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Internal migration and regional population dynamics in Europe: a synthesis

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4. A comparison of internal migration intensities

In this section of the report we attempt to arrive at a comparable quantitative measure of the intensity of internal migration within the ten countries studied. This is a difficult endeavour. However, lack of such a measure leaves a large hole in the comparative statistics on population dynamics, in the collection of which the Council of Europe has played such a crucial role. There are many possible summary measures of internal migration. Here we develop one invented by the eminent French demographer Daniel Courgeau, which has the virtue of producing a comparable measure from migration flow statistics between spatial units of different sizes and numbers.

What are the problems that need to be overcome in order to develop comparable measures of migration? The problems result from the dependence of migration measures on

(1) the spatial scale of the territorial units used

(2) the time interval used

(3) the concept of migration used

(4) the age distribution of the population at risk.

Each of these problems has been extensively researched in the past quarter of a century. Very important contributions have been made by Courgeau to the solution of problems (1) and (2). Courgeau (1980) provides a general conceptual framework for the quantitative analysis of migration, while two papers (Courgeau 1973a and 1973b) outline methods for overcoming spatial and temporal differences. We can also draw on work by Long and Boertlein (1991) and Rees (1977) for insight into the time interval problem. The variation of migration intensities by age has been extensively studied by Rogers and his co-workers (Rogers, Raquillet and Castro 1978; Rogers and Castro 1981).

In this section we will concentrate on the dependence of the measure of migration on the spatial scale. Information on the number or even on the rate of migration does not really provide us with the indication on the intensity of the mobility of the population. This is due to the fact that, in most countries, migration is counted only when migrants cross the boundary of the administrative unit. For large administrative units observed mobility will be low as a substantial part of migration occurs over short distances; for small administrative units it will be high. There is therefore a need to make

the migration measurement independent of the territorial division of the country.

4.1 Theoretical derivation of Courgeau's index

Courgeau (1973b) has proposed a general index of internal migration for countries that is independent of the spatial scale of measurement. The basic argument is as follows.

The probability of migration between two areas is inversely dependent on the distance between them. The relationship is independent of the potential of origins to generate migrants or of the distribution of opportunities at destinations. The fall-off of migration is not linear but steeper. Many studies have fitted negative power functions successfully:

$$m_{ij} = M_{ij}/(P_i\ P_j) = f(d_{ij})^{-K} = a\ (d_{ij})^{-K} \qquad (1)$$

where M_{ij} is the number of migrants between areas i and j, P_i and P_j are populations of origin area i and destination area j respectively, d_{ij} is the distance between the centre of area i and the centre of area j, a is a constant of proportionality and K is a distance decay parameter. The populations are used as surrogates for migration potential at the origin and opportunities at the destination.

Such a general relationship implies that the logarithm of migration intensity varies with the logarithm of distance:

$$\ln m_{ij} = \ln a - K \ln d_{ij} \qquad (2).$$

An alternative to the power function to describe the decay of migration with distance is the negative exponential function:

$$m_{ij} = a \exp(-bd_{ij}) \qquad (3)$$

which leads to the linear relationship

$$\ln m_{ij} = = \ln a - bd_{ij} \qquad (4).$$

Given this relationship, what happens when we vary the size of area used to the migrations measured, when intra-area migrations are excluded? Courgeau (1973b) derives a formula, assuming a division of national territory into equal sized squares, each with the same population density, that relates overall migration intensity to the number of units used in the measurement (p.520)

$$M(n)/P = K \ln n \qquad (5)$$

where M(n) is the number of inter-area migrants observed when the national territory is split into n units and P is total national population. The rela-

tionship is confirmed under different assumptions about areal geometry (triangular units, rectangular units) and variable density.

Courgeau (1973b, p.520) then explores whether this relationship holds in the more realistic situations where the simple assumptions do not hold. This is done by fitting equation (3) to observed migration rates for different spatial scales using linear regression:

$$M(n)/P = a + b \ln n \qquad (6)$$

where a is set to 0 and b is K. Courgeau uses the term K for both the theoretical parameter and the empirical coefficient, which is confusing, but it is probably best to retain Courgeau's K as the empirical parameter so that the equation to be fitted is

$$M(n)/P = K \ln n \qquad (7).$$

Values of K for different *n* can be computed as

$$K(n) = [M(n)/P]/\ln n \qquad (8).$$

The degree of uniformity of K gives an indication of how well the relationship fits.

4.2 Comparison of migration intensities over time and space

Based on the data on the number of migrations, or migrants on the stocks of population and on the number of units, Courgeau's Kindex of internal migration intensity was computed. Table 4.1 summarizes the values of Courgeau's K for different various countries and various periods of time. Appendix 1 provides all of the data that were entered into the computations.

The calculations were made for two cases: in the first one regression line was forced to intercept the origin. In the second case it was not and an intercept coefficient was calculated from equation (4). Van Imhoff (personal communication) suggests that values of the intercept may serve as a measure of the goodness of fit of the Courgeau's model, departure from zero indicating decreasing goodness of fit.

K may be interpreted as an indicator of mobility independent of the administrative settings used for the measurement of migration. It is the rate at which inter-area migration increases with one order of magnitude increase in the number of units used to measure that migration. The higher the value of K the larger the mobility. England and Great Britain demonstrated the highest mobility over time and space in countries under investigation in the 1960s with the K value above 2. However, these figures refer to migration over 5 year intervals and are not directly comparable with the one year interval measures for the other countries and years. Roughly speaking, we need

to divide the 5 year interval measures by 3 to 3.5 to derive an annual equivalent (Rees 1977). The England and Great Britain annual K figures for 1961-66 and 1966-71 are in the range 0.6 to 0.7.

Table 4.1 Comparable measures of the intensity of internal migration in ten European countries, using an index developed by Daniel Courgeau

Country	Period of observation	Courgeau's K Intercept at 0	Courgeau's K With intercept	Intercept point
Czech Republic	1984	0.31	0.27	0.15
	1994	0.21	0.18	0.13
England	1961-66	2.03	2.16	-0.69
Great Britain	1966-71	2.14	2.07	0.79
	1970-71	0.68	0.65	0.30
	1980-81	0.54	0.53	0.12
	1990-91	0.52	0.51	0.11
Estonia	1995	0.33		
Germany	1984	0.21		
	1993	0.47	0.54	-0.34
	1994	0.51	0.60	-0.44
Italy	1984	0.21	0.22	-0.12
	1994	0.19	0.25	-0.42
The Netherlands	1984	0.58	0.54	0.21
	1994	0.61	0.57	0.19
Norway	1984	0.71	0.58	0.61
	1994	0.71	0.58	0.59
Poland	1984	0.24	0.32	-0.54
	1994	0.15	0.22	-0.45
Portugal	1979-1981	0.41	0.41	-0.01
	1985-1991	1.10	1.10	-0.93
	1989-1991	0.38	0.38	-0.25
Romania	1984	0.13		
	1994	0.16	0.12	0.27

The goodness of fit of the model was demonstrated by the value of intercept point a. The absolute value of the intercept varied from 0.93 to 0.01 (Portugal). A number of issues impact the calculations. In some cases (Estonia 1995, Germany 1984) data were available for one spatial division only. It was possible to calculate the value of K forcing the regression line through the origin, based on the assumption that if we use the whole country as a measurement unit, there will be no internal migration. Comparability

of K calculated in this manner with K calculated for larger number of units may be questioned. In many other cases calculations were made for only two spatial divisions. The most trustworthy results are obtained for regressions fitted for three or four different spatial divisions.

The countries can be considered in four groups, which are shown on Figure 4.1. The first group consists of Norway, the Netherlands and Great Britain (96% of the United Kingdom for which comparable migration data are available) which had high values (above 0.5) on the Courgeau index in both 1984 (or 1980-81) and 1994 (or 1990-91). The second group consits of Portugal, which has a middle value of K around 0.4. The third group have low K values below 0.33. The countries involved are Estonia, the Czech Republic, Poland, Romania and Italy. In all these countries, where we have observations, K values in the early 1990s were not radically different from those in the early 1980s. However, there is a final group, with one member, Germany, which experienced a radical increase in the index between 1984 and 1994, shifting from the low band in 1984 to the high band in 1994. This was undoubtedly associated with a radical increase in migration between eastern and western *Länder,* consequent on unification in 1990.

How should we interpret the differences between countries in migration intensity? They seem to be associated with level of per capita incomes (low incomes equal low mobility) and with the degree to which housing is supplied by the state sector (the barriers to migration within state sector housing are considerable). That is why Norway, the Netherlands and the UK have high mobilities and Estonia, the Czech Republic, Poland and Romania have low intensities and Portugal is placed in between. An additional consideration for non-transition countries may be the degree to which the private housing market is dominated by rental accommodation or owner occupied housing. The higher proportion of owner occupied housing in the UK may explain why the migration index is lower than in the Netherlands.

Two countries fall outside of this interpretation. Italy has level of migration activity far below its relative economic position. Germany's position in 1993 and 1994 is consistent with its economic position and flexible housing market (large private rental sector), but its low level in 1984 requires another explanation and further investigation.

Only three countries, Germany, the Netherlands and Romania, have shown increases in mobility in the decade 1984-1994. The reduction in mobility in majority of countries may be attributed to increases in commuting fields observed in several countries of Western Europe and difficult economic conditions in the countries in transition.

Figure 4.1 Migration intensities in selected European countries in the early 1980s and early 1990s