



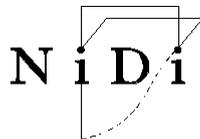
Bridging the micro-macro gap in
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Report on user need assessment

Work Package 6
Dissemination of results:
web site, books, reports, user needs and perspectives

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MicMac User Need Assessment

1. Introduction

In the last few decades as well as the years to come the structure of European populations is changing significantly. The steady rise in the older population together with significant changes in the younger age groups, increasingly bears a disproportionate share of the tax burden for providing healthcare and pension services. To cope effectively with these complex population changes requires more sophisticated methods than currently available to analyze population structures and predict how they will develop in the future.

The aim of the research project MicMac was to develop a new demographic projection model that bridges the gap between aggregate projections of cohorts (Mac) and projections of the life courses of individual cohort members (Mic). The software tool MicMacPack is developed as a generic tool that can be used by national statistical offices (NSOs) throughout Europe in order to prepare detailed demographic projections. The first version of MicMac does not include all possible features that might be relevant for compiling population projections. Given the flexible design of MicMac, however, in a later stage existing models can be extended, or additional features can be added relatively easy.

As MicMac is developed to be used by NSOs, it was necessary to keep in close contact with the statistical offices and the users of population projections in Europe from the beginning until the end of the project. For this reason an Advisory Board has been installed which is composed of representatives of the National Statistical Offices of the Netherlands (SN) and Italy (ISTAT) and the European Commission (Eurostat, DG Employment and Social Affairs and DG ECFIN). In addition we have had an open discussion with our target group during the whole duration of the project. On the one hand we provided on a regular basis information to anyone who was interested in MicMac, while on the other hand we asked for feedback on ongoing work and input for future plans. In this way, we tried to involve the expected users of MicMac as far as possible in the (further) development of the model. Information has been spread through the MicMac website (www.micmac-projections.org), the MicMac newsletters and several presentations at for instance Eurostat Working groups and (scientific) conferences.

This so-called “needs assessment” has covered the methodology proposed, how it will be used, and how the new methodology can contribute to improved population projections and scenarios. Furthermore, attention has been paid to prioritizing possible extensions of the model as well as to the question of how to formulate assumptions on future (demographic) developments.

The current report describes developments and activities of importance for this needs assessment as well as how we tried to incorporate the needs of the users in the MicMac model.

2. National practices

In the summer of 2006, Eurostat addressed a questionnaire to the Member States of the European Union, the Acceding and Candidate countries, as well as some other European countries, in order to give an overview of national practices in the field of population projections. In total they received the filled in questionnaires of 32 countries. The answers provided by the countries are described in the report “Questionnaire on Population Projections; Report on the latest National Practices”, which was presented during the Eurostat Working Group on Population Projections in Luxembourg, November 2006. Below, we summarize the outcomes of the questionnaire as far as of relevance for MicMac.

Questions especially of importance for MicMac refer to the type of projections and the characteristics distinguished, the methods used to analyze trends and to set future values of key indicators, and the scenarios used and the way uncertainty has been taken into account.

Type of projections

In addition to national population projections most countries also compile regional or subnational projections and quite some countries carry out household projections and or labour force projections. A few countries compile educational projections, but hardly any country computes projections by marital status, household position, citizenship or country of birth.

Only a few countries analyze non-demographic variables. The mostly used variables are educational level and labor force participation for fertility; educational level and trends in drinking and smoking habits for mortality; and social and political trends as well as labour force participation and unemployment rate for international migration.

Most countries use Excel to compile their projections, sometimes in combination with SAS, Visual Basic/C++ or Pascal/Delphi. Generally they use own software, that can not be used by others. About half of the countries express a need for (new) software. Only two of them explicitly mention what they need: a) software for regional, ethnic, household, and labour force projections; b) a package to run their own assumptions.

Methods used

Several methods can be used for analyzing past trends. The mostly used methods are trend analysis of age specific trends, expert opinions and curve fitting. Hardly used methods are regression against time (with the exception of migration) and explanatory models.

Assumptions on future levels are most often stated on key indicators and not on age specific rates. The most often used methods to determine future levels are a) target levels followed by interpolation; b) trend extrapolation of age specific rates; and c) assuming constant levels (with the exception of mortality). Only in a few cases examination of errors in previous forecasts is used.

Although only a few countries consult other countries in their process of assumption making, most of the countries use trends in other countries to set their own assumptions on fertility and mortality. Often they refer to trends in groups of countries: Western, Northern European or EU-patterns. Sometimes they refer to neighboring countries or Central or Southern European countries or even Japan.

Apart from trends in other countries, the following information might be used: birth expectations, reported health situation in surveys, national and/or political plans, fertility theories, and the impact of background information.

Scenarios and uncertainty

To deal with the problem of uncertainty, most of the countries compile additional projection variants or scenarios. However, almost all countries state that uncertainty is not properly taken into account and quite some countries cannot estimate the probability that the interval defined by their low and high variants will cover the real value of their key indicator in the last year of their projections. Although only one country compiles stochastic projections, several countries intend to change over to stochastic projections in the near future.

Conclusion

To sum up the results of the questionnaire, a new software application to make population projections that 1) takes into account non-demographic variables, 2) can be used to set assumptions, 3) takes into account uncertainty and 4) can be used by everyone without limitations, seems to match the needs of the most important potential users of MicMac, namely the National Statistical Offices of Europe.

3. The use of expert opinions in demographic assumption

The outcomes of population projections depend heavily on the assumptions used to calculate the projections. For instance, will fertility increase, how much more gains in life expectancy may we expect, and what will be the impact of migration on population development? An important question therefore, is what are the assumptions used and how are the assumptions obtained. A key component in the process of assumption making, is the inclusion of expert insights. The way in which demographic forecasters make their assumptions, however, may vary.

In one of the first steps of MicMac, a questionnaire has been developed to collect information on the current use of external experts in defining fertility, mortality and migration assumptions in the context of national population projections. This part of the study was carried out within Work Package 3 by the International Institute for Applied Systems Analysis (IIASA). All NSOs of the European Union countries were asked to provide information on what had been done during the production of their most recent population projections. The aim of the questionnaire was twofold: 1) to assess the current status of expert involvement and methodology in making population projections by the national statistical offices; and 2) to evaluate what future improvements could be made in the process by which experts contribute to the definition of assumptions in population projections.

Each office received a questionnaire from Eurostat – designed by the International Institute for Applied Systems Analysis (IIASA). 21 out of 25 NSOs returned the completed questionnaire. The outcomes of the questionnaire are presented in MicMac deliverable D14: An analytical summary of the current practices of definition of assumption making in population projections, prepared by IIASA.

The results of the questionnaire showed that the involvement of external experts and meetings are clearly important although there is a marked gap between the Member States of the old EU15 and the new Member States. If there are problems in finding a consensus on values, most offices make in-house decisions after consulting the experts. A few offices commissioned scientific studies from outside experts for the explicit purpose of helping with the definition of assumptions. The most common approach is to create scenarios that cover a “plausible” range. Half of the respondents define storylines (either combined for the three components of change, or for each component separately) behind the assumptions.

All national statistical offices agreed that there is need for improvement in the methods used to make assumptions. Generally speaking, improvements in networking and in advancing the conventional methodology of scenario-based forecasts seem to have priority. The introduction of stochastic/probabilistic forecasting methods is not a high priority for most offices. It is not clear, however, if the slow pace of adoption of stochastic/probabilistic forecasts is to do with scientific criteria, or is simply due to the non-availability of human resources with the appropriate knowledge of the methodology.

There is clear common agreement among all respondents that there is a need for improvement to define the assumptions on future fertility, mortality and migration. The most widely chosen improvement options were the interactions among agencies, experts, or the involvement of more experts. The institutes who already consult relatively large numbers of external experts wish to have more interactions with other statistical offices about their assumptions. It is clear that the highest ranking goes to structured interactions with the European demographic research community. This is true for both the state of the art of their knowledge and about future demographic trends.

4. Argument based assumption making and the expert meeting on assumptions in the field of mortality and morbidity

As already been anticipated in the writing of the MicMac proposal and confirmed by the survey of the NSOs, a major weakness of the usual process of defining assumptions is the lack of consistent and comprehensive evaluation of alternative scientific arguments that would suggest different future pathways. In particular, there are many reasons to move away from purely expert-based assumptions to argument-based assumption making. The reason lies in the ample evidence that experts tend to have all kinds of personal biases and therefore, expert opinion should not be taken simply at face value, even if they are very prominent experts. Instead, the experts must present substantive arguments that support their views. These arguments can

then be evaluated in a scientific discourse which makes the argument independent from the personalities of the experts who put them forward.

In principle there are two ways of setting up scenarios: a purely statistical approach, like trend analysis and high and low variants, versus scenarios based on forces or arguments for demographic indicators, for instance expressed in story lines behind the different scenarios. An example for the statistical approach is to define scenarios in terms of a strong versus moderate decline in the general pattern of mortality, together with convergence versus divergence of differences between groups. An example for the second approach refers to scenarios based on forces, for instance a scenario that assumes a poor medical progress together with healthy life styles.

In the context of MicMac, IIASA developed and operationalized an expert questionnaire for assessing substantive arguments on the future course of fertility, mortality and migration. In collaboration with the UK Office for National Statistics (ONS) an interactive Excel-based version was developed. The questionnaire was used by ONS to get a greater understanding of the factors that the experts of their National Population Projections Expert Advisory Group believe to be important in determining how future demographic indicators will develop. Furthermore, the questionnaire has been used and tested in the MicMac Expert Meeting on Assumptions on Mortality and Morbidity in Europe, organized at IIASA in September 2007. The aim of this Expert Meeting was to discuss with academic experts, population forecasters and policy makers the arguments behind possible assumptions on mortality and morbidity in order to define alternative plausible scenarios about future trends.

The questionnaire on mortality and morbidity is structured along six major forces: L1: changes in biomedical technology; L2: effectiveness of health care systems; L3: behavioral changes related to health; L4: possible new infectious diseases and resurgence of old diseases; L5: environmental change, disasters and wars; and L6: changes in population composition and differential trends in population subgroups. For each of these forces, several arguments are listed that imply either an upward or downward pressure on that driver.

Most scenarios will be rather useless to governments in an isolated context; taking into account a bundle of scenarios can bring to light policy implications that otherwise would have been remain hidden; furthermore, differences in scenario outcomes for different countries can provide policy explanations.

Apart from how many years people are expected to live, it is important to look at the number of years they are expected to live in good health. Health status therefore should be included in the projections, and future differences among social classes should be considered in the assumptions.

Stress consistency between assumptions: there is a need to structure and document the reasoning and conclusions that lead to the scientific model input (that's where the argument based expert opinion – questionnaire enters the model). The users will compose their own scenarios, but consistency between assumptions is a must.

5. Comments of the Advisory Board

The members of the Advisory Board were invited to all general project meetings:

- kick-off meeting at NIDI in The Hague (June 2005)
- restricted MicMac meeting during the Eurostat Work Session on Projections in Vienna (September 2005)
- first annual progress meeting at VID in Vienna (January 2006)
- MicMac side meeting during the EPC2006 in Liverpool (June 2006)
- second annual progress meeting at INED in Paris (January 2007)
- Expert Meeting on Assumptions on Mortality and Morbidity in Europe at IIASA in Vienna (September 2007)
- third annual progress meeting at Bocconi University in Milan (January 2008)
- MicMac side meeting during the EPC2008 in Barcelona (July 2008)
- fourth annual progress meeting at EMC in Rotterdam (January 2009)
- the MicMac workshop at MPIDR (April 2009)

Their comments and advices are summarized below.

- The needs of MicMac seem to match the needs of the NSOs. To make sure that the needs will not go into different ways, it is important to keep the NSOs informed
- Data requirements are really important; in this respect, take into account the new Member States and take as point of departure not the best countries, but the worst cases
- Although the lack of resources of NSOs has been recognized, do not underestimate the effort NSOs have to make to prepare the data; if in the end data requirements will be too high, the use of MicMac might be seriously hampered
- A certain flexibility should be allowed in designing the state space; this would permit the final user to adapt the MicMac approach to its own needs
- Even though probabilistic projections are not part of the project design, including in the final output a measure of the uncertainty associated to the projections results/assumptions would be an important advantage of MicMac
- The importance of fully open-source software has been stressed
- If possible, pay some attention to migration as well as to the labour force, even though these topics are taken away from the proposal in reply to the comments of the evaluation committee. Especially migration is too important to neglect. Please try to take into account in some way the allocation of migrants to the different categories used in the scenarios. Furthermore, MicMac should be able to use net migration rates instead of immigration and emigration separately
- From the point of view of the NSOs the model should be flexible in terms of assumption making, data and user friendliness of the software
- The more sophisticated the model, the higher the risk it will become a black box; the model should be as transparent as possible: forecasters do have to know what they are doing and how to explain the model and the results to the consumers of the projections.
- It is recommended to develop a simple model and simple illustration that can be explained to non-specialists; in addition, training of users is very important
- It would be a main advantage of MicMac if the model will go beyond the national level and will meet the need of a common methodology for all Member States

- We have to consider consistency between Mic and Mac, even if we do not know how successful we will be. Also the possibility of reaching consistency between Mac and national projections by age and sex carried out in the countries themselves is important for the National Statistical Offices
- An important topic for a possible extension of MicMac is to include mixed couples and the behavior of migrants
- The software should be able to take into account different kind of rates, not only from a methodological point of view, but also from a data point of view
- It is very important that at the end of the project, with the first release of MicMac, there is a software program that can be applied by the NSO's, including something on migration and consistency

6. The first release of MicMac

In the first release of MicMac we took into account the comments of the Advisory Board and the user needs as inferred from the questionnaires and the expert meeting, in the following way:

Model specification:

- Possibility to take into account non-demographic variables: 1) The development of a flexible method to evaluate age profiles and relative risks given by time-fixed and time-varying covariates for transitions in the field of families and fertility. This method can be applied to every setting where micro-level data on transitions are available from a large-scale representative survey and for different kind of transitions. The method is implemented in R in the MAPLES package. 2) The development of a new methodology for deriving age profiles of disability transition rates (incidence rates, recovery rates) and related mortality rates (of disabled and non-disabled people, respectively) using multi-state Markov (MSM) modeling methods.
- Flexibility of the state space: there is no pre-defined state space; the user can define the state space according to his or her own needs
- Take into account uncertainty: apart from the software application, a scenario approach has been developed
- The model has to be as transparent as possible: a clearly written users manual will be provided with the software in which the model will be described in a non-technical way (from a users perspective)

Scenario design:

- Improvement of the definition of assumptions: 1) The development of an expert questionnaire to assess substantive arguments on the future course of fertility, mortality and migration. 2) The development of a method that uses linear splines for modeling the relationship between age patterns to be projected and standard age schedules: TOPALS (Tool for projecting age-specific rates using linear splines, implemented in R)
- Differences among social classes: have been taken into account using the variable educational attainment; education is a determinant at the individual level (to increase the chance of a person to realize his or her potential) as well as at the society level (to increase political and democratic stability). Moreover, it has a

- Smoking and obesity are desirable scenario components; the combination however is complex and may cause inconsistencies; as yet only smoking has been taken into account

Software application:

- Open source software: the MicMac software application is open-source software; the processor is written in Java, the pre- and post-processor are written in R; the application is available free of charge
- Migration is too important to neglect: migration is included in the software package, but no migration analyses are carried out; so far migrants are allocated proportionally to all categories used in the scenarios
- Training of users is very important: a workshop has been organized for population forecasters and users of population projections from around Europe to provide them with hands-on training. The workshop focused on the actual application of the MicMac software and its potential use for population projections
- Consistency between Mic and Mac: is work in progress; will be added in the second release