The use of demographic trends and long-term population projections in public policy planning at EU, national, regional and local level

Summary, conclusions and recommendations

by

the Lot 1 Study Group:

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The full electronic report will later be available at the EU’s web pages.
1. Summary of results and recommendations

The principal aim of the study was to analyse how population projections are used as an instrument in public policy at EU, national and sub-national levels. The study draws conclusions on how policy makers could best benefit from demographic projections. In addition, the study points to demographic risks that have received insufficient attention.

Main results

Population projections are widely used in various policy-making processes. Demographic forecasts have created awareness of population ageing and resulted in changes in pension, health care, and other public policies throughout the world. Demographic projections are indispensable in the design and implementation of spatial (e.g. urban and housing) policies. In other domains, the role of projections varies.

The study reveals important differences in existing practices across different countries. This gives us the opportunity to point out best practices.

The first result relates to the way the uncertainties of future demographics are taken into account. Demographic projections are always uncertain and erroneous projections can lead to misleading or even wrong policy decisions that may cause all kind of losses. Research has increased understanding of demographic processes but unfortunately this has not improved forecast accuracy. Therefore, good policies should be robust against a wide range of demographic futures.

A traditional way of handling uncertainty is to present alternative variants (say, high and low fertility) in addition to a benchmark projection. One can then study a given policy problem (say the sustainability of a pension system) under each. The problem is that, a priori, it is hard to determine what aspects of future demographics should be varied and by how much. In some cases, the use of variants can even be harmful, if they give a false impression that all relevant contingencies have been covered.

Because the alternatives rarely can be given a clear interpretation, they add little if any value to policy-making. It is our opinion that either the use of demographic variants of current form should be abandoned, or they should be made into proper scenarios by providing “storylines” that can be substantiated by empirical research. Another way is to create variants so that explicit probabilities can be attached to them. A third alternative is to take the uncertainty explicitly into account by presenting stochastic population projections (see Table 1 on page 12). One can then analyze the effects of a given policy under a realistic range of different population paths.

An important advantage with stochastic population projections is that they lead naturally to what we call a strategy approach in policy-making. By this, we mean formulating policies so that they state what action will be taken under a large number of possible states of the world that cover a realistic range of demographic developments (see page 9).
Secondly, in several EU-25 countries there are serious deficiencies in the availability and quality of demographic data. Currently the situation varies a lot between European countries, and the trend in many countries seems to be for the worse. The key worries here concern migration data, and therefore also the size of the working age population (see page 10). But other parts of the demographic data system must also be kept in mind, especially those concerning living arrangements and generational time series.

Thirdly, despite of some recent promising examples, the link between demographic forecasts and public policy making is still weak. Producers of official population forecasts seem to have significant difficulties to assess the demographic impact of existing or planned public policies. The users of population forecasts complain that there is not enough information about the interaction between demographic trends, socio-economic factors and policy. Consequently, past and future demographics appear as less interesting and less useful to policy makers. A more explicit discussion of the role of planned policies for future demographics may contribute to a better understanding of what is feasible.

**Summary of recommendations**

We recommend that
- The Commission should consider whether and how to expand the Nordic-type population register system to the whole EU.
- The Commission should fund both theoretical research and practical pilot efforts to see how information in various administrative records, public and private, could be used to provide information about migration, given the constraints posed by citizens’ right to privacy. Funds should also be directed for research on how practices in estimating migration flows that are used elsewhere could be adapted to the European setting.
- The Commission should encourage participants in actual decision-making processes in different member countries and policy domains to use stochastic population simulations and consider the strategy approach.
- The study of Turkey’s population development should be given a high priority in the EU.

### 2. The methods and the case studies

#### 2.1 A decision theoretic framework

We structured the analysis using a theoretic framework of decision-making, which is shortly described below and more formally in the Appendix of the full report.

All demographic forecasts, current and past, together with actual demographic data, form a **demographic information set**. It is used, together with relevant non-demographic information, in making predictions about the consequences of policy alternatives for different issues (e.g. the pension system, the labour market, the housing market). The set of such analysis forms the **property set** for a **set of policy alternatives**. A **policy** is chosen by a decision maker from the set of policy alternatives. In making the choice, the decision
maker weighs the consequences of the alternatives and their likelihood, given the information set. Available resources and time limits constrain the decision-making process.

The chosen policy determines, together with the actual demographics that materialize, the citizens’ welfare in the future. Welfare should be the ultimate criterion for judging whether the whole decision making process works well or not, and in particular, whether forecasts have appropriately been used. Although this criterion is difficult to make operational explicitly, it is our opinion that it must be kept in mind when considering how population projections should be used in policy planning. It is not sufficient to look at the issues entirely from the angles of those involved in the policy-making process.

2.2 The survey

We arranged a survey questionnaire to people who use the demographic data in policy planning. Among the 28 participants were members of the Working Group on Ageing of the Economic Policy Committee, other country experts, one expert from the Commission of the EU and from the Congressional Budget Office of USA and seven regional policy experts. Two thirds both from the EU-15 countries and from the new member countries were represented as well as one accession country. The survey consisted of 47 questions.

The respondents typically use demographic forecasts of Eurostat and national statistical offices. The elements used are mainly total population, population by sex and age and projection of the vital demographic processes. The most often mentioned policy domains in which demographic data was used were public pensions and care, labor market policy and education. In transition countries the menu of policy domains was markedly shorter.

The survey provides a mixed picture of the weaknesses and strengths in the decision making process. The following problems very likely restrict the set of policy alternatives considered in policy making and weaken the quality of decisions made.

- The amount of demographic information is in many countries clearly insufficient.
- Quality of current data is a problem, especially concerning migration.
- Uncertainty in population projections has been noted, but is largely unsolved or even neglected issue.
- The assumptions used by the producers of the projections have not been communicated to the users well enough.
- The users wanted to have more information about the interaction between demographic trends and economic and other explanatory variables.
- Deficiencies exist in receiving non-demographic data, such as health status.

2.3 Population projections in pension policy and public finance planning

The first case studies the use of demographic projections in pension policy and public finance planning in two countries, one with a relatively stable historical development
The case shows that demographic variants have been widely used in policy planning but without effects to decisions. Stochastic population simulations have recently been presented and discussed in Finland and to a lesser effect also in Lithuania, but it is too early to assess their usefulness in practice, except by noting that they are a more demanding instrument than conventional population projections. Arguments in favor and against the use of stochastic simulations are presented and the strategy approach is discussed in the full (electronic) report.

We have also included a shorter report concerning the regulation of annuity markets, which are an important part of any private pension system. In our view, the regulation of annuity markets (and the market for life insurance in general) is a promising example of a policy area where stochastic population projections could be highly useful.

### 2.4 Population projections in immigration policy

The second case study focuses on the use of demographic projections in the design and implementation of immigration policies at the national level. The motivation is twofold. Firstly, the huge geographical differences in living standards may cause new, large migration flows. Secondly, the expected decline of working age population and the acceleration of population ageing may lead to increasing numbers of labor migrants.

The countries chosen for this case study, Germany, Spain, and the Netherlands, have different experiences of and future needs for migration. In Germany, there seems to be no link between demographics and immigration policies. The same appears to be hold for Spain as well, although that may be changing now. In the Netherlands, in contrast, information on past and future demographic developments, especially concerning population of non-Western origin, has been frequently and increasingly used for making migration policy recommendations. There are also substantial differences in the availability of data concerning migration and its impact on demographics. The German report mentions a specific case of missing research: the impact of migration on the demographic structure of the population at the regional level is not well researched.

### 2.5 Population projections in urban and regional policy

The huge variation in the age structure in different districts and the strong selectivity of migration with respect to age highlights the need to build regional and local population forecasts. The third case study reports on the use of population projections in the Helsinki region in Finland and in the design of spatial and housing policies in the Netherlands.

Over- or underestimating future population change may lead to wrong decisions with respect to service networks, land use plans or infrastructure. Omitting the information of population projections can also cause non-optimal decisions of service network, and the case of the Helsinki region found evidence of that. The report also notes that well
functioning administrative population registers in Nordic and several Central European countries make it possible to produce reliable and sufficiently detailed population statistics. However, there are major problems in the quality and availability of population statistics especially in new EU-countries, especially the incomplete registration of out-migration.

The Dutch report describes the production and use of a comprehensive system of population and household projections at a NUTS-5 level (over 400 municipalities) called PRIMOS. It covers the whole country, area by area, and is consistent with national level forecasts. PRIMOS takes uncertainties explicitly into account in that confidence intervals are included. It combines demographic projections with a model of the housing market so that projected migration flows are consistent with housing supply. Recently, population projections have been used intensively in the preparation of long-term strategies. It appears, however, that detailed municipal-level information has not been used.

2.6 Role of demographics in Turkey’s membership negotiations

The fourth case study analyzes the demographic development in Turkey, a candidate country, and discusses whether these trends are already taken into account in EU countries’ policy-making. The relative size of Turkey is expected to increase, because its population is growing faster than that of the EU countries. But there is also large uncertainty about the future size and age structure of the population as well as its relative position in Europe. We show that the chances are 9 out of 10 that Turkey will be bigger than Germany in 2030 and that the chances are 1 out of 10 that Turkey is 30% bigger. This means that it will have to have a larger share of the political power than any other EU country according to the existing principle of approximate proportional representation.

In view of the far-reaching consequences of the different policy choices concerning Turkey’s full or affiliate membership in the EU, it would seem that the study of Turkey’s population development should have a high priority in the EU and the world. This is currently not the case, however. Turkish national statistical agency and the U.N. hold quite different views of even recent past Turkish migration, let alone of future migration. There are also several reasons to expect that the aging of Turkey is faster than assumed by the U.N. or the national statistical agency. It is unthinkable that such a large country would be member of the Union and not have population statistics and forecasts of comparable quality as those of the member countries.

3. Results, conclusions and recommendations

*How the use of demographic projections has affected decision-making in various public policy domains? How (and if) policy-makers at different layers of public administration take into account demographic considerations in their policy-making?*

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1 The questions in italics are those presented in the Commission’s call for tenders for this study.
Population projections are widely used in various policy-making processes. Demographic forecasts have created awareness of population ageing and resulted in numerous changes in pension, health and care and other public finance policies throughout the world. In urban and regional policy issues, such as land use and infrastructure planning, health, planning of social and education services, housing policy, and evaluating and planning regional labour supply, demographic projections are also indispensable. In other policy domains the role of demographic projections varies more.

According to the questionnaire, the actual influence of population projections on policy decisions is most obvious in pension policy, but also labor market policies and education policies were mentioned often. The need for future health reforms is compelling, but this has not yet contributed to the implemented policy.

The Finnish case study reveals that expected population ageing appears to have been an important motivation behind reforms in pension policy and an essential element in public finance planning during the last 15 years. Social partners, politicians and civil servants are all aware of population ageing, at least to some degree. Projections based on demography are often made. In Lithuania the pension reform that started in year 2000 and took effect in 2004 was the first case when demographic projections were an important factor.

Although it is clear that demographic projections have had a significant impact on pension policies and policies in related domains, it is open to debate whether things have been satisfactory from a citizen’s point of view. We should ask whether policy-making processes should have reacted earlier to the expected ageing prospect, or whether the systematic underestimation of the speed in mortality decline should have been noted earlier and taken into account in policy considerations.

To what extent do demographic aspects influence the public policy debate?

In the survey the influence of demographic aspects on public policy debate was reported to be most intense in domains of provision of pensions and care. In case of care this reflects early awareness, since the problems are expected to come after 15-20 years and the role of demographics is uncertain. About a half of respondents reports either very much or rather much influence in migration policy and labor market policy domains. Regional aspects raise little interest, even though these are likely to be much discussed in future. Almost all respondents agreed fully or to some degree that Turkey’s future demographics should be considered more in EU countries’ decision making.

The expectation of future population aging appears to have been the main factor behind the reform debate in Finland. In Lithuania demographics have also been an important background factor, but the vast economic and social changes that have taken place in the transition from a socialist economy to a market economy have affected pension and public finance policies even more significantly. In countries with stable historical development it is easier to concentrate on future threats than in countries facing rapid changes.
To what extent can the differences between projections and actual trends lead to problems in decision-making, or influence the political discussion?

The respondents of the questionnaire note that in most of the countries experienced forecast errors did not raise much discussion nor influence policy choices. One must remember that information on past errors is usually not readily available.

How are the assumptions used by demographers in long-term demographic projections affected by current policies or policy targets?

Some survey respondents reported that the assumptions in their own country were affected by population policy, giving as examples family or migration policy. That may merely show efficient but innocuous exchange of information. A serious concern of credibility, however, can be inferred from the fact that about one in three respondents think that in other countries political aspirations influence the assumptions.

How has uncertainty in demographic projections been handled?

The main way to address the uncertainty in demographic projections is using variants (scenarios without storylines attached). Stochastic population simulations have recently been sometimes used. A third alternative is simply to describe past erroneous projections.

The Finnish and Lithuanian case studies show that scenarios are often used to describe uncertainty in pension expenditure and other fiscal projections, without noticeable effects on policy. In migration issues the Netherlands case study reveals that very few migration policy (recommendation) makers have attempted to use results of projection variants. The survey confirms that the dominating method of describing uncertainty is to use many variants, but the alternatives seldom affect policy decisions. The users of population projections report that they are reasonably well aware about the levels of forecast errors, although lack of credible uncertainty estimates was also quite often mentioned.

The researchers and planners for regional and local population projections are aware of the uncertainty of projections. However, they lack sufficient tools to analyze, describe and quantify the uncertainty. The most important source of uncertainty is migration.

Table 1 describes and compares the properties of conventional and stochastic population forecasts. In general, population renewal can be expressed as: (population at t + 1) = (population at t) + (births during t) - (deaths during t) + (net-migration during t). In the cohort-component method the book-keeping is done by age and sex. Both conventional and stochastic forecasts use the same book-keeping. In the cohort-component method births and deaths are generated via vital rates. In conventional forecasts they are specified as a set of numbers, whereas in the stochastic forecasts they are taken to be random variables. From a logical point of view, a conventional forecast is a special case of a stochastic forecast, when all variance parameters are zero. From a practical point of view the main properties are those depicted in Table 1.
Table 1: Conventional and Stochastic Population Forecasts: Pros and Cons

<table>
<thead>
<tr>
<th>Transparency</th>
<th>Conventional Population Forecast</th>
<th>Stochastic Population Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>prerequisites</td>
<td>Involves addition, subtraction and multiplication only. The results may be checked by direct inspection, and understood based on modest education.</td>
<td>Forecasts are carried out by simulation. Checking is more complex. Understanding the results requires more education (including probabilities and statistics).</td>
</tr>
</tbody>
</table>

| Simplicity of Presentation    | Middle variant may be sufficient to convey the main message. Alternative calculations may be provided, with one leading to a higher population, another leading to a lower population etc. These can be printed back-to-back in a book. Results for aggregated age-groups are produced by addition. | A full predictive distribution is approximated via computer simulation. Still, it may not be necessary to display more than the point forecast for a lay audience. Prediction intervals can be published for individual ages, but to produce intervals for aggregates a database of simulated values must (and can) be accessed. |

| Ease of Preparation           | Only a point forecast needs to be specified. | In addition, the specification of variances and correlations is required. |

| Interpretation and Logical Coherence of Intervals | High and low intervals are (usually) interpreted as providing a “plausible range”. But, there is no way to guarantee the comparability of the ranges for different ages, different sexes, different forecast years, etc. The results for different demographic functionals are necessarily incoherent. | Intervals with desired probability content for the size of any population aggregate and for the size of any demographic functional (such as age ratios) at any future time can be provided. |

| Ability to Handle Uncertainty | Cannot handle uncertainty in a coherent and interpretable manner. | Uncertainty is handled in a coherent and interpretable manner. |

| Use of Past Data              | Only trend estimates can be used. Judgment is necessary for questions like which models and which data periods to use. Knowledge of intermediate correlations (i.e., different from ± 1) across demographic variables cannot be used. | Can utilize information on varying trends, lack of fit, changes of volatility etc. The uncertainty related to the choice of models and data periods can be incorporated statistically. Knowledge of intermediate correlations can be incorporated. |

| Conditional Forecasts and Scenarios | Can represent scenarios that correspond, e.g., to assumed effects of policy interventions or exogenous factors. | Can, in addition, incorporate information about the uncertainty concerning the effects of interventions or exogenous factors. |

| Sensitivity Analysis          | Can vary values of fertility, mortality or migration to see what the effect is. | Can, in addition, vary second moments. |

| Ease of                       | A large number of computer programs are | Several computer programs are available, but |
Computation available. There is extensive experience of their use. Results are obtained in seconds. with differing capabilities. There is experience of their use from the past 10-15 years only. Results are obtained in minutes.

How can policy-makers best handle the uncertainty inherent to demographic projections?

One must first ask whether proper information on the uncertainties is available. Statistical offices and other demographic forecasters should provide information on past errors. Past forecasts should be readily available in databases, but this is usually not the case. Specific studies on the errors should be carried out. A set of stochastic population simulations is one important candidate for inclusion in the information set of the decision-making process.

The survey reveals that handling uncertainty in demographic projections is problematic. The main obstacle is insufficient experience in dealing either with demographic uncertainty or joint uncertainty of demographic and economic variables. Also lack of agreed procedures to consider uncertainty was noted often. Stochastic population forecasts were not well known. These obstacles should be removed or alleviated by both doing more research on the issues and by learning from countries with more advanced practices.

Alternative demographic scenarios, without storylines attached to them, have been the dominant but ineffective way of discussing the uncertainty in demographic projections. It may well be that uncertainty will be handled in more influential ways, when knowledge of the potential magnitude of this uncertainty and its consequences to economic outcomes in pension systems and public finances increases. The Finnish government’s report on the future, which contains discussion on past errors in population projections and a presentation of stochastic population simulations, points this way (see the full electronic report).

There is relatively little experience of stochastic population simulations in Europe. It is possible, however, to learn from the practices in the U.S., where stochastic projections are routinely used in public finance evaluations. Some lessons seem obvious: disseminating the information in stochastic population simulations is not easy, and using them in policy analysis requires both refined tools and learning time. Thus there will be, and already is, opposition to their use among different participant groups in policy-making processes. It is our opinion, however, that the method will gain ground, because among different ways of dealing with uncertainty it is particularly suitable for policy analysis. Furthermore, from the citizen’s point of view, policy decisions should be based on best possible analysis, within the time and resource limits, instead of most convenient one.

Stochastic population simulations lead to what may be called a strategy approach to policies, utilizing stochastic population simulations with economic models and defining and evaluating various policy outcomes on a large number of possible states of the world that cover a realistic range of economic and demographic developments. It is clear that this approach demands more from almost every part of the decision-making process. More quantitative information on risks and uncertainties is needed, and the tools for handling this information must usually contain explicit models. The set of decision alternatives is very likely to grow larger and the policies themselves can be more complicated, e.g. contain automatic adjustment mechanisms. More time is needed for
analyzing different alternative states and the policy consequences in each of them. Still, given the uncertainty in demographic projections and the failure of demographic variants in dealing with it, we find no convincing reasons for not trying to apply the strategy approach. It has thus far been applied to pension policies (see Box 1). Whether and how the approach could be applied in other policy fields is an open question.

**Box 1: The Swedish pension reform as a strategy**

The new Swedish first pillar pension system provides an example of strategies that can be created to assess demographic uncertainty. The earnings-related system consists of pay-as-you-go financed defined-contribution notional account part (NDC) and of individual fully-funded account. The first pillar also includes a separate means-tested tax-financed basic pension.

The NDC part is designed to be financially stable, i.e. regardless of demographic or economic development it will be able to meet its financial obligations with a fixed contribution rate and fixed rules for calculating benefits. Stability is assured through an adjustment of benefits for changes in longevity and by an automatic balancing mechanism that covers all other risks. Longevity adjustment is applied to the cumulative balance of the nominal account of an employee at the time of retirement. It is based on average observed life expectancy. The adjustment is likely to cut pension expenditures markedly and to eliminate major part of the variation in the contribution rate due to unexpected changes in mortality. Employees are able to react to a downward adjustment by extra private saving or by deferred retirement, since changes in life expectancy are slow.

The balance in the nominal account is normally indexed to per capita income growth. The automatic balancing mechanism will lower the indexation as long as the financial sustainability of the system is in danger. If a period with reduced adjustments is followed by a surplus in the system, the pensions will be adjusted upwards until the level of original average income index is reached. Sustainability is measured yearly by comparing system’s assets to liabilities. Assets consist of the buffer fund and the capitalized value of contributions, and the liabilities consist of the future pensions. Demographic forecasts are not used in these calculations, just observed demographics, but the system reacts automatically to population developments in a manner that is defined in the rules and thus in principle known to every individual.


*Conclusions on how policy makers could best benefit in the future from the design of demographic projection*

Current practices (using point forecasts of future demographics) have created awareness of population ageing. This state of affairs should not be jeopardized. In the future the goal should be that major changes are foreseen as early as possible.
The availability and high quality of detailed population data is a necessary precondition for reliable population projections both at national, regional and local level. Population registers which cover all the population and are continuously updated by legally controlled administrative procedures provide the best basis for population data. Countries relying on censuses are in a much weaker position and the estimates obtained reflect errors both in census coverage and in vital registration.

The main problem in most population data systems in EU countries is the registration of out-migration. Because being registered is frequently a precondition for opening of bank accounts, entitlement to subsidized or low cost social and health services etc., there are incentives for migrating people to in-register in the new country/region/municipality. On the contrary, in most cases there are no incentives to out-register in the old place of stay. There are three basic approaches that could improve the situation. The most obvious solution to this problem would be organizing the exchange of migration registration records within the EU. This would mean that the information of all in-migration records from the population registers of destination countries/regions/municipalities are delivered to the registers of the original place of stay. This system has been in use within and between the Nordic countries for a long time and it functions well. Adopting this system in other EU-countries would, however, involve a major reorganization in their basic social information systems, and may not be politically realistic. The Commission should consider whether and how to expand the Nordic-type population register system to the whole EU.

Second, administrative records can also provide information about migration. Vast amounts of information are collected by banks, credit card companies, phone companies, health care systems, school systems etc. In principle, such information could be used to estimate migration flows via dual-systems estimation, for example. The Commission should fund both theoretical research and practical pilot projects to see how such information can be used in practice, given the constraints posed by citizens’ right to privacy. The use of such symptomatic data is far from simple, so due attention must be paid to the robustness of the statistical methods underlying the estimates.

Third, sample surveys are used in the United States to estimate migration flows both directly, and indirectly, by assessing the accuracy of the censuses. This could also be applied in Europe. Such surveys must tackle considerable problems of non-response and data errors. The Commission should fund research to see how practices developed elsewhere could be adapted to the European setting.

The assumptions and their consequences made for the demographic projections should be expressed clearly and with good reasoning. This is important for widening the use of projections in decision making.

The use of alternative demographic variants in policy-making should either be substantially improved or it should be abandoned. They require a fair amount of time and effort but seem to add little if any value to using only the baseline demographic projection. They could be turned into proper scenarios, with consistent and well-founded storylines attached. This could make their users think of possibly relevant alternatives.
Another way is to pick variants so that some probabilities can be attached to them. This could be achieved by picking the variants from stochastic population simulations. A third alternative is to forsake variants in policy making and move fully into stochastic population simulations. Alternative policy options could then be “crash-tested” under a much wider range of assumptions than is currently the case.

Efforts should be stepped up to translate stochastically produced demographic projections into policy conclusions on future risks for those policy domains where future demographics are important. The strategy approach to policy-making is in our opinion a promising alternative to current policy-making practices. More research is needed on how to best apply it and to develop better tools for it, but some tools exist already and experiments and development should start from them. We recommend that the Commission, first, makes resources available for research concerning the strategy approach and the tools needed, and, second, encourages participants in actual decision-making processes in different member countries and policy domains to consider the approach. In pension policies, one way could be the inclusion of this approach in the agenda of the open method of coordination.