DEMOGRAPHIC SCENARIOS FOR EUROPE

Henk Hilderink

Introduction

Demography is the science that studies developments in size, structure, composition and regional distribution of the population, and the societal causes and effects of these developments. Population size and structure are determined by three fundamental demographic processes fertility, mortality and migration. In this memo a brief overview is given of demographic developments in Europe. First, an overview is given of available forecasts/scenarios/variants. Secondly, a more detailed description is given of the Phoenix Europe, which is an application of the SRES scenarios methodology applied to Europe. The focus is on national projection while the final purpose is to provide popualtion scenarios at the NUTS2 level.

Available projections

In the table below, an overview is given of existing demographic projections /available demographic data for Europe. At the NUTS0 / National level various projections exist. However, these are rather outdated (CBS/NiDi) or comprise only variants instead of scenarios (e.g. Eurostat). The only more recent scenario collection is given by Phoenix 1.4 (Hilderink, 2003, Hilderink, 2004), which is based on the SRES methodology. At a lower aggregation level, the Eurostat NUTS2 (1995) variants are available.

Table 1. Overview of available population projections (for detailed description see appendix).

Subject	Geographical coverage	Period	Source	Remarks
Population	European Regions (WEUR, EEUR)	2000-2100	IPCC SRES 2002	Scenarios: A1-B1-A2-B2
	NUTS0 (EU15)	1998-2050	Eurostat 1998	Variants: Baseline High-Low
	NUTS0 (EU15)	1998-2050	Eurostat 1998 / CPB 2003	Adjusted Eurostat 1998 scenario's for Four Futures
	NUTS0 (EUR40)	1996-2050	CBS/NiDi	Two scenarios: diversity and uniformity based on a consistent set of fertility, mortality and migration

				assumptions
	NUTS0 (EUR40)	2000-2050	UN WPP 2001	Variants: Medium High Low
	NUTS0 (EUR40)	1950-2050	MNP 2003 (Phoenix 1.4)	A1-B1-A2-B2 scenarios
	NUTS2 (EU15)	1995-2025	Eurostat 1995	Baseline
Urbanization	NUTS0 (EUR40)	1995-2030	UN 2001 (UN, 2001)	Baseline
Agricultural employment	NUTS2	1999-2002	Eurostat 2002	

The 'scenarios' used in CPB Four Futures are based on Eurostat. The high and low variant, however, were considerd to be too extreme and were adjusted by multiplying their deviation from the baseline with 2/3. This rather crude way of constructing scenarios –or actually adjusted variants-, in combination with the relatively old data and the coverage of only EU15-countries, gives reason to use a more advanced application. This will be described in the following sections.

Scenarios for Europe

For PHOENIX Europe, all European countries included in the previously mentioned NiDi/CBS study (Huisman and Imhoff, 1999) were selected. A clustering of countries is used to describe demographic changes. All 38 European countries are classified, making use of six clusters. For each cluster, assumptions are made taking the assumptions for the Netherlands on life expectancy and number of children per woman (expressed in the total fertility rate, TFR) as reference points or representative of European developments. For migration, crude migration rates (i.e. net number of migrants per 1000 of the population) will be used instead of absolute numbers. This enables comparison of developments among the countries (and reflects a more quota-oriented EU policy, which might be implemented in the future). Nevertheless, a more extensive description, in which consequences of different future developments concerning expansion of the European Union are taken into account, is obviously preferable.

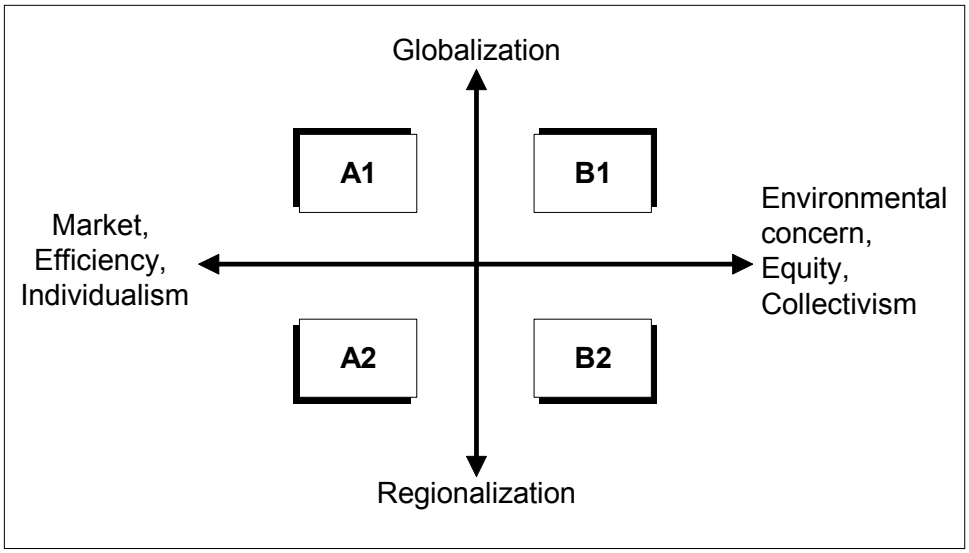


Figure 1. Four scenarios in SRES.

Assumptions

The vertical axis of the scenarios (globalization versus regionalization) is also used for the interpretation of the future of the European Union (See CPB, 2003). In the A1/B1 worlds, Europe is successfully enlarged within the coming 15 years with 10-15 countries. All European countries will reach the levels similar to those in the Netherlands (De Jong and Hilderink, 2004) in the corresponding scenarios, although some faster than others. The convergence levels in scenario A1 of 3 migrants per 1000 inhabitants and 2.1 in scenario B1 differ only slightly from the original NiDi/CBS assumptions (3.5 in south Europe and 2.5 in all other countries). The expansion also implies free traffic of persons, and leads to higher (intra-continental) migration flows between 'new', mostly Eastern European countries and the other EU countries. This is reflected in higher migration rates[1].

In the A2/B2 worlds only the clusters Western, north and south Europe (the current EU-15) will reach the representative levels of the Netherlands while others will stay behind. In this 'two-speed' or even 'three-speed Europe', Eastern European countries will have lower life expectancies combined with low fertility rates, as currently observed in these countries. In A2/B2, expansion will not be as successful and results in lower migration flows from – if any – new countries to the old ones due to higher barriers, since only restricted labour migration will be permitted. The values for migration, fertility and mortality for the other countries (i.e. those not specified by the previously described

[1] An origin-destination matrix would be a more adequate way to describe migration flows. Far more analysis is required to be able to pinpoint the flows correctly and goes beyond the scope of this exploration of European futures.

values for the Netherlands) are based on the NiDi/CBS diversity scenario. An overview of all scenario values is given in Appendix 2.

Table 2. Overview of assumptions for European population projections.

Input	A1	A2	B1	B2
Fertility	Converging High	Diversity Low	Converging High	Diversity Medium
Life expectancy	Converging Medium High	Diversity Low	Converging High	Diversity Medium
Migration	Converging High	Diversity Low	Converging Medium High	Diversity Low

Results

Simulation results are shown in Figure 2 for the five clusters. The results for the total population are more distinctive for the 1 versus 2 World than the A versus B World (see Figure 2). In 2050, the collective population of all the countries ranges from 625 million in B2 to 925 million in A1. These outcomes are explained in the combination of low and high values especially for migration and fertility, respectively. The population in Former Soviet Union, however, will decrease, at least for the coming decades. Differences in age structures due to different historical patterns underlie these deviating outcomes.

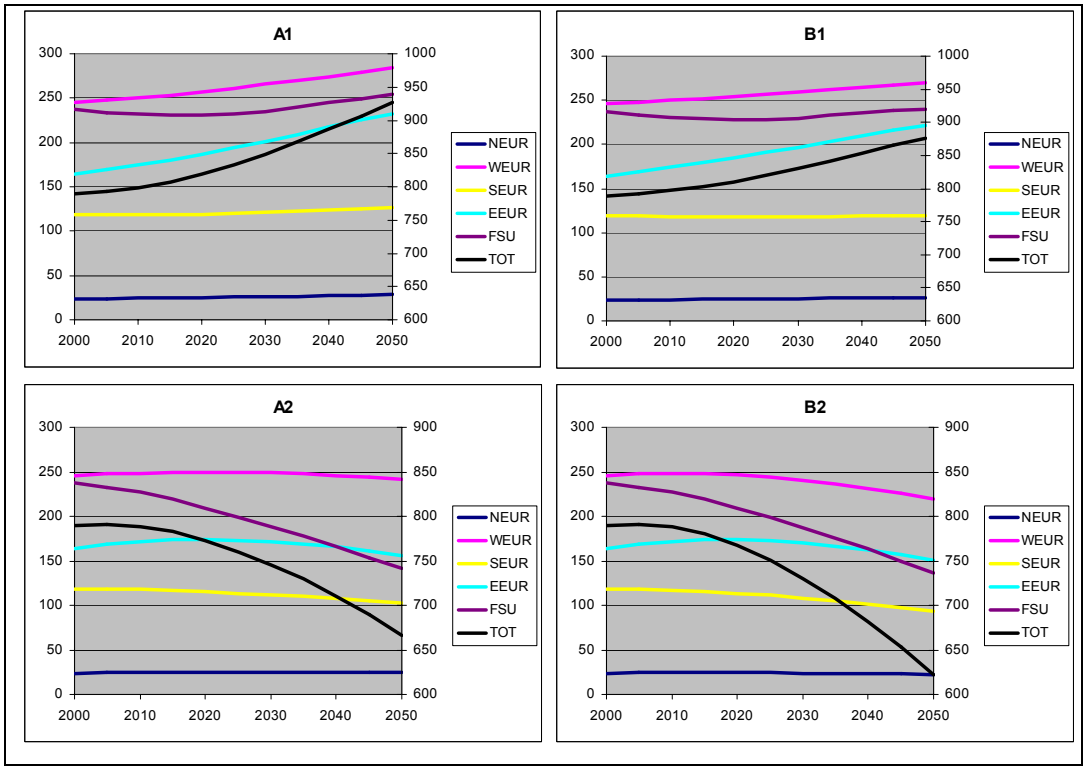


Figure 2. Population (in millions) simulation results for the clusters in Europe (black line shows the total population displayed on the right axis), 2000-2050.

Focusing on the EU, a similar range can be seen. Figure 3 shows the results for the EU15 countries. In the A1 World the high migration rates result in the highest population of 425 million, which is comparable to the highest projection of Eurostat. The low fertility, mortality and migration assumptions of the B2 Scenario result in a population of just above 320 million, a decrease of 50 million compared to the current size. This result is higher than the low Eurostat projection, mainly due to a somewhat higher level of the number of children per woman. The annual net migration into the EU15 ranges from just over 1 million migrants per year in A1, 760 thousand in B1, 550 thousand in A2 and 288 in B2. Consequences for ageing are also presented in the figure below. Results are given for the green (population younger than 15 years as a ratio of the potential economically active population aged 45-65 years) and grey pressure (65 and over as a ratio of 15-64 years). The green pressure shows clearly the differences in fertility levels. The higher fertility levels cause a higher inflow in the younger cohorts. On the other hand, the grey pressure illustrates the ageing process. The population of 65 and over is expected to increase substantially. This reconfirms the upcoming wave of ageing, which can neither be averted by higher fertility levels, nor by high migration inflows. Ageing seems to be inescapable and has to be dealt with in all scenarios.

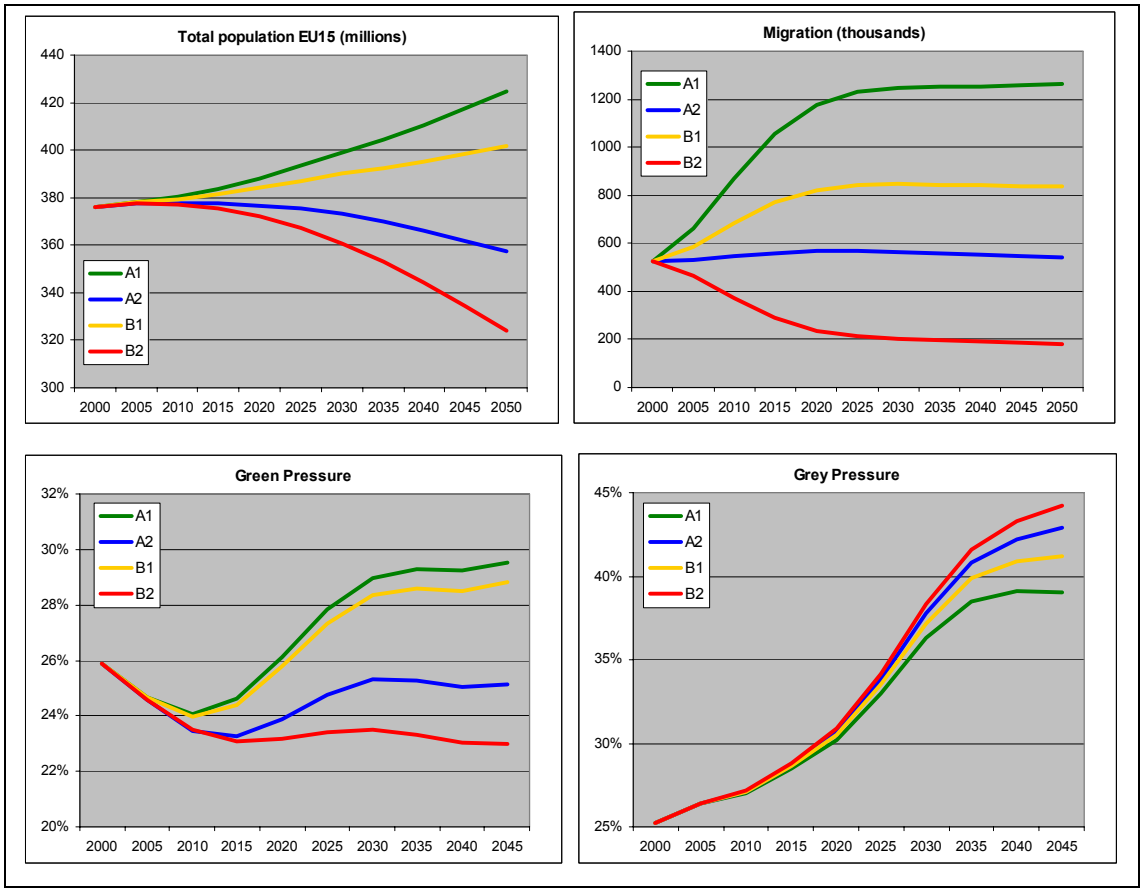


Figure 3. Population (in millions) simulation results for the EU-15, 2000-2050.

The results for the EU+10 and Bulgaria, Romania amd Turkey are shown in the figures below.

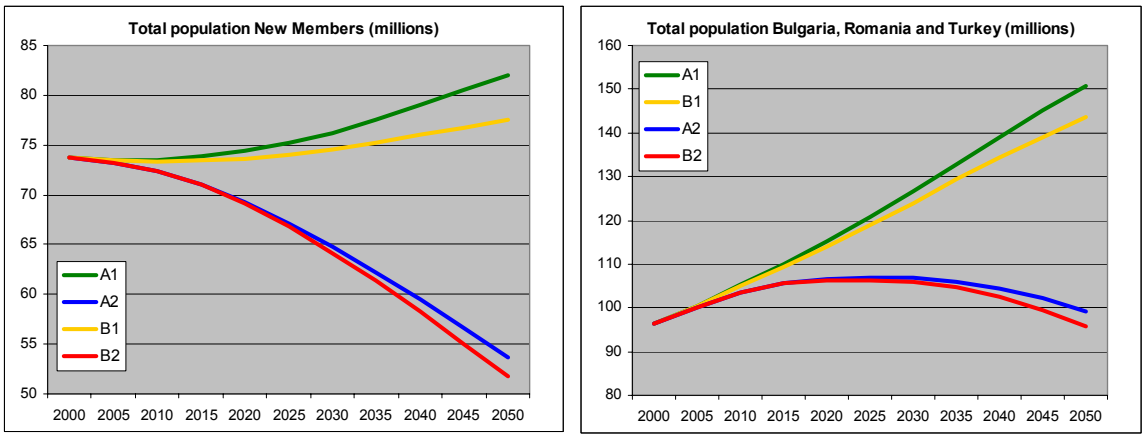
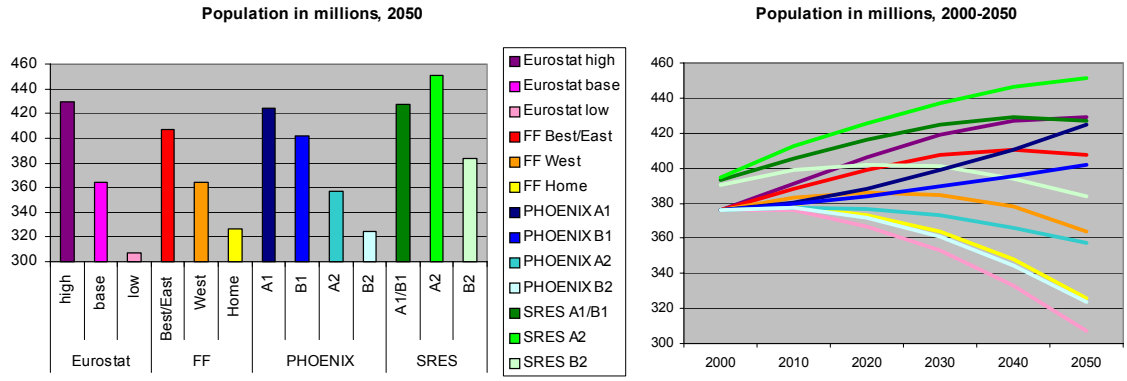


Figure 4. Population (in millions) simulation results for the 10 New Memebers and Bulagria, Romania and Turkey, 2000-2050.

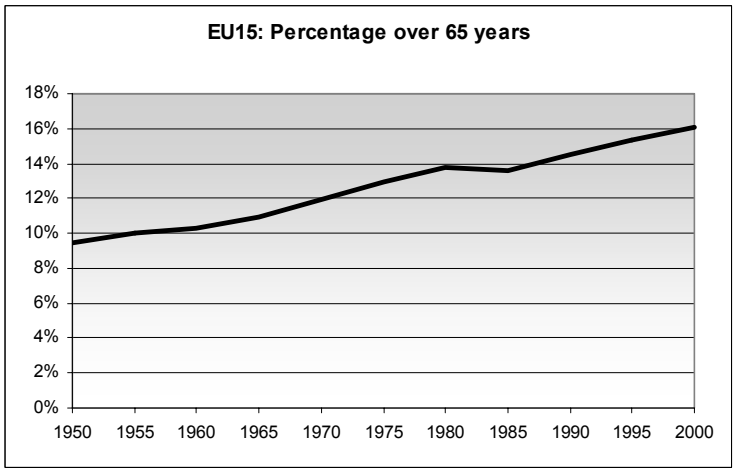
Comparison with other projections



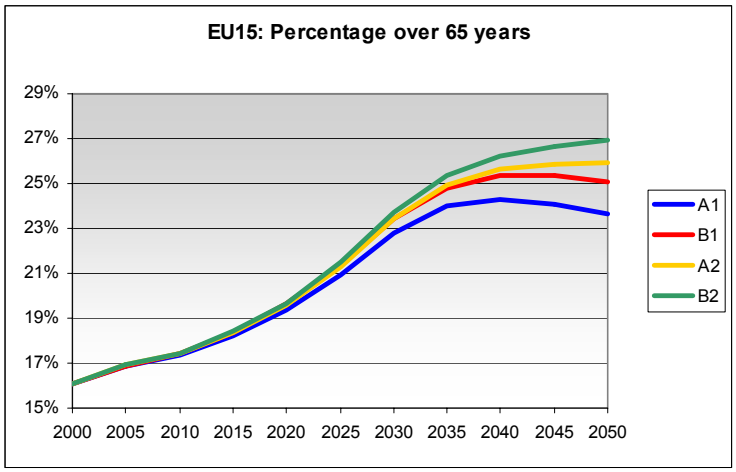
From the figures above can be concluded that the four Phoenix scenarios for the countries of European Union 15 show a comparable range as the three Eurostat variants (High-Base-Low). The SRES scenarios show a higher range which can partly be explained by differences in region definition; Western Europe includes countries as Norway, Iceland and Switzerland. In the year 2000 the consequences of these different definitions can already be observed. The order of outcomes differs also. Is A2 in SRES the highest scenario, while in the others A1 has the highest population numbers.

Ageing

One of the other most relevant outcomes is the age structure of the population. The process of ageing has set in already several decades ago, as a combination of lower fertility levels and increased life expectancies. In 1950, the percentage of the EU15-population older than 65 years was just below 10% and increased steadily to a level of 16% in 2000. The disruption of this increase in th 1980s can be attributed to the effects of World War I.



Looking at the future, migration is sometimes mentioned as a solution to anticipate the ageing process. In the four scenarios, the growth proportion of the population over 65 years will continue, despite of the relatively high net migration in e.g. A1. The pathway for the coming decades is more or less fixed and the percentage will be in 20 years just over 21%. In the period afterwards, a range of 23-27% is obtained in 2050.



Urbanisation

For the (future) urban and rural populations the UN World Urbanization Prospects (WUP) have been used The WUP is the only data source concerning future urbanization rates. These data, however, should be used carefully since underlying definitions of what is considered to be an urban population is taken from the countries themselves and shows a big variation. The threshold value of communes to be defined as urban varies from 200 (Iceland, Norway) 1500 (Ireland) to 10000 (Spain, Portugal).

% Urban Pop	1950	1970	1990	2000	2010	2020	2030
Austria	63.6	67.5	67.0	67.3	69.3	72.9	76.4
Belgium	91.5	94.3	96.5	97.3	97.9	98.2	98.4
Denmark	68.0	79.7	84.8	85.1	85.3	86.2	87.8
Finland	32.0	50.3	61.4	59.0	59.0	59.9	65.0
France	56.2	71.0	74.0	75.4	77.2	79.6	82.2
Germany	71.9	79.6	85.3	87.5	89.2	90.5	91.7
Greece	37.3	52.5	58.8	60.1	63.1	67.4	71.6
Ireland	41.1	51.7	56.9	59.0	62.1	66.1	70.5
Italy	54.3	64.3	66.7	66.9	69.0	72.6	76.1
Luxembourg	59.1	67.8	86.3	91.5	94.3	95.5	96.0
Netherlands	82.7	86.1	88.7	89.5	90.5	91.6	92.6
Portugal	19.2	25.9	46.7	64.4	74.7	79.0	81.6
Spain	51.9	66.0	75.4	77.6	79.9	82.3	84.5
Sweden	65.8	81.1	83.1	83.3	83.7	84.9	86.6
United Kingdom	84.2	88.5	89.1	89.5	90.3	91.3	92.4
Bulgaria	25.6	51.8	66.5	67.5	68.2	70.9	74.6

Czech Republic	40.9	52.0	74.8	74.5	75.4	77.6	80.5
Estonia	49.7	64.9	71.1	69.4	70.2	72.8	76.3
Hungary	39.3	48.5	62.0	64.5	67.6	71.3	75.0
Latvia	51.6	62.0	70.3	60.4	60.4	60.7	65.7
Lithuania	31.1	49.5	67.8	68.5	70.2	73.2	76.6
Malta	61.2	77.4	87.6	90.9	93.0	94.2	94.9
Poland	38.7	52.3	60.7	62.3	64.8	68.5	72.5
Slovakia	30.0	41.1	56.5	57.4	60.0	64.5	69.1
Slovenia	19.9	37.0	50.4	49.2	50.0	53.9	59.6
Cyprus	29.8	40.8	65.0	69.9	73.0	76.2	79.3
Turkey	21.3	38.4	61.2	65.8	69.9	73.7	77.0
Romania	25.5	41.8	53.6	55.1	57.4	61.5	66.4

Regionalisation

To obtain the population at NUTS2 level, the Phoenix scenarios have been downscaled applying the outcomes of the Eurostat regional population projections at NUTS2 for EU15. For A1 and B1 the high variant has been used, for A2 the base and for B2 the low variant. Due to the lack of data, other NUTS2 desaggregation have been done assuming the 2000 distribution of the population over the NUTS2 regions.

Appendix

UN WPP

The UN has a long history of population projections. The latest UN World Population Prospects (UN, 2002) consist of population projections up to 2050 for 228 countries (detailed statistics for 183 major countries). The three variants (Medium, High and Low) are actually only fertility variants, since the TFR is the only varying factor. Countries are clustered in three fertility categories. Assumptions corresponding with the three categories are made for each variant on the pace (change in the TFR per decade) or the convergence level (e.g. replacement level). Mortality is projected on the basis of the models for change of life expectancy. The future path of international migration is set out on the basis of past international migration estimates and an assessment of the policy stance of countries with regard to future international migration flows. Migration differs only slightly for the three variants. It is based on numbers of migrants which are also assumed to be constant over time. No explanation is given on the source of these assumptions.

RIVM-Population Research Centre/PHOENIX

PHOENIX is a simulation model developed to assess the impact of developmental and policy factors on population dynamics (Hilderink, 2000). The model is part of an integrated framework of global change models developed by RIVM. In addition, a visualization package was developed to display the various components of population dynamics graphically. The model was used to assess the effect of such socio-economic factors as income and literacy on fertility behaviour using Bongaarts' approach (Bongaarts and Potter, 1983) of proximate determinants for fertility (e.g. contraceptive use, age at marriage, divorce). The mortality approach is partly based on the population and health module used in TARGETS 1.0 (Niessen and Hilderink, 1997). In the Mortality subsystem, the population is subdivided by distinguishing people according to mortality risks strongly allied to socio-economic factors (e.g. poverty and education) and environmental factors (e.g. food availability and access to drinking water).

EUROSTAT

Eurostat (Eurostat, 2003)collects and publishes demographic statistics for all EU15 countries at national, but also at a regional, level (NUTS3). National population projections are made on a regular basis up to the year 2050. The latest projections were made in 1995 with a revision of the assumptions and outcomes in 1999 (Eurostat, 2003). Although four additional EFTA countries (Norway, Switzerland, Iceland and Liechtenstein) are officially included, they have been left out here. Only straightforward assumptions are made for the 15 countries on life expectancy, total fertility rate and the net number of migrants. No further qualitative scenario embedding seems to be used. The results for the EU15 countries are presented in Appendix 1.

Four Futures (in Dutch)

In de FF studie worden de bevolkingsprojecties gebruikt die gemaakt zijn door Eurostat. Deze projecties, een baseline en een hoge en lage variant, stammen uit 1999 en hebben betrekking op de EU-15. In de baseline/midden variant neemt de bevolking van de EU-landen eerste toe van 375 miljoen in het basisjaar 1995 tot 386 miljoen in 2025 waarna een daling optreedt tot 364 miljoen in 2050. Deze daling komt met name doordat het totaal vruchtbaarheidscijfer verondersteld wordt substantieel lager zal blijven dan het vervangingsniveau van 2,1 kinderen per vrouw. Het migratiesaldo in de baseline variant is verondersteld op 600 duizend personen per jaar. Voor sterfte, als laatste component van bevolkingsveranderingen, wordt verondersteld dat de levensverwachting van 75 en

81,2 jaar voor mannen respectievelijk vrouwen zal toenemen tot 80,1 en 84,4 jaar. Voor het Transatlantic Market scenario is deze baseline gekozen.

In de hoge variant zijn vruchtbaarheid (1,94 kinderen per vrouw), levensverwachting (83,7 en 87,0) en het migratiesaldo (900 duizend per jaar) hoger. Dit leidt tot een EU-15 bevolking die doorgroeit naar 429 miljoen personen in 2050. In de lage variant neemt de bevolking af tot 307 miljoen in 2050. Met name de lage vruchtbaarheid van 1,42 kinderen per vrouw en het migratiesaldo van 300 duizend bepalen deze ontwikkeling. De resultaten van de hoge en lage variant zijn door het CPB als te extreem beschouwd. Deze twee varianten konden niet worden verenigd met de veronderstellingen ten aanzien van de economische scenario's. Daarom is de bandbreedte van de hoge en lage variant met eenderde gereduceerd. Voor Global Economy en Strong Europe is deze aangepaste hoge variant genomen terwijl voor Regional Communities de aangepaste lage variant gekozen is.

CBS/NiDi

For the European Population Conference (EPC) in The Hague in 1999, NiDi/CBS had developed two different population scenarios for all 33 countries in Europe. These two scenarios are *Uniformity*, where, in the long term, economic and cultural trends will converge and, consequently, differences across countries will decline, and *Diversity*, where differences will persist or even increase, resulting in different levels of fertility mortality and migration for various regions in Europe. In these scenarios, possible future images are depicted on the basis of cause and effect relationships. One major source of uncertainty is whether the differences in cultural and economic developments between countries will be reduced, remain at the same level or even increase. In view of these uncertainties, two different scenarios have been compiled for 33 European countries.

The first scenario, *Uniformity,* assumes that economic and cultural trends will, in the long term, converge and, consequently, differences between countries will disappear. In this scenario, increasing political integration and easy diffusion of cultural values are assumed, with successful transition from a communist to a capitalist economy for the former communist nations. Large economic growth, stimulated by internal free trade, will be achieved through a high rate of technological progress. The second scenario, *Diversity*, assumes that existing economic and cultural differences between countries will persist or increase. Political integration will be limited and will thus hamper the free market and, consequently, economic and technological growth.

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