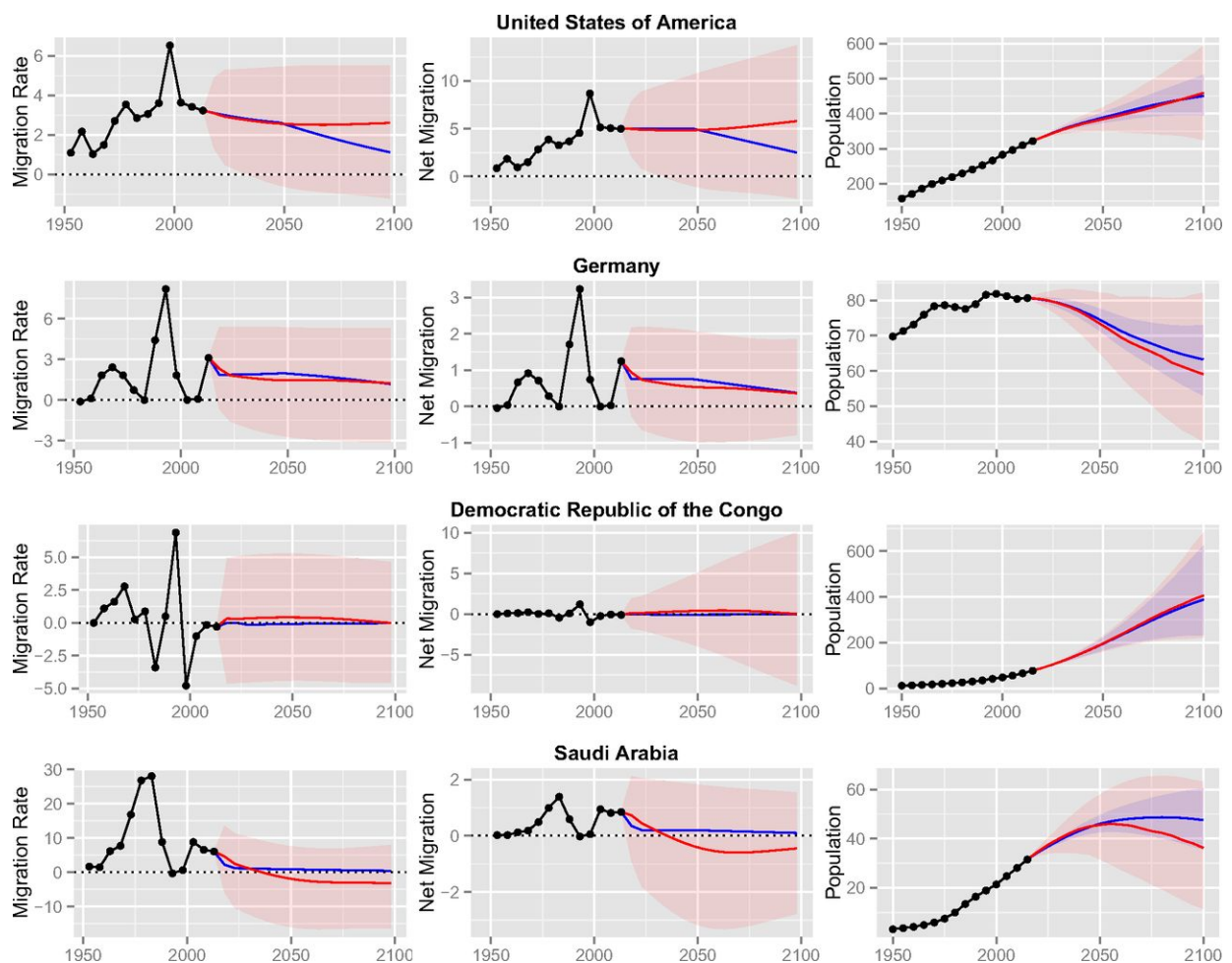


Experts develop method for including migration uncertainty in population projections

May 24 2016, by Deborah Bach



Projected net migration rate (net annual migrants per thousand people), net migration count (five-year count, in millions of people), and population (in millions) for the United States, Germany, the Democratic Republic of the Congo

and Saudi Arabia. Credit: Adrian Raftery / University of Washington

Statisticians at the University of Washington have developed the first model for projecting population that factors in the vagaries of migration, a slippery issue that has bedeviled demographers for decades.

Their work, published online this week in the *Proceedings of the National Academy of Sciences*, also provides population projections for all countries worldwide—and challenges the existing predictions for some, particularly the United States and Germany.

"It turns out that for quite a few countries, migration is the single biggest source of uncertainty for population projections," said principal investigator Adrian Raftery, a UW professor of statistics and sociology.

For the first time, the researchers used a "probabilistic" model that draws on migration rates in each country and worldwide over the past 65 years, along with patterns of fertility and mortality, to project population around the world. The findings were most striking for Germany, whose bureau of statistics has called [population decline](#) "inevitable" as the country's populace ages.

But the UW model predicts that when migration is factored in, Germany's population decline could be offset by the arrival of more than 1 million immigrants every five years for most of the next century. The data in the study was collected before the influx of more than 965,000 migrants and refugees into the country in 2015, so the near-term difference could be even more dramatic.

"Our model could change the perception of the future of Germany from a country that goes into decline for the rest of the century to one that

may not, if its policy of accepting migrants continues," said Raftery, also a faculty affiliate for the UW Center for Statistics and the Social Sciences and the UW Center for Studies in Demography and Ecology.

The researchers also predict that France and the United Kingdom are likely to have bigger populations than Germany by 2060, given both countries' higher fertility rates.

They also predict that the U.S. population has a 10 percent chance of exceeding 610 million over the next 85 years—nearly double the current population—when migration is factored in, versus a projected high of 510 million if it isn't. While that likelihood is small, it has large ramifications, said lead author Jonathan Azose, a doctoral student in the UW Department of Statistics.

"If you think about planning for social welfare programs, sometimes the biggest issues arise when these unexpected events occur," he said. "Countries need to be prepared for the possibility."

But migration is a difficult force to predict, driven by factors ranging from war to economic crises, employment opportunity, family dynamics and even [migration policy](#), which can themselves be difficult—if not impossible—to foresee. To come up with their projections, the researchers looked at past [migration patterns](#) in each country to determine a range of probability for future outcomes, reasoning that recent history creates an environment that is likely to create similar migration patterns going forward.

"A lot of the influences that have produced migration levels in the recent past are baked in and likely to continue to play a role in the future," Raftery said. "It's almost impossible to tease out all factors, but using current levels of migration, this is the best we can do."

The researchers then incorporated global migration patterns to build a statistical model and make population projections for each country. Some regional patterns emerged. Smaller European countries that have experienced broad swings in migration over the past half-century are more likely to be impacted by migration uncertainty than countries like India and China, where migration rates are smaller relative to their large populations.

In some African countries, including the Democratic Republic of Congo, migration uncertainty is expected to be less of a factor in population change than fluctuations in mortality and fertility rates. And projections were adjusted for Gulf countries that in past decades have had large influxes of oil industry workers, since in-migration is expected to decline as the sector cools off in that region.

The researchers' model contrasts with the traditional "deterministic" approach that projects current mortality, fertility and migration rates into the future to estimate population size. But migration rates vary considerably in many countries and fluctuate over time, Raftery said, making for unreliable estimates.

Leaving migration out of the equation can lead to long-term challenges for nations in planning for social programs, the researchers said. Many European countries are cutting education funding in anticipation of declines in school-aged populations, Azose said, which could lead to school closures and fewer trained teachers.

"If the school-age population turns out to be larger than the space allocated for them, there can be huge costs associated with opening or reopening schools and finding teachers to staff them," he said.

"International migration, and especially refugee migration, typically includes large numbers of school-aged children."

The new research stems from a collaboration between Raftery and his colleagues and the United Nations Population Division that started 10 years ago. The team was enlisted by the U.N. to incorporate uncertainty about fertility and mortality to develop more accurate population prediction models. But migration remained a critical, and unaccounted for, determinant. Raftery hopes the new model may eventually be incorporated into U.N. projections.

"Including [migration](#) uncertainty in population projections could make a substantial difference in how we understand [population](#) changes," he said. "As far as we know, nobody has done this before."

More information: Jonathan J. Azose et al. Probabilistic population projections with migration uncertainty, *Proceedings of the National Academy of Sciences* (2016). [DOI: 10.1073/pnas.1606119113](https://doi.org/10.1073/pnas.1606119113)

Provided by University of Washington

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