Technological Forecasting & Social Change xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

Consequences of a universal European demographic transition on regional and global population distributions

Vegard Skirbekk [a,b,*], Marcin Stonawski [d], Guido Alfani [c]

[a] Department of Health Statistics, Norwegian Institute of Public Health, Oslo, Norway
[b] Columbia Aging Center, Columbia University, New York, United States
[c] Bocconi University and Dondena Centre for Research on Social Dynamics, Milan, Italy
[d] International Institute for Applied Systems Analysis (IIASA), Austria and Cracow University of Economics, Poland

ARTICLE INFO

Article history:
Received 22 August 2014
Received in revised form 30 April 2015
Accepted 2 May 2015
Available online xxxx

Keywords:
Population growth
Demographic transition
Europe
Simulations
Demographic transition Multiplier

ABSTRACT

This study provides simulations showing what global and regional population sizes would be if the rest of the world would have experienced similar population growth patterns as what was observed in Europe during the demographic transition. In 1820–2010, slower growth was observed in Europe & North America where population increased by 4.6 times to a level of 1088 million. The population of Asia increased from 720 million to 4165 million. However, the biggest change from 1820 to 2010 was observed in regions that had relatively small populations in 1820 — Latin America (which increased by 38 times to 597 million) and Africa (which increased by 14 times to 1031 million). Our simulations show that if the French pattern of population growth had been followed (French population size increasing by 2.5 from 1820–2010), the global population would have merely doubled during the demographic transition (increasing to 2.02 times its original size) over the 1820–2010 period. All regions would have had a significantly lower population size: Europe & North America would have increased to 474 million and Asia to 1453 million, while Africa would have grown to 150 million, which is just 15% of its current population. Projections suggest that population implications of following the in the coming decades would have been much lower. While UN median variant projections suggest that it would reach 914 million people by 2100.

© 2015 Elsevier Inc. All rights reserved.

1. Introduction

Long term population growth and alternative assessments of contemporary population change are seldom used in research focusing on environmental, social and economic change. The UN routinely highlights variants in future population growth patterns (UNPD, 2013), while alternative scenarios leading to variation in current population size are not presented. Yet, for instance Chinese authorities argue that their relatively low fertility over the last decades reduced carbon emissions ("Reducing Carbon by curbing Population", New York Times, 5. August. 2014). All other things being equal, decreased population growth results in lower emission levels, affecting ones ability to reach greenhouse gas reduction targets (Campbell et al., 2007; O'Neill et al., 2010; Menz and Welsch, 2012; Jorgenson and Clark, 2013).

During the demographic transition which in Europe tended to take place from the early 19th to the end of the 20th century, the population in European countries and its overseas offshoots increased by a factor five or less, which is low compared to the increase now taking place in most other regions of the world. This study provides simulations showing what global and regional population sizes would be if the rest of the world would experience similar population growth patterns as what took place in Europe.

European[1] regions distinguished themselves through choices that led to the *European marriage pattern*, characterized by late

* Corresponding author at: Department of Health Statistics, Norwegian Institute of Public Health, Postboks 4404 Nydalen, 0403 Oslo, Norway.
E-mail address: vesk@fhi.no (V. Skirbekk).

[1] In this article, when the European case is discussed, it is referring to Western Europe (i.e., west of the "Hajnal" line), and not the entire continent.

http://dx.doi.org/10.1016/j.techfore.2015.05.003
0040-1625/© 2015 Elsevier Inc. All rights reserved.

ARTICLE IN PRESS

marriage, significant shares not marrying, low levels of extra-marital childbearing and comparatively low fertility (Hajnal, 1965; Van de Walle, 1986; Clark, 2008; De Moor and Van Zanden 2010). One important consequence for the region where the European marriage pattern dominated was the relatively low population growth that took place in this part of the world.

Scientific investigations commonly focus analyses of population growth on observations from the mid-20th century or later (Cleland et al., 2011; National Research Council, 1986). We present an indicator of population growth, the demographic transition multiplier (DTM), which estimates relative population growth over time. We further present alternate global and regional population growth trajectories to investigate what the world would have been like if it had followed different growth trajectories. Had European demographic behaviour been replicated elsewhere, this would have far-reaching consequences in terms of global and regional population growth, with likely social, economic and environmental consequences. It is plausible that the demographic experiences of Europe and European offshoots may, at least to a significant extent, have been replicated in some other parts of the world (particularly in Asia), under some not entirely unrealistic conditions.

The environmental impact of population size varies significantly by world region. For example average CO_2 emission in the world in 2010 equalled 4.6 metric tons per capita, whereas in Europe and North America it was 11.1, Asia 3.9, Africa 1.1, Latin America 2.9 and Australia and New Zealand 15.3.[2] Different paces of population change could have an impact on total world emission of CO_2. If per capita emissions by region were the same, but population by region were that of our scenario "European World" (world population size equal to 4.8 billion in 2010 instead of 6.9 billion), total emissions would have been around 19% lower than what was observed in 2010. In the case of the scenario "French World" (2.1 billion) total emissions would have been 65% lower (Source: Own estimates based on World Bank, 2015 data).

1.1. Defining the period of the demographic transition

Until recent centuries, high levels of fertility did not lead to rapid population growth, due to high mortality rates. This balance implied population growth at extremely low levels, with sometimes zero or negative growth. Population growth, resulting from the excess of births over deaths, occurs where death rates decline faster than birth rates. The process of demographic transition began in Western Europe around 1800, but much later in other regions — and it is still underway in many parts of the world today (Rathke and Sarferaz, 2010; Lee, 2003; Coale, 1973).

We define the demographic transition as the movement from a long term situation where birth and death rates are high (c. 35–40 per thousand) to a steady state of low birth and mortality rates (c. 10–15 per thousand). Defining the onset of this process is difficult. In most instances, the decline in mortality started earlier than the decline in fertility, and this delay produced unprecedented natural growth rates (Livi Bacci, 2012). Regarding fertility, the European Fertility Project (EFP) defined the onset of the transition as a 10% decline in the index of marital fertility, which never again reached pre-transitional levels. As we consider the demographic transition to consist of the movement of *both* birth and death rates, we identify the start of the demographic transition as follows. We choose 1820, a year where sustained mortality decline had not been observed in almost any country and population growth had been slow — population levels observed then can therefore represent population size before the onset of the demographic transition. Most scholars place the initiation of sustained mortality decline around this period or later (e.g., Lee, 2003, 170). We acknowledge that this does not take into account that some countries had a much later onset of the demographic transition. However, as population growth was modest prior to the demographic transition, this would have relatively little effect on the initial demographic values.

For "end point" values, we use both 2010 values (to assess the population growth to date) as well as population size in 2100 (medium variant UN population projections, UNPD World Population Prospects — The 2012 Revision) as proxies for a population size at advanced stages of or at the end of the demographic transition. We acknowledge that many countries would have completed the demographic transition long before these years, which would not affect the results to a large degree. We also note that some nations are projected to not have completed the demographic transition by the year 2100 — a longer projection period is likely to have revealed that the differences in population growth between nations are greater, still.

1.2. The demographic transition multiplier

The demographic transition multiplier (DTM) is a simple measure of the change in population over the period of the demographic transition. For country *j*, the DTM is:

$$DTM_j = \frac{Pop_{j,t}}{Pop_{j,t-T_{dt}}}$$

Where $Pop_{j,t}$ is population at time t (post-transition) and T_{dt} is the duration of the transition. Therefore $Pop_{j,t-T_{dt}}$ is population at the start of the transition. The size of the DTM depends on the relative growth of the population from time t to time $t - T_{dt}$.

The components of the DTM are births (B), deaths (D) and net migration (NM):

$$DTM_j = \frac{\sum_{i=1}^{T_{dt}} \left(B_{j,i} - D_{j,i} + NM_{j,i}\right) + Pop_{j,t-T_{dt}}}{Pop_{j,t-T_{dt}}}.$$

The DTM is a measure of two stock variables, population before and after the demographic transition. Its scale will be purely determined by the flow of births, deaths and net migrants. However, as many nations lack historic data, we are for some nations not able to observe the entire demographic transition window. We then provide data for the part of the demographic transition that we can observe. With a base year set in 1820 we are able to observe most of the demographic transition for almost all countries/regions. For some countries we only have 1950 as the base year. We provide two end points, 2010 (as it is of interest to observe the DTM close to

[2] Own estimates for world and regions based on World Bank (2015).

Please cite this article as: Skirbekk, V., et al., Consequences of a universal European demographic transition on regional and global population distributions, Technol. Forecast. Soc. Change (2015), http://dx.doi.org/10.1016/j.techfore.2015.05.003

Download English Version:

https://daneshyari.com/en/article/7256593

Download Persian Version:

https://daneshyari.com/article/7256593

Daneshyari.com