-91, and 1999-00 periods. The parameters described in the previous section are projected forward and then included systematically in the log-linear model to identify the impact each parameter has on the regional net migration levels by age and on the origin-destination-specific migration flows by age.

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

For projection purposes, auxiliary information may be used to predict migration flows (see, for example, Rogers, Willekens and Raymer 2003). Let $n_{ij}^*(x)$ denote a hypothetical migration flow table. The migration flow table for the current period may be predicted on the basis of, for example, assumed or known (1) level of the migration system, (2) proportions of migrants originating from regions i , and (3) some (e.g.,

historical) information on the interaction between places represented by $n_{ij}^*(x)$. The model is specified as:

$$\hat{n}_{ij}(x) = n_{ij}^*(x)\tau\tau_i^O . \quad (5)$$

The result is a migration flow table that exhibits the assumed or known level of overall migration and proportions of migrants originating from regions i , but adopts the structure of the *offset*, $n_{ij}^*(x)$.

For this section of the paper, we illustrate the projection model by making some predictions about the log-linear parameters based on past trends and then we incorporate those parameters to project the 1999-00 patterns forward. The offset, for this case, is the log-linear decomposition of the 1999-00 age- and origin-destination-specific migration patterns.

3.2 Projection Scenarios of Future Migration in Italy

If a linear trend was assumed in the overall level of the interregional migration system based on the levels observed in 1980-81, 1990-91, and 1999-00, then the projected 2010-11 level would be 374,816 migrants, which is only 209 migrants more than in 1999-00. However, if the linear projection was based just on the 1990-91 and 1999-00 patterns, then the projected level would be 534,537 --- 160 thousand more migrants. Clearly, projecting the overall level has great impact on the outcomes. The projections carried out in this paper assume a conservative approach by combining the patterns found in the three periods. This approach is simplistic and is meant solely for the purpose of illustrating the model. Ideally, one would have strong reasons and empirical

evidence for projecting each of the components in the log-linear model forward. The model presented is flexible enough to allow both quantitative and qualitative judgment about each of the parameters.

Since the projected overall level (i.e., τ) is nearly the same as observed in 1999-00, we assume a constant level of interregional migration. This also allows us to identify the impact of changing the values of each component has on the predicted outcomes. The outcomes are compared in terms of age-specific net migration, i.e., $\hat{n}_{+z}(x) - \hat{n}_{z+}(x)$, in each region z . To start, consider the 2010-11 projected origin and destination main effects (i.e., τ_i^O and τ_j^D , respectively) set out in Table 2. These projected values were based on a linear projection using the 1980-81, 1990-91, and 1999-00 proportions as inputs, which were then standardized to unit area. For the origin main effect parameters, we see that the projected proportions decline for migrants from the Northwest, Northeast, and Centre regions and increased for migrants from the South and Islands. The most substantial changes predicted were for the Northwest and Islands regions. The main effect parameters for destination show the reverse trend, i.e., proportionally more migrants to the Northwest, Northeast, and Centre and less to the South and Islands.

Table 2. The origin and destination main effects of Italian interregional migration, 1980-81, 1990-91, 1999-00, and projected 2010-11

Region	Observed			Projected
	1980-81	1990-91	1999-00	2010-11
<u>Origin main effects</u>				
Northwest	0.29032	0.23754	0.15529	0.08994
Northeast	0.11466	0.11580	0.09029	0.08247
Centre	0.14882	0.14545	0.11025	0.09508
South	0.30613	0.34581	0.27625	0.28650
Islands	0.14006	0.15540	0.36792	0.44600
<u>Destination main effects</u>				
Northwest	0.28881	0.29830	0.28837	0.29238
Northeast	0.16582	0.18205	0.25808	0.30078
Centre	0.20802	0.22578	0.22830	0.24722
South	0.21702	0.18516	0.16329	0.12398
Islands	0.12033	0.10871	0.06196	0.03565

The main effect parameters for age $\tau^A(x)$ were also projected forward and are set out in Figure 8. Here we see that the overall age profile of migration for Italy is projected to include a more narrow labor force peak that is slightly shifted to the right (centered on the 25-29 age group) of the corresponding observed 1980-81, 1999-00 and 1999-00 age profile. The age-specific proportions after age 45 are the same as the earlier patterns, whereas the age-specific proportions are significantly lower for ages 0-24 years.

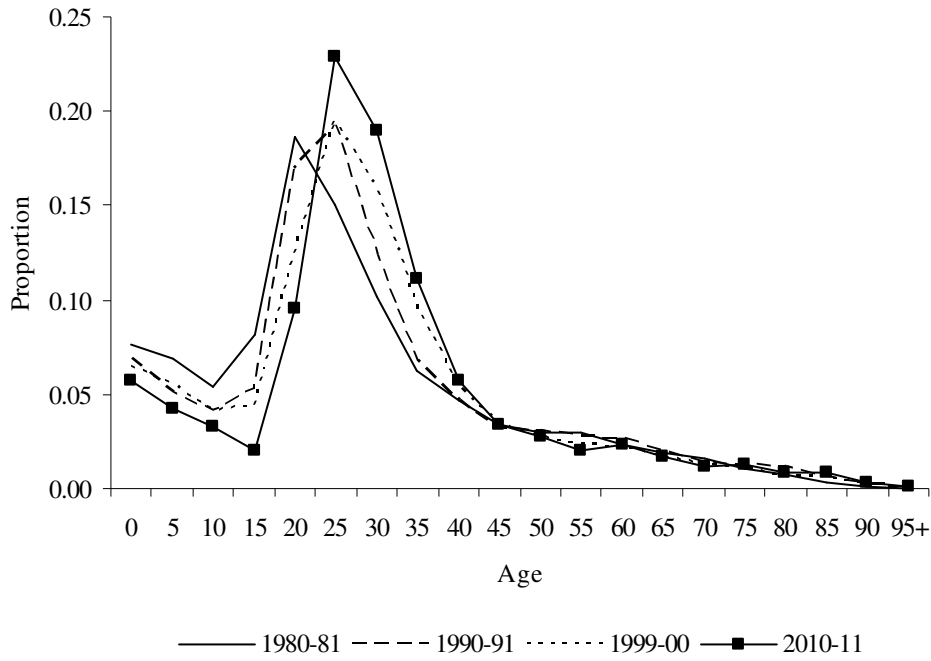


Figure 8. The age main effect parameters of interregional migration in Italy: 1980-81, 1990-91, 1999-00, and projected 2010-11

The projections were carried out in a systematic matter. In each case, the parameters for the 1999-00 patterns were used as the offset. First, the projected origin main effects replaced the 1999-00 origin main effects. Second, the projected destination main effects were included. Third, the projected age main effects were included. The fourth projection scenario allowed both the origin and destination main effects to change. And the fifth projection allowed the origin, destination, and age effects to change. The net results of these simple projection scenarios are set out in Figure 9.

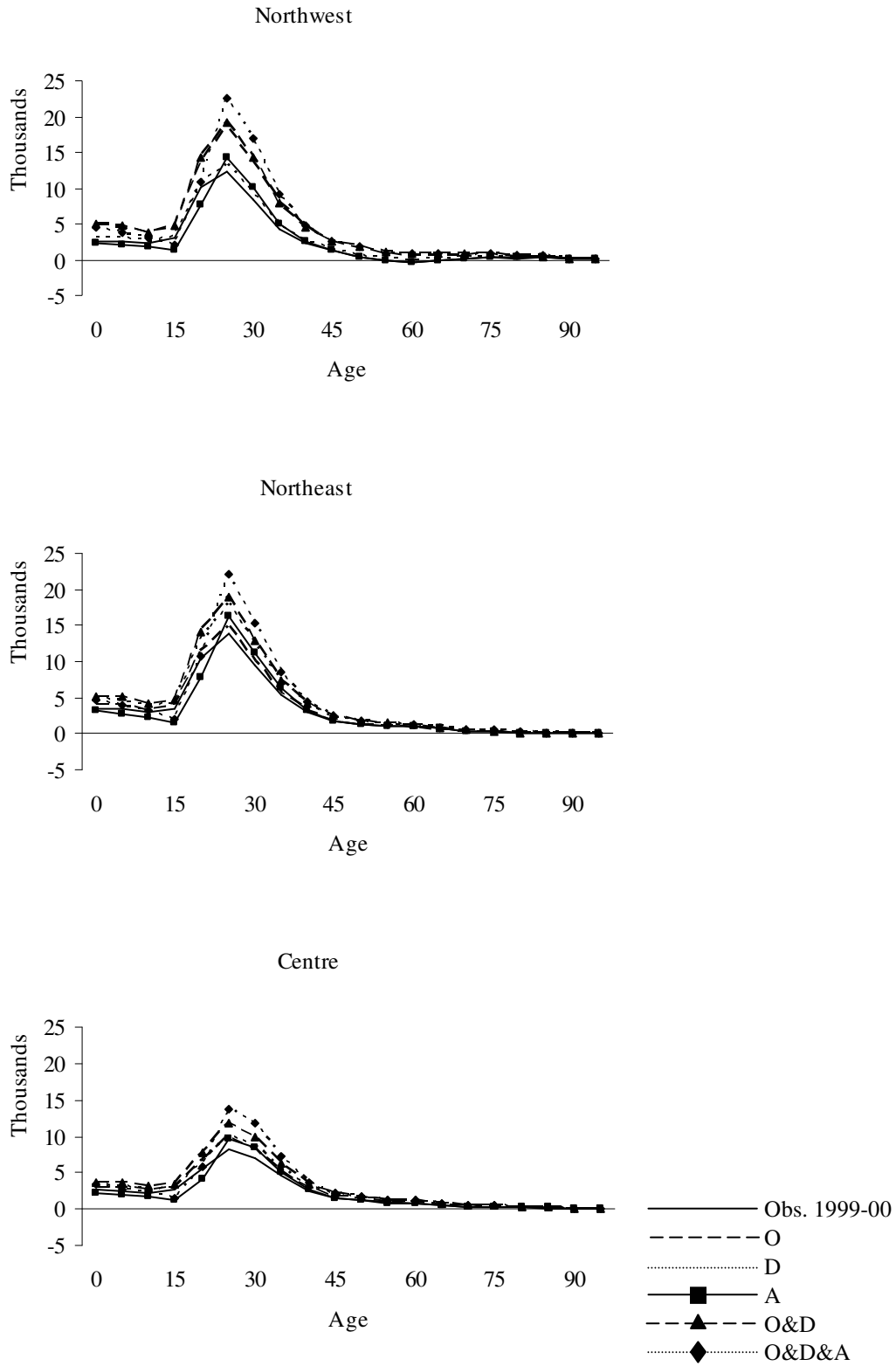


Figure 9. Projected 2010 net migration in Italy by region: Various scenarios involving the projection of the main effect parameters

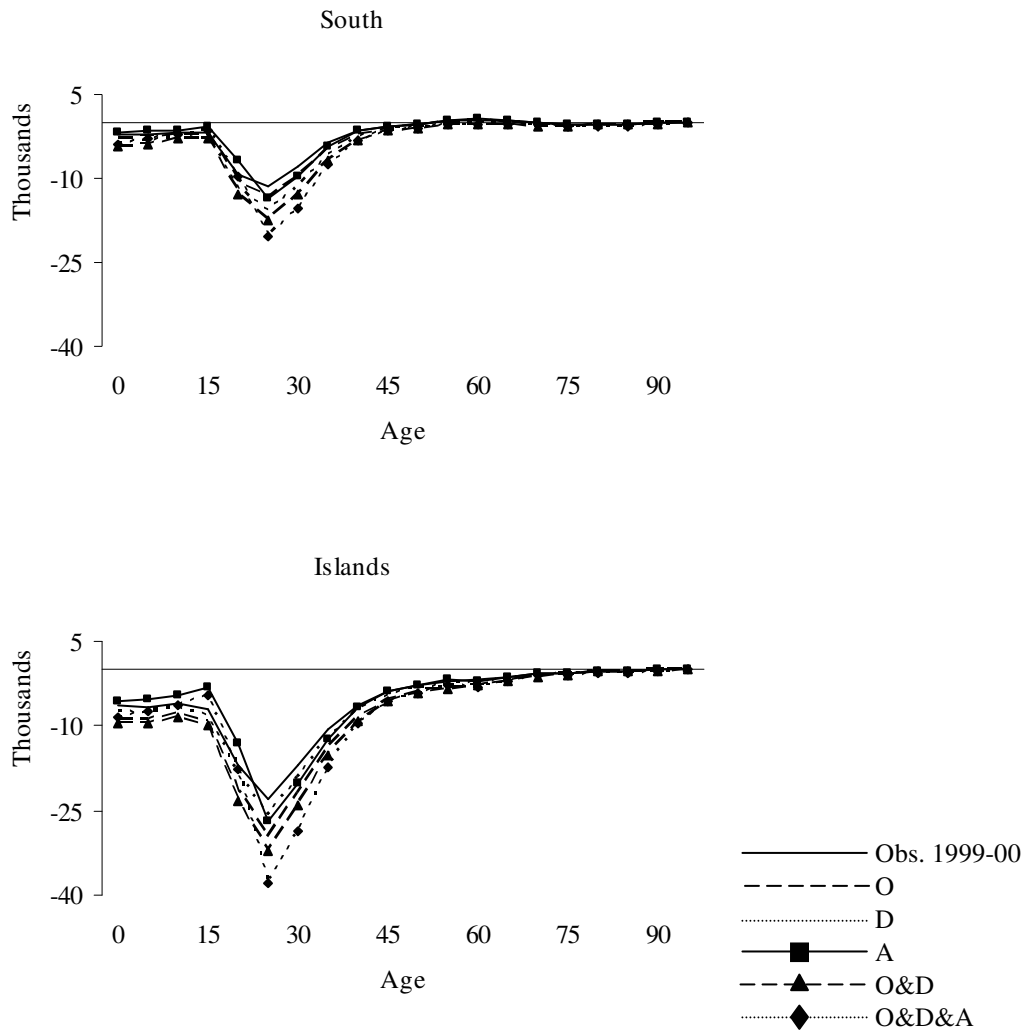


Figure 9 (Continued). Projected 2010 net migration in Italy by region: Various scenarios involving the projection of the main effect parameters

The projections set out in Figure 9 show that the Northwest was largely affected by changes in the origin main effect parameter with an aggregate increase 34.1 thousand. The destination main effect parameter had a much smaller impact on this region's projected net migration level (6.5 thousand). Combined, these two main effects increased the net migration to this region by 38.7 thousand. The age main effect decreased the net migration to this region by 0.8 thousand. The Northeast exhibited the opposite patterns

with regard to the origin and destination main effect parameters: 3.7 thousand and 19.2 thousand, respectively. Similar to the Northwest, the age main effect decreased the net migration to this region by 1.1 thousand. The Centre experienced increases of 7.4 thousand and 10.8 thousand with changes in the origin and destination effect parameters, respectively. The age main effect decreased the net migration by 0.5 thousand.

The South and Islands regions had negative projected net migration levels. When the origin main effect was altered, the net migration decreased by -10.7 thousand from 42.3 thousand to 53.0 thousand. The destination main effect had an even bigger impact by decreasing the net migration to 63.9 thousand. The age effect parameter had a slight negative impact of -0.1 thousand. The Islands region showed a very large decrease by 34.5 thousand when when the projected origin main effect parameters were included. The predicted destination main effect parameters decreased the negative net migration by another 15.0 thousand. Interestingly, the predicted age main effect parameters increased the net age project by 2.6 thousand.

In all of the above cases, the age main effect parameter caused the age profile to shift to the right and become more pointed in the labour force years. And when more than one main effect parameter was allowed to change, the result was additive (for the most part).

In the next scenario, the origin-destination, origin-age, and destination-age interaction parameters are projected forward. The only noticeable differences in the projected net migration age profiles between the earlier projections and the ones with two-way interactions was the one found in the Northwest region. For all other regions, introducing predictions of the two-way interaction parameters had little effect on the

projected net migration levels. For the Northeast region, the level of net migration dropped 17 and 18 thousand (models OD and OD&OA&DA, respectively) when the projected origin-destination interaction parameters were included.

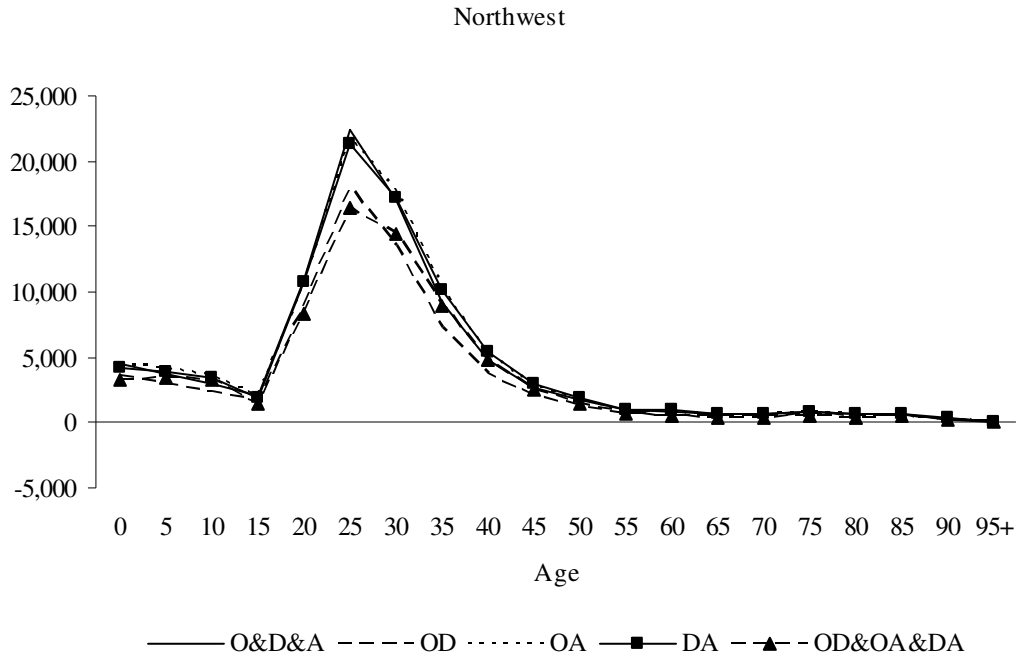


Figure 10. Projected 2010 net migration in Italy in the Northeast region: Various scenarios involving the projection of the two-way interaction parameters

The above results focus on the net results of the projection. The model actually projected the age-and origin-destination-specific flows. Figure 11 sets out the observed 1999-00 and projected migration flows between the Northwest and Islands regions. The two projections illustrated come from the following log-linear models:

$$\hat{n}_{ij}(x) = n_{ij}^*(x) \tau \tau_i^O \tau_j^D \tau^A(x) \quad (6)$$

and

$$\hat{n}_{ij}(x) = n_{ij}^*(x) \tau_i^O \tau_j^D \tau^A(x) \tau_{ij}^{OD} \tau_i^{OA}(x) \tau_j^{DA}(x). \quad (7)$$

In Figure 11, Equation 6 corresponds to projection “A” and Equation 7 corresponds to projection “B”. The results for the Northwest to Islands flow show that the projected levels were substantially lower (i.e., 3,427 and 3,861) than the reported 1999-00 flow (i.e., 10,419). The model that included two-way interactions (i.e., “B”) displayed a slightly higher retirement peak. Both projections for the Islands to Northwest flow were higher than the reported 1999-00 flow of 51,381, but the projection that included the two-way interactions were much closer to the 1999-00 levels (i.e., 53,330) than one that only included the main effects (i.e., 62,092).

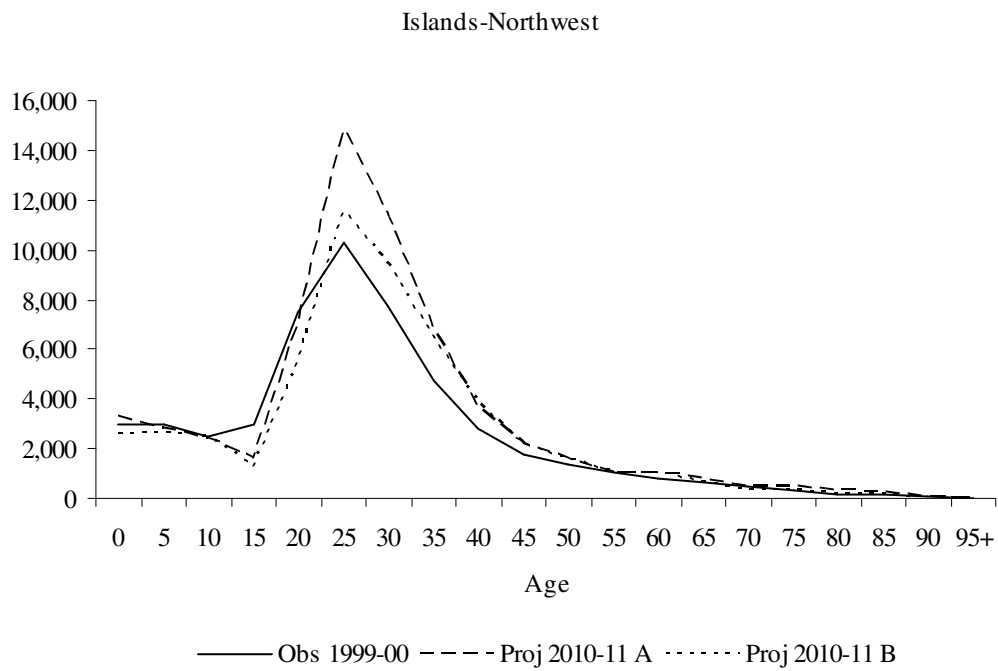
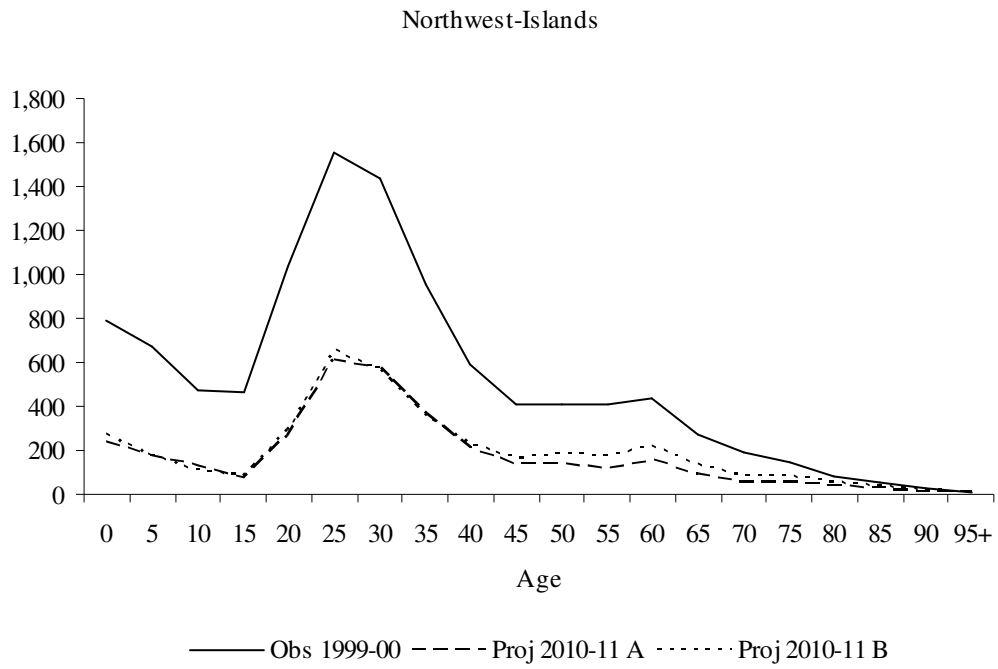


Figure 11. The observed 1999-00 and projected 2010-11 Northeast to Islands and Islands to Northeast interregional migration flows in Italy: Main effects model (A) and Two-way interactions model (B)

4. SUMMARY AND DISCUSSION

A general method for describing and projecting a set of age- and origin-destination-specific flows has been presented in this paper.

The recent increase the levels of interregional migration in Italy are 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). The future development in the interregional migration could be influenced by the differentials in the regional demographic growth which will cause in the future a large decrease of the working age groups for the Central and Northern regions and a parallel increase of these groups for the South and the Island regions.

The spatial and the age structure of interregional mobility also are significantly changing, particularly in the 1990's. The increased spatial interactions between the Southern regions (as origin and destination) and the other regions, the interaction between age, origin and destination, characterized by a larger proportion of younger labor force years in the out-migrations from the Southern regions and retirement age year in the in-migration to the latter, confirm that we are probably going back to the traditional interregional migration patterns.

The projection scenarios allow us to assess the implications, in terms of regional net migration by age, of the evolution in the spatial and age structures of interregional migrations. The scenario of future migration in 2010-2011 shows an increase of migrations gains for the three Northern and Central regions, mainly due to the origin main effect, in the case of Northwest, and destination main effect, in the case of

Northeast, while the projected main and interaction effects imply heavier migration losses in the South and Islands.

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