Changes in population dynamics

People in Motion

Marek Kupiszewski studies population dynamics using the MULTIPOLES model

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In the time of European integration, population dynamics forecasts have to account for the increasing role of migration on the regional, country-wide, and continental level

Contemporary models of population dynamics stem from two methodological traditions: the demographic and the geographical one. The former focuses on mortality and fertility and the process of population reproduction. The most advanced models derived from the demographic tradition are cohort-component models, which for years served as a basic tool in the preparation of population forecasts. The geographical tradition, in turn, originates to a large extent from models based on Markov chains, and focuses on the spatial redistribution of the population. These two traditions merged in the concept of multiregional demography proposed in the late 60s and early 70s by Andrei Rogers, which has been further developed over the last 30 years by Rogers himself, Phil Rees, Frans Willekens and many others. The models currently in use are very advanced from the methodological point of view. They are used as the main regional forecasting tool in many countries around the world, particularly in Europe and North America.

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Modern means of transport facilatates the free flow of people

The existing models are not complex enough to accommodate all key demographic processes observed in the contemporary world. Firstly, they are not, in most cases, prepared to handle international migration. Secondly, they ignore the necessity of modeling of a group of countries, rather than a single country, something that is important given the strong migration interaction between certain countries. Thirdly, following Eurostat concerns, there is an evident need for multi-country regional forecasts based on a unified methodology and set of assumptions. This problem, of a practical rather than methodological nature, is important for the European Union, a large, highly integrated supranational organization with decision-making powers and ambitions to create regional policies of almost continental scope.

The MULTIPOLES model

The arguments for taking international migration into account in the modeling of population change and dynamics derive from two basic premises. If we assume that population processes are of a systemic nature, then international migration may be interpreted as an interaction between elements of the population system, that is between national and regional populations. The second assumption is quintessentially practical: ignoring international migration does result in very large forecasting errors – some researchers show the magnitude of such errors based on the example of Eurostat forecasts for the 1980s. Clearly, incorporating international migration into population dynamics models is key to the process of reducing forecasting errors. The best way to do so is to use a matrix of flows between countries, rather than net migration, and to use emigration rates where possible.

The above premises were taken into account in the construction of MULTIPOLES, a new multiregional multilevel model of population dynamics. MULTIPOLES simultaneously models population change in countries and in regions, taking account of interregional internal migration and international migration both between the modeled countries and from outside the system. So far only one model of similar capacity has been developed for the member states of the EU, by Phil Rees in 1992 (Rees, Stillwell, Convey 1992; Rees 1996). This was based on data from the REGIO database. Other much simpler models only covered the populations of entire states, neglecting the regional dimension to population change. Some models that did take regional division into account (i.e. DEMETER or EUROPOP) gave consideration to net international migration only. From the methodological point of view, the MULTI-

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As a result of migration, countries become homelands for people from different regions

POLES model derives from a multiregional cohort-component family of models and was designed using state-of-the-art multiregional demographic modeling.

Implementation of the model

The MULTIPOLES model can be used to project or forecast multinational populations by region, age and gender. The model has been described as multilevel, since it handles migration on three geographic levels. First, on the lowest level, interregional, intranational migration is taken into account. On the second level, international migration between the countries being modeled is considered. Finally, on the highest geographic level, migration between each of the modeled countries and the rest of the world is taken into account. The model uses occurrence-exposure rates on the two first levels, whereas net migration is used on the third level. The model is multiregional in the sense of the word used by A. Rogers, who sees the population as a system, and migration as a link between elements thereof.

It was decided that, whenever possible, observed schedules of demographic events

should be used in the MULTIPOLES model instead of hypothetical model schedules. As a consequence of this decision, much effort was required in order to collect data and to set up the Regional Population Information System. This approach was rewarded by a reduction of uncertainty and error generated by difficult-to-verify assumptions on the distribution of demographic events.

Two simulations

One of the applications of the MULTIPOLES model was assessing the impact of international migration on the magnitude and structure of populations in Central and Eastern European countries and regions. Two simulations were run, and the results contrasted. Age-specific rates of fertility, mortality and internal migration remained unchanged in both simulations. The first simulation adopted the scenario of international migration. The second simulation assumed no international migration. Comparing the results of the two simulations shows how significant and far-reaching an impact international migration has on populations. Importantly, it was possible to quantify the difference international migration would make in each country and each region over a 25-year period. Germany, for instance, would gain due to migration over 10% of its starting population. On a regional level, international migration in some cases changes the character of population development from population decline to population increase. This is very typical for the German regions. In practice, it shows that neglecting international migration in population dynamics models leads to fundamental errors, as the model is not even able to correctly identify the direction of population change in some regions, not to mention the magnitude of the changes. This allows us to make a categorical statement to the effect that population dynamics models must take account of not only internal, but also international migration.

The MULTIPOLES model has also been used to forecast the elderly population, to forecast labor force development, to analyze the interplay between replacement migration, labor force participation and retirement age in Central and Eastern Europe and to produce multivariant subnational forecasts of regional populations in Austria and surrounding countries. ■

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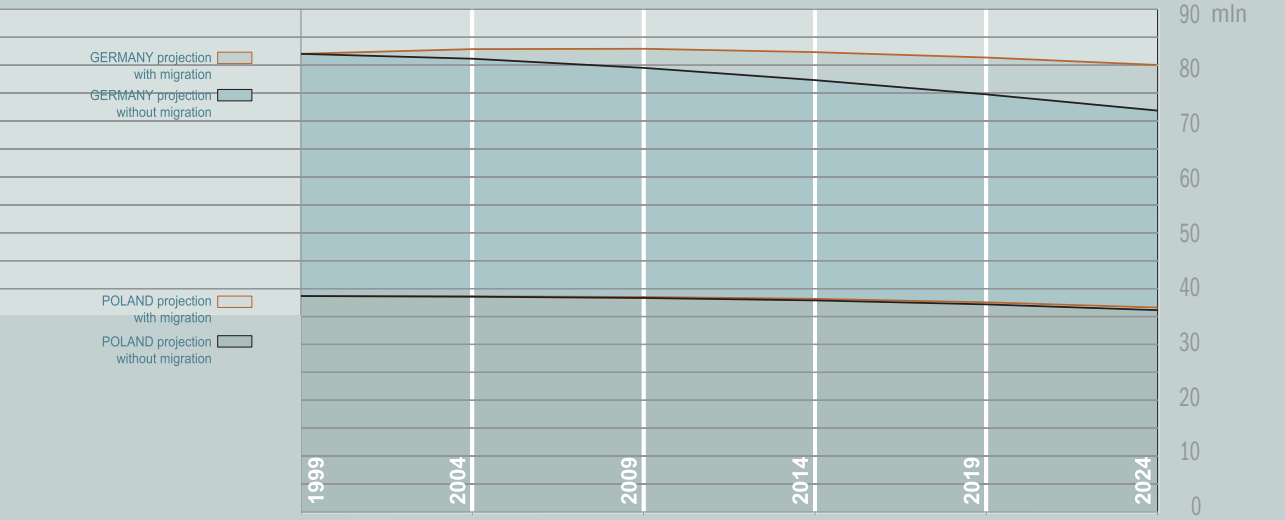
POPULATION DYNAMICS WITH AND WITHOUT INTERNATIONAL MIGRATIONS



Further reading:

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