Targeted support to the update of analysis of global megatrends for the European Environment State and Outlook Report 2015 Global megatrends assessment

Increasing divergence in global population trends: Analysis for update and improved assessment of this megatrend

European Environment Agency
25 July 2013

bio Intelligence Service

Document information

CLIENT	European Environment Agency
CONTRACT NUMBER	EEA/SKI/08/004
REPORT TITLE	Increasing divergence in global population trends: Analysis for update and improved assessment of this megatrend
PROJECT NAME	Targeted support to the update of analysis of global megatrends for the European Environment State and Outlook Report 2015 Global megatrends assessment
PROJECT TEAM	BIO Intelligence Service
PROJECT OFFICER	Anita Pirc-Velkavrh, European Environment Agency
DATE	25 July 2013
AUTHORS	Ms Polina Dekhtyar, BIO Intelligence Service Ms Tanja Münchmeyer, BIO Intelligence Service Mr Shailendra Mudgal, BIO Intelligence Service
KEY CONTACTS	Shailendra Mudgal sm@biois.com Or Tanja Münchmeyer tm@biois.com

Table of Contents

List of Tables

List of Figures

This page is left intentionally blank

Chapter 1: Introduction

The European Environment Agency (EEA) is conducting an update of the assessment of global megatrends and their potential impact on Europe's environment, specifically to resource efficiency. The work will contribute directly to the 2015 European State of the Environment and Outlook Report (SOER 2015) and potential EEA briefings. BIO Intelligence Service supports the EEA in the update of the following three global megatrends: *increasing divergence in population trends*, *living in an urban world*, and *accelerating technological change: racing into the unknown*. This background paper presents the analysis for the megatrend of increasing divergence in global population trends.

The global population has today surpassed seven billion people, and is projected to continue increasing until 2050, driven primarily by significant growth in developing countries. At the same time, population trends are characterised by notable regional variations, whether in overall population change, fertility levels, mortality, migration patterns or population age structure.

Population trends are driven by a variety of direct and indirect drivers, such as fertility, mortality, economic factors and governance. However, population trends and their drivers are subject to a number of uncertainties, which make them difficult to project reliably. Further, the major drivers of population change are often interconnected, with changes in one driver affecting the effect of another.

Without effective change to consumption and production behaviours, population growth and changing population structures are likely to have a substantial environmental impact, driving increased resource consumption and adverse environmental impacts, such as waste, pollution and emissions. While declining populations in Europe may facilitate a response to key environmental issues, effective policies will have to be developed to mitigate the effects of European lifestyles (e.g. existing consumption patterns, levels of industrial production, etc.) on the environment and its natural resources. Europe will also have to help drive effective environmental policy in vulnerable developing regions, to curb both local and global environmental impacts.

Key changes to the 2010 background paper on this megatrend are presented in the box below.

Box 1: Key changes to the 2010 analysis

▶ General **update of information and figures**: Most figures, for example on population growth, are now based on data published since 2010, e.g. the UN World Population Prospects 2012 revision.

▶ The 2010 paper included two megatrends: population growth, decline and international migration and population ageing and youth bulges. These two topics have now been combined into a **single megatrend**, though the separate sub-trends are also discussed individually.

▶ Chapter 2 (Description of the Megatrend) has been restructured to focus more on the **key opportunities and challenges** which developing and developed countries face with respect to population trends.

▶ A chapter on the impact of the divergence in global population trends on **European resource efficiency** (see section 5.2) was included.

▶ Potential **economic and social impacts** of the megatrend are no longer discussed in detail. Instead, the discussion on potential environmental impacts has been deepened.

▶ **Key drivers and uncertainties** of the megatrend have changed somewhat, in adaptation to the new structure and to better reflect the drivers and uncertainties discussed in the SOER 2010 report.

Chapter 2:   Description of the megatrend

While the overall population of the world is growing, substantial divergence can be observed in global population trends. More developed countries are characterised by a marked slowdown in population growth, and many will even be experiencing population decline in the coming decades. By contrast, populations are increasing in much of the developing world, though a slowdown in the growth rate is being experienced in many areas. At the same time, migration flows are affecting the global population distribution, notably driving increasing numbers of international migrants from less developed to more developed regions. Trends in population structures are also divergent, with population ageing observed in much of the developed world and youth bulges affecting certain developing nations. Demographic trends are affected by a multitude of drivers and in turn have a significant impact on economic growth, as well as social and political dimensions of societies. Indeed, certain of today's demographic trends present an opportunity for economic growth, while others give rise to social and economic challenges.

2.1   Overview of global population trends

By 1960, the world population had reached three billion. Since then, it has increased by another billion every 12-14 years, leading to more than a doubling of the global population over the past fifty years. While another doubling of the population over the next 50 years is unlikely, **the population is still growing, albeit at a slower rate**. Today, the global population has surpassed seven billion people[1] and is growing by approximately 1.1 per cent annually.[2] The UN projects that the global population will reach 9.6 billion by 2050.[2] However, it needs to be noted that this figure is only the medium variant, as the UN's estimates range from 8.3 billion to 10.9 billion people by 2050.[2] The medium variant is defined by certain assumptions about future fertility trends in developed and developing countries, and is not in any way a 'mean' growth estimate.

As global population growth is complex to predict, other projections vary somewhat from those of the UN. For example, the IIASA predicts a 2050 medium-variant population of 8.75 billion, with a range from 7.8 to 9.9 billion. Figure 1 below illustrates the difference in projections between the UN and the IIASA.

Figure 1: World population projections, IIASA probabilistic projections compared to UN projections (updated)

Note: the UN Population Division studies fertility-evolution scenarios to produce high, medium and low variant figures, whereas the IIASA bases its calculations on assumptions for fertility, mortality and migration (the latter only affecting regional projections).
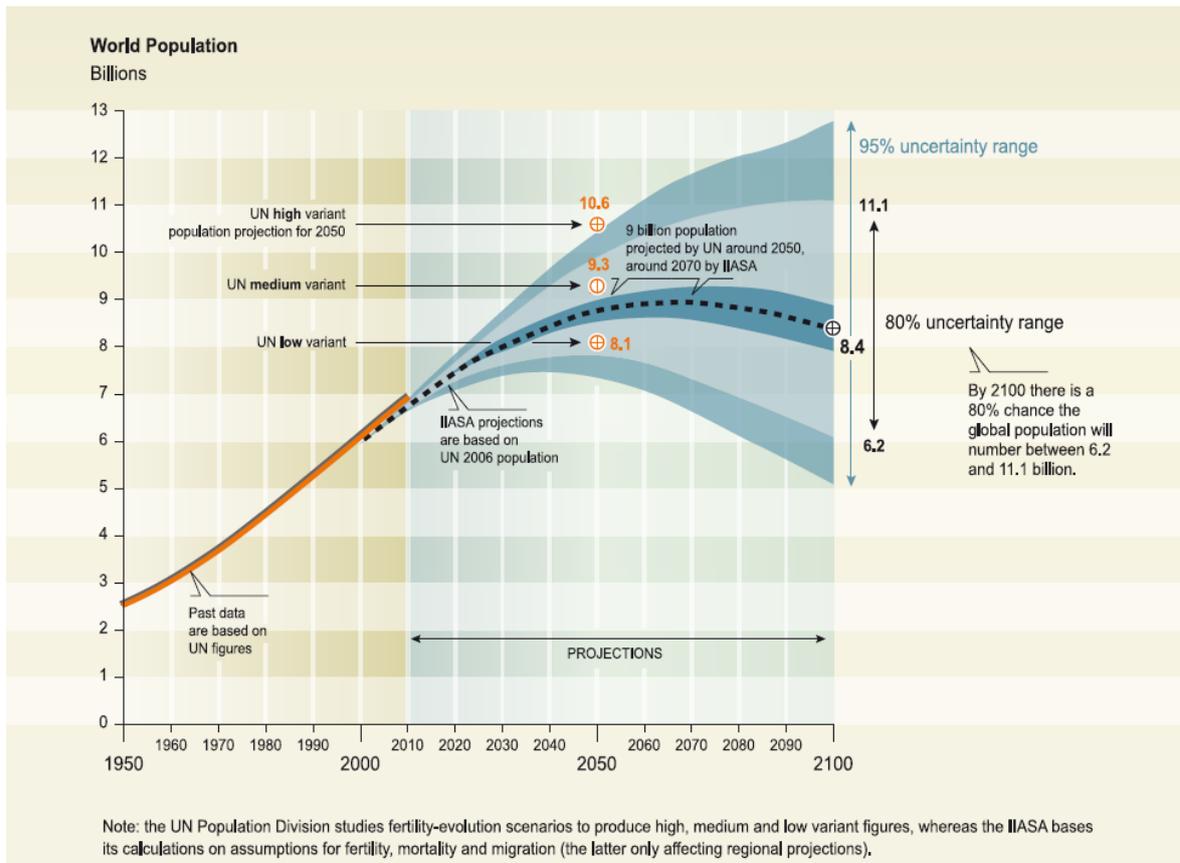
Sources: Wolfgang Lutz, Warren Sanderson and Sergei Scherbov, 2007 Probabilistic World Population Projections, International Institute for Applied Systems Analysis (IIASA); UN Population Division (2011): World Population Prospects: The 2010 Revision

Population growth trends differ significantly throughout the world. While the population of the more developed countries is estimated to grow very slightly from 1.25 billion in 2013 to 1.3 billion by 2050, that of the least developed countries (LDCs) is projected to double, from 0.9 billion to 1.8 billion, in the same time period.[2] The population of the other developing countries is set to increase by about 30 per cent by 2050.[1] It is projected that **Asia and Africa will account for most of the world's population growth**, while only three per cent of the growth will occur in the most developed countries (i.e. Australia, Canada, Europe, Japan, New Zealand and the United States). As a result, it is estimated that by 2050, about 8.2 billion people will be living in the developing world. Thus, about 14 per cent of the global population will be living in the more developed countries[2], down from 18 per cent in 2011 and 24 per cent in 1980.[3]

With regards to population structure, **population ageing** is a significant trend in both developed and developing nations, as the proportion of the population aged 60 and over is increasing in all regions of the world. Declining fertility levels in many regions of the world, coupled with gains in life expectancy, are contributing to this trend. Globally, the population aged 60 or over is expected to rise from 841 million people in 2013 to two billion in 2050, or over 20 per cent of the medium-variant population.[2] Overall, the population of older people is growing at a rate of about 2.6 per cent a year.[4] According to the UN Human Development Report, the share of the elderly in the

population is expected to rise for all Human Development Index (HDI) groups, with greater increases for higher-HDI groups.[5] This trend will lead to worldwide increases in median age, as illustrated in Figure 2 below.

Figure 2: Median age projections, 1950-2050 (updated)
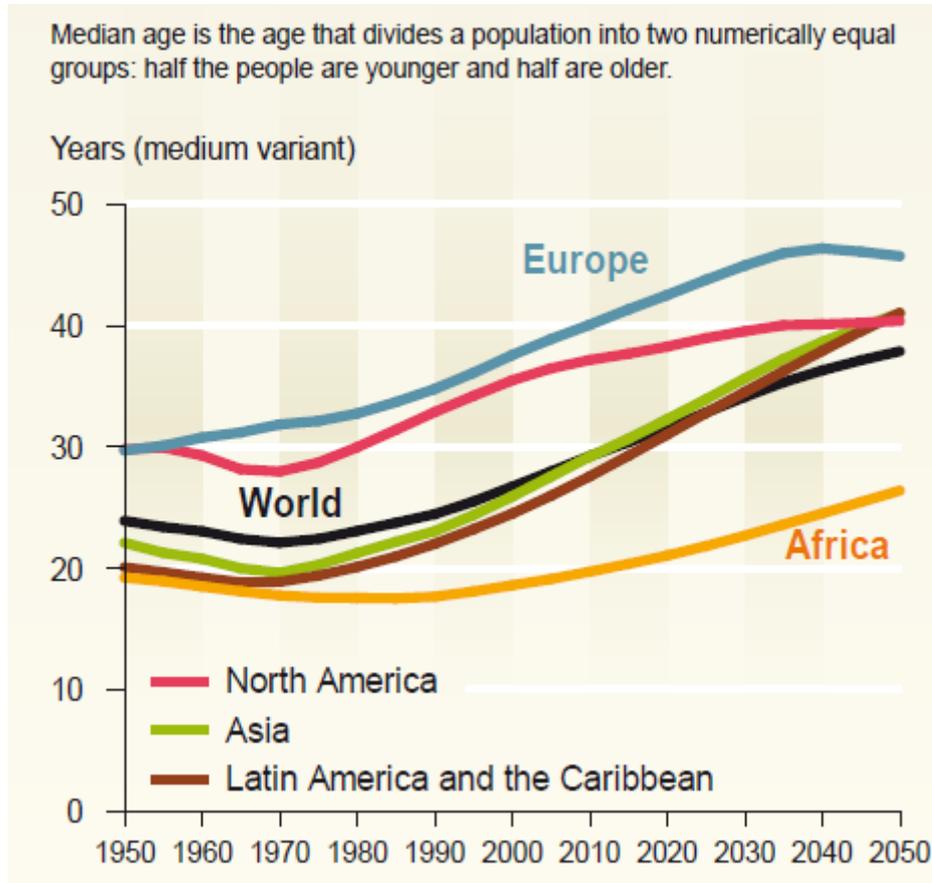
Source: UN Population Division (2011) World Population Prospects: The 2010 Revision

Figure 3 below provides a more detailed breakdown of the proportion of young and older cohorts in the population, illustrating the growing relative significance of the above-65 group in all world regions.

Figure 3: Percentage of total population under age 20 versus age 65 and above in major regions of the world, 2010 and projected for 2030 and 2050 (new)
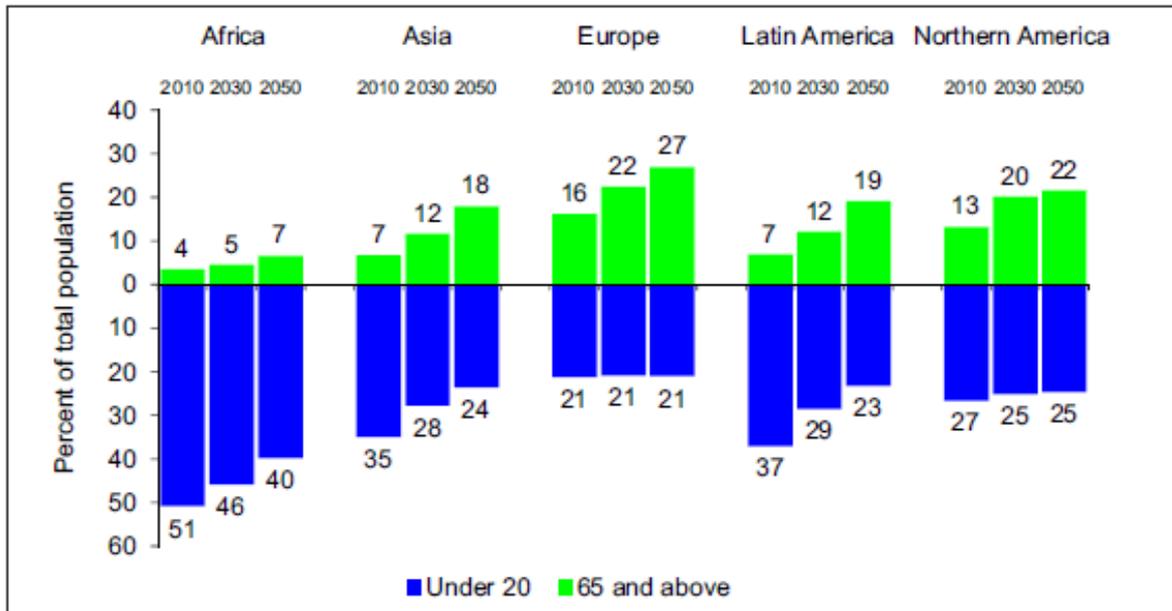
Source: National Transfer Accounts (2011) The Economic Consequences of Population Ageing[6]

Population ageing has a significant impact on society, lowering the proportion of the working age population, affecting overall labour productivity and raising pressures on social, health and other systems needed to support retirement-age populations.

At the same time, it should be noted that the societal burden of ageing is not just a question of chronological age, as, for example, physical and mental health can differ substantially at the same age, leading to differences in an individual's dependency on societal goods and services. The comparability of the age indicator across countries or regions has therefore been questioned, and one recent study proposed an alternative indicator based on age variation in cognitive functioning. The study found that cognitive functioning varies widely at the same chronological age, impacted, for example, by duration and quality of schooling, nutrition, exposure to disease and other lifelong factors. The pressures placed on a society by its population of a certain age may therefore differ substantially.[7]

Contrary to the trend towards ageing in developed economies, several countries of the developing world are or will be, in the near decades, experiencing substantial **youth bulges**[1]. Several of the countries with the largest youth bulges are among the world's most fragile – unstable or potentially unstable – countries. Large cohorts of young people, many of whom are facing job shortages and volatility, particularly in times of global economic downturn, are presenting an important demographic challenge for their countries, and may pose a risk of civil unrest or conflict.

Figure 4 highlights some of the near-term differences in regional population pyramids, such as population growth versus decline, as well as population ageing and youth bulges in developing countries such as Nigeria or India.

---

[1] Disproportionately large populations of young people, usually defined as being in the 15-to-24 or 15-to-29 year-old age group.

Figure 4: Population by age (not updated)

DEMOGRAPHICS:
Population by Age

· Eight billion people in the world by 2025
· Nearly all growth in the developing world.
· Absolute decline in Europe, Japan, Russia, and Korea.
· The U.S. will add 50 million people by 2025 (unique among the developed countries of the world).

PYRAMID KEY
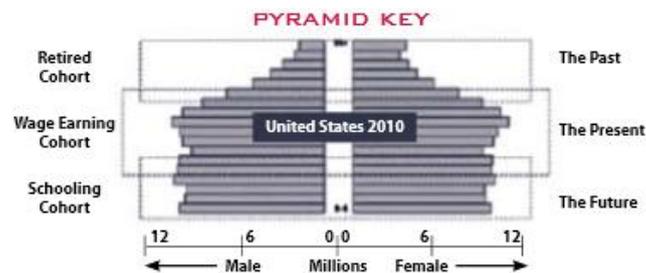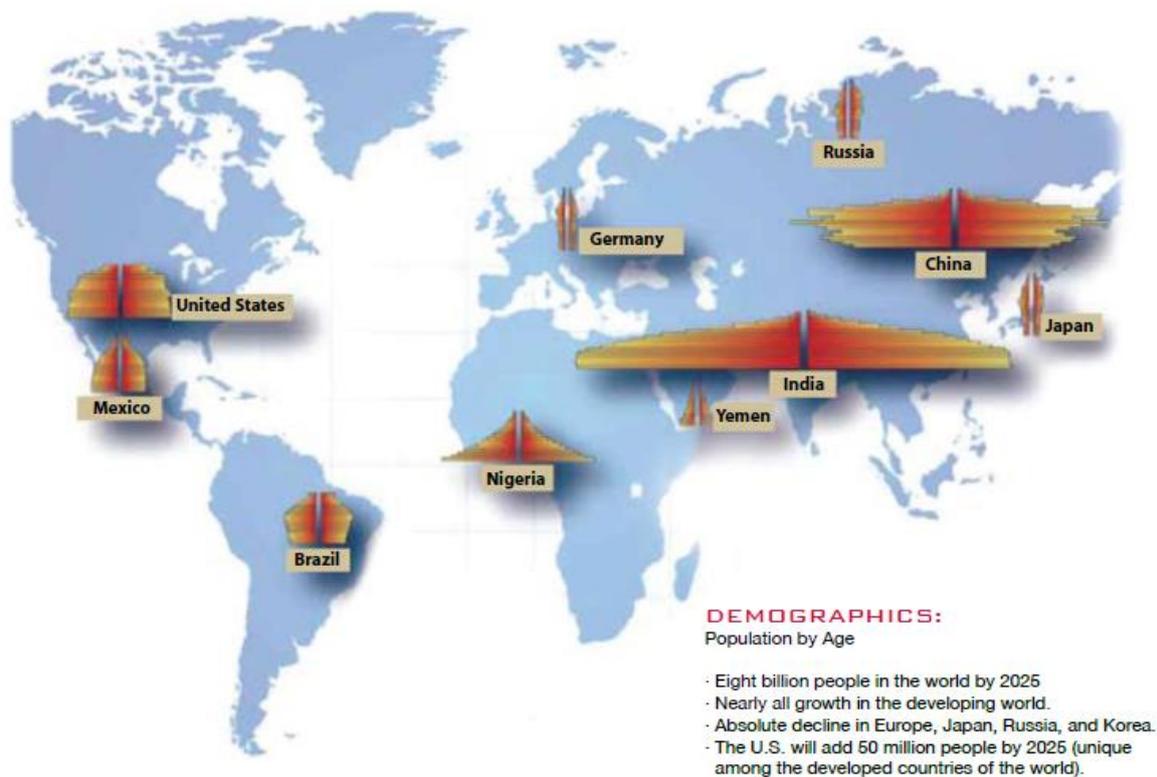
Source: USJFC (2010) Joint Operating Environment[8]

The global population outlook, as well as economic growth and development, will depend notably on **human capital** and on the evolution of **educational attainment**, particularly amongst women. Better education is associated with lower fertility and mortality rates, better health, different migration patterns and stronger economic growth, all of which affect future population trends. It has therefore been argued that education is an essential source of population variation, which needs to be taken into account in population analyses.[9] One set of population projections based on different education scenarios highlights the potential impact of this factor on population size – with 2050 global population projections of 8.9 and 10.0 billion people for the highest and lowest education scenarios, respectively.[9]

Education, and particularly female education, can have a marked impact on fertility rates, notably by influencing contraceptive use, desired family size and timing of marriage and births. Better-educated women tend to want fewer children, find better access to contraception and are better equipped to overcome obstacles to family planning.[10] In 24 sub-Saharan countries, birth rates were found to be four times as high among uneducated girls aged 15-19 as among their peers with at

least secondary schooling. Further, gaps in contraceptive use and birth rates between educated and uneducated girls have been found to be widening.[11]

Education can also affect population trends via mortality and morbidity levels. Better education is linked to several factors that contribute to greater longevity, including healthier behaviour and better access to health care.[12] Better education has also been found to be associated with lower levels of morbidity and disability. Lower levels of morbidity amongst young people can help drive growth via a better-educated and stronger work force, higher standards of living and greater equality, and amongst the elderly can help ease the pressures of ageing populations by reducing dependency on resources and services.[13] Education has also been found to be a better determinant of child survival than factors such as household income.[9]

Recent demographic multi-state modelling by the IIASA has also demonstrated a clear positive effect of education on both individual income and overall economic growth.[9] Higher levels of education are further associated with a number of other determinants of well-being, such as good governance and the transition to democracy.[9] The human capital of a population is therefore just as important to take into account as its population size and demographic structure.

The regional differences in population growth rates, age structure evolution and improvements in educational attainment over the first half of the 21st century are illustrated in the population pyramids below. The population pyramids clearly illustrate varying demographic trends across three world regions – Europe, Africa and Asia. Africa's population is set to grow significantly, with a substantial youth cohort persisting throughout the coming decades, in parallel with a growing older population. Asia, on the other hand, while also experiencing marked population growth, will face a significantly ageing population. Education opportunities will continue expanding in the next several decades in both Asia and Africa. Europe, in the meantime, will see a contracting, ageing population.

Figure 5: Population pyramids for 2000 and 2050 – European Union (not updated)

Population by age, sex and educational attainment
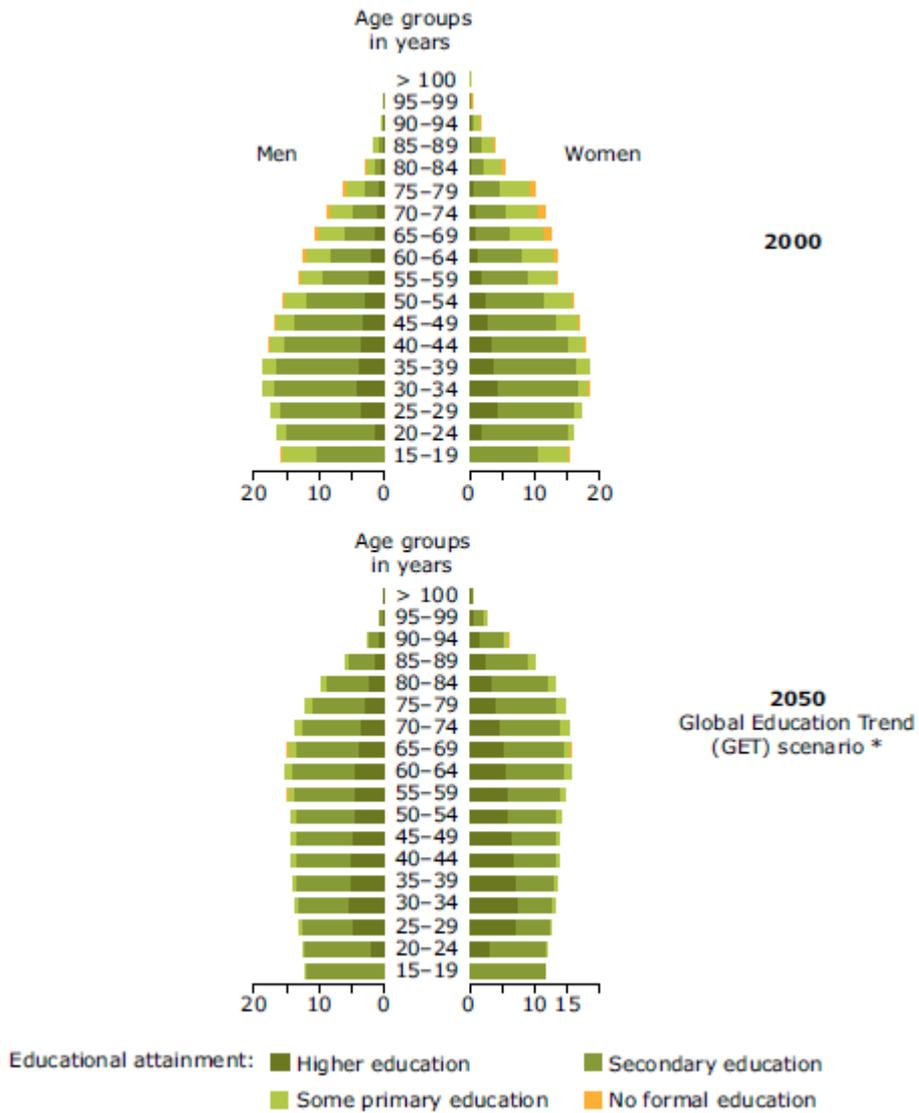
Educational attainment: Higher education / Secondary education / Some primary education / No formal education

Note: * The GET scenario is not derived from a simple assumption. It is based on the country's educational expansion of historical trend.

Source: Samir et al (2010) Projection of populations by level of educational attainment, age and sex for 120 countries[12]

Targeted support to the update of analysis of global megatrends for the European Environment State and Outlook Report 2015 Global megatrends assessment

Figure 6: Population pyramids for 2000 and 2050 – Africa (not updated)

Population by age, sex and educational attainment
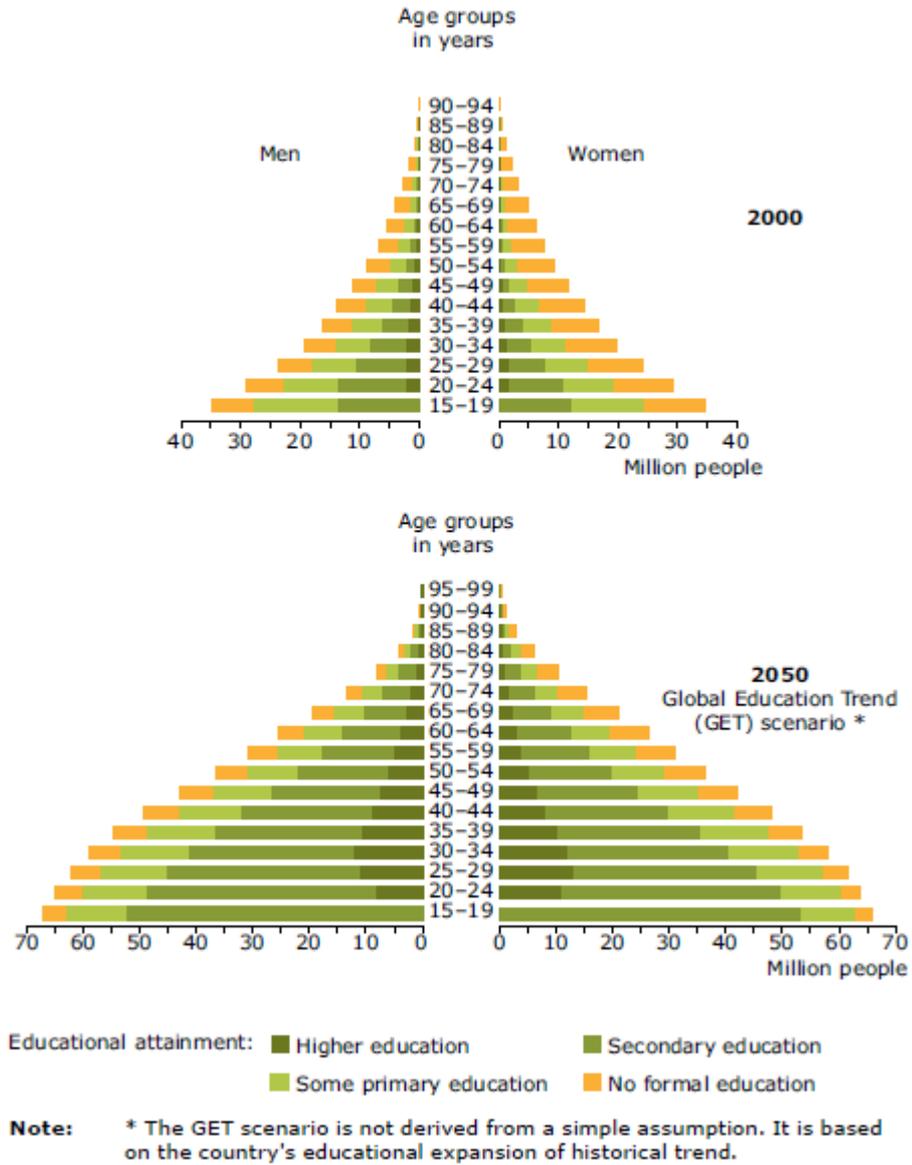
Educational attainment:
- Higher education
- Secondary education
- Some primary education
- No formal education

Note: * The GET scenario is not derived from a simple assumption. It is based on the country's educational expansion of historical trend.

Source: Samir et al (2010) Projection of populations by level of educational attainment, age and sex for 120 countries

Figure 7: Population pyramids for 2000 and 2050 – Asia (new)
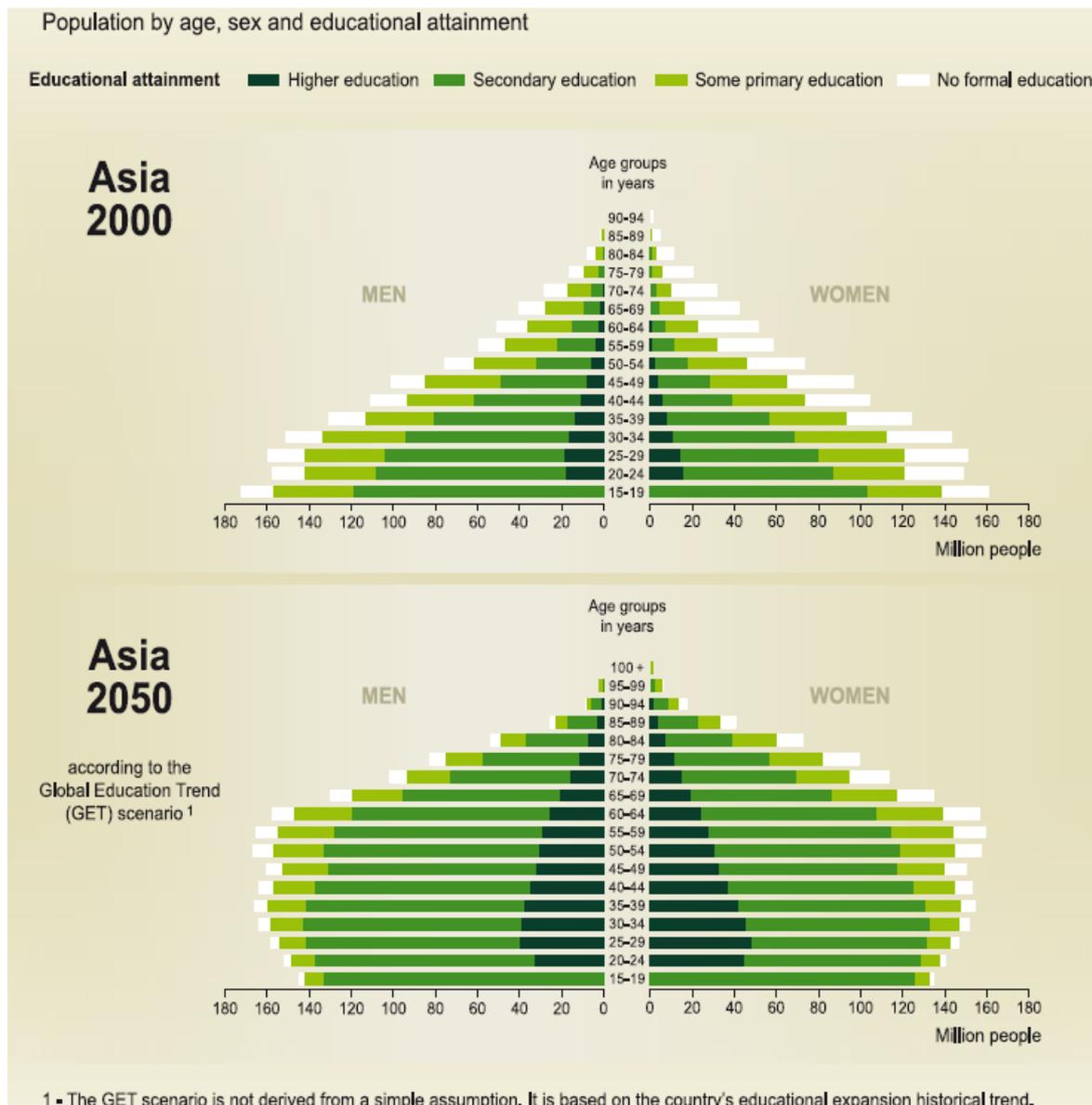
1 - The GET scenario is not derived from a simple assumption. It is based on the country's educational expansion historical trend.

Source: Samir et al (2010) Projection of populations by level of educational attainment, age and sex for 120 countries[14]

In parallel with national and regional developments in population size, age structure and human capital, diverging global population trends are further driven by **global migration patterns**. Global migration has been growing, particularly to developed areas, helping to replenish declining populations in several developed countries. At the same time, South-South migration is also becoming increasingly important, driving population patterns in certain developing regions. Migration flows supplement natural population growth and decline to determine overall population levels, and are thus a major component of global population trends. In certain low-fertility developed countries, positive immigration flows may also help soften the effect of population ageing by introducing a younger population, particularly if fertility levels in the immigrant group are higher than in the host country.[15]

Targeted support to the update of analysis of global megatrends for the European Environment State and Outlook Report 2015 Global megatrends assessment

Migration is expected to play an important role in demographic change over the next 50 years as it has an impact on growth rates and leads to populations becoming more diverse.3 More people in the world live outside of the country of their birth than ever before, and the global number of international migrants (voluntary and forced) increased from 155 million in 1990 to 214 million in 2010[16] (or about 3.1 per cent of the world's 2010 population).[17]

The interplay between some of today's key demographic, environmental and migratory trends is represented in Figure 8 below.

Figure 8: Global migration flows (not updated)
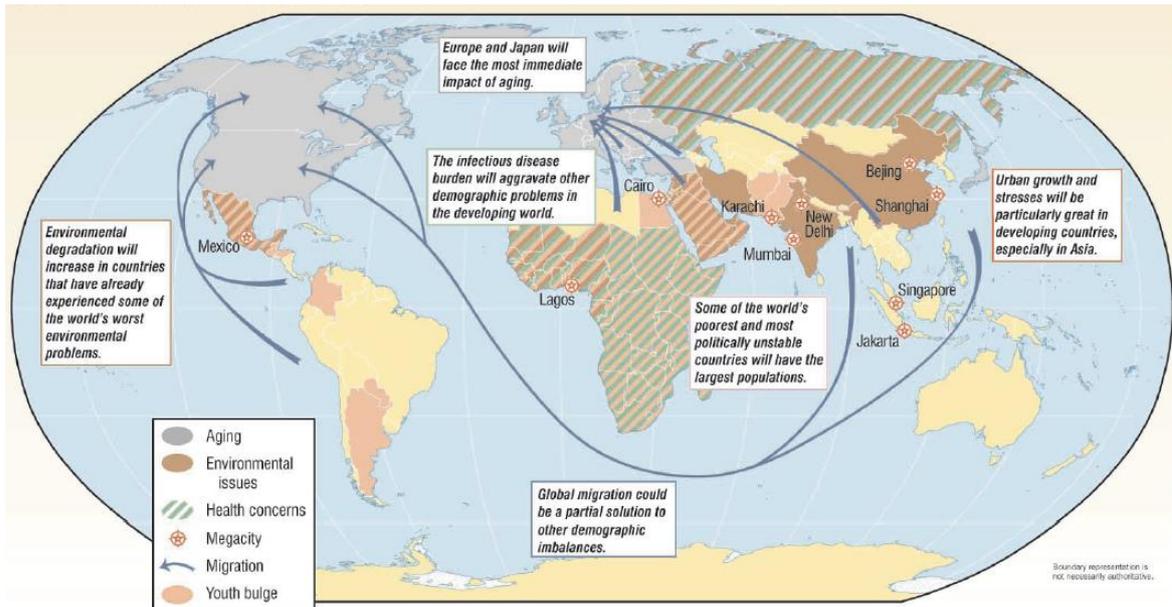
Source: CIA (2001) Long-Term Global Demographic Trends: Reshaping the Geopolitical Landscape[18]

Box 2: Major trends characterising diverging population trends

Four key elements of the megatrend, all of which contribute to an increasing divergence in global population trends until 2050, will be discussed in greater detail below:

▶ Demographic trends in developing countries

▶ Demographic trends in developed countries

▶ Youth bulges, particularly in fragile states

▶ Increasing importance of migration, notably South-North but also South-South migration

2.2 Key elements of the megatrend

2.2.1 Demographic trends in developing countries – window of opportunity

Population growth remains strong in much of the developing world. However, certain countries are already experiencing a slowdown in their population growth rate, and parts of the developing world will soon be experiencing population stagnation or even decline, as well as a trend towards population ageing. Many developing nations are therefore seeking to take advantage of a window of opportunity created by a sizable and relatively young work force[19], and a number of them have seen particularly strong and rapid advances in economic growth and human development[5]. However, seizing the opportunity of a favourable demographic structure is not always easy, given the uncertain global economic environment. The developing world therefore continues to face the challenges of social and economic inequalities, which may, in some cases, be intensified by new expectations for change and growth amongst its populations.[19]

2.2.1.1 *Population growth in developing countries*

Overall, the developing world is experiencing continuing population growth, at a significantly higher rate than the developed world.

Figure 9 below shows the projected distribution of the global population by region, illustrating the growing share of the world's population in developing countries.

Figure 9: Distribution of the world population by major area, medium variant, 1950, 2010, 2050 and 2100 (updated)
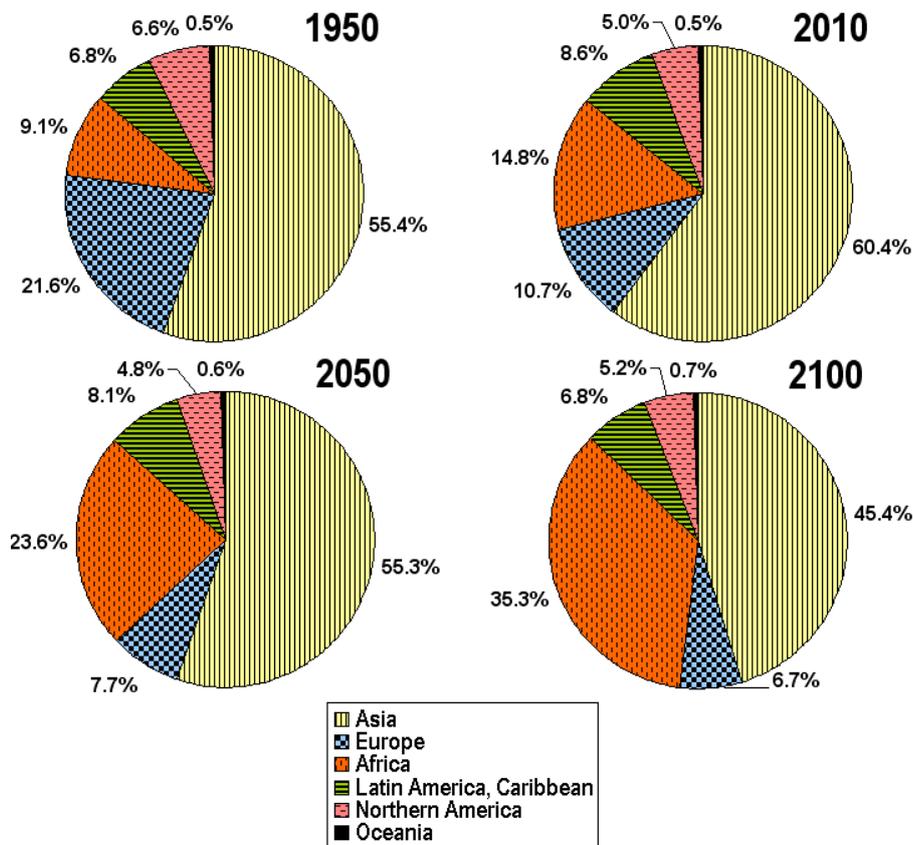
Source: UN Population Division (2011): World Population Prospects: The 2010 Revision

The population of the developing countries is projected to grow by about 1.2 per cent per year until 2050.[20] During the period 2013-2100, seven of the eight countries that are expected to account for half of the world's population growth will be developing countries. These eight key growth countries are Nigeria, India, the United Republic of Tanzania, the Democratic Republic of Congo, Niger, Uganda, Ethiopia and the United States, listed according to the size of their contribution to population growth during that period.[2]

Populations of the 49 LDCs have been on the rise over the past several decades, with at least a four-fold increase in population since 1950 for most LDCs, and a six-fold increase in Niger and Uganda.[20] Today, the LDCs continue to have the highest population growth rates in the world (2.3 per cent per year for the overall population), and by 2050 about 19 per cent of the world's population will be living in these countries.[2] Fertility levels in the LDCs are significantly higher than those of the rest of the developing world, and the slowdown in fertility has been less marked in LDCs than in other developing countries.

2.2.1.2   *Future population stagnation and decline in developing countries*

Despite continuing population growth in much of the developing world, in the future, developing nations will begin to experience population stagnation and decline. In most developing countries, fertility is falling, and some developing nations will already experience population decline by 2050 (see Table 1 below for a list of such countries). According to the UN, these countries include, for

example, Georgia, Thailand, Armenia, Martinique and China.2 In 2004, the overall fertility level in Asia and Latin America was of 2.6 children per woman, which was only half the level of 1970. The high fertility levels in these regions in the past led to large numbers of women in childbearing age now. However, the slowing fertility levels will now translate into lower numbers of women of childbearing age in the future, resulting in rapidly declining population growth (see Section 3.1.1 for a discussion on fertility rates).

Table 1: Countries or areas whose population is projected to decrease between 2013 and 2050 – less developed regions (updated)

Rank	Country or area	Population (thousands)		Difference	
		2013	2050	Absolute	Percentage
	Less developed regions				
1.	Georgia	4 341	3 563	- 778	-17.9
2.	Cuba	11 266	9 392	-1 874	-16.6
3.	Trinidad and Tobago	1 341	1 155	- 186	-13.9
4.	Grenada	106	95	- 11	-10.2
5.	Other non-specified areas	23 330	21 371	-1 959	-8.4
6.	Thailand	67 011	61 740	-5 270	-7.9
7.	Armenia	2 977	2 782	- 195	-6.5
8.	United States Virgin Islands	107	103	- 4	-3.8
9.	Puerto Rico	3 688	3 611	- 77	-2.1
10.	Mauritius	1 244	1 231	- 13	-1.1
11.	Martinique	404	400	- 4	-0.9
12.	China	1 385 567	1 384 977	- 590	0.0

Source: UN Population Division (2013) World Population Prospects: The 2012 Revision

2.2.1.3   *Population ageing in developing countries*

In the developing world, population ageing is less advanced that in developed countries, given that fertility rates in recent decades have generally not been as low as in the developed world. However, a number of developing countries are set to experience rapid population ageing in coming years. Overall in the developing world, the population aged 60 or over is expected to grow at an annual rate of over three per cent in the next three decades, rising from just nine per cent of the population today to 20 per cent in 2050.[2] Nonetheless, the least developed countries, which are generally still experiencing high rates of fertility and mortality, will continue to see a relatively young population.

2.2.1.4   *Window of opportunity and economic growth*

Several growing economies have benefited from a substantial demographic dividend. In many developing countries, strong population growth and a sizable working-age population with relatively few dependents have contributed to significant economic growth in recent years.[19] The developing world, led by Brazil, China and India, is bolstering global economic growth and contributing an increasing share of global economic output – up from about a third in 1990, to about half today. By 2050, Brazil, China and India are projected to account for 40 per cent of global

output, surpassing the production of the six traditional economic leaders of the developed world (Canda, France, Germany, Italy, the United Kingdom and the United States).5

This economic growth has been accompanied by significant advances in health, education, civic engagement and other contributors to human development. Many countries have also experienced substantial reductions in the proportion of their population living in poverty. Further, the developing countries are accounting for an increasing share of global consumption, due notably to a rapidly expanding middle class[2]. Indeed, the developing world's share of the global middle class grew from 26 per cent to 58 per cent between 1990 and 2010, and is projected to rise to 80 per cent by 2030, accounting for 70 per cent of global consumption expenditure.5

These trends are shifting the global North-South dynamics, particularly as many developed countries have experienced a slowdown during the economic recession. The leading developing countries are becoming an increasingly crucial in the global economy, and even the least-developed countries are beginning to benefit from positive growth and development spillovers from other developing nations.5

Nonetheless, future demographic trends, particularly population ageing, may represent a challenge for developing countries, and effective management of demographic change will be critical to sustaining growth. Developing countries that are experiencing rapid population ageing may struggle to support an older population while seeing a decline in the working-age population, particularly if these countries remains poor.5 However, nations can take measures to manage these demographic changes, and the capacity of lower-income countries at the beginning of this demographic transition to experience a demographic dividend will depend not only on demographic and economic factors, but also on the policies used to shape them.[21] These policies may include raising educational attainment to help increase living standards and lower fertility (and thus the overall number of dependents in the population) (see Sections 2.1 and 3.1.1), boosting employment opportunities and labour participation and productivity to help provide the needed support to the ageing population5 and promoting long-term growth by saving and investing some of the resources saved by having a smaller cohort of dependents[21]. The developing world's ability to make use of the current demographic window of opportunity, as well as to pre-emptively manage upcoming demographic shifts, will thus help drive sustainable economic growth and human development.

---

[2] Please note that the term middle class can be defined in relative terms as 'the middle income range of each country' or in absolute terms as 'a fixed band for all countries' (commonly defined as between USD 10-100 a day per person at purchasing power parity (PPP)). The absolute definition of middle class allows for one common definition for all countries but excludes many people that are recognisably middle-class but earn less than USD 10 a day. As this report is looking at the emerging global middle class, the term middle classed is based on the absolute definition, despite its shortcomings. For more information, please see 'Who's in the middle?', accessible at http://www.economist.com/node/13063338

2.2.2 Demographic trends in developed countries – uncertainties in the social contract

In contrast to ongoing growth in developing nations, the developed world will be increasingly characterised by low birth rates and declining natural populations. Further, most developed nations are already experiencing a notable trend of population ageing, which places increased pressure on a relatively smaller work force and creates concerns about the reliability of social entitlements and therefore the social contract. Migration, particularly of young workers, can help offset some of the impacts of population ageing, but the risk of discontent stemming from uncertainty amongst elderly populations and young workers alike remains.

2.2.2.1 *Low population growth, stagnation and decline in Europe and the developed world*

Overall, in the developed world, fertility has marginally increased in the past few years, and, coupled with sustained migration, will help drive slight population growth until 2050, from a total of 1.25 billion in 2013 to about 1.3 billion in 2050. However, the overall population of developed countries is expected to decline slightly after 2050, and would be in decline before 2050 were it not for the net increase due to migration from developing countries.[2]

Despite slight overall growth, the populations of several countries in the developed world are in decline (see Table 2 below for a list of developed countries whose population is expected to decline by 2050). Russia's population, for example, is projected to face a steep decline of as many as ten million people by 2030.[22] After a slight increase in population in 2011 and 2012, Russia is currently experiencing a negative growth rate of -0.02 per cent.[23] Negative growth rates are also common in other countries of Eastern Europe. Amongst the Asian countries, Japan stands out as experiencing a significant decline in population, with a growth rate of -0.1 per cent.[24]

While Europe's population as a whole grew in the first decade of this century, growth is slow, with a current annual rate of 0.2 per cent[24], and the fertility rate has been nearly stagnant at well below replacement level (the fertility level at which the population stabilises, taking into account the mortality rate before childbearing years; see Section 3.1.1).[25] Migration still accounts for the largest proportion of the EU's population growth[25], but Europe's population is nevertheless expected to drop from 739 million in 2011 to 709 million in 2050 in the medium variant scenario.[2]

Table 2: Countries or areas whose population is projected to decrease between 2013 and 2050 – more developed regions (updated)

Rank	Country or area	Population (thousands)		Difference	
		2013	2050	Absolute	Percentage
	More developed regions				
1.	Bulgaria	7 223	5 077	-2 146	-29.7
2.	Republic of Moldova	3 487	2 484	-1 004	-28.8
3.	Serbia	9 511	7 074	-2 437	-25.6
4.	Ukraine	45 239	33 658	-11 581	-25.6
5.	Belarus	9 357	7 359	-1 997	-21.3
6.	Latvia	2 050	1 674	- 376	-18.4
7.	Romania	21 699	17 809	-3 890	-17.9
8.	Croatia	4 290	3 606	- 684	-15.9
9.	Russian Federation	142 834	120 896	-21 938	-15.4
10.	Lithuania	3 017	2 557	- 460	-15.3
11.	Japan	127 144	108 329	-18 814	-14.8
12.	Bosnia and Herzegovina	3 829	3 332	- 498	-13.0
13.	Estonia	1 287	1 121	- 166	-12.9
14.	Germany	82 727	72 566	-10 160	-12.3
15.	Poland	38 217	34 079	-4 138	-10.8
16.	TFYR Macedonia	2 107	1 881	- 226	-10.7
17.	Montenegro	621	557	- 65	-10.4
18.	Hungary	9 955	8 954	-1 001	-10.1
19.	Slovakia	5 450	4 990	- 461	-8.5
20.	Portugal	10 608	9 843	- 765	-7.2
21.	Greece	11 128	10 668	- 460	-4.1
22.	Malta	429	417	- 13	-2.9
23.	Albania	3 173	3 094	- 79	-2.5
24.	Slovenia	2 072	2 023	- 49	-2.4
25.	Italy	60 990	60 015	- 975	-1.6

Source: UN Population Division (2013) World Population Prospects: The 2012 Revision

2.2.2.2 *Population ageing in developed countries*

Population ageing is most pronounced in countries, which have had relatively low fertility levels for a sustained period of time, i.e. developed regions and a few developing countries. In the more developed regions, the percentage of the population aged 60 or over is projected to increase from 22 per cent today to 32 per cent in 2050.2 According to Eurostat, ageing is expected to be a key demographic challenge in Europe, as projections show that by 2050 population ageing will attain unprecedented levels in 31 European countries.[15] The post-World War II baby boom, followed by a lengthy period of declining fertility and gains in life expectancy, has driven the ageing process in Europe.

2.2.2.3 *Impacts of low population growth and population ageing – the destruction of the social contract and the role of migration*

Population decline and ageing in developed economies in Europe, North America or Japan can lead to fragility in the established socio-economic system. Many industrial economies are based on debt and retirement transfer payments that rely on a growing population base. A smaller population, however, results in a smaller work force and thus fewer taxpayers. This may lead to concerns about the destruction of the social contract, which until recently has been taken for granted in developed countries. Ageing citizens may face uncertainties about the availability of social entitlements and support in their old age, while their younger counterparts may experience substantial pressure in having to support a large elderly population as part of a decreased work force.[4] These concerns, which have been exacerbated by the economic downturn and rising household and national debts of recent years, have contributed to a sense of diminished hope and expectations with regards to the social contract.[4] Meeting social contracts for both the younger and older populations will depend at least partially on renewed growth in the global and national economies.[4]

Migration, particularly of working-age populations, can help partially offset some of the effects of ageing in developed countries. The introduction of young workers can help counterbalance a declining working population, and can ease the pressures of an ageing population on the work force. Eurostat predicts that in the future, the EU labour force will increasingly include people of immigrant background, as most immigrants to the EU are relatively young, and as the foreign population in Europe is already younger than the national population.[25]

2.2.3 Demographic challenges of youth bulges in fragile states

Overall, people under the age of 25 make up 43 per cent of the world's population today, reaching as much as 60 per cent in some countries.[1] Most youth bulges today are in the developing world (see, for example, Figure 6, which shows the population age distribution of the African region), and form a crescent, which stretches from the Andean region of Latin America across Sub-Saharan Africa, the Middle East and the Caucasus, before finally reaching the northern parts of South Asia. By 2025, three quarters of the countries with youth bulges will be located in Sub-Saharan Africa, with the rest located in the Middle East and a few across Asia and among the Pacific Islands.[3]

Figure 10: Youth (15-24) Population shares of total population in 2010 (updated)

Source: United Nations, World Population Prospects
Prepared by USAID Economic Analysis and Data Services
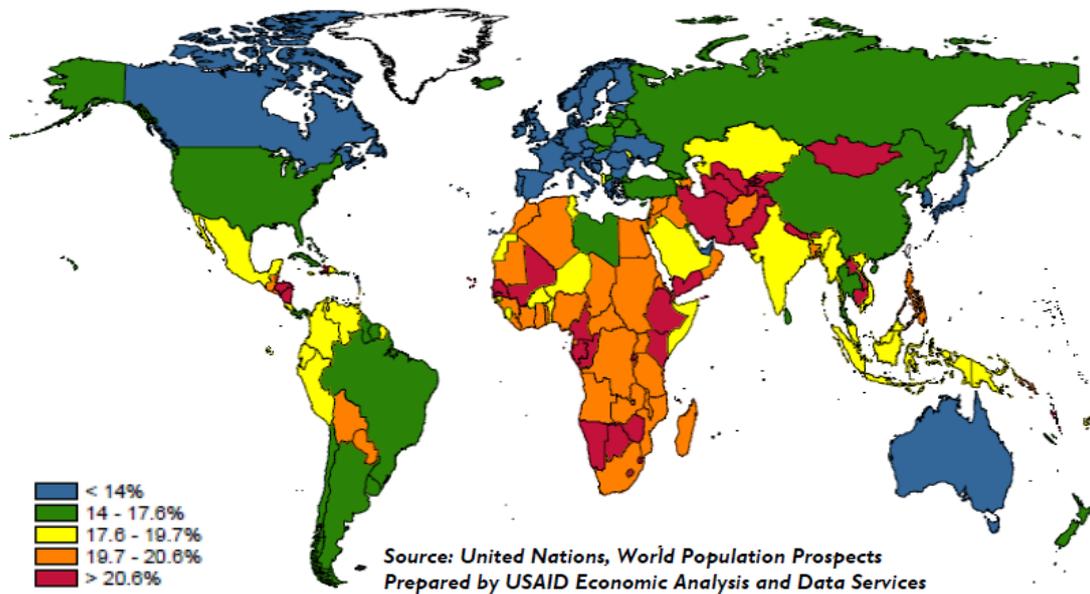
Source: USAID (2010) Technical Brief: Youth Bulges and Conflict[26]

Youth bulges are particularly notable in some of the world's least developed and most fragile states. While the world as a whole reached a peak in its share of young people (aged 15-24) around 1985, in the least developed countries this peak occurred more recently, in 2005, and the proportion of young people in the population of these countries will remain high in the coming decades.[27]

Figure 11: Share of youth in world population and in least developed countries, 1950-2050 (new)
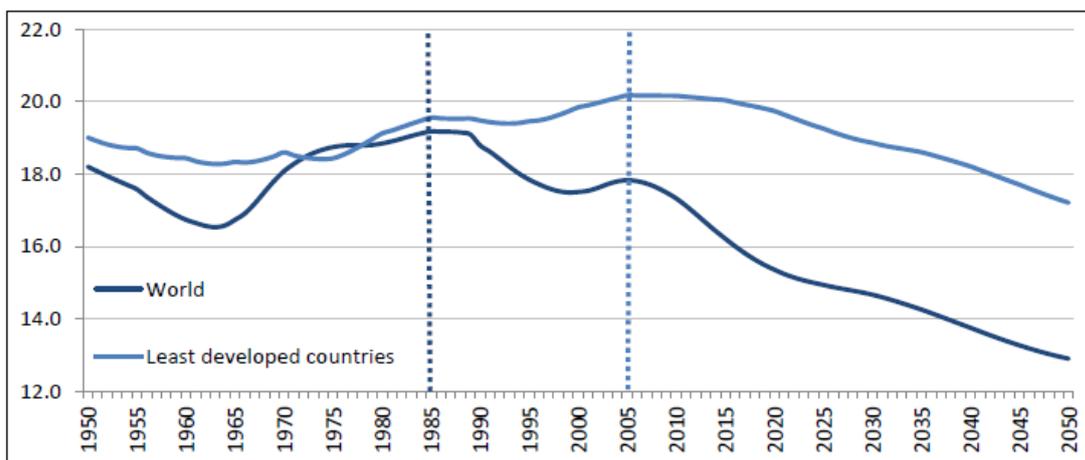
Source: Authors' calculations based on United Nation's *World Population Prospects: The 2010 Revision* (2011)
Note: Least developed countries are based on the UN classification.

Source: Ortiz, I. and M. Cummins, UNICEF (2012) When the Global Crisis and Youth Bulge Collide

Large populations of young people growing up in some of the world's poorest and most fragile states are posing urgent demographic challenges, as their countries are struggling to provide them with basic health, education and employment. The trend towards significant job shortages and

youth unemployment has been exacerbated in recent years by the global economic crisis, as young people have been disproportionately affected by unemployment in the crisis years.[28]

Several studies have explored the relationship between youth bulges and conflict, and the relationship has been found to be complex. While large populations of young people facing employment trouble may pose a risk to stability, other social and economic factors may play a more prominent role in determining whether conflict actually arises.[27] Nonetheless, some have argued that youth bulges and youth dissatisfaction were strong contributors to recent Arab Spring unrest in North Africa and the Middle East. Many countries in the region have sizable youth cohorts with 15- to 29-year-olds reaching 43 per cent of the population in Egypt, for example. Youth unemployment is rampant with nearly a quarter of to 24-year-olds in the region being unemployed, compared to a global average of 12.7 per cent. This can lead to friction and volatility, leaving large numbers of young people available to be recruited for political causes.[29] One study has found that young countries are prone to conflict, and that their chance of adopting and maintaining democracy increases as the share of the youth population declines. When the share of youth in its working-age population falls to between 36 and 42 per cent, the country has a 50-50 chance of achieving democracy, and its chances improve if it can mature.[29]

Developing countries facing youth bulges in the coming years will have to try to address the demographic challenges of young populations. At the same time, such a population also presents opportunities, such as a larger workforce, an active population and potential for growth. In order to ensure long-term economic growth and human development, developing countries should aim to seize such opportunities, notably by expanding education and employment opportunities for both men and women.

2.2.4   Increasing international migration flows

The key global demographic trends are further linked by global migration flows. Rural-urban migration and South-North migration are particularly prominent, but migration flows to developing countries are also becoming increasingly important. Migration plays a key role in driving global demographic patterns, and in either exacerbating or counteracting demographic trends at the national level.

2.2.4.1   *Overview of international migration*

Since the 1960s, migration patterns have been marked by an increase in the share of migrants from developing countries, with developed countries receiving the bulk of global migrants. The divergence in incomes in different regions of the world contributes significantly to the explanation of these movement patterns. By 2010, nearly 70 per cent of international migrants were from the South, with half of these migrating to the North. Migration into the OECD countries and Russia saw a modest slowdown in 2008-2010, largely due to the global economic crisis, but began to increase again in most of these countries in 2011.[30] Overall, 60 per cent of global international migrants in 2010 were living in more developed regions, and migrants represented 10.3 per cent of the population of the more developed countries.[17]

According to the 2010 UN World Population Prospects, 32 of 45 developed countries were net receivers of migrants over the period 2000-2010. In some of these countries, migration flows helped to slow or even reverse population decline. Overall, relatively few countries accounted for most of the world's international migrant stock: in 2010, ten countries hosted 52 per cent of international migrants.[17]

If the percentage of international migrants stays at 2005 levels or continues to increase at the same rate as in the last decades of the 20th century, the total number of international migrants is expected to reach between 235 and 415 million by 2050, with a median estimate of 275.[31] However, the UN World Population Prospects, which takes into account the migration policy stance of developed countries, predicts that international migration flows to developed regions will decline smoothly in the coming decades, from an annual average of 3.4 million people in the period 2000-2010, to about 2.3 million per year in 2040-2050.2

In the period 2040-2050, the UN projects that the major net receivers of international migrants will be the United States (an average of about 1 million annually), Canada (200,000), the United Kingdom (170,000), Australia (150,000), Italy (120,000), France (100,000) and Spain (100,000). The major countries of net emigration are projected to be Bangladesh (-320,000), China (-300,000), India (-236,300), Mexico (-200,000), Indonesia (-140,000) and Pakistan (-128,500).2

At the same time, migration patterns are marked by a strong prevalence of rural-to-urban migration, as population growth places pressures on rural economies, and rural populations move to cities in search of better resources and employment opportunities (Please see the background paper on *GMT 2: Living in an urban world* for more information). Indeed, the rural population is predicted to decline around 2023, while the urban population is set to continue growing.4

Overall, however, migration levels are difficult to monitor and projections of future migration rates and patterns are difficult to make.

Table 3 below shows the estimated number of migrants living in various world regions in 2010, illustrating the relatively greater presence of a migrant population in more developed regions.

Table 3: Estimated number of international migrants and their percentage distribution by major area, 2010 (updated)

Geographic region	Number of migrants (million)	As a percentage of total migrants in the world	As a percentage of total regional population
World	213.9	100	3.1
Africa	19.3	9.0	1.9
Asia	61.3	28.7	1.5
Europe	69.8	32.6	9.5
Latin America and Caribbean	7.5	3.5	1.3
Northern America	50.0	23.4	14.2
Oceania	6.0	2.8	16.8

Source: UN (2011) International Migration Report 2009

2.2.4.2 *Effects of international migration on Europe*

Between 1960-1970 and 2000-2010, the average annual net number of migrants to Europe grew from 95,000 to nearly 1.9 million2, steadily increasing in significance as a component of European population, as can be seen in Figure 12 below.

Figure 12: European population change by component, 1960-2009 (per 1000 population) <mark>(new)</mark>
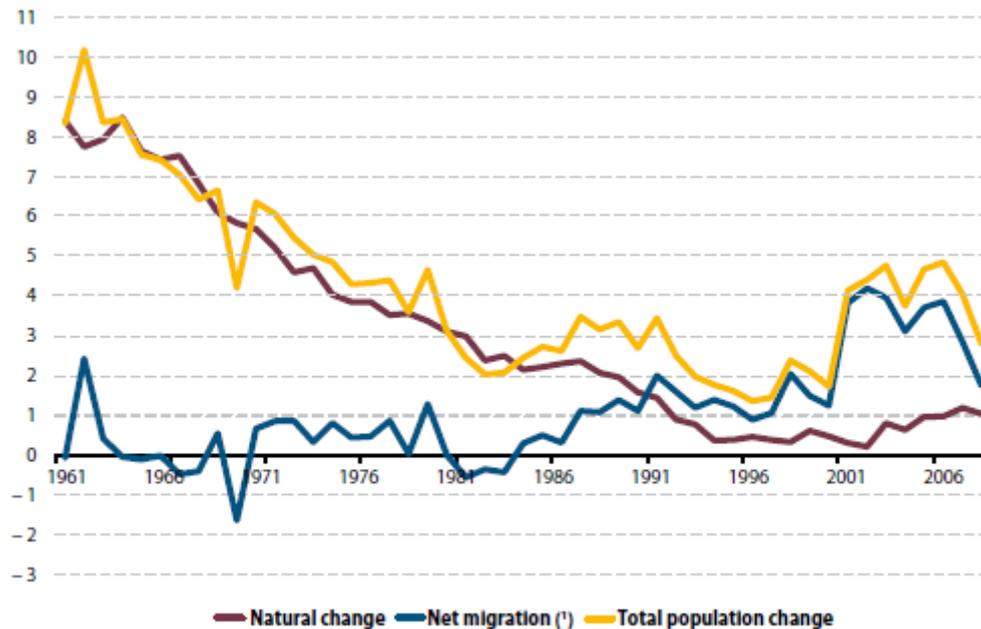
(¹) Including statistical adjustment.

Source: Eurostat (2011) Migrants in Europe[32]

International migration remains the most important driver of European population growth today. Indeed, twenty of the thirty countries in the world, which experienced population growth in 2000-2010 primarily due to net migration (rather than natural increase) are European countries.[17] More than one million immigrants come to Europe annually from outside the EU, many from Muslim countries in North Africa, the Middle East, and South Asia. In 2010, about 70 million international migrants lived in Europe, or about 9.5 per cent of the total population.[17] The National Intelligence Council Global Trends report estimates that by 2025, non-European minority populations could reach 15 per cent in nearly all Western European countries. In addition to directly raising current population figures, migration can also impact future population trends by affecting total fertility rates in host countries. Given regional differences in fertility rates, migrants to Europe may, due to cultural, religious or other differences, retain a higher fertility rate than the local population and thus increase the country's overall fertility. In the UK, for instance, although natural change replaced net migration as the main driver of population growth after 2008, the associated rise in fertility levels has itself partially been driven by higher fertility amongst the growing immigrant population. Indeed, in 2010, the total fertility rate of the foreign-born population in the UK was at 2.45, while that of the native UK population was 1.88. Overall, between 1999 and 2010, the percentage of children in England and Wales born to foreign-born mothers increased from 14 per cent to 25 per cent[33].

2.2.4.3   Migration flows to developing countries

Despite the persisting trend since the 1960s of movement from less developed to more developed regions, migration flows to and between developing countries has been growing in recent years.

In 2010, the growth rate of the international migrant stock in developing countries surpassed that of developed countries for the first time[17], and several developing countries (e.g. Kuwait, South Africa, Thailand, etc.) have been attracting significant numbers of migrants, including refugees from neighbouring countries.[34]

China, Southern India as well as possibly Turkey and Iran could attract more labour migrants as their working-age population slows whereas wages rise. Labour migration into the United States is projected to decrease as certain areas of South America are expected to attract labour migrants who would traditionally have gone to the United States.[3]

2.2.4.4   *Environmentally induced migration*

Although economic and political factors remain dominant in the decision to migrate, environmental change is becoming increasingly important in the context of climate change and global warming. The concept of environmental refugees was introduced by Lester Brown of the Worldwatch Institute in the 1970s. Following a United Nations Environment Programme (UNEP) policy paper published in 1985 and called 'Environmental Refugees'[35], the term entered into common use and is generally defined as people that are displaced because of environmental change in their home.

The exact number of environmentally induced migrants is very difficult to estimate. This is due to the difficulty in disentangling the interlinkages between the multiple causes for environmental migration, and because most environmentally induced migration takes place not across international borders but within countries. Indeed, it has been estimated that on a general level, international migration makes up only about one-fifth of all migration in the world. When it comes to environmental migration, those who are most vulnerable to environmental change (poor populations in developing countries) are also those who are less likely to be able to migrate internationally.[36] The numbers of environmentally induced migrants depend on the extent of worldwide environmental change, and on which of the scenarios for the advance of climate change presented by the Intergovernmental Panel on Climate Change (IPCC) will prove to be most accurate.[37]

Further, it is difficult to forecast the number of environmentally induced migrants over any period of time because environmental changes are in themselves difficult to predict. For cases of gradual environmental degradation in particular, political, social, and economic factors play a major role in the choices made by migrants. The number largely depends on the extent of future environmental degradation as well as on the planning and resources that are at a government's disposal to adapt to and mitigate the results of environmental change. Estimates of the number of environmentally induced migrants and its future development are therefore divergent.

In 2005, the United Nations High Commission on Refugees (UNHCR) estimated that as of that date there were 24 million people affected. By 2050, Christian Aid predicts that this number could increase to 647 million people. The International Organization for Migration, in assessing the current state of knowledge on the subject, found that 200 million people by 2050 is the most frequently cited figure, but that projections vary widely, from 25 million to one billion[38].

Countries that have a low capacity to adapt to environmental change, as well as countries with particularly susceptible geographies, such as small island states, are the most vulnerable to the

effect of environmental degradation and climate change – meaning that the developing world tends to be particularly affected. The UN highlights that out of the 28 countries that are in danger of suffering from climate change, 22 are located in Africa.[39] Over 97 per cent of all casualties due to climate change related disasters occur in developing countries.[40] Cities in developing countries may be particularly affected, as they face the dual challenges of population growth due to increased rural-to-urban migration and increasing vulnerability due to the effects of global environmental change.[36]

Figure 13 below presents the main hotspots of environmental change as well as the resulting migration trajectories. According to this figure, Europe is to expect its main influx from environmentally induced migrants from Africa.

Figure 13: Environmental change and migration: Hotspots and trajectories (not updated)
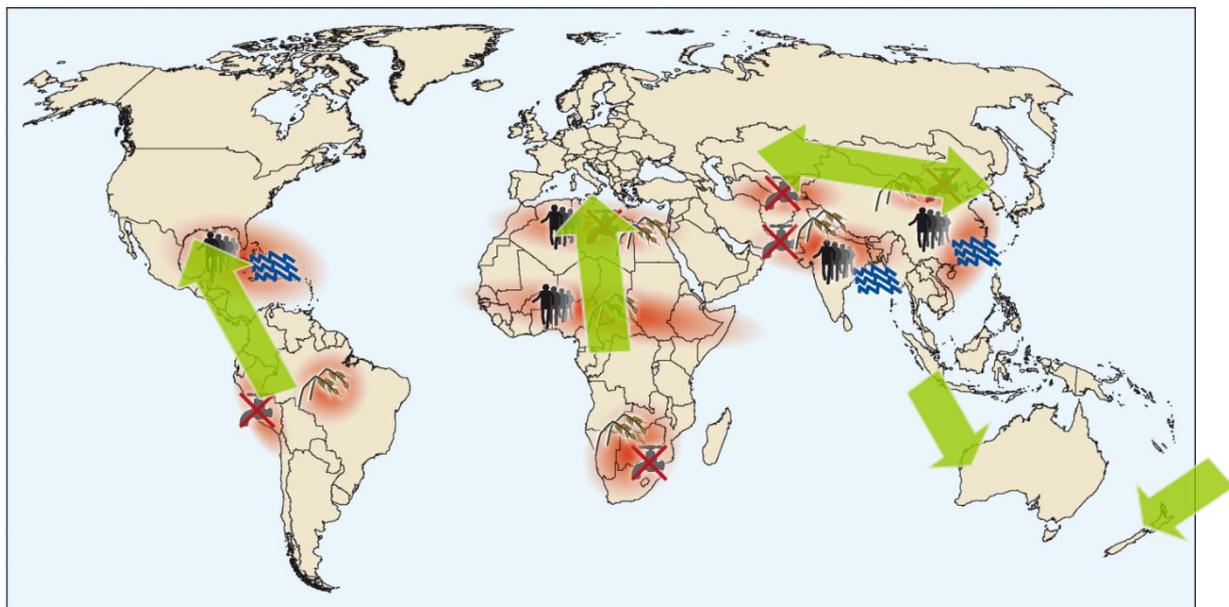
Source: Warner, K. (2008), EFMSV Germanwatch Session[41]

While environmental change is expected to continue impacting migration into the future, its effects can to some extent be mitigated via bi-pronged policy action that works to reduce the impact of climate change while simultaneously taking a planned approach to migration. Migration can be seen as a means of adaptation to climate change by helping to ease people out of vulnerable situations and, if managed appropriately, can in some cases serve to benefit both source and destination communities and build long-term resilience. In taking a planned approach to migration, particular attention should be paid to urban centres that are at increasing environmental risk while simultaneously experiencing rapid population growth.[36]

Chapter 3: Key drivers and interlinkages with other megatrends

Demographic trends are influenced by a wide range of drivers. Table 4 provides an overview of some of the key drivers of diverging global population trends, which will be discussed in greater detail in this section. These key drivers have been broadly organised into the five STEEP (Social, Technological, Environmental, Economic or Political) categories.

Table 4: Main drivers influencing diverging global population trends

STEEP categories of drivers	Diverging global population trends
Social	**Fertility levels** (and sub-drivers, e.g. education) **Life expectancy**
Technological	*No technological drivers are discussed in detail on their own; however, some technological factors contribute to fertility and mortality, including:* Availability of effective contraception Advances in medical, pharmaceutical and sanitation technology
Economic	**Economic development** **Income levels and poverty**
Environmental	*Environmental factors are only indirect drivers of population growth and decline. However, the following factors can directly influence migration, as discussed in Section 2.2.4.4:* Climate change Environmental degradation Natural disasters
Political	**Global and national governance** *(can have either a direct or indirect effect on population trends)* Health and reproductive policy Migration policy Economic policy Education policy Policy regarding women Fiscal policies

The key drivers of population trends, highlighted in bold in the table and discussed in greater detail below, stem largely from the social, economic and political categories.

3.1   Key drivers (direct)

3.1.1   Fertility levels

One of the most direct drivers of population growth is the fertility level, and assumptions about fertility underlie all population growth projections. Fluctuations in fertility levels can therefore have a strong impact on current and future population growth or decline, as well as on the age structure of the population.

A country's total fertility rate is the number of children that women of childbearing age will have over their lifetime. The global average 'replacement level of fertility' at which a country's population stabilises is 2.33. This figure is higher than 2.0, at which two parents would reproduce two children, because mortality before the childbearing years has to be taken into account. This also explains why the replacement level of fertility depends on the country: child mortality is higher in poorer countries and the replacement level of fertility can therefore go up to 3.0 and above, whereas in richer, lower-mortality countries it is of 2.1.[42] Some population literature uses 2.1 as the single global replacement fertility level.

Fertility has been declining throughout the world since the 1970s, falling in nearly all of the 185 countries or areas for which data is available, and dropping below low-mortality replacement levels (2.1) in 75 countries. The median global fertility level has declined from 5.6 to 2.4 children per woman between the periods 1970-1979 and 2000-2007.[43]

Fertility rates and trends do, however, vary significantly by region. In the developing countries, fertility levels already fell by more than half since the 1970s[43], and are expected to decline even further, from 2.7 children per woman in 2005-2010 to 2.3 in 2045-2050.[2] Some of the most significant declines in the later decades of the 20th century were experienced in Asia, North Africa and Latin America, which is linked to strong social and economic development at the same time.[44] Differences have become more significant with some countries, such as China, Hong Kong, Singapore and South Korea, having reached replacement fertility levels very quickly, while others saw less significant or much slower change in overall fertility levels.[45] In the 1990s, the decline in fertility levels was less significant and a number of countries, such as Bangladesh and Egypt, even experienced stalling fertility levels.

Fertility levels in the least developed countries, which remain some of the highest in the world, have fallen only moderately since the 1970s, but the pace of decline increased substantially after 1999.[43] The least developed countries are projected to experience a sharp decline in fertility rate in the coming decades, from 4.5 today to 2.9 by 2050.[2]

In the more developed countries, on the other hand, fertility levels were already relatively low in the 1970s and continued to decline slowly over the following years. More recently, since the 1990s, however, about half of the developed countries experienced small increases in fertility levels, and fertility levels for developed countries overall are projected to continue increasing slightly in the coming decades. However, despite the recent moderate gains in fertility, the overall fertility rate in the developed countries is still well below replacement levels. In the EU, fertility has been growing slightly, with much of the increase coming from countries that had previously experienced 'lowest-low' fertility of 1.3 or lower, notably the newer Member States. Today, the highest fertility

levels are observed in Ireland (2.1), France (2.0) and the UK (2.0). Latvia, Hungary and Portugal have some of the lowest fertility rates in Europe, at just about 1.3.[25]

Figure 14 below shows the development of the total fertility rates until 2050 by regions of the world, and illustrates the different regional trends. Although the current world fertility rate is still above the global replacement level, this is expected to change by 2020, as the global fertility rate is foreseen to fall below the global replacement level of fertility.[46]

Figure 14: Total Fertility Rate by regions of the world, 1950-2050 (updated)
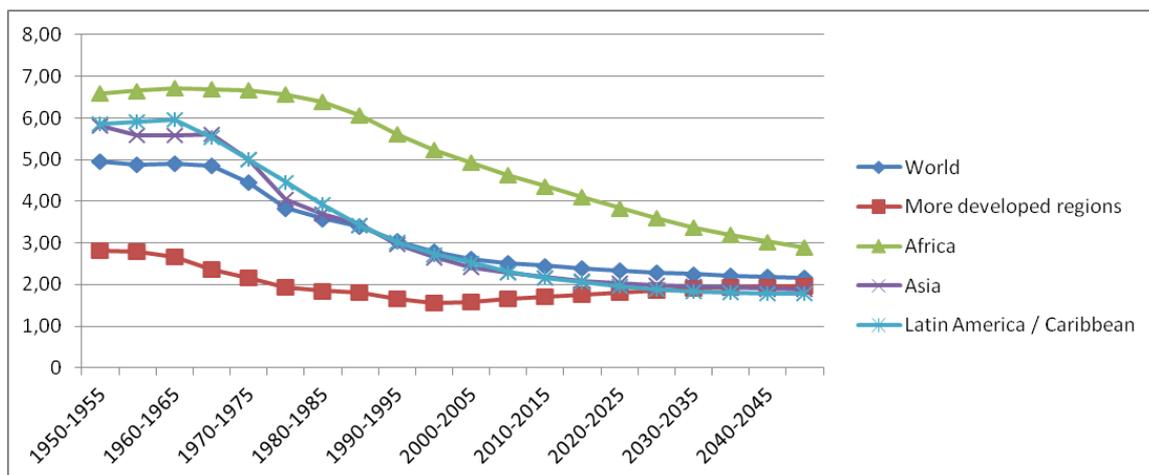
Source: UN Population Division (2011) World Population Prospects: The 2010 Revision

The global fall in fertility rates does not, however, mean that the global population will start shrinking in 2020. Countries in which the earlier generations were characterised by high fertility rates will have large numbers of women of childbearing age. More children will be born even if each mother has fewer children, leading to more numerous but smaller families.

It should be noted that while many projections regard fertility rates in relation to replacement fertility levels, this does not necessarily mean that replacement level fertility is most desirable. Indeed, one recent paper posits that when taking into account considerations such as country-level population structures or evolution of education, a determination of 'ideal' fertility curves challenges the desirability of replacement-level fertility in a number of countries.[47]

Fertility itself is driven by many factors, among which living standards, social and religious norms, education levels, availability of contraceptives, increased access to medical treatment, female social standing and other social factors, as well as economic factors, such as poverty and economic development.

As discussed in Section 2.1, education, and particularly female education, can have a strong impact on fertility rates. Improvements in female education, coupled with access to family planning services, may therefore be key to determining future fertility trends, particularly in developing countries. Indeed, universal access to reproductive health, including voluntary family planning, is one of the targets of the Millennium Development Goals[48], and improved access to contraception is key to preventing unwanted pregnancies and achieving some of the decreases in fertility projected in developing countries in the following decades. A recent briefing paper by the UNFPA

estimated that addressing the unmet need for contraceptive information and services would result in about 22 million fewer unplanned births.[49]

Figure 15 below illustrates the correlation between fertility and the adult female literacy rate in different regions of the world.

Figure 15: Correlation between fertility and adult female literacy rate, 2000-2009 <mark>(not updated)</mark>

Note: Adult literacy rate is the percentage of people aged 15 and above who can, with understanding, read and write a short, simple statement on their everyday life.

Please note the scale difference between the two graphics.

* The European countries considered here are: Belarus, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Romania, Russia, Serbia, Spain, Sweden, Switzerland, the Netherlands, Ukraine, the United Kingdom. Data: 2000 to 2009.

Source: UNESCO (2010) Human Development Report 2010

Health programs, particularly those targeting women's and reproductive health, can also play a role in fertility rates. National and local health programs can, for example, help improve access to reproductive planning, or provide health care during pregnancy, both of which can impact fertility levels while simultaneously reducing the risk of maternal mortality.

3.1.2 Life expectancy

Coupled with fertility, life expectancy determines the course of population growth and impact population age structures. Mortality rates also define the replacement level fertility rate necessary

to maintain population sizes. Together, trends of fertility decline and increased life expectancy result in population ageing, discussed in Sections 2.1, 2.2.1 and 2.2.2. The effects of changes in life expectancy are increasingly being taken into account in demographic projections, in order to make more accurate predictions as to population growth and structures.

Mortality has been declining significantly in recent decades. Since the 1950s, global life expectancy has experienced the most significant increase in history, rising from 48 years in 1950-1955 to 69 years in 2005-2010.[2] Over the same period, childhood mortality (mortality under the age of five) fell from 203 to 60 per 1000 live births.[50] Life expectancy is projected to continue rising, increasing to 75 years by 2045-2050.[2]

Nevertheless, notable differences can be observed between life expectancies of different world regions, with more developed regions having historically had higher life expectancies than developing ones. Although substantial gains in longevity in developing countries over the past half-century have narrowed the gap between the two, developed countries today still have an average life expectancy 11 years higher than that of developing countries.[50]

Within developed regions, trends have diverged since the 1970s between Europe and other regions. Indeed, while the rest of the developed world, and significant parts of the developing world, has seen steady increases in longevity, Europe experienced a slowdown in the increase of life expectancy, due largely to sharp decreases in life expectancy in several Eastern European countries.[34]

Amongst the less developed countries, progress has also been varied by region. Asia and Latin America and the Caribbean have seen steady gains in life expectancy since the 1950s, while in Africa progress stagnated after the 1980s.[34] The 49 least developed countries, over half of which are highly affected by HIV/AIDS, still have some of the highest mortality rates in the world today. Life expectancy in these countries is projected to rise but to remain relatively low, reaching 70 years in 2045-2050.[2] However, this evolution will depend notably on the success of reducing mortality from HIV/AIDS and other major diseases.

Figure 16 shows some of the regional disparities in life expectancy that can be observed today.

Figure 16: Global life expectancy at birth, 2011 (updated)
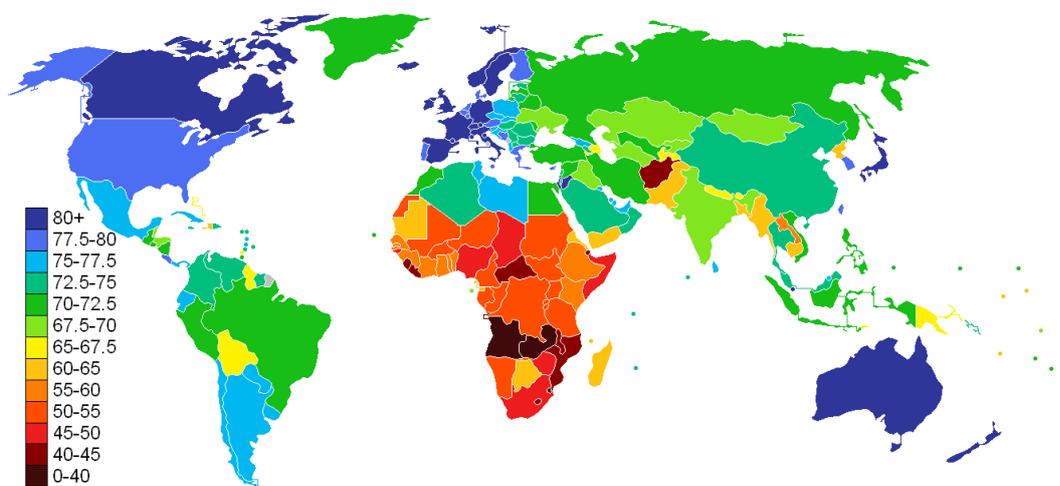
Source: CIA (2011) World Factbook

Mortality is heavily impacted by social, economic and health factors. Poverty, instability, conflict, spread of disease, lack of adequate health services and other factors can all increase mortality. On the other hand, improvements in medicine, sanitation, nutrition, access to health services all help further drive longevity and reduce childhood mortality.

3.2 Other drivers (indirect)

3.2.1 Economic development and the shorter-term economic cycle

Economic development can impact both of the key components of population growth – fertility and mortality.

Research shows that there is a strong relation between fertility levels and economic development. With increasing levels of economic development and improved infrastructures, fewer children are needed to support parents when they get older. Increased economic development may also allow for better access to reproductive health services and contraception, further driving down fertility. It has been shown that fertility starts to drop at an annual income of 1000 – 2000 dollars per person and falls until it hits the replacement level at an income of 4000 – 10 000 dollars per person per year, which generally corresponds to a middle-income status. After this point, fertility continues at, or below, the replacement level, and increases again for some.[51] Figure 17 below shows the relation between fertility levels and economic development as of 2007:

Figure 17: Fertility vs. GDP, 2007 (not updated)
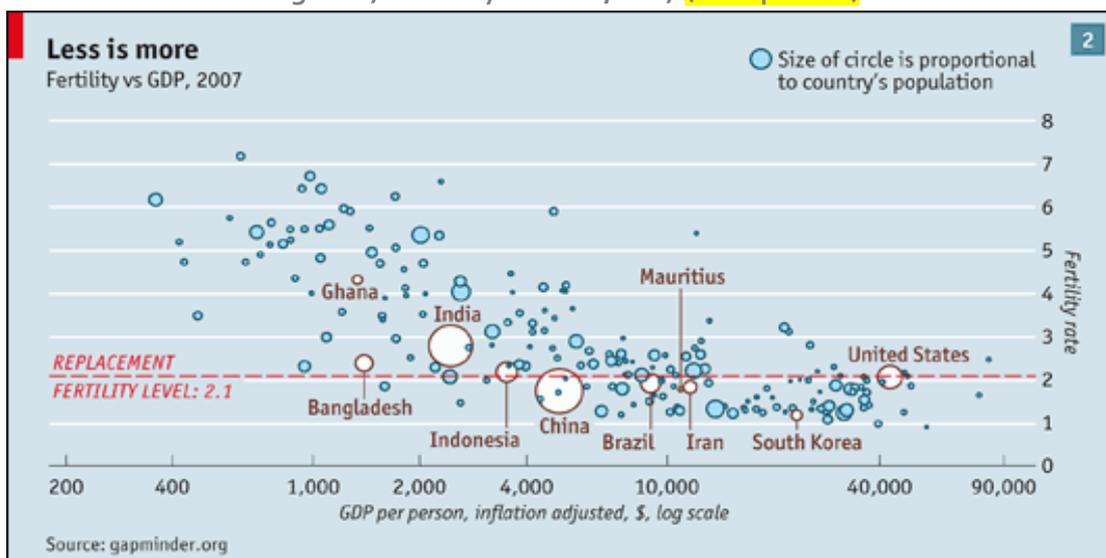
Source: The Economist 2009[51]

The extent of the contribution of economic development to lower mortality rates has been the subject of academic debate since the 1970s, with some attributing gains in longevity predominantly to economic growth, and others delegating the bulk of the credit for life expectancy

gains to other factors, such as medical improvements. Nonetheless, there appears to be general agreement that economic development contributes at least partially to reductions in mortality. Economic growth can notably help improve life expectancy via improved nutrition, and may thus have had a particularly strong effect on deaths from diseases sensitive to nutritional quality. One recent study of declining mortality in the second half of the 20th century attributes between 30 and 45 per cent of mortality reduction to economic growth.[52] Differences in economic development may be one of the factors behind life expectancy disparities across countries and regions today.

Economic growth also has an impact on migration patterns, as discrepancies in development levels appear to act as one of the factors inducing migration from one country to another.

Despite a slowdown in the global economy during the years of the economic crisis, economic expansion is expected in the coming decades, driven notably by substantial growth in Asian production (see *GMT5: Continued Economic Growth*?). This global economic expansion, particularly in Asia, may have a strong regional and worldwide effect on fertility and life expectancy.

Relatively more short-term economic developments may also have an impact on population growth. At a certain level of economic development, the economic cycle is believed to be linked to period fertility levels, with economic recession leading to a fall in birth rates, and vice-versa.[53] The uncertainties and unemployment that accompany economic downturns may lead to postponement of childbearing, particularly for first births, but this trend may also be compensated later on during economic recovery.[54] Eurostat found that, on the whole in Europe, changes in fertility partially follow the economic cycle, though with a small time lag.[53] Overall, studies tend to find that fertility rates are reactive to the economic cycle, through the effects are usually relatively small and short-term.[54] It is also important to keep in mind that the relationship between economic downturns and fertility is complex, as childbirth decisions are differentiated by factors such as women's employment status[53], age, sex and ethnicity, and are further driven by the presence or lack of relevant government interventions.[54] In addition, in many European countries the downward impact on fertility was found to be more pronounced amongst women of foreign nationalities than amongst the native population.[53]

3.2.2   Poverty and income inequality

According to the UNFPA, countries in which poverty levels are highest tend also tend to be those with the highest fertility levels and population growth rates. Linkages have been found between poverty and fertility rates, and poorer areas also tend to have higher mortality levels.

Research has shown that the relationship between poverty and fertility is bi-directional. Poverty may increase fertility via several mechanisms. For example, child mortality tends to be higher in poorer families, potentially inducing poorer families to have higher numbers of children in order to reach the desired family size in the longer term. Families in poverty may also have to rely on the additional labour and income brought in by greater numbers of children (with the assumption that they will be able to contribute more than they consume). This trend may be exacerbated in countries with inadequate social safety nets for people in poverty, as parents in these countries expect to rely solely on their own families for support. Further, women in poor households tend to

marry earlier and to have less education, both generally and about family planning specifically, all of which may drive up fertility levels.[55] Poorer households also tend to have inadequate access to reproductive health services and contraception.[20] According to the UN, in virtually all developing countries poorer women have higher birth rates and lower levels of contraceptive use than wealthier women.[11]

At the same time, high fertility levels can have an impact on poverty, as greater numbers of children place greater stress on family resources. Indeed, smaller families have been found to be more likely to be able to rise out of poverty.[56] High population growth levels and poverty are thus at risk of creating a vicious cycle.

It should be noted that poverty is not just a measure of income, as poor people face deficits in, for example, health, education, safety and social acceptance. The Multidimensional Poverty Index (MPI), which takes into account health, education and standards of living, may offer a more comprehensive view of poverty, which includes not just a headcount of the population below a certain income level, but also a measure of the intensity of people's poverty as experienced in their everyday life. In the 104 countries covered by the MPI, the proportion of people living in multidimensional poverty tends to exceed those living on less than $1.25 a day, though it is below those living on $2 a day. The differences tend to be more marked in lower-HDI countries. Measures to address poverty in order to help reduce fertility and improve longevity should take into account the multidimensional nature of the issue and look beyond income and at other measures of standards of living.[5]

Figure 18 below illustrates the variation in the gap between income poverty and multidimensional poverty in a selection of developing countries.

Figure 18: Variation among countries in the gap between income poverty and multidimensional poverty (new)
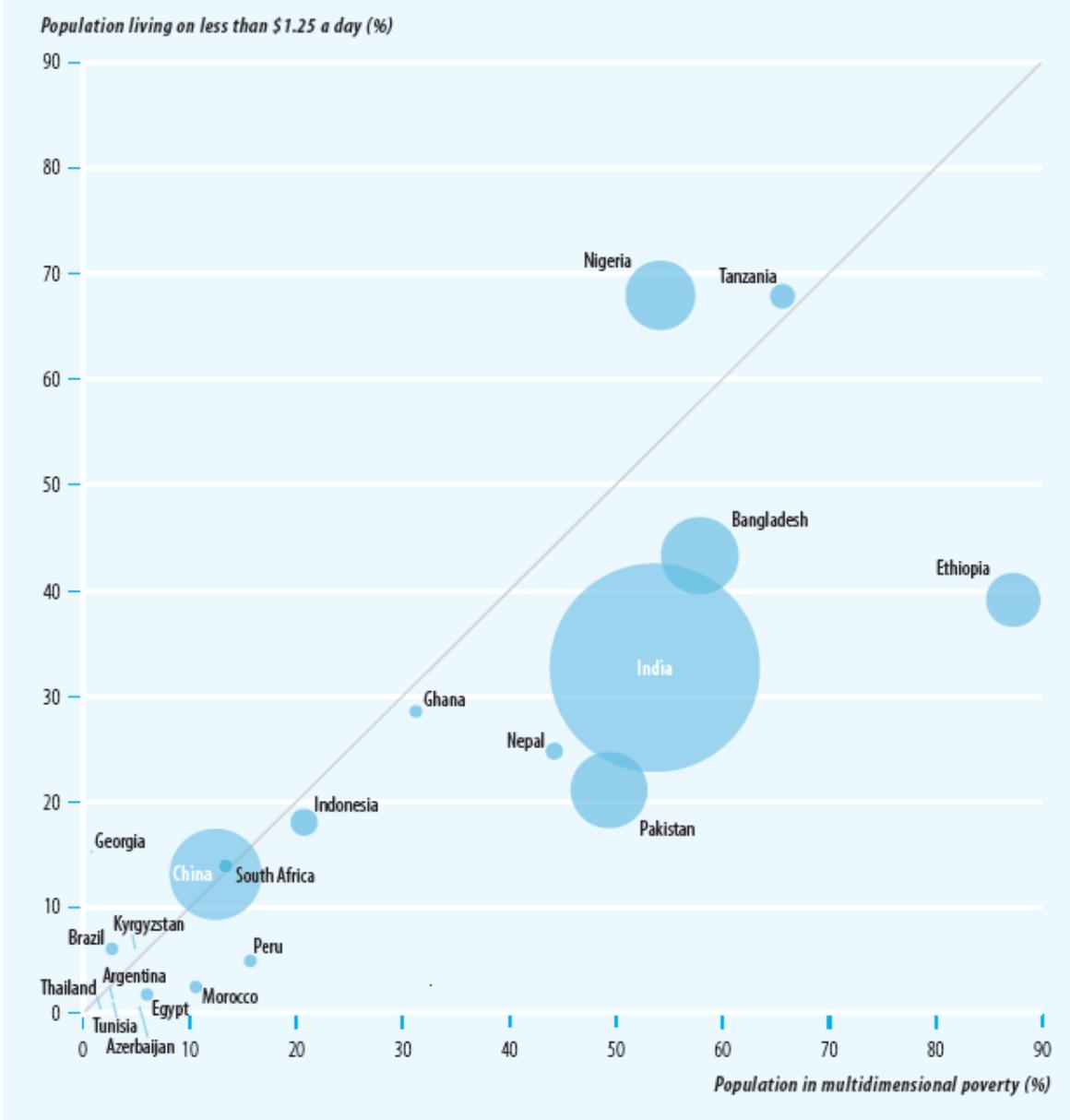
Note: Data refer to 2002–2011. Bubble size is proportional to the number of people in multidimensional poverty. Diagonal line indicates where population living on less than $1.25 a day equals population in multidimensional poverty.

Source: UN (2013) Human Development Report 2013

Substantial progress has been made in reducing poverty5, and absolute poverty is expected to diminish over the next two decades[57], though entrenched poverty will remain, as can be seen in Figure 19 below.

Figure 19: Projected poverty in key regions 2030 (new)
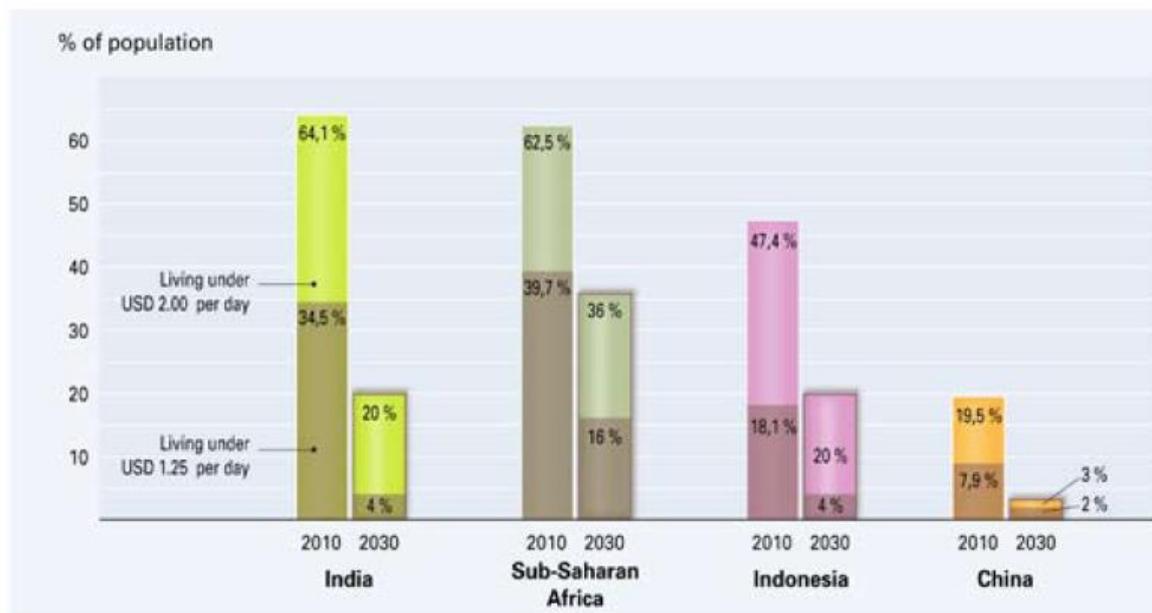
Source: EUISS (2012) Global Trends 2030

Despite progress in reducing poverty, today's world remains characterised by significant income inequality on both a global and national level, with the poorest half of the world's population owning less than one per cent of global assets, and the top one per cent owning close to half4. This inequality partially underlies some of the demographic variations that can be observed on a global, regional or even national level. For instance, in China, residents of Shanghai earn an average of $20,000 dollars more and have an average life expectancy 15 years greater than those of the province of Guizhou.4 Targeted approaches to reducing income inequality and making further progress towards eradicating extreme poverty (e.g. expanding access to healthcare and education, improving nutrition, facilitating development of SMEs, boosting infrastructure development, improving access to information, and others) will help drive down high fertility levels and increase longevity more equally around the world.

3.2.3   Governance

Governance plays a significant role in steering population trends, with a variety of social and economic policies, for example on migration, health, education, social status of women, contraception, or income distribution, able to affect population growth or decline.

Some effects of governance are of a more direct nature, notably in the case of migration policy, which can directly help promote or limit legal migration flows. Policy governing availability of and access to contraception, as well as education surrounding contraceptive use, can also have a direct impact on birth rates, notably by reducing unwanted pregnancies.

The effects of other policies are less direct, but no less significant. Economic policies which are able to achieve reductions in the prevalence of poverty and promote economic development may also lead to lower fertility levels, as well as increased longevity, as discussed in Sections 3.2.1 and 3.2.2.

Improved healthcare, as well as expanded access to quality health services, also help reduce mortality in all stages of life. Further, policies targeting women and their opportunities in society, as well as their access to education and reproductive health, may help reduce birth rates and delay childbirth, particularly in developing nations (see Section 4.1.2).

Immigration, labour and other policies may also mitigate the social and economic impacts of population ageing in the developed world, for example by extending the possibility of later retirement to local workers or by introducing selective immigration quotas for skilled workers.

Global governance is increasingly characterised by regional cooperation; groupings of governance leaders; diverse approaches to regulation, including softer forms of policy, and growing relevance of non-state actors in governance (see *GMT11 Environmental Regulation and governance: increasing fragmentation and convergence*). These new forms of cooperation and governance could facilitate exchange and diffusion of best practices, in order to best shape and adapt to demographic trends on a global level.

3.3   Interlinkages between drivers

The main drivers of population trends do not exist in isolation. Rather, they are often interconnected and have the capacity to influence one another, as has been discussed in some of the sections above. The factors driving population changes are therefore complex, making it difficult to reliably predict future developments.

The most direct drivers of population trends – notably fertility and life expectancy – should be viewed within a higher-level economic and policy context, which plays a key role in shaping their evolution and impact. They are thus closely connected to the more indirect drivers discussed above, such as economic development or governance.

Economic factors, such as growth, equality and poverty, all impact fertility and life expectancy, as discussed in Sections 3.1.1 and 3.1.2. This relationship is complex and can occur via a variety of links, such as quality of nutrition, access to education, relative mobility, extent of women's participation in the workforce and others.

Governance has the capacity to target a variety of social and economic issues in order to steer demographic trends, mitigate demographic challenges and benefit, where possible, from a demographic dividend. As discussed in Section 3.2.3, policy can focus on several areas relevant to population trends, such as education, contraception, migration, health, women's rights, economic policy, urban development and others. These policy areas can in turn have a notable direct or indirect impact on fertility and/or life expectancy (e.g. the direct impact of accessible contraception on fertility, or of improved health services on longevity, versus the indirect impact of better education on both fertility and life expectancy).

Fertility and life expectancy in turn have a strong impact on economic factors and governance, as they directly shape the population structures that impact economic development and policy needs. These demographic trends can present both opportunities and challenges to their countries, depending on the context. For instance, in some contexts, high fertility may lead to persistent poverty; in others, it may represent an opportunity for growth.

Governance and economic factors are further strongly interconnected, and can either mitigate or reinforce the relationship that each has with demographic trends. Ultimately, a combination of sound policy and strong economic growth is ideal for best managing population trends, preventing unwanted pregnancies, increasing longevity, capitalising on current and future population pyramids and pre-emptively addressing upcoming demographic challenges.

Chapter 4:   Key areas of uncertainty

Several of the contributing factors to population trends are difficult to project or even measure with certainty, often due to the complexity and unpredictable nature of their driving factors, as well as to a lack of reliable and comparable data.

Key areas, which help impact population growth but for which significant uncertainties exist, include migration flows, female education and access to birth control, fertility rates and access to healthcare and life expectancy. Uncertainties in global and national economic growth, governance and evolution of relevant policies, all of which indirectly affect population growth via its various factors, further complicate population projections.

4.1   Key uncertainties

4.1.1   Migration flows

International migration remains difficult to monitor, making migration forecasts some of the most uncertain of the demographic trends. As migration may be influenced by a wide range of volatile and evolving drivers, migration trends may evolve in unexpected ways. In the short term, social, political, environmental and other events, which may often be difficult to predict, can result in the sudden movement of a significant number of people. In the longer term, social, economic, political and environmental trends may also influence migration levels. Changes in migration policy can also have either shorter or longer-term effects on migration flows.

4.1.2   Female education and access to birth control

As discussed in Section 2.1, female education and birth control have a significant effect on population trends. At the same time, female education and access to birth control are difficult to monitor, as data is uneven between countries and often very scarce in certain regions. In a recent compilation of family planning data, 43 per cent of 194 countries and areas were found to have no recent data for unmet need for family planning. Cross-country methodological differences in data gathering also make global estimations difficult.[58] Further, female education and contraceptive access are influenced by a variety of complex factors, including, for example, economic standing, as well as societal attitudes towards women, reproduction and contraception. The evolution of relevant national policy also plays a role, as policy – itself based on factors such as ideological attitudes, role of religion, political priorities and economic feasibility – can either inhibit or facilitate female education and access to reproductive services. These various contributing factors make education and contraceptive access complicated to project into the future.

4.1.3   Fertility rates

Despite the fertility level projections discussed in Section 3.1.1, uncertainties remain with respect to the evolution of regional and global fertility rates over time, given the numerous social, economic and other drivers that can affect them. Evolution of social norms, which can help determine women's choices about marriage and age and extent of childbearing, are difficult to predict, as are economic developments, which have a sizable impact on fertility, as discussed previously. Further, the evolution of a region's cultural and religious composition, whether due to local developments or the impact of migration, may also affect birth rates. Beliefs with respect to marriage, sexuality, childbearing and divorce are prominent in most major religions, and the relative sizes of secular and religious populations in a country, which are difficult to predict reliably, can affect the course of its demographic trends[59]. At the same time, changing population structures (e.g. population ageing) make future fertility difficult to predict with accuracy.

Given these uncertainties, assumptions about the evolution of fertility rates can vary. Different fertility projections, among other considerations, can lead to divergent overall population projections, as can be seen, for example, in comparing UN and IIASA projections in Figure 1. It is important to note that even small differences in fertility levels can have a substantial impact on population size and growth. According to the UN World Population Prospects, the medium variant, which predicts a population of 9.6 billion by 2050, assumes that the global average fertility rate will decline from 2.5 children today to about 2.2 children in 2045-2050. If, however, the fertility rate were 0.5 children higher than the medium, the global population would more than double in the next century, reaching 16.6 billion by 2100. If, on the other hand, the fertility rate were 0.5 less than the medium, the global population would grow to 8.3 billion by 2050, but eventually decline to 6.8 billion by 2100.[2]

A different recent study argues that future fertility rates could converge at well below replacement level, and thus looks at projected population growth for a broader range of fertility rates (from 0.75 to 2.5), coupled with three maximum life expectancy scenarios. The study's projections confirm the long-term sensitivity of population size to even very small differences in fertility: under the scenario with the lowest life maximum expectancy (90 years), the global population could range from 7.5 billion to 10.1 billion in 2050, and from 3.5 to 15.1 billion in 2100.[60]

4.1.4   Access to healthcare and life expectancy

As discussed in Section 0, global life expectancy has been on the rise, due notably to medical improvements and greater access to health services. However, uncertainties remain as to the future evolution of this trend, given the unknown limits to human longevity, the difficulty of predicting the evolution and extent of technological advances, as well as the uncertain evolution of the quality and accessibility of healthcare in various parts of the world.

Access to healthcare, both in terms of available health infrastructure and in terms of healthcare affordability, varies significantly across the world. While the World Health Organization advocates a drive towards universal health coverage, many countries remain far from this goal.[61] Access to healthcare is largely dependent on policy, economic development and income levels, as well as on technological improvements in health services. Economic development and income levels vary

widely across countries. Healthcare policy is also highly variable, for example in terms of government spending on healthcare (as can be seen in Figure 20), the structure and extent of healthcare coverage and insurance, and other policy choices. Given the variety of factors, which contribute to healthcare accessibility, its evolution is difficult to predict reliably.

Figure 20: Government expenditure on health as a percentage of total government expenditures by WHO region, 2000-2007 (new)
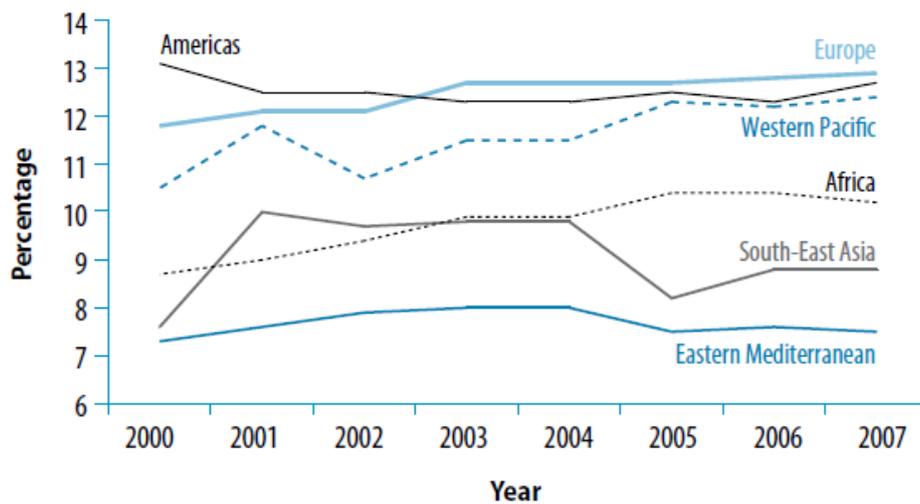
a These are unweighted averages. Government health expenditure includes health spending by all government ministries and all levels of government. It also includes spending from compulsory social health insurance contributions.

Source: WHO (2010) World Health Report 2010

Chapter 5: Potential environmental impacts of population trends

Population dynamics, including growth rates and population structures, are key drivers of environmental impacts, notably via their impacts on consumption and production and economic growth. Population growth, coupled in many areas with increased urbanisation, tends to lead to increased pressure on, and depletion and degradation of natural resources and systems, as well as to an increase in negative environmental impacts, such as emissions, waste or pollution. In addition, population structures, such as age structure, help determine consumption habits, as well as labour inputs, further affecting resource use and environmental impacts.[62] At the same time, environmental impacts can be reduced despite population growth, notably via improved production and consumption patterns and behaviours, as well as via more efficient technologies, processes and systems. Current global environmental policy attempts to address and mitigate the environmental effects of anticipated population growth, particularly in the most vulnerable areas (typically less developed regions). In Europe, population decline will help ease the population's impact on the environment, but will still have to be coupled with sound environmental policy in order to achieve substantial reductions in today's adverse environmental impacts of an industrialised society and its material consumption habits.

5.1 Potential impacts on the European environment

5.1.1 Land use and biodiversity

A growing population, linked to changes in lifestyles, can have a strong impact on land use, both via increased demand for agricultural land and increased land use for urbanisation. This in turn may have adverse effects on biodiversity, via disruption or destruction of natural habitats.

The IIASA predicts that the growing world population, coupled with climate instability, will put unprecedented pressure on land needed for agricultural production.[63] The OECD projects that use of agricultural land will grow in the next two decades to meet increased food demand from a growing population, peaking in 2030. Agricultural land use should then ease after 2030, due to slowing population growth and improved yields.[62] At the same time, increased population flows to urban areas will lead to greater use of land for urban construction and sprawl.

In Europe, population decline will put less pressure on agricultural land, though much will be determined by the evolution of the population's consumption patterns (e.g. diets, both in terms of amount consumed and the constitution of the diet). At the same time, increased urbanisation and urban sprawl, further augmented by sustained migration, may increase use of land for urban infrastructure. However, European urban and environmental planning is actively aiming to reduce the land pressures linked to urban sprawl.

5.1.2   Waste generation

Population growth leads to increased production and consumption, which in turn tends to lead to an increase in waste generated. For example, when it comes to Municipal Solid Waste (which includes mostly household waste, but also waste from some local enterprises or municipal institutions), the World Bank estimates that, based on current population and growth trends, generation levels will nearly double by 2025.[64]

In Europe, declining population could help reduce waste generation to a certain extent. At the same time, population alone does not determine waste levels, as the production and consumption patterns and practices of the population play a major role in driving waste reduction via reduced per capita waste generation. For example, according to a 2011 study on waste prevention, average EU waste generation could decrease by between 12 and 62 kg per capita by 2020 via a combination of waste prevention measures across the life cycle chain.[65] European waste prevention, recycling and reuse policies, including improvements in design and production processes, involvement of producers and consumers, and improved recovery and reuse in the end-of-life phase, will therefore play a major role in achieving waste reduction in coming decades. Coupled with population decline, these policies could have a significant downward impact on waste generation in Europe.

The impact of population growth on waste will therefore heavily depend on waste policies in affected countries. Further, waste generation in other regions can also have an impact on the European environment. For instance, landfilling in both developed and developing countries can lead to an increase in certain GHG emissions, which would have a global impact (see Section 5.1.3). Promoting effective waste policy throughout the world should therefore be a priority for Europe. Given the potential global effects of improper waste disposal, European countries should also avoid exporting and dumping waste in other regions, particularly those without proper waste management, recycling or recovery systems.

5.1.3   Air pollution and greenhouse gas emissions

Air pollution will tend to increase with higher populations and rising demand for goods and services created via polluting industries. Europe's declining population may therefore help curb pollution. However, air pollution in other regions of the world may still have an effect on European pollution levels, as pollutants are transported via intercontinental airflows. Increasing air pollution in other regions (e.g. strongly developing Asian economies) is therefore still of concern to Europe, and the EU should continue working towards helping to reduce pollution outside of its boundaries.

All else equal, greenhouse gas emissions would increase with a growing global population, as greater numbers of people would require greater use of the main sources of emissions (e.g. electricity production, transportation, agriculture, etc.). In reality, however, emission levels also depend on factors such as technological progress (achieving emission reductions in everyday technologies, systems and processes), as well as per capita emissions, which, as can be seen in Figure 21, already differ significantly across the world by level of development (and accompanying levels of industrial production, infrastructure, energy use, etc.), and could be driven downward by improved consumption and production patterns and behaviour.

Figure 21: GHG emissions per capita: Baseline scenario, 2010-2050 (new)
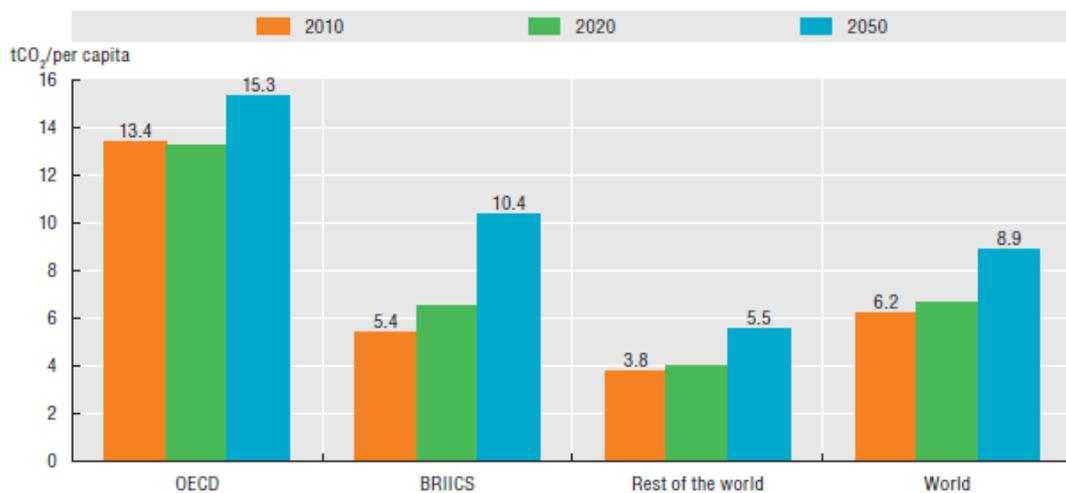
Source: OECD Environmental Outlook Baseline; output from IMAGE/ENV-Linkages.

StatLink http://dx.doi.org/10.1787/888932570487

Source: OECD (2012)

Europe's declining population will facilitate the task of curbing local emissions levels and mitigating climate change. However, meaningful reductions in emissions levels will have to be primarily driven by effective emissions policy and technological progress. In addition, emissions-driven climate change affects all regions of the world, regardless of the source. Europe will therefore feel the effects of growing global emissions even if it is able to achieve local reductions. It is therefore essential to work on global cooperation on this issue in order to curb the impacts of emissions.

5.1.4 Water and land pollution

Similar to other negative environmental impacts, water and land will tend to increase with greater population levels, as demand for pollution-creating technologies and processes will increase (e.g. industrial production, waste disposal, transportation, etc.). According to UNESCO, for example, demographic processes create some of the greatest pressures on water quality, notably via increased disposal of waste and pollution into water bodies and poor treatment of used water.[66] Nonetheless, per-capita pollution levels can be reduced via appropriate policy in order counteract the effects of population growth. In Europe, population decline will facilitate pollution reduction at a local level, but if rising populations lead to increased global demand for European goods (for example, food, fish, raw materials or manufactured goods), their supply may drive land and water pollution in Europe.

5.2   Potential impacts on European resource efficiency

Population growth and decline have strong impacts on the consumption of natural resources, such as energy, land, water, ecosystem services and others. Historically, population growth and

affluence have been some of the biggest drivers of resource use. Figure 22 below maps the use of some key resources in relation to population and GDP.

Figure 22: Global material extraction and energy production from 1900 to 2008 (new)
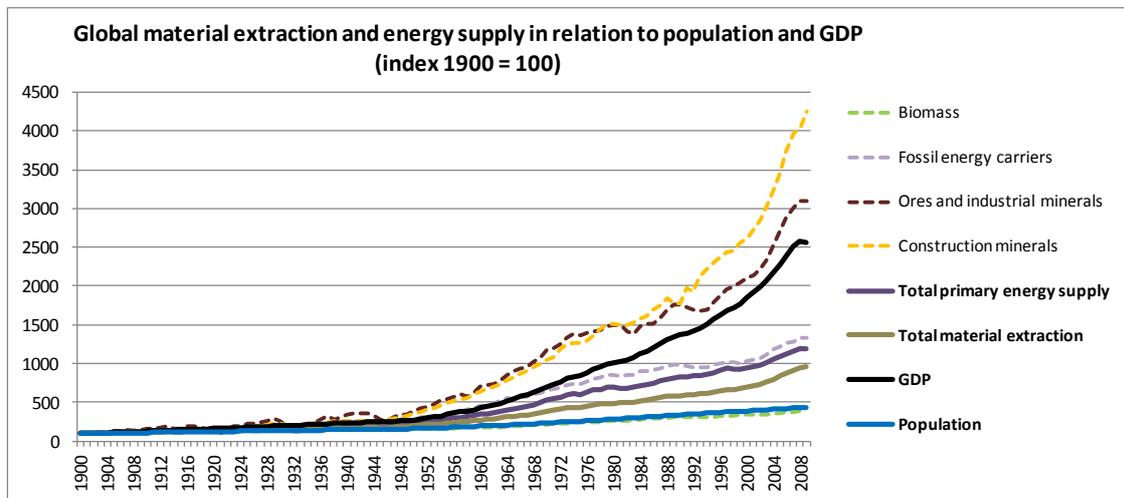
Source: Krausmann et al. (2009). Growth in global materials use, GDP and population during the 20th century[67]

Rising global population levels, as well as structural changes in populations, continue to place increasing pressures on natural resources today, as they drive economic growth and consumption. According to the National Intelligence Council, global demand for three key resources – food, water and energy – will grow by approximately 35, 40 and 50 percent, respectively, by 2030, due notably to increasing populations and increasing consumption by an expanding middle class.[22] Resource vulnerability is most significant in the least developed countries, which have some of the highest poverty and population growth rates, and which are already facing shortages in certain critical resources.[68] However, promoting sustainable production and consumption behaviours in more developed, highly material consumptive regions, is also crucial to achieving global sustainable resource use.

Given the projected rates of population growth in the coming decades, maintaining the current level of resource use may jeopardise the availability of resources for future generations. Thus, one of today's key environmental policy objectives is the achievement of absolute decoupling of resource use from other growth factors, via improved resource efficiency. In the EU, progress has been made in improving resource efficiency, and, as seen in Figure 23 the figure below, relative decoupling can be observed for some resources, but absolute decoupling for all major resources has yet to be achieved.

Figure 23: EU consumption of different resources in relation to population and GDP (new)
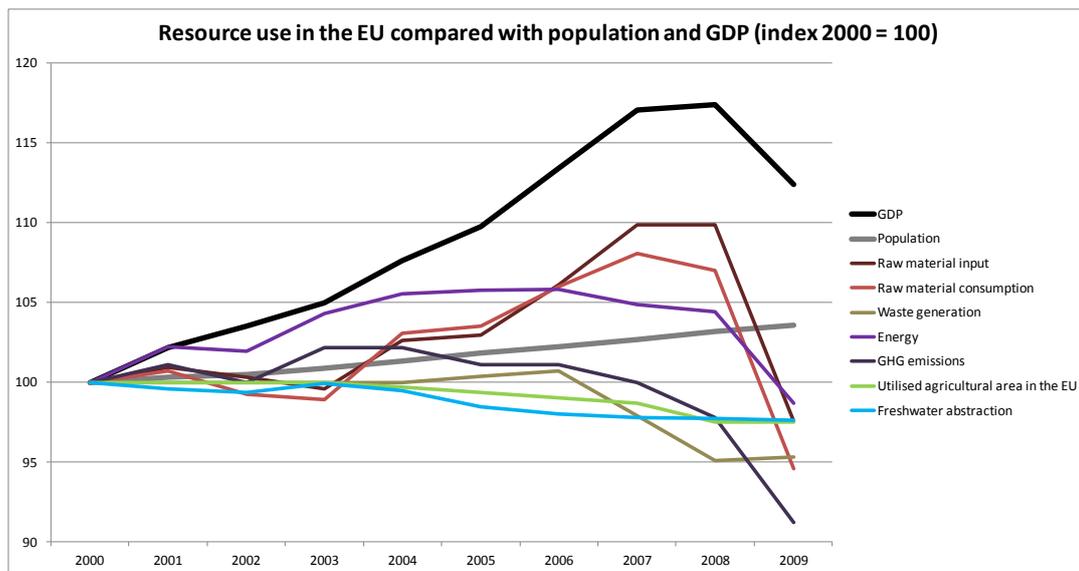
Source: Eurostat

Notes:
- *Waste data only available for 2004, 2006, 2008 and 2010 (extrapolation was used to fill data gaps)*
- *Energy is measured as Gross Inland Energy Consumption*
- *Data gaps in freshwater abstraction were filled by using data from the latest year available and using per capita abstraction data from neighbouring countries*
- *Data gaps in utilised agricultural area were filled by using data from the latest year available*

While population size is a major driver of raw material extraction and use, and per-country material use is closely tied to the number of inhabitants, it is important to note that per capita material consumption varies significantly by country, with economic development and population density having been identified as accounting for much of this variation. Indeed, at a similar standard of living, densely populated areas need fewer resources than sparsely populated ones.[69] It appears, therefore, that not only population size, but also population patterns, can play a role in determining the need for material consumption. European countries, which tend to be more densely populated than other parts of the world, tend to have relatively lower per-capita material consumption needs. Further, given that most population growth will take place in the least developed countries, and that these countries also tend to be less densely populated than the developed world, the increase in their resource consumption in the coming decades can be expected to be relatively higher than that of developed countries.

In Europe, looking forward, the ongoing trend of population decline should help reduce resource demand (as fewer people would need to be provided with the basic resources that they need), and could ease some of the stress on the environment. Of course, at the same time, other socio-demographic trends, which surround the population, such as increased urbanisation, rising quality of life expectations, or increased use of everyday equipment, appliances and technologies, may place additional stresses on resources such as land or energy. Anticipating a population decline is therefore insufficient for achieving sustainable resource use, and a shift towards resource efficiency via improved technologies and increasingly efficient production and consumption

practices will be necessary to help curb material consumption and decrease the population's overall environmental burden.

Further, as global population trends affect other regions of the world, Europe may experience an impact on its resource use via its global trade flows. Rising populations abroad may place extra pressure on European exports, and may lower the availability of traditionally imported resources. Population dynamics in other countries may therefore threaten resource security in the EU, and cannot be ignored.

While total population size is an important factor in overall resource use, various socio-demographic characteristics of the population can have more nuanced impacts on the consumption of natural resources. Certain such characteristics which may be relevant to Europe are discussed below. It is important to note that while the following discussion broadly addresses the impact on natural resources as a whole, variations in resource-specific impacts may exist for certain of the characteristics highlighted below.

Population age structure

Population ageing, highly relevant in Europe, is likely to have an impact on consumption patterns. For example, it has been found that older and retired people tend to need more services (rather than material goods). On average, people over 60 in Europe tend to have lower household expenditures than younger people, due notably to income differences. However, retired households, while spending less on household necessities, also tend to spend more on gifts.[70] The overall difference in resource use between different ages is thus difficult to calculate, but the various potential impacts of ageing on the types and quantities of resources consumed should be kept in mind.

At the same time, it is difficult to predict the consumption patterns of future older populations, given that the characteristics of this population will be different from the older population today. Indeed, it is possible that today's young and middle-aged populations, accustomed to certain levels of material consumption, may carry some of their consumption patterns with them into their old age, and that the age differences in consumption observed today will no longer be entirely valid in 2050. Consumption levels of future generations of older people will also depend on income levels in this population.

As discussed above, societal age structures also impact the size of the labour force, and thus production, economic growth and associated resource use.

Presence of immigrant populations

The impacts of international migration on resource use are double, easing the burden on areas of emigration and placing more stress on natural resources in the receiving countries. Overall, continued migration to Europe will supplement the population and will account for additional consumption of resources. Migration patterns from Eastern to Western Europe may result in a shift of the burden on natural resources within Europe itself, to countries which are net receivers of migrants.

In addition, as discussed previously, migrant populations in Europe tend to be younger than native populations. Migration to Europe may therefore counteract some of the consumption, production and resource use impacts of population ageing. The influx of younger workers into the labour force

may allow for greater production levels, and the consumption patterns of the younger foreign populations may be more in line with those of young native populations.

Given regional differences in resource consumption behaviour, the question remains whether immigrants tend to retain their local consumption and waste patterns or rather emulate the behaviours of host countries.

Urbanisation

Urbanisation, as well as its associated changing consumption patterns, is an important driver of global resource use. Urbanisation drives demand for land for construction, mineral resources and energy, amongst other resources. As the global urban population will increase via population growth and migration to cities, natural resources will be placed under greater pressure, unless urban planning, technology and governance are able to increase efficiency and shift consumption patterns.

5.3 Potential risks and opportunities from a European Environmental policy perspective

As discussed above, demographic trends have a significant impact on sustainable development and environmental issues. Indeed, according to the World Economic Forum's latest Global Risk Report, population-related risks – unsustainable population growth, mismanagement of population ageing and unmanaged migration – are becoming increasingly important risks to sustainable development.[71] Given the substantial global challenges to achieving food, land, water and energy security[72], as well as the growing risk of unmitigated environmental change, mismanaging the projected population trends of the coming decades presents the risk of exacerbating the environmental issues the world is likely to face. Failure to address population dynamics may result in an exhaustion or degradation of certain natural resources, and may negatively affect health and longevity, leave climate change unchecked and provoke displacement and migration.[72] All of these risks are highly relevant to Europe, and both local and global population dynamics have the capacity to affect sustainable development in the EU.

Keeping in mind the global nature of environmental issues, Europe will need to both persist in its own environmental policy and continue to engage in international dialogue on the issues with other regions.

5.3.1 Environmental policy and targets in Europe

At a local level in Europe, varied demographic structures, as well as the implications of population ageing, might result in varied environmental pressures. Therefore, there is a need for further research into the impacts of demographic change on the European environment, in order to best incorporate demographic considerations into environmental policy and targets. A quantitative and qualitative analysis of the implications of demographic change on the environment should therefore be carried out at an EU level.

Following on this analysis, Europe's changing demographic make-up could be taken into account in setting future environmental targets and objectives. Migration flows and their short- and long-term impacts on local demographic structures could also been taken into account, to the extent that they can be projected.

Understanding and anticipating Europe's demographic trends will allow the EU to reach out to its population, to promote awareness, and to invest in its human capital, in order to help drive a more sustainable economy. Anticipating demographic trends, such as population ageing or increased urbanisation, will allow EU countries to pre-empt many of the associated challenges, for example via smart urban design or effective support structures for older populations. These anticipatory responses to demographic challenges can help tackle some of Europe's environmental and sustainability issues more quickly and effectively.

5.3.2 European participation in global environmental policy

Europe will also be affected by environmental issues outside of its borders. Many environmental impacts are truly global and will affect the EU regardless of their origin. In addition, significant impacts of environmental change in other regions may drive displacement and migration flows to Europe, impacting European populations not only demographically, but also economically, socially, culturally and politically.

Several particularly salient strategies exist for addressing environmental issues on both a local and global level. These include, for example, the engagement of various actors in improved resource-efficient production and consumption practices, particularly with respect to key resources, such as energy, water and land. Resource efficiency policies must keep in mind population dynamics, adapting policy to population growth levels and understanding the implications of population age structures on consumption patterns and production possibilities (e.g. size of labour force). These may also include policies to place limits on emissions and pollution, particularly for those countries, which are most responsible. These limits and targets should be set with population projections (and related emissions- or pollution-causing production and consumption) in mind.

Another important strategy for addressing the environmental risks that may be aggravated by population change is investment in technological progress. Technological advances could help counterbalance some of the impacts of an increased population, ideally in complement with improved production and consumption behaviours. This could be done both by allowing for resources to be used more efficiently (e.g. by developing energy-efficient lighting or appliances) and by reducing adverse environmental impacts of everyday processes (e.g. improving vehicle design to reduce emissions). Using demographic data to best invest in human capital and promote uptake of technologies amongst the population could help drive the success of technology-related measures.

Further, promoting awareness of environmental issues is a key aspect of environmental policy, and one, which could benefit substantially from taking the demographic make-up of populations into account. Communication and information around environmental issues can be most successful if appropriately targeted towards populations, and could be developed with demographic trends in mind.

At the same time, on a global level the response to environmental challenges should be accompanied by policies, which specifically tackle population dynamics in a positive way. These include, notably, measures to expand access to reproductive services, increase women's access to education and improve health services.

Chapter 6:   Interlinkages with other megatrends

Population trends are interconnected with other key megatrends in various ways, some of which are highlighted below.

The links between population and **urbanisation** are particularly strong and reciprocal. Perhaps most directly, much of the global population growth until 2050 will take place in urban areas.[73] Given that most international migrants tend to move to urban areas[74], growing international migration flows will likely further contribute to the global urbanisation trend. The growing global population will also have environmental consequences, some of them felt particularly acutely in rural regions (e.g. impacts on agricultural land, river pollution, deforestation, etc.), which may induce even greater migration to urban areas. On the other hand, urbanisation may have an impact on future population dynamics, as population trends are found to vary somewhat between rural and urban areas. For instance, fertility rates in urban areas are almost universally lower than those of rural areas.[74] The relationship with mortality rates is fairly complex. On the one hand, urban dwellers historically faced worse sanitation conditions and a greater risk of infectious disease, leading to higher mortality levels than the rural population. However, more recently many urban populations have also had better access to health and education services, thus reversing the mortality trend in many areas. Nonetheless, higher urban than rural mortality levels can be observed again today for inhabitants of urban slums in certain countries.[74] Greater urbanisation, coupled with improvements in urban environments (in terms of better access to health and reproductive services, improved education, reduction of overcrowding, improved sanitation, etc.) may therefore affect both long-term fertility and mortality levels.

As discussed in Section 3.2.1, the key factors of population growth – fertility, mortality and migration – are all linked to **economic growth**. Persisting economic inequalities will account for some of the differences in population dynamics between different regions of the world, and will contribute to migration flows between regions. At the same time, population growth and structures have the potential to impact economic growth. For example, population age structures will determine the size of the labour force and its dependent population, thus affecting productivity and growth. Migration of skilled and other workers can also supplement the labour force of host countries, accelerating growth.

Strong connections exist between demographic trends and **environmental regulation and governance**. Environmental policy must take into account current and future population trends, in order to best address existing and upcoming environmental issues, alleviate environmental burdens driven by population patterns and offer feasible solutions. At the same time, population trends, and particularly migration patterns, will be partially impacted by environmental change, whose significance will in turn depend on the success of environmental regulation.

The link between population trends and **disease burdens** exists primarily with respect to mortality rates, which are directly affected by the prevalence of infectious and non-infectious diseases, as well as global pandemics. Reproductive behaviour and use of proper contraception, which is central to the evolution of population growth, is also related to the spread of sexually transmitted diseases. Better education surrounding reproductive health, as well as access to reproductive

health services, can therefore have a dual effect on population growth and transmission of certain infectious diseases.

Certain links may also exist between population trends and **accelerating technological change**. For example, technological change may lead to advances in health (including reproductive health), thus leading to reduced mortality at all ages. Technological progress can also help offset some of the environmental pressures caused by a growing population (see Chapter 5:). At the same time, countries' demographic composition is one of the factors that helps shape its labour force (skilled and unskilled), which in turn affects the capacity for technological progress and innovation. The demographic structure of the population may also impact the rate of uptake of new technologies.

The relationship between population trends and environmental impacts, such as **climate change**, **increasing pollution**, **intensified global competition for resources** and **decreasing stocks of natural resources** is described in more detail in Chapter 5:. Without a significant shift in consumption patterns, a growing population will place greater pressure on the world's natural resources. Increased production and consumption will also result in increased adverse environmental impacts, such as pollution or climate-change inducing emissions. Pronounced regional differences will be observed, driven by varied population trends, as well as differences in incomes, development, population density, culture and other factors. Nonetheless, many environmental impacts will be global, despite regional differences.

[1] UN (2012) Delivering Results in a World of 7 Billion. Available at:
https://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/16434per cent20UNFPAper cent20AR_FINAL_Ev11.pdf

[2] UN (2013) World Population Prospects - The 2012 Revision. Available at: http://esa.un.org/wpp/index.htm Key Findings and Advance Tables available at:
http://esa.un.org/wpp/Documentation/pdf/WPP2012_%20KEY%20FINDINGS.pdf

[3] National Intelligence Council (2008) Global Trends 2025: A Transformed World. Available at:
www.dni.gov/nic/NIC_2025_project.html

[4] World Economic Forum (2012) Global Risks 2012. Available at: http://reports.weforum.org/global-risks-2012/#

[5] UN (2013) Human Development Report 2013. The Rise of the South: Human Progress in a Diverse World. Available at:
http://hdr.undp.org/en/media/HDR_2013_EN_complete.pdf

[6] National Transfer Accounts (2011) The Economic Consequences of Population Aging. Available at:
http://www.ntaccounts.org/doc/repository/NTAbulletin3Final.pdf

[7] Skirbekk et al. (2012) Variations in "Variation in cognitive functioning as a refined approach to comparing aging across countries." Proceedings of the National Academy of Sciences 109.3 (2012): 770-774. Available at:
http://www.pnas.org/content/early/2011/12/13/1112173109.full.pdf+html

[8] United States Joint Forces Command (2010) Joint Operating Environment. Available at:
http://www.fas.org/man/eprint/joe2010.pdf

[9] Lutz, W. and Samir K.C. (2011) Global Human Capital: Integrating Education and Population, published in *Science*. Available at: http://www.oeaw.ac.at/vid/news/news_science_jul11.shtml

[10] IIASA (2011/2012) Education spells hope for world wellbeing, in *Human Wellbeing and Sustainable Development*. Available at: http://www.iiasa.ac.at/web/home/resources/publications/IIASAMagazineOptions/index1.html

[11] UNFPA (2012) State of World Population 2012. Available at:
https://www.unfpa.org/webdav/site/global/shared/swp/2012/EN_SWOP2012_Report.pdf

[12] KC, S. et al. (2010) Projection of populations by level of educational attainment, age, and sex for 120 countries for 2005–2050, published in *Demographic Research*. Available at: http://www.demographic-research.org/Volumes/Vol22/15/

[13] K.C., S. and Harold Lentzner (2010) The effect of education on adult mortality and disability: a global perspective, published in the *Vienna Yearbook of Population Research 2010*.

[14] K.C, S. et al, 2010. Projection of populations by level of educational attainment, age, and sex for 120 countries for 2005-2050, International Institute for Applied Systems Analysis (IIASA). Available at:
www.iiasa.ac.at/Research/POP/popecon/index.html?sb=14

[15] Eurostat (2011) The Greying of the Baby Boomers. Available at:
http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-11-023/EN/KS-SF-11-023-EN.PDF

[16] UN (2012) International Migration and Development. Available at: http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N12/452/13/PDF/N1245213.pdf?OpenElement

[17] UN (2011) International Migration Report 2009. Available at:
http://www.un.org/esa/population/publications/migration/WorldMigrationReport2009.pdf

[18] CIA (2001) Long-Term Global Demographic Trends: Reshaping the Geopolitical Landscape. Available at:
https://www.cia.gov/library/reports/general-reports-1/Demo_Trends_For_Web.pdf

[19] World Economic Forum (2012) Global Risks 2012. Available at: http://reports.weforum.org/global-risks-2012/#

[20] UN (2011) Population dynamics in the least developed countries. Available at:
https://www.unfpa.org/webdav/site/global/shared/documents/publications/2011/CP51265.pdf

21 National Transfer Accounts (2012) Lower-Income Countries and the Demographic Dividend NTA Bulletin, No. 5. Available at: http://www.ntaccounts.org/doc/repository/NTAbulletin5final.pdf

22 National Intelligence Council (2012) Global trends 2030 : Alternative Worlds. Available at: http://info.publicintelligence.net/GlobalTrends2030.pdf

23 Russian Federal State Statistics Service (2013) Available at: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/en/figures/population/

24 CIA World Factbook. Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/ja.html

25 Eurostat (2011) Demography Report 2010. Available at: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KE-ET-10-001/EN/KE-ET-10-001-EN.PDF

26 USAID (2010) Technical Brief: Youth Bulges and Conflict. Available at: http://c.ymcdn.com/sites/www.allianceforpeacebuilding.org/resource/collection/9E786610-CF07-4073-9E34-A03818697B2E/USAID_Youth_Bulges___Conflict.pdf

27 Ortiz, I. and M. Cummins, UNICEF (2012) When the Global Crisis and Youth Bulge Collide. Available at: http://www.unicef.org/socialpolicy/files/Global_Crisis_and_Youth_Bulge_-_FINAL.pdf

28 UNICEF (2012) When the Global Crisis and Youth Bulge Collide. Available at: http://www.unicef.org/socialpolicy/files/Global_Crisis_and_Youth_Bulge_-_FINAL.pdf

29 Hvistendahl, M. (2011) Young and Restless can be a Volatile Mix, published in *Science*. Available at: http://www.sciencemag.org/content/333/6042/552

30 OECD (2012) International Migration Outlook. Available at. http://www.oecdbookshop.org/oecd/display.asp?K=5K9CSF15F9XW&CID=&LANG=EN

31 Development Research Centre on Migration, Globalisation and Poverty (2008) Demographics and Climate Change: Future Trends and their Implications for Migration. Available at: www.migrationdrc.org/publications/working_papers/WP-T27.pdf

32 Eurostat (2011) Migrants in Europe. Available at : http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-31-10-539/EN/KS-31-10-539-EN.PDF

33 Waller, L et al., Centre for Population Change (2012) Working Paper : Understanding recent migrant fertility in the United Kingdom. Available at: http://cpc.geodata.soton.ac.uk/publications/2012_Understanding_recent_migrant_fertility_WP27_Waller_et_al.pdf

34 UN (2011) World Population Prospects - The 2010 Revision: Highlights. Available at: http://esa.un.org/wpp/Documentation/pdf/WPP2010_Highlights.pdf

35 Berlin Institute (2009) Environmental Degradation and Migration. Available at: www.berlin-institut.org/online-handbookdemography/environmental-migration.html, last accessed August 27, 2009

36 Foresight (2011) Migration and Global Environmental Change. Available at: http://www.bis.gov.uk/assets/foresight/docs/migration/11-1116-migration-and-global-environmental-change.pdf

37 ETH Online (2009) 'Climate Refugees' test Society and Semantics. Available at: www.isn.ethz.ch/isn/Current-Affairs/Podcasts/Detail/?&lng=en&id=98461, last accessed August 28, 2009

38 International Organization for Migration (2009) Migration, Environment and Climate Change: Assessing the Evidence. Available at: http://publications.iom.int/bookstore/free/migration_and_environment.pdf

39 The Guardian (2009) Migration: When the sea forces millions from their land, December 5th, 2009

40 International Organisation for Migration Online (2009) Migration, Climate Change and the Environment. Available at: www.iom.int/jahia/webdav/shared/shared/mainsite/policy_and_research/policy_documents/policy_brief_envmig.pdf, last accessed on August 27, 2009

41 Warner, K. (2008), EFMSV Germanwatch Session

42 The Economist (2009) Fertility and living standards: Go forth and multiply a lot less, October 29th, 2009. Available at: www.economist.com/displaystory.cfm?story_id=14743589, last accessed November 30th, 2009

[43] UN (2009) World Fertility Report 2009. Available at:
http://www.un.org/en/development/desa/population/publications/fertility/world-fertility-2009.shtml

[44] Population Council (2008) Fertility Transitions in Developing Countries: Progress or Stagnation? Available at:
http://www.popcouncil.org/pdfs/wp/pgy/007.pdf

[45] Bongaarts, John (2002) The End of the Fertility Transition in the Developing World. Available at:
http://www.un.org/esa/population/publications/completingfertility/RevisedBONGAARTSpaper.PDF

[46] The Economist (2009) Fertility and living standards: Go forth and multiply a lot less, October 29th, 2009. Available at:
www.economist.com/displaystory.cfm?story_id=14743589, last accessed November 30th, 2009

[47] Striessnig, E. and W. Lutz (2013) Can below-replacement fertility be desirable? Available at:
http://www.iiasa.ac.at/publication/more_XJ-13-072.php

[48] UN (2011) UNFPA Maternal Health Thematic Fund Annual Report 2011. Available at:
https://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/MHTFper cent202011per cent20annualper cent20reportper cent2008_2_2012.pdf

[49] UN (2010) Briefing Paper: The Right to Contraceptive Information and Services for Women and Adolescents. Available at: http://www.unfpa.org/webdav/site/global/shared/documents/publications/2011/Contraception.pdf

[50] UN (2012) World Mortality Report 2011. Available at:
http://www.un.org/en/development/desa/population/publications/pdf/mortality/worldMortalityReport2011.pdf

[51] The Economist (2009) Fertility and living standards: Go forth and multiply a lot less, October 29th, 2009. Available at:
http://www.economist.com/displaystory.cfm?story_id=14743589, last accessed November 30th, 2009

[52] Javier A. Birchenall (2007) Economic Development and Escape from High Mortality. Available at:
http://econ.ucsb.edu/~jabirche/Papers/development.pdf

[53] Eurostat (2013) Towards a 'baby recession' in Europe ? Differential fertility trends during the economic crisis. Available at: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-13-013/EN/KS-SF-13-013-EN.PDF

[54] Sobotka, T. et al. (2011) Economic Recession and Fertility in the Developed World. Available at:
http://onlinelibrary.wiley.com.libproxy.mit.edu/doi/10.1111/j.1728-4457.2011.00411.x/pdf

[55] Bremner, J., J. Davis, D.L. Carr. (2012). Population Growth, Ecology, and Poverty. In *Integrating Ecology and Poverty Reduction*. J. C. Ingram, F. DeClerck and C. Rumbaitis del Rio eds. Available at:
http://www.geog.ucsb.edu/~carr/DCarr_Publications/bremner_davis_carr_pop_ecology_poverty_springer2012.pdf

[56] UNFPA (2012) Impacts of Population Dynamics, Reproductive Health and Gender on Poverty. Available at:
http://www.unfpa.org/webdav/site/global/shared/documents/publications/2012/UNFPA-Impactsper cent20onper cent20Poverty-1.pdf

[57] Institute for Security Studies European Union (2012) Global Trends 2030 – Citizens in an interconnected and polycentric world. Available at: http://www.iss.europa.eu/publications/detail/article/espas-report-global-trends-2030-citizens-in-an-interconnected-and-polycentric-world/

[58] Alkema et al. (2013) National, regional, and global rates and trends in contraceptive prevalence and unmet need for family planning between 1990 and 2015: a systematic and comprehensive analysis. Available at:
http://www.thelancet.com/journals/lancet/article/PIIS0140-6736per cent2812per cent2962204-1/abstract

[59] Goujon, Anne, et al. (2007) New times, old beliefs: Investigating the future of religions in Austria and Switzerland. Joint Eurostat/UNECE Work Session on Demographic Projections (2007): 347-60. Available at:
http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-RA-07-021/EN/KS-RA-07-021-EN.PDF

[60] Basten, S. et al. (2013) Very long range global population scenarios to 2300 and the implications of sustained low fertility, published in *Demographic Research*. Available at: http://www.demographic-research.org/Volumes/Vol28/39/

[61] WHO (2010) World Health Report 2010. Available at : http://www.who.int/whr/2010/en/index.html

[62] OECD (2012) Environmental Outlook to 2050. Available at: http://www.oecd-ilibrary.org/environment/oecd-environmental-outlook-to-2050/socio-economic-developments_env_outlook-2012-5-en

[63] IIASA (2011/2012) Options: Human Wellbeing and Sustainable Development. Available at:
http://www.iiasa.ac.at/web/home/resources/publications/IIASAMagazineOptions/index1.html

64 World Bank (2012) What a Waste: Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/07/25/000333037_20120725004131/Rendered/PDF/681350WP0REVIS0at0a0Waste20120Final.pdf

65 ARCADIS (2011) Analysis of the evolution of waste reduction and the scope of waste prevention. Study commissioned by the European Commission, DG Environment. Available at: http://ec.europa.eu/environment/waste/prevention/pdf/report_waste.pdf

66 UN World Water Development Report (2009) Water in a changing world, Chapter 2 : Demographic, economic and social drivers : http://unesdoc.unesco.org/images/0018/001819/181993e.pdf#page=54

67 Source: Krausmann et al. (2009). Growth in global materials use, GDP and population during the 20th century. Ecological Economics, 68, 2696-2705. Available at: http://www.uni-klu.ac.at/socec/downloads/2009_KrausmannGingrichEisenmenger_Growth_in_global_materials_use_EE68_8.pdf

68 World Economic Forum (2012) The missing link in sustainable development: a call to integrate population in the water, food, energy nexus. Available at: http://www3.weforum.org/docs/WEF_GAC_MissingLinkSustainableDevelopment_GlobalAgenda_Overview_2012.pdf

69 UNEP (2011) Decoupling Natural Resource Use and Environmental Impacts from Economic Growth. Available at: http://www.unep.org/resourcepanel/decoupling/files/pdf/decoupling_report_english.pdf

70 Power, Kate and Oksana Mont (2010) The Role of Formal and Informal Forces in Shaping Consumption and Implications for Sustainable Society: Part II. Published in *Sustainability*. Available at: https://www.mdpi.com/2071-1050/2/8/2573/pdf

71 World Economic Forum (2013) Global Risks Report. Available at: http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf

72 World Economic Forum (2012) The missing link in sustainable development: a call to integrate population in the water, food, energy nexus. Available at: http://www3.weforum.org/docs/WEF_GAC_MissingLinkSustainableDevelopment_GlobalAgenda_Overview_2012.pdf

73 German Advisory Council on Global Change (2011) World on Transition: A Social Contract for Sustainability, accessible at http://www.wbgu.de/fileadmin/templates/dateien/veroeffentlichungen/hauptgutachten/jg2011/wbgu_jg2011_en.pdf

74 Wolfgang Lutz and KC, Samir (2010) Dimensions of global population projections: what do we know about future population trends and structures? Available at: http://rstb.royalsocietypublishing.org/content/365/1554/2779.full.pdf+html