

Empirical Prediction Intervals for Forecasts of Nordic Fertility

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Abstract

The Nordic countries have experienced rapid and unexpected fertility declines in the last decade. Future paths of fertility are a key input when charting the sustainability of social security systems. Hence realistic views of possible future paths of fertility, including the uncertainty regarding these paths, is critically important for economic and social planning in the Nordic countries.

An almost universal finding of probabilistic forecasting is that model-based prediction intervals are too narrow. The result is a misleadingly confident view of the future. We approach the problem of prediction uncertainty by generating empirical prediction intervals for our forecasts of Nordic period fertility up to 2050.

We derive the empirical prediction intervals for our forecasts from an out-of-sample cross-validation, utilizing historic forecasting errors. These quantify how uncertain we should be about the forecasts given the demonstrated forecast performance of the past. We then validate the calibration of the empirical prediction intervals and compare them to the performance of model-based prediction intervals. We use the following forecast models applied to data from the Human Fertility Database: First, a naïve approach fixing the last observed Total Fertility Rate (TFR). Second, a GARCH model of the TFR. Third, the Lee-Carter method for age-specific fertility rates. And fourth, a probabilistic, random-walk based forecast around the assumption that the ongoing fertility postponement would gradually slow down and come to an end by 2050.

In addition to presenting forecasts of Nordic fertility up to 2050, we expect to find that the empirical prediction intervals provide a more realistic view of the forecast uncertainty, exhibiting wider prediction intervals in comparison to the model-based prediction intervals.