

# Demography's end-of-history moment: Are population projections losing its foresight capacity for policymaking in post-transition countries?

## Introduction

Population projections provide a tool for anticipating the nature of future changes in population size and structure and the implications for economic, environmental, societal, and geopolitical developments that depend on human activity. Therefore, insights into the future of populations have been essential for policy formulation (Kaneda and Bremner 2014). We argue that this capacity of population projections to inform policy makers is challenged in demographically advanced regions that are well into the post-demographic transition phase by two developments.

Firstly, there is a lack of a theory to explain the trajectory of fertility once it has fallen to low levels, which is particularly relevant for making assumption about the future course of fertility used in population projections (see for example Skirbekk 2022). A large body of research has looked into the drivers of low fertility, but a comprehensive theoretical model has not yet been derived. To this point, the general assumption is that fertility stays low once countries or regions have gone through the transition from high to low fertility in the course of modernisation. However, whether fertility will continue to decline to extremely low levels or whether it will stabilise or slightly rebound has become the major point of difference between models of global population projections (Bhattacharjee et al. 2024).

Secondly, the traditional notion of demographic foresight rooted in perceiving demographic dynamics as inertial, predictable, and self-contained—primarily driven by fertility and mortality—is facing challenges. With sustained low fertility, migration becomes an increasingly important driver for population change (Billari 2022). Furthermore, migration trends are much more uncertain and volatile than fertility and mortality making it difficult to project population change (Bijak 2018). The relationship of fertility and migration is not fully understood and new perspectives on the impact of migration in low fertility settings have been proposed (Parr 2023).

After outlining the relevance of population projections for informing policy-making, we develop our arguments by reviewing the capacity of demographic theory to produce population projections. We then compare the evolution of major global population projections from different institutions, all of which present a different picture of the future. The different projections are further placed in the context of findings from a global survey of demographic expert opinion on the drivers and consequences of demographic change and their estimates of future demographic trends before deriving conclusions about what this means for the capacity of demographers to do projections.

## Population projection's relevance for policy processes

Many national statistical offices regularly produce population projections for the purpose of economic and fiscal forecasting or to guide the planning of health services or education infrastructure. At the global level, several organisations develop population projections for all countries and regions of the world. The population estimates and projections of the United Nations are used in more than half of the over 300 indicators to monitor the progress towards the 17 Sustainable Development Goals of the 2030 Agenda. The global projections of the Wittgenstein Centre for Demography and Global Human Capital are used by the Intergovernmental Panel on Climate Change in their assessment of the influence of demographic dynamics on future climate change. The Institute for Health Metrics and Evaluation produces population projections that inform their Global Burden of Disease study, the largest and most comprehensive project to quantify health loss across places and over time worldwide.

## Theoretical Considerations

### *Arriving in an era of low fertility*

A decade ago, Gerland et al (2014) published an article in this journal that argued that the stabilisation of the world population was unlikely in the 21<sup>st</sup> century. This finding was based on newly released probabilistic

projections of the United Nations. Released every two years, the UN projections have since then shown an increasing likelihood of reaching the end of global population growth this century with every revision. The question is no longer if, but when and at what level the global population will start declining (Adam 2021). In the latest 2024 publication, the median projection has the global population peaking at 10.3 billion in the 2080s. The demographic research groups at IIASA (KC et al. 2023) and at IHME (2020) project an even earlier peak in the 2070s and at a lower number under 10 billion.

A major source of difference in the projections has been the assumption of the speed of future fertility decline in Africa, especially sub-Saharan Africa, where the large majority of population growth until 2100 is projected across all projection models. That fertility will decline in all countries is the major model of the demographic transition that is used by all three groups. It is a well-established empirical observation in demography that over the course of modernisation and development countries transition from high levels to levels of mortality and fertility. Population expands during the transition period as the decline in mortality usually precedes the decline in fertility.

The assumption that all countries would indeed go through the demographic transition was less agreed upon at the beginning of this century when the decline in fertility levels in many sub-Saharan African countries appeared to stagnate or slow-down (Bongaarts 2008), bringing population growth and its environmental, social, economic, and political effects back to the global policy agenda (Bongaarts 2011). However, in the 2010s the pace of fertility decline accelerated again reaffirming the global validity of the transition model.

Fast forward to today and the latest projections from the group at IHME (Bhattacharjee et al. 2024), limited only to fertility, has indicated a newly emerging major source of difference, of which demographic theory is much less informative: How far will fertility levels continue to decline? Two thirds of the global population now live in countries that have completed the demographic transition and experience fertility below the replacement level of 2.1 births per woman, the general level of fertility at which a population replaces itself from one generation to the next. Twenty years ago this was still less than half of the global population, and in 1950 only 3 per cent. Countries that have now gone through the demographic transition and reached below replacement-level fertility include not only the richest countries, but middle-income countries such as Bangladesh, India or Iran. Populations of countries or regions well into the post-transition phase are starting to decline such as China or the EU.

Migration has become a major component for demographic change where fertility levels have been persistently low. While its impact is minor in the initial demographic transition from high to low levels of fertility, migration increasingly influences population change where fertility is low and mortality improvements occur primarily at older ages. In high-income countries, migration is often driving population growth, counterbalancing natural declines from births exceeding deaths in the population. However, while migration might prevent decline in size it cannot realistically prevent population ageing. Migration is also having the opposite effect in countries with sustained low levels of fertility. Many Eastern European countries have experienced population decline due to emigration.

However, migration trends are much more volatile and uncertain than fertility or mortality trends. Furthermore, migration data are much more unreliable. That makes it difficult to project migration and most projection models, in the absence of better salutation, revert to simple assumptions such as letting migration run to zero over the long-term or applying historic averages. For example, the United Nations probabilistic population projections are only partially probabilistic. While they produce fertility and mortality projections with prediction intervals to give levels of uncertainty, the migration model is still modelled deterministically. While probabilistic methods have been developed the large uncertainty produced by these models makes the results difficult to be used and interpreted by policy and decision makers. The better treatment of migration in population projections remains a major task for the future.

### *Demography's end-of-history moment*

Demographers generally assume that fertility stays at low levels in countries that have gone through that first demographic transition. Fertility rates might have dipped to very low levels around 1.0 births per woman such as during the transition period of former socialist countries in Eastern Europe in the 1990s, but these troughs were temporary, explained largely by the postponement of childbearing to later ages, and followed by a rebound in fertility to moderately low levels. Therefore, most projection models have fertility in the post-transition phase levelling-off around 1.5 births per woman and, over the long-term, recover slightly to around 1.6 to 1.8 births per woman.

This assumption of fertility fluctuating around moderately low levels throughout the century is becoming increasingly questioned in the face of recent, unexpected fertility trends. While in the case of countries with high fertility, demographers can rely on the demographic transition theory as universal reference indicating the direction of change, in post transition contexts there is a lack of theoretical explanation to inform projections future trajectories (Skirbekk 2022). Two theoretical concepts have been widely used to explain persistent low fertility in post-transition societies. Second Demographic Transition Theory (Lesthaeghe 2010) focuses on social and cultural changes in post-industrial societies and puts emphasis on changes in family structures, relationships and norms. Gender equality theory of the fertility transition (McDonald 2000) explained difference among low fertility countries with the status of women in societies, arguing that gender equality is a precondition for fertility to rebound from very low levels.

However, both theories have been a poor fit in explaining recent oscillating fertility dynamics in high-income countries such as very low fertility levels in East Asia or the decline in fertility in the Nordic countries of Europe in the past decade, which were considered demographic forerunner countries. The theories were developed in a time-specific context when fertility had declined below replacement level and, in the case of gender equality theory, when fertility declines were levelling-off and they may no longer capture the main drivers of fertility.

The explanatory power of demographic theories has always been a point of discussion in the discipline. There has been much debate about what explained the initial first demographic transition from high to low levels of mortality and fertility. Demography is often considered as having merely a strong empirical observation at its core without a comprehensive theory to explain it. This strong empirical observation is now lacking in the post-transition era. It appeared that fertility is levelling-off below replacement level with a long-term expectation of moderately low levels between 1.4 and 1.9 births per women depending on country context.

Hence, the assumption of continuity of low fertility in countries that have completed the demographic transition remains largely grounded in weakening empirical observation rather than a robust theoretical foundation. Borrowing the term 'end-of-history' famously coined by Francis Fukuyama to describe liberal democracy as the final stage of an evolutionary historic process, and the weakening pervasiveness of that assertion with a different turn in world events, we use it for demography and its state of theory. In a time where most countries have completed or are completing the first demographic transition, their future population dynamics appear more and more difficult to project long-term. However, in the absence of alternative theories, demographers project the continuity of low fertility.

### **Methodology**

In a first step, we compare the evolution of fertility projections from the three main institutions producing projections for the world. We include the six rounds of the United Nations World Population Projections published biannually since 2013, when the projection methodology changed to a probabilistic model. We include the three rounds of projections from IIASA published in 2014, 2018 and 2023 and the projections from IHME from 2020 as well as their updated fertility projections from 2024. In a second step, we contrast the projection models with results from a global survey with demographic experts. In the survey, people working on demography from around the world were asked to assess the validity and relevance of alternative arguments about the forces that could shape future fertility, mortality, and migration trends in the country of

their choice. Experts also gave their estimate of fertility and mortality levels in 2050 and 2100, while only having to indicate a tendency in the case of immigration and emigration.

### Very Preliminary Findings

First exploratory analysis of the evolution of the trends in population projections from the three institutes producing global projections shows that projections of fertility have been converging in countries that are still going through the demographic transition phase. For Africa, and especially sub-Saharan Africa, there is less difference in the assumption about the speed of the demographic transition. This results, for example, in less difference in the timing of the projected peak of the global population. At the same time, there is more difference in projected fertility levels for post-transition countries, especially with IHME moving away from the assumption of fertility recovery and letting fertility decline to very low levels. The paper will dive deeper into explaining the difference between the projection models. For example, the UN model for fertility followed the idea of the double logistic model. This model fits the course of the Total Fertility Rate during the demographic transition with one logistic curve modelling an increasing rate of decline in the early phase and one a decreasing decline in the later phase. The post-transition phase is modelled without such strong assumption.

Demographic experts also assume that fertility trends converge towards similar levels of low fertility throughout the century around 1.5 births per woman. It underlines the assumption of stability of fertility at low level in post-transition countries over such long projection horizon. While demographers would agree that fertility levels in 2050 and 2100 are likely to be different, they proceed with the assumption that fertility will remain at similar level, staying below the replacement level, yet also not falling below a minimum of 1.0 birth per woman. That brings expert opinion closer, but slightly below, the projected fertility trend by the UN and IIASA. The relative difference to the very low fertility trends in the 2024 IHME projection is larger, but all institutions have successively corrected their fertility projections downwards for the post-transition phase.

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