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Household Projections for Rural and Urban Areas of Major Regions of the World

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Contents

Abstract

Demographic dynamics are important drivers of environmental change, including effects on climate through energy and land use that lead to emissions of greenhouse gases. These dynamics include changes to population size, age structure, and urbanization, as well as changes in household living arrangements. Population and household projections are therefore essential for investigating potential future demographic effects, but no long-term, global projections exist that simultaneously describe consistent outcomes for population, urbanization, and households. We therefore develop a new set of population/household projections for nine world regions. The projections are based partly on existing population and urbanization projections, partly on new multi-state projections for China and India, and on a new household projection using age-, size-, and urban/rural-specific headship rates. We discuss principle results that foresee future aging, urbanization, and trends toward smaller household sizes.

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Leiwen Jiang
Brian C. O'Neill

1. Introduction

Projections of future changes in population size, composition and distribution are crucial for understanding how demographic dynamics, interacting with other factors such as economic growth and technological changes, affect the environment, including the global climate system. An increasing number of studies suggest that in addition to changes in population size, changes in population age structure and rural-urban distribution are key demographic trends that should be taken into account while studying future greenhouse gas (GHG) emissions and climate changes (Dalton et al., 2008; Dalton et al., 2007; Prskawetz et al., 2004; O'Neill and Chen, 2002). Other studies also stress the importance of using the household, rather than the individual, as the demographic unit of analysis in emissions and climate change research (e.g. MacKeller et al., 1995; Jiang, 1999; Liu et al., 2003), given that the household is often the unit of consumption of energy and other goods and services, and even a unit of production in many traditional societies.

Consistent population and household projections with sufficiently detailed information on future changes in age and rural-urban population structures are not only useful to the population-environment field in general, they are essential for our continuing work on developing global emissions scenarios using the Population-Environment-Technology (PET) model (Dalton et al., 2008). Although a number of institutions, including the United Nations Population Division (UNPD), the International Institute for Applied System Analysis (IIASA), and the US Bureau of Census make population projections for countries or major regions of the world, there are currently no global projections available of self-consistent changes in population and households by rural and urban areas. We therefore produce a new set of global household projections, based in part on existing population projections, at the level of nine world regions in order to match our emissions modeling needs: China (CHN), India (IND), Latin America and Carribean (LAC), Sub-Saharan Africa (SSA), other developing countries (ODC), the US (USA), the European Union (EU 27+), transitional countries (TC), and other industrialized countries (OIC).

The next section describes the methods we use for population and household projections. Section 3 describes the data sources we use, and section 4 presents and discusses projection results.

2. Methodology Description

We produce three population/household projections in this analysis: a high, medium, and low scenario. Producing these projections involves two major steps: (1) a population/urbanization projection, and (2) a household projection based on the results of the population/urbanization projection in the first step. In this section, methods involved in the two steps are described separately.

2.1 Population and urbanization projections

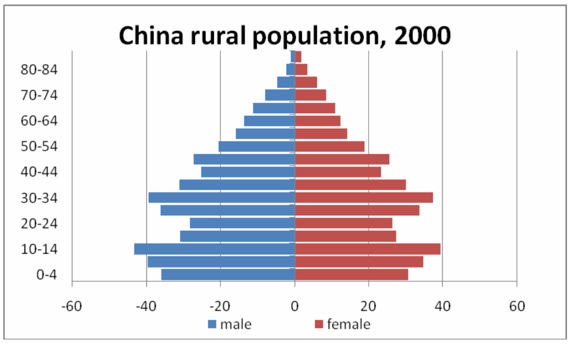
For the population/urbanization projection, we draw mainly on the 2003 United Nations Long-term Population Projection (United Nations Population Division, 2004) and an extrapolation of UN urbanization projections carried out at IIASA (Gruebler et al., 2007). We use the UN 2003 long-term population projection for two reasons. First, it is the most recent population projection that contains information for every country of the world and also projects population at least until 2100. Second, the medium population scenario of an earlier version of the UN long-term population projection is used in the IPCC SRES B2 scenario, which we are also using in a forthcoming emissions scenario analysis. Similarly, we rely on an extension of a UN urbanization projection because it is the only credible source for prospective urbanization levels of all countries of the world, from which we derive urbanization levels for the regions in our projection. Moreover, the UN urbanization projection is the outlook for urbanization which is most consistent with its long-term population projection.

We use two approaches in the population/urbanization projections depending on the region, according to the degrees of urban-rural disparities and data availability in the regions.

First, for all regions except China and India, we derive the population size by age and sex for the period 2000-2100 from the UN 2003 Long-Term Population Projection, by summing up the projected population sizes of all countries in each region. We then use the projected urbanization levels of each country for the B2 scenario developed by the Greenhouse Gas Initiative (GGI) at the International Institute for Applied Systems Analysis (IIASA; Gruebler et al., 2007). The IIASA projection draws on the detailed UN country level urbanization data for the period 1950 to 1990 and the UN projection to the year 2030 contained in the 2001 UN Urbanization Prospects (United Nations Population Division, 2002). To extrapolate urbanization rates, a simple logistic curve is fit to the combined historical data and UN projection, and used to determine alternative trends beyond 2030. The projection assumes that countries in which the urbanization level is currently low (<60%) will approach 80% urban in the long term. For countries where current urbanization rates are already higher than 80%, they assume an asymptote for the logistic curve that is 10% above current level.

Based on the IIASA projected urbanization rates and the UN 2003 Long-term Population Projection results, we calculate the population size of the rural and urban areas of each country for the period 2000-2100. Summing up the rural and urban population of all countries in a region, we derive regional rural and urban population size, from which we calculate the projected urbanization levels of each region. The derived regional urbanization scenario is applied to the high, medium and low population projections.

As the urbanization projection by IIASA and the UN does not have information on the age structure of the rural and urban populations, we assume the same age structure for the rural and urban areas in the region. This approach is reasonable for developed country regions that are highly urbanized and where rural-urban differences in age structure are relatively small. However, in developing regions population age and sex compositions are rather different between rural and urban areas, because of different fertility and mortality paradigms and age selectivity in rural-urban migration. For instance, the population age structures in rural and urban China are quite different according to the China 2000 Census (Figure 1). Because a large number of young adults migrated from rural to urban areas, there is a large proportion of the urban population aged between 20 and 30, while rural areas have a larger share of population age below 15 due to its relatively high fertility rate. Assuming age structures are identical therefore introduces significant bias in these regions over the next few decades before they become predominantly urban. In order to at least partially address this shortcoming, we use a second approach – multistate population projections – to simultaneously project rural and urban populations for India and China, the two largest countries in our developing country regions and jointly accounting for about 50% of the population of the developing world.



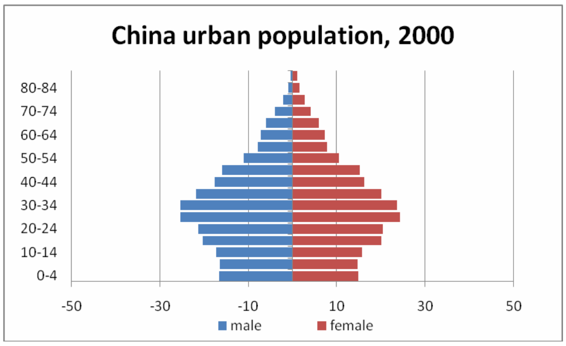


Figure 1. Population age structure in China rural and urban areas (millions)

2.2 Multistate projections for China, India

The basic formula of the multistate population projection model (Rogers, 1984) is as follows

$$\begin{bmatrix} U_{t+5} \\ R_{t+5} \end{bmatrix} = \begin{bmatrix} 1+n_u-m_{u,r} & m_{r,u} \\ m_{u,r} & 1+n_r-m_{r,u} \end{bmatrix} \begin{bmatrix} U_t \\ R_t \end{bmatrix}$$

where U_{t+5} and R_{t+5} are respectively the urban and rural population at year $t+5$, n_u and n_r are the natural population growth rate in urban and rural areas respectively, $m_{u,r}$ is the migration rate from urban to rural, and $m_{r,u}$ is the migration rate from rural to urban. Therefore,

$$U_{t+5} = U_t + U_t \times n_u - U_t \times m_{u,r} + R_t \times m_{r,u}$$

$$R_{t+5} = R_t + R_t \times n_r - R_t \times m_{r,u} + U_t \times m_{u,r}$$

Extending the formulas above to account for changes in age and sex-specific rural and urban populations, we derive an equation for projecting rural population aged 5 and above at time *t+5* as follows

$$P^{t+5}_{x+5,s,r} = (P^t_{x,s,r} + P^t_{x,s,r} \times m_{x,s,u-r} \times 5 - P^t_{x,s,u} \times m_{x,s,r-u} \times 5) \times S_{x,s,r}$$

where $P^{t+5}_{x+5,s,r}$ is the population aged *x+5*, with sex *s*, in *r* (rural area), at time *t+5*, $m_{x,s,u-r}$ is the urban to rural migration rate of age *x* and sex *s*, $S_{x,s,r}$ is the survival rate for rural population of age *x* and sex *s*. We here assume migrants who move into a rural area follow the same survival rate of the rural population of the same age and sex.

Similarly, we can derive the formula for projecting urban population of age 5 and above at time *t+5*:

$$P^{t+5}_{x+5,s,u} = (P^t_{x,s,u} + P^t_{x,s,u} \times m_{x,s,r-u} \times 5 - P^t_{x,s,r} \times m_{x,s,u-r} \times 5) \times S_{x,s,u}$$

For the youngest age group in the rural area, the formula is expressed as

$$P^{t+5}_{0-4,s,r} = (\sum_{i=15}^{49}(P^t_{i,f,r} \times ASFR_{i,r} + P^t_{i,f,r} \times S_{i,f,r} \times ASFR_{i+5,r}) \div 2 \times 5$$
$$+ P^t_{0-4,s,r} \times 2.5 \times m_{0,s,u-r} - P^t_{0-4,s,u} \times 2.5 \times m_{0,s,r-u}) \times S_{0,s,r}$$

where $ASFR_{i,r}$ is the age specific fertility rate of rural women, $P^t_{i,f,r}$ is the rural female population of age *i* at time *t*. We assume half of the births by $P^t_{i,f,r}$ happen when women are aged *i* with fertility rate of age *i*, half happen to those survived to age *i+5* with fertility rate of age *i+5*. We assume that children moved from rural to urban areas will follow the survival rate of their urban counterparts of the same age and sex. We also assume migrants moving into the rural (or urban) areas have the same fertility rate as the non-migrants in the rural (or urban) areas. Making such assumptions is motivated mainly by lack of information, and implies only relatively small errors.

To be consistent with other regions, in the multi-state population/urbanization projection for China and India we use the same scenarios for the national average total fertility rate (TFR) and life expectancy for China and India from the UN 2003 Long-term Population Projection. We also ensure that future urbanization levels of China and India are the same as those in the UN/IIASA urbanization scenarios by adjusting the overall migration rates over time so that the same urbanization levels are produced.

2.3 Household projections

We use a household headship rate method to make household projections. A conventional headship rate method uses headship rates distinguished by age and/or sex of the heads. Our projections go beyond this approach by employing headship rates that are distinguished by household size, age and rural-urban residence.

The age-size-rural/urban household headship rate model is expressed as follows

$$H_t = \sum_a \sum_s \sum_r P_{(a,s,r,t)} \times h_{(a,s,r,t_0)}$$

where H_t is the number of households at year *t*, $P_{(a,s,r,t)}$ is the population by age *a*, household size *s* and rural/urban resident *r* at year *t*, and $h_{(a,s,r,t_0)}$ is the headship rate in the base year.

The headship rate is derived from the number of household heads by age *a*, household size *s* and rural/urban resident $r, H_{(a,s,r,t)}$, over the population of corresponding age and rural/urban residence denoted as $P_{(a,r,t)}$. The basic relation is

$$h_{(a,s,r,t)} = \frac{H_{(a,s,r,t)}}{P_{(a,r,t)}}$$

Since changes in future household headship rates are unavailable, we assume the headship rates of the base year remain constant for the whole projection period for most of the regions, except the US and China. Using constant headship rates is a common practice in household projections that use headship rate methods, which have the advantage of being relatively simple, having only moderate data requirements and being applicable in most settings. Our approach captures changes in the composition of the population by household type due to changes in population age structure and urbanization levels, and, combined with the additional specification of headship rates by household size, this represents a significant improvement over conventional household projections using only age- and/or sex-specific headship rates. However, the constant headship rate assumption implies that there are no changes in household formation behavior within each population group (e.g. by age and rural-urban division). These behaviors include household formation and dissolution due to demographic events, such as fertility, mortality, marriage, co-residence with parents by adult child, and co-residence with adult child by elderly parents. Such changes may generate important impacts on the living arrangements of future population, particularly in societies experiencing rapid social and demographic changes. A dynamic household projection model, which takes into account the effects of important demographic events on household formation and dissolution and accordingly on headship rates, is more appropriate. However, dynamic household models require data that is often not available in conventional data sources and particularly difficult to carry out in most regions/countries where data is difficult to get. Therefore, in our household projection, we assume constant headship rates for all regions except China and the US.

For the US and China, we take advantage of existing detailed, long-term household projections that capture behavioral changes that have recently been carried out using a macro-dynamic household projection model ProFamy (Jiang and O'Neill, 2007; Zeng, Wang, Jiang and Gu, 2008). We use the age-size-rural/urban headship rates for future decades derived from these projections (although in the US case there are no rural/urban distinctions). The future household headship rates resulting from the ProFamy projection take into account the occurrences of many demographic events, such as fertility, mortality, migration, marriage, divorce, remarriage, (child) leaving the parental home, (elderly) co-residing with adult children, and their impacts on household formation and dissolution. They thus offer an improvement over the static headship rate assumption.

Based on the projected number of households by size and age in the rural and urban areas, we obtain the number of people living in different types of households.

$$p_{a,s,r}^{t} = h_{a,s,r}^{t} \times s$$

where $p_{a,s,r}^{t}$ is the number of people living in household of size *s*, with a head of age *a*, in *r* (rural/urban) area, and in year *t*.

All headship rate projections must employ an adjustment to ensure consistency of the rural and urban population size in the population projection and the rural and urban population size implied by the household projection. We make this adjustment by applying a ratio *c* to adjust up/down the population of all types of household so that the rural and urban population size from the two projections is consistent:

$$P_{r}^{t} = \sum_{a}\sum_{s} p_{a,s,r}^{t} = \sum_{a}\sum_{s} h_{a,s,r}^{t} \times s \times c$$

3. Data Sources

3.1 Baseline population

The data for the baseline population (by age, sex, and rural/urban residence) for the multistate population/urbanization projection of China and India is derived from China 2000 Census and India 2001 Census respectively.

We adopt the Whiple Index method and other demographic techniques to solve the problem of serious age-heaping in India 2001 Census data. From the Indian 2001 Census Report, we derive age-specific fertility rates of women in both rural and urban areas, and construct life tables of rural and urban populations by sex. The information on the number of rural-urban migrants in the Indian 2001 Census Report is limited: it has only the numbers of migrants across very coarse age categories. Therefore, we adopt Andrei Rogers (1981) Regional Migration Model Schedule approaches, combined with the data available in the 2001 India Census on rural-urban migrants over the five-year period of 1996 to 2001, and derive improved age- and sex-specific rural/urban migration rates.

The fertility rates directly derived from the China 2000 Census are extremely low and believed to be subject to underreporting of births. Therefore, age-specific fertility rates for the rural and urban areas are estimated based on the 1997 and 2001 National Sampling Survey on Reproductive Health. The age-sex-rural/urban-specific death rates and rural/urban migration rates are derived from the China 2000 Census data.

3.2 Age-size-rural/urban-specific headship rates

To make household projections, we need age-size-rural/urban-specific headship rates which are not available in the conventional reports of censuses or surveys. We calculate the headship rates from a series of micro-level data from censuses or household surveys from many countries. The data sources for deriving household headship rates for all the regions are included in Table 1. To calculate the rates for the Latin America region from the Brazilian and Mexican data, the rates calculated from each country are weighted according to their population size. Data for age-size-rural/urban-specific headship rates are not available for the Sub-Saharan Africa region.

Table 1. Data sources for deriving household headship rates

Region	*Representative country*	*Data source*
USA	USA	Base year from 5% sample of Public Use Microdata Sample from the 2000 Census, future years from dynamic household projections using ProFamy model
EU 27+	EU 25	2005 EU-SILC (Community Statistics on Income and Living Conditions) Survey
transitional countries (TC)	Russia	Microdata of 2003 Russian Household Budget Survey
other industrialized countries (OIC)	Japan	Japan 2000 Census
China (CHN)	China	Base year from China 2000 Census 1% sample of long form micro-level data; future years from dynamic household projections using ProFamy model
India (IND)	India	India 2001 National Household Survey
Latin America and Carribean (LAC)	Mexico and Brazil	The 2005 Mexican National Survey of Household Income and Expenditure (ENIGH) and the 2002-2003 Brazilian Consumer Expenditure Survey
other developing countries (ODC)	Indonesia	The 2002 Indonesian National Socioeconomic Survey
Sub-Saharan Africa (SSA)	-	not available

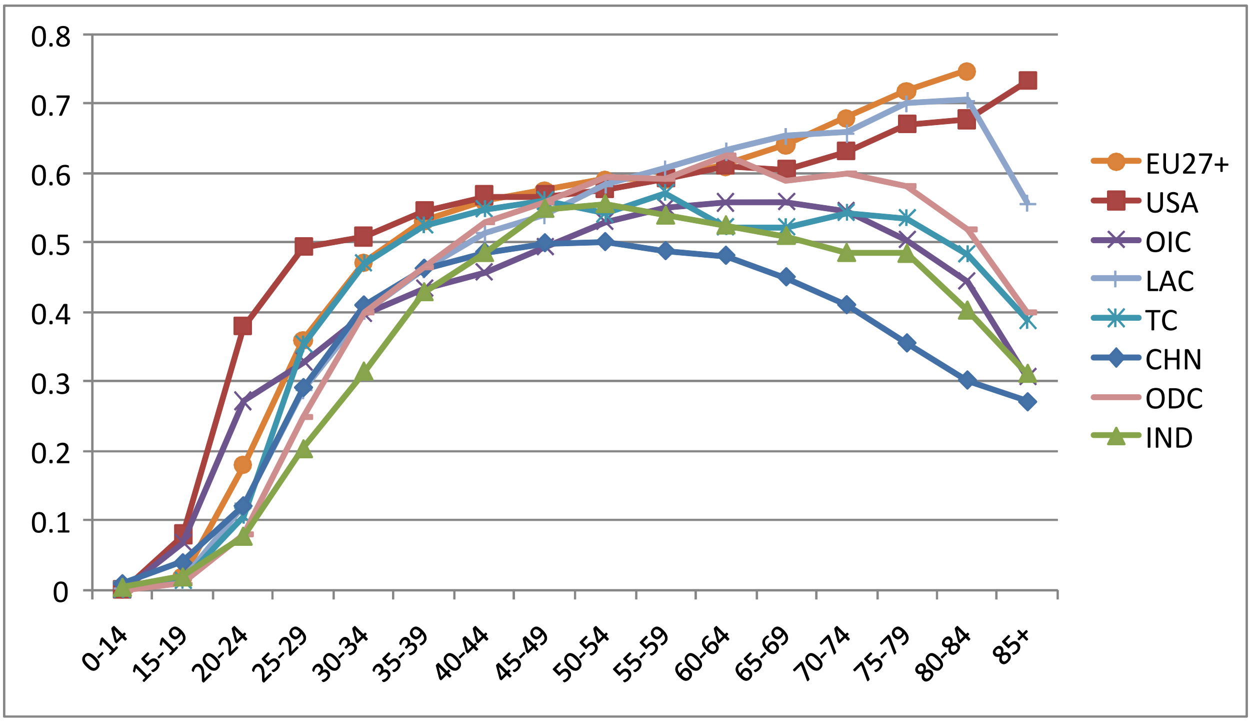
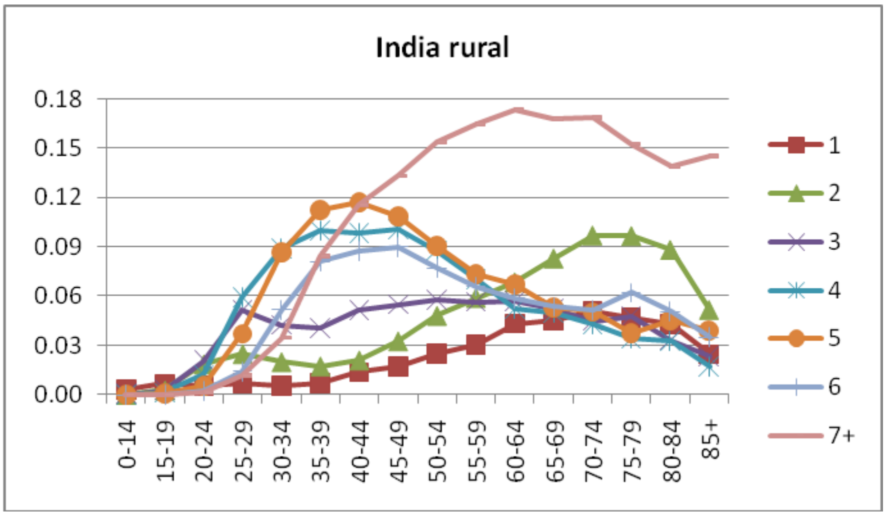


Figure 2. Overall age-specific household headship rates by regions

The overall headship rates (the total number of household heads to the total population) are 0.42 for EU27+, 0.40 for the US, 0.37 for other industrialized countries, and 0.35 for transitional countries, which are significantly higher than those in India (0.21), other developing countries region (0.25), Latin America (0.26) and China (0.28). The age-specific headship rates, displayed in Figure 2, are generally higher in the industrialized regions than in the developing world. The headship rate increases from early adulthood in all regions, and continues to go up in old age groups in the US and EU27+ regions. In other regions, rates peak at middle age (in India, China and the TC regions) or early old age (in the ODC and OIC regions) before declining. The headship rates of the US and OIC region increase very quickly in early adulthood, in contrast to the much lower rates in India and the ODC region. This reflects the different patterns of household formation in developed and developing regions. In the industrialized countries like the US and EU27+, young people leave the parental home and form their own households earlier for the purposes of education or being independent, while their counterparts in developing countries continue to live with parents for a much longer period of time even after marriage. Moreover, people in developing countries are more likely to live with adult children and transfer the headship title to the younger generation or move to live with adult children when they reach old age. In contrast, the phenomena of co-residence with and transition of head title to adult children by the elderly is far less common in industrialized countries, such as the US and EU27+ regions. It is interesting to note that the headship rate in Latin America is rather unique. It is generally low, particularly low in the young age group. However, it continues to increase until the oldest old group. This may hint at the very common living arrangement in this region that young adults live with parents who keep heading the households.


India rural
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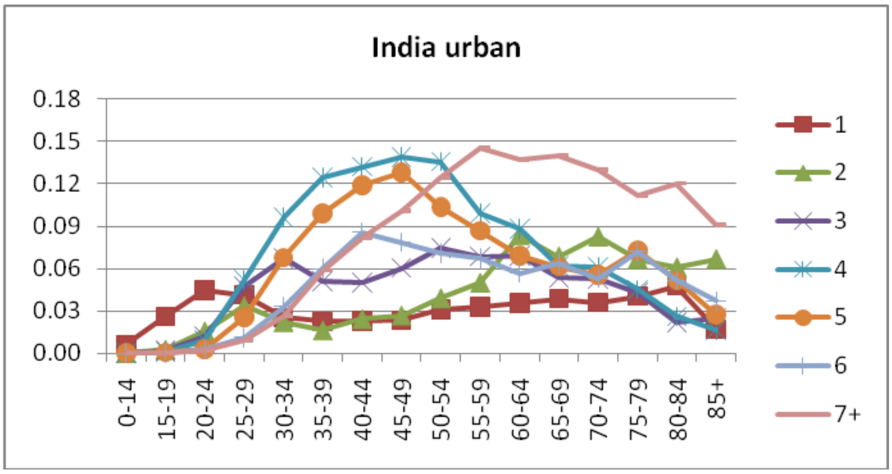
India urban
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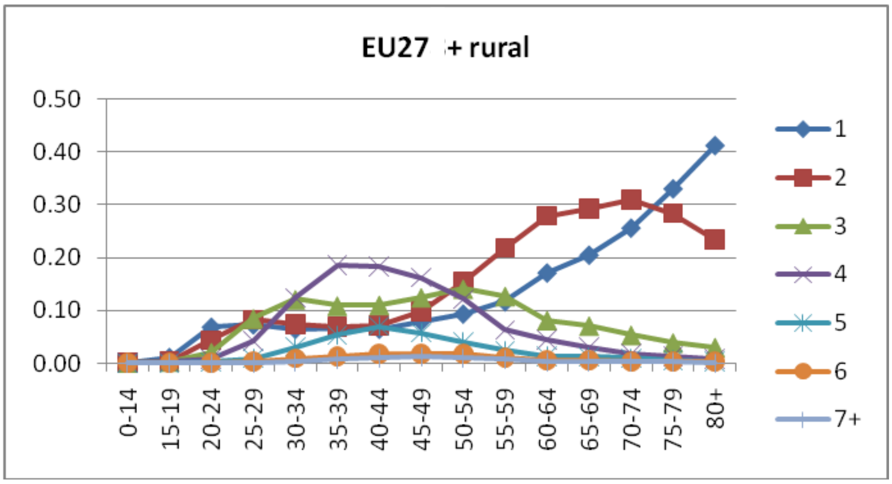
7+


EU27 + rural
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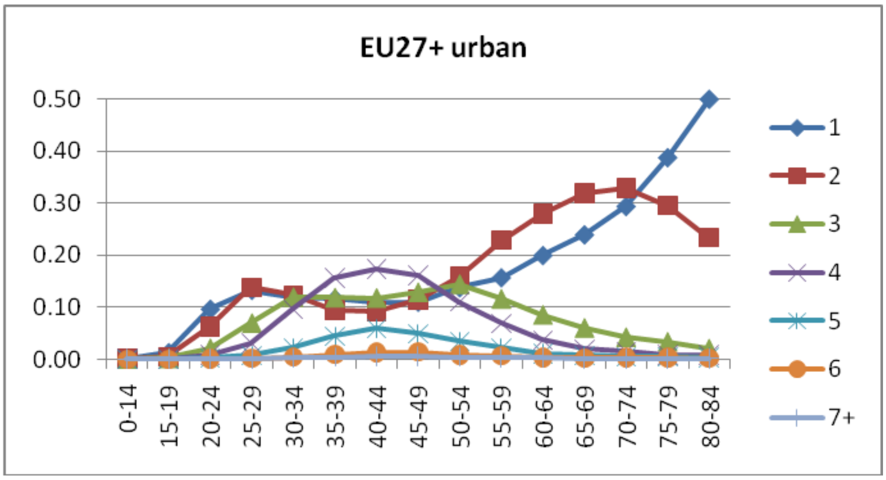
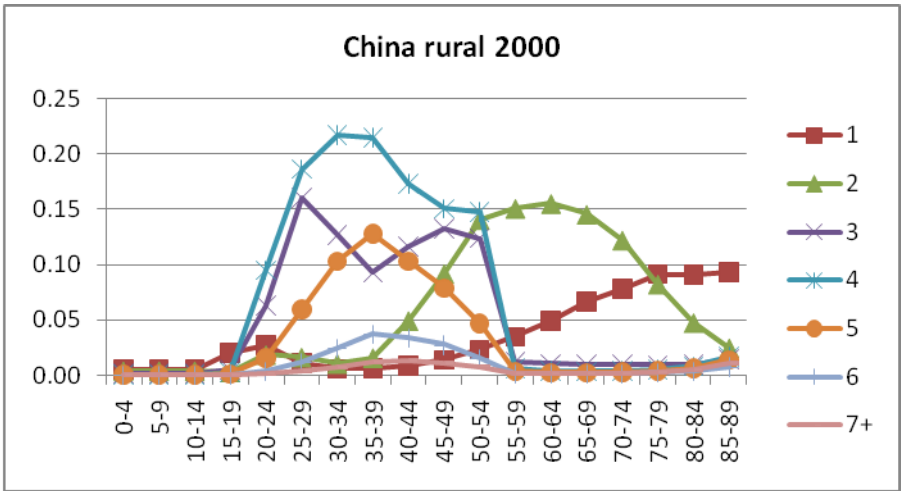


Figure 3. Age-size-specific headship rates for the rural and urban populations of India and EU27+

To more carefully examine the headship rates across households by size, Figure 3 shows the age-size-specific headship rates of the rural and urban areas of India and the EU27+ region which have the lowest and highest overall headship rates respectively. It indicates a much higher headship rate of smaller size (less than 5 persons) households but significantly lower rates of larger size households in the EU27+ region than in India. The headship rates of the largest households (7+ persons) are especially high in rural India, while the headship rates of the smallest size households are much higher among young adults in urban areas than in rural areas. In the EU27+ region, the relationship between urban and rural headship rates for small households is similar but less pronounced.



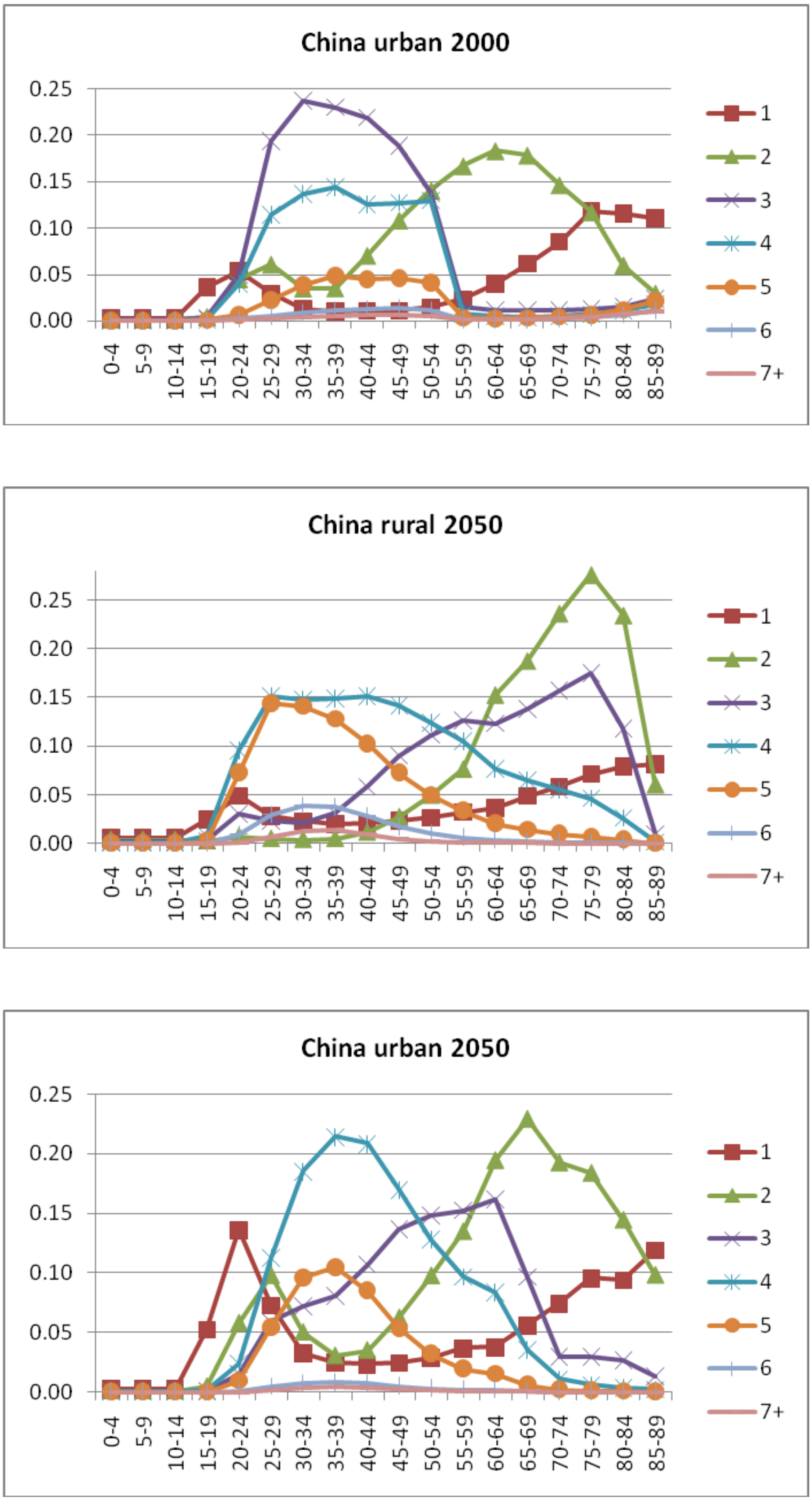


Figure 4. Changes in headship rates for rural and urban China

Figure 4 demonstrates how age-size-specific headship rates may change over time, using China as an example. The impacts of major demographic events are reflected in the evolution of the headship rates. In the baseline year, the middle age rural population has a higher chance to head a 4-person household, while their urban counterparts have higher headship rates for 3-person household. This pattern is due to the stricter implementation of the one child policy in the urban areas, while rural couples have a greater chance to have a second birth.

By 2050, however, the headship rates of 4- and 5-person households for the middle age population will increase significantly in the urban areas, and headship rates of 5-person households will also increase in the rural areas. This is mainly due to the assumed increasing fertility rate in the underlying projection. According to the medium scenarios of the UN Long-term population projection, TFR will increase from a recent level of 1.65 to 1.85 by year 2035, and to 2.1 by the end of the century. The headship rate of 3-person household will remain high and the curve moves to the right due to aging of couples of the large cohort who have only one child. One-person headship rates increase in early adulthood particularly in the urban areas, but remain stable among the elderly. Two-person headship rates increase considerably. This is because the large portion of the population that are only-children leave the parental home, resulting in a large number of empty-nests. Even though older parents traditionally intend to stay with one of their married children, there are not enough children for them to stay with. The increase of 2-person household headship rates may also be due to the increase in life expectancy, as increasing numbers of old couples are able to share longer life spans.

The same set of age-, size- and rural-urban-specific household headship rates of each region is applied to the high, medium and low population scenario for projecting future household changes.

4. Projection Results

4.1 Population size

Table 2 shows the main projection results. It indicates that, under the medium scenario, the world population will increase from about 6.1 billion in 2000 to 8.9 billion in 2050, peak in around 2075 and then drop to about 9 billion by the end of the century (consistent with the UN Long-Term projection). However, changes in total population size vary substantially under different scenarios: by the end of the century, it could be as high as 14 billion under the high scenario, or decline to 5.5 billion under the low scenario, mainly driven by the different assumptions on fertility levels.

Moreover, there will be tremendous regional variation in future population growth. Under the medium scenario, all developed regions, except the US, will experience population decline, while all developing regions, except China in the latter half of the century, will experience significant population growth. In particular, the population size of the Sub-Saharan region will more than triple.

As a result, the majority of the global difference between scenarios is from the developing world. In addition, the three most populous countries, China, India and the US, account for about 40% of the total differences.

4.2 Urbanization

Table 2 also displays the assumed changes in urbanization (indicated by the proportion of urban population to the total population) over the century. It demonstrates that slightly more than half of the world population was still living in the rural area in the beginning of the century. However, in the middle of the century, two-thirds of the world population will reside in the urban areas. This proportion will continue to increase and reach three-quarters by the end of the century. Although the population of developed regions will continue to urbanize, the process of urbanization will be much more significant in the developing regions (Figure 5). The proportion of urban population in most of the developing regions (except India and Latin America) will increase from 25-35% in the 1990s to 70-80% by the end of century. Urbanization in India is relatively slow - it reaches only around 60% by 2100. Latin America as one of the developing regions is already highly urbanized in the base year, and its urbanization level will increase from about 70% in 1990 to above 90% in 2100, which resembles the patterns of most developed countries. The proportion of urban population in the transitional countries is unique. It was higher than most developing regions (except Latin America) in the base year, but declined in the 1990s. The reduction of the urbanization level in the transitional countries region reflects the enormous demographic changes after the dramatic change in the political system in the early 1990s in this region, when population (particularly urban population) declined in many countries, resulting in considerable reduction in population size and urbanization levels. The proportion of urban population in the transitional countries will increase from 2000, and reach 80% by 2100, which is close to the level of most developing regions.

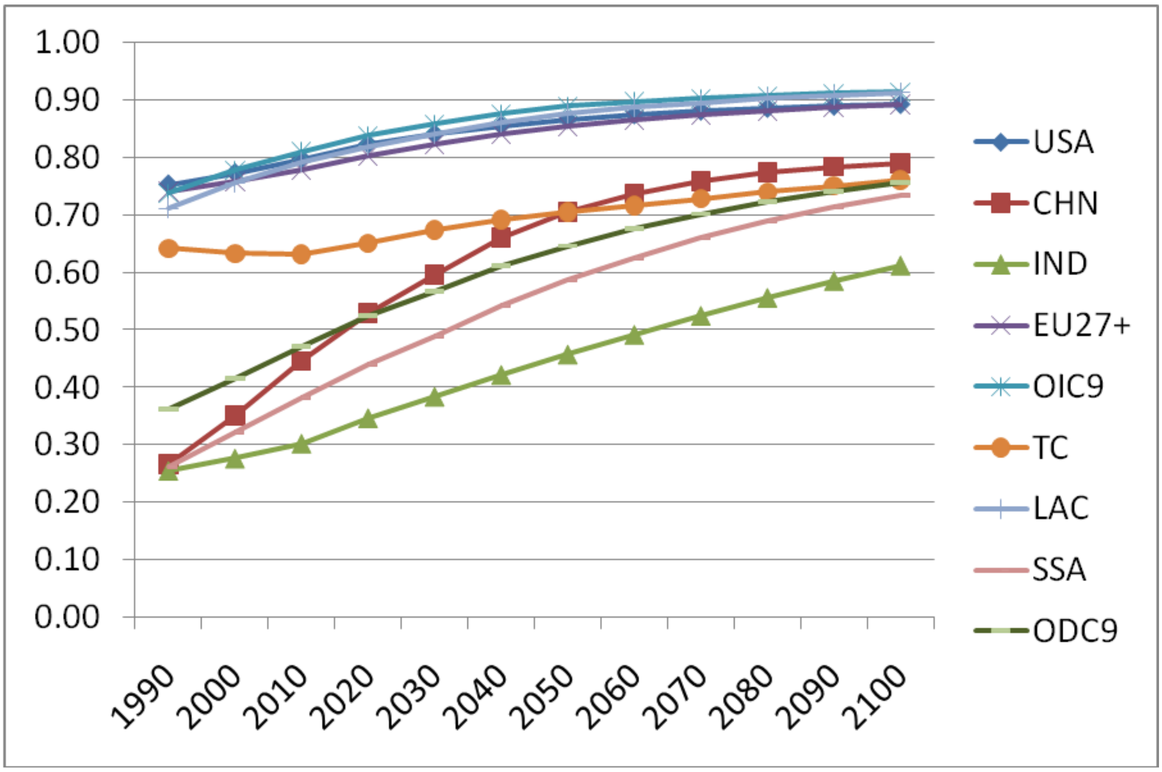


Figure 5. Changes in proportion of urban population by regions

4.3 Household size

The household projection results suggest an important demographic trend – declining average household size. Figure 6 shows that under the medium population projection, while the average household size will become smaller in all regions, the reduction will be much more significant in the developing regions. This is mainly due to the fact that the average household sizes are still much higher in developing countries, while they have already declined below 3 persons in all the developed regions. The reduction in average household size in some developing regions, such as India and China, is mostly due to the declining proportions of the very large households (with 5 or more members), while the proportion of their 1- or 2-person households remain quite stable. In contrast, reduction of average household size in the developed regions (e.g. EU27+) involves a continuous increase of the share of 1- or 2-person households. It should be noted that the changes in household size reported here are very likely an underestimate since we assume constant headship rates for most of the regions, which does not take into account household formation behavioral change. For instance, one would expect that as fertility rates continue to decline, the possibility for Indian people to head households with 7 or more members will not be the same in the future as it is in the base year. For the same reason, the average household size under the low population scenario is smaller than under the medium population scenario, while the average household size is relatively larger under the high population scenario.

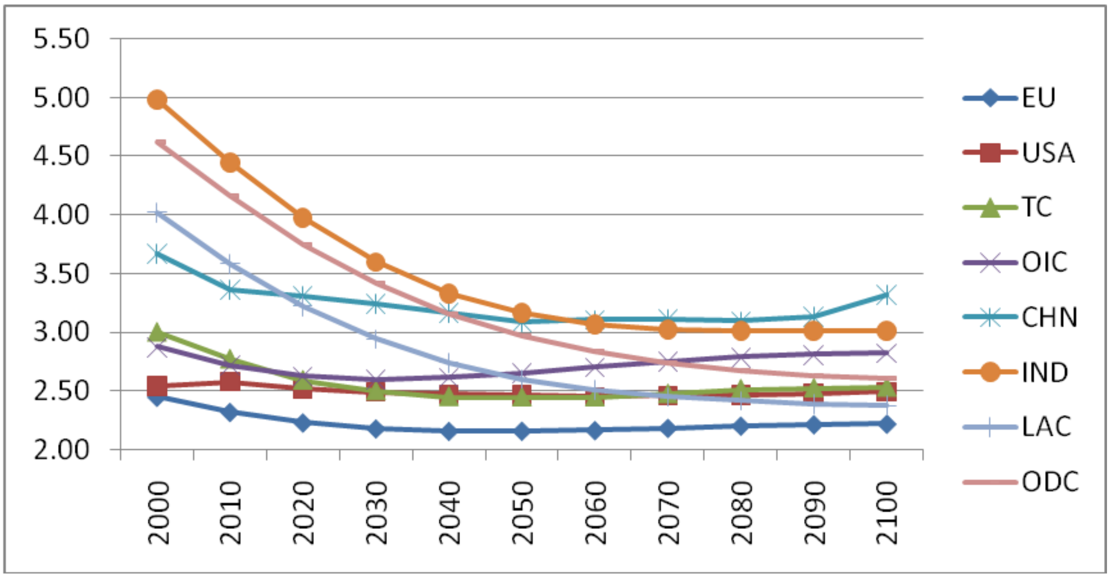


Figure 6. Changes in average household size under the medium population scenario

4.4 Population by household characteristics

As shown in Figure 7, the proportion of population living in small (1- to 3-person) households was already higher than 45% in all the developed regions in 2000. Under the medium scenario, this proportion will continue to increase in all the developed regions, and exceed 50% by the end of the century. In particular, it will increase to more than 60% in the Transitional Countries and the US. However, the increase of population living in small households is not consistent in the developing regions, except the Latin America region. For example, the proportion of Chinese population living in small households will increase in the period of 2000 to 2030, but drop back afterwards. One of the important reasons is that the TFR in China is assumed to increase in the next decades. This proportion will not change much in India because the major shift in household size composition is the size of the population living in households of size 6 and above moving to households of size 4 or 5, while the proportion of population living in 1- to 3-person household remains rather stable.

Under other (high and low) population scenarios, changes in the proportion of population living in small households generally follow the same direction mentioned above, although the proportion is lower under the high scenario and higher in the low scenario. However, it should be pointed out that these differences are much more significant for China and the US. This is mainly because the household projections for China and the US are based on the headship rates derived from the dynamic household projection model ProFamy, which change over time due to a range of demographic events. This also demonstrates that accounting for the possible changes in headship rates due to future changes in the behavior of household formation and dissolution may produce larger differences in household composition across different scenarios.

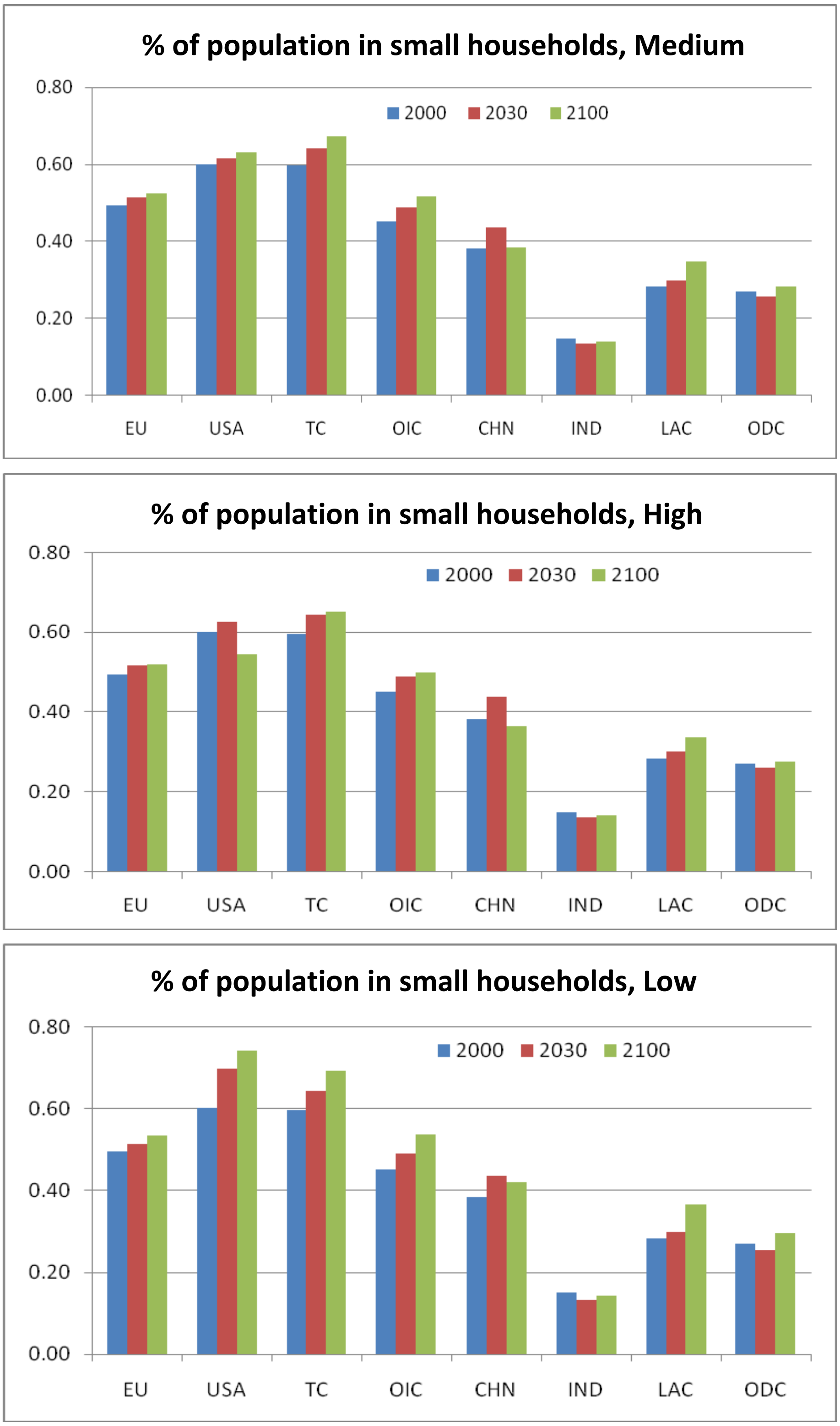
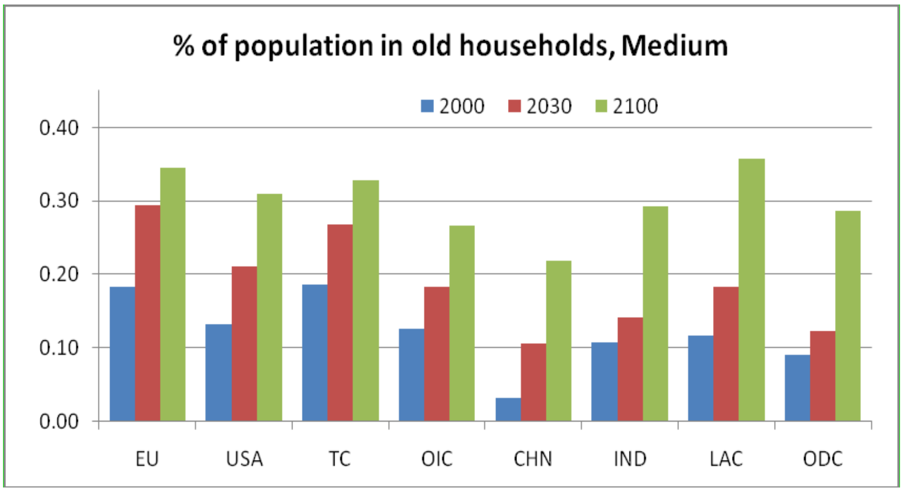
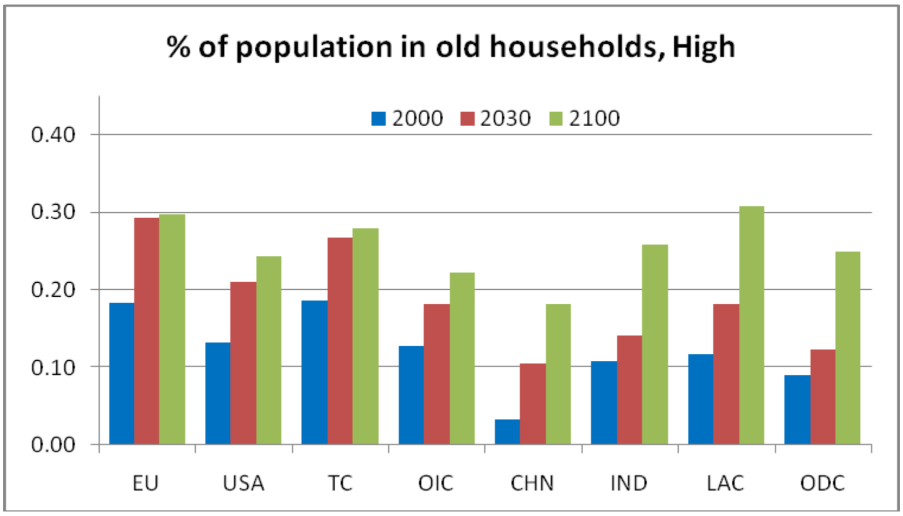


Figure 7. Changes in the proportion of population living in small (1, 2 and 3 person) household

Another important change in living arrangement is that an increasing proportion of the population will be living in the households headed by the elderly (aged 65 and above), largely as a consequence of population aging (Figure 8). While all regions of the world will experience this change, the increase is more significant in the developing world in the latter half of the century. In fact, Latin America becomes the region with the highest proportion (36% by 2100) of population living in old households. This result is driven by two factors: (1) the aging process will be accelerated later in many developing countries, compared to developed countries which have already entered aging society; and (2) given the assumption of constant headship rates, at the end of the century there is still be a large proportion of extended families in the developing countries, where the elderly generation lives with children and/or grandchildren while remaining as household head. This is particularly the case in Latin America. In contrast, in China the proportion of population living in households headed by the elderly is relatively low in the base year as well as in the future decades, even though China will experience a dramatic aging process in the next decades. This is due to the current practice of the Chinese older generation transferring headship to adult children while living in extended families. Under other (high and low) population scenarios, the increase of population living in old households persists given the overall pattern of population aging under all scenarios. However, the increase under the high population scenario is relatively small, but significantly larger under the low population scenario.





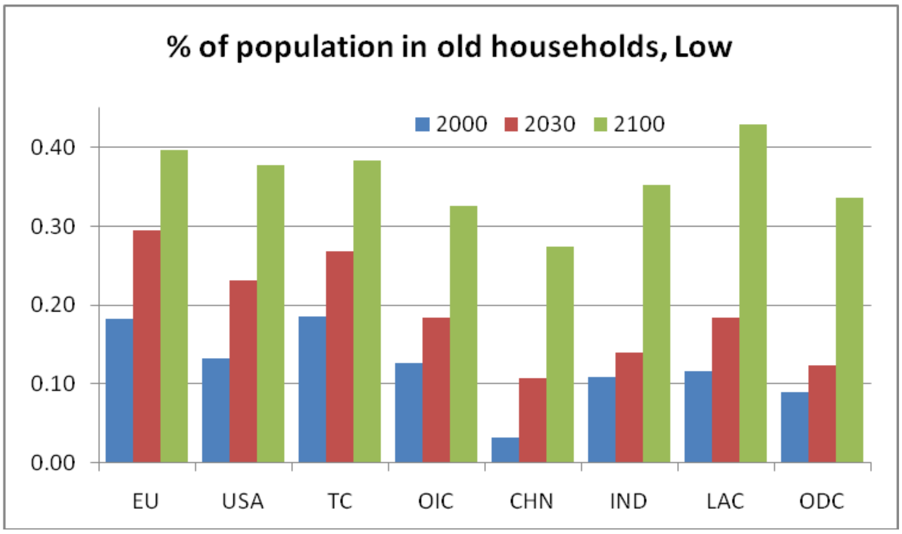


Figure 8. Change in the proportion of population living in households headed by the elderly (aged 65+)

Table 2. Regional population changes by urban/rural, age and household size

			CHN	USA	IND	EU	OIC	TC	LAC	ODC	SSA	world
Population size (million)												
medium	2000		1261	285	1029	494	236	297	520	1316	623	6060
	2030		1456	370	1449	489	246	277	711	2028	1131	8157
	2050		1397	409	1569	464	235	252	768	2357	1498	8949
	2100		1196	437	1429	407	200	209	733	2487	1946	9045
high	2030		1581	393	1591	509	254	292	775	2214	1222	8831
	2050		1694	470	1920	517	258	292	924	2827	1754	10655
	2100		1991	645	2333	592	284	328	1171	3835	2751	13929
low	2030		1340	348	1300	469	237	262	643	1844	1042	7485
	2050		1151	355	1260	415	213	218	623	1939	1265	7440
	2100		636	292	792	277	141	128	407	1495	1327	5495
Proportion of urban population (%)												
	2000		0.35	0.77	0.28	0.76	0.78	0.63	0.76	0.42	0.32	0.47
	2030		0.59	0.84	0.38	0.82	0.86	0.67	0.84	0.57	0.49	0.59
	2050		0.70	0.86	0.46	0.85	0.89	0.70	0.88	0.65	0.59	0.66
	2100		0.79	0.89	0.61	0.89	0.91	0.76	0.91	0.76	0.73	0.76
Population by age of householder (%)												
medium	2000	-44	0.72	0.56	0.50	0.39	0.55	0.44	0.53	0.54	0.87	0.59
		45-64	0.25	0.31	0.39	0.43	0.32	0.38	0.35	0.37	0.10	0.31
		65+	0.03	0.13	0.11	0.18	0.13	0.19	0.12	0.09	0.03	0.09
	2030	-44	0.52	0.50	0.43	0.28	0.45	0.33	0.40	0.44	0.85	0.50
		45-64	0.38	0.29	0.43	0.43	0.37	0.40	0.41	0.44	0.11	0.37
		65+	0.11	0.21	0.14	0.29	0.18	0.27	0.18	0.12	0.04	0.14
	2050	-44	0.45	0.48	0.34	0.26	0.40	0.31	0.33	0.37	0.78	0.44
		45-64	0.37	0.30	0.46	0.39	0.36	0.36	0.41	0.45	0.16	0.37
		65+	0.18	0.22	0.20	0.36	0.24	0.32	0.26	0.18	0.05	0.18
	2100	-44	0.42	0.41	0.28	0.29	0.40	0.33	0.27	0.28	0.56	0.37
		45-64	0.36	0.28	0.43	0.37	0.33	0.34	0.37	0.44	0.26	0.36
		65+	0.22	0.31	0.29	0.34	0.27	0.33	0.36	0.29	0.19	0.27
high	2030	-44	0.52	0.52	0.43	0.28	0.45	0.33	0.41	0.44	0.86	0.50
		45-64	0.37	0.27	0.43	0.43	0.36	0.40	0.41	0.44	0.10	0.36
		65+	0.11	0.21	0.14	0.29	0.18	0.27	0.18	0.12	0.03	0.13
	2050	-44	0.52	0.54	0.38	0.28	0.43	0.34	0.37	0.40	0.81	0.48
		45-64	0.33	0.27	0.44	0.38	0.34	0.35	0.39	0.43	0.14	0.35
		65+	0.16	0.19	0.18	0.35	0.23	0.31	0.24	0.17	0.05	0.17
	2100	-44	0.45	0.47	0.31	0.32	0.44	0.37	0.31	0.31	0.60	0.40
		45-64	0.37	0.29	0.43	0.38	0.33	0.35	0.39	0.45	0.24	0.37
		65+	0.18	0.24	0.26	0.30	0.22	0.28	0.31	0.25	0.15	0.23

			CHN	USA	IND	EU	OIC	TC	LAC	ODC	SSA	world
low	2030	-44	0.51	0.48	0.43	0.27	0.45	0.33	0.40	0.43	0.84	0.49
		45-64	0.38	0.29	0.43	0.43	0.37	0.40	0.42	0.44	0.12	0.37
		65+	0.11	0.23	0.14	0.29	0.18	0.27	0.18	0.12	0.04	0.14
	2050	-44	0.38	0.43	0.27	0.24	0.36	0.29	0.28	0.33	0.75	0.39
		45-64	0.42	0.32	0.52	0.39	0.38	0.38	0.44	0.48	0.19	0.40
		65+	0.20	0.25	0.21	0.37	0.26	0.34	0.28	0.19	0.06	0.20
	2100	-44	0.37	0.36	0.25	0.26	0.36	0.30	0.22	0.24	0.50	0.33
		45-64	0.35	0.26	0.40	0.34	0.32	0.32	0.35	0.42	0.27	0.35
		65+	0.28	0.38	0.35	0.40	0.33	0.38	0.43	0.34	0.23	0.32

Population by household size (%)

			CHN	USA	IND	EU	OIC	TC	LAC	ODC
medium	2000	1-3	0.38	0.60	0.15	0.49	0.45	0.60	0.28	0.27
		4+	0.62	0.40	0.85	0.51	0.55	0.40	0.72	0.73
	2030	1-3	0.44	0.62	0.13	0.51	0.49	0.64	0.30	0.26
		4+	0.56	0.38	0.87	0.49	0.51	0.36	0.70	0.74
	2050	1-3	0.44	0.61	0.14	0.53	0.52	0.67	0.32	0.26
		4+	0.56	0.39	0.86	0.47	0.48	0.33	0.68	0.74
	2100	1-3	0.39	0.63	0.14	0.53	0.52	0.67	0.35	0.28
		4+	0.61	0.37	0.86	0.47	0.48	0.33	0.65	0.72
high	2030	1-3	0.44	0.63	0.14	0.52	0.49	0.64	0.30	0.26
		4+	0.56	0.37	0.86	0.48	0.51	0.36	0.70	0.74
	2050	1-3	0.42	0.59	0.14	0.53	0.51	0.66	0.32	0.26
		4+	0.58	0.41	0.86	0.47	0.49	0.34	0.68	0.74
	2100	1-3	0.36	0.54	0.14	0.52	0.50	0.65	0.34	0.28
		4+	0.64	0.46	0.86	0.48	0.50	0.35	0.66	0.72
low	2030	1-3	0.44	0.70	0.13	0.51	0.49	0.64	0.30	0.25
		4+	0.56	0.30	0.87	0.49	0.51	0.36	0.70	0.75
	2050	1-3	0.47	0.72	0.14	0.53	0.54	0.68	0.33	0.26
		4+	0.53	0.28	0.86	0.47	0.46	0.32	0.67	0.74
	2100	1-3	0.42	0.74	0.14	0.53	0.54	0.69	0.37	0.29
		4+	0.58	0.26	0.86	0.47	0.46	0.31	0.63	0.71

5. Conclusions

The population, urbanization, and household projections presented here foresee substantial changes in population size, age structure, urbanization level, and household structure. They should be useful as input to analyses examining the consequences of future demographic change. We note that there are several caveats that should be kept in mind that make these projections somewhat conservative with respect to future demographic change. First, the UN population projections on which they are based only vary fertility assumptions across scenarios, not mortality and migration, and therefore underestimate uncertainty in some respects, particularly the plausible range of future age structures. Second, we use a single urbanization scenario across population scenarios. Clearly there is a wider range of possible urbanization futures that could be explored. Last, the household projections, with the exception of the US and China, assume constant headship rates, which underestimates the potential for structural change in households. Nonetheless, we believe these projections represent the best source of consistent assumptions for future demographic change when joint population, urbanization, and household outcomes are required. We plan to further develop such projections over time to include multi-state urban and rural projections for all major world regions, and eventually include dynamic household headship rates for all regions.

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