Total Fertility Rate and Life Expectancy Bayesian Probabilistic Models to Predict the Population of Puerto Rico for 2050

MASTER THESIS

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Abstract

Until recently population projections using the cohort component method have been deterministic. There is now agreement that it is best to use a probabilistic approach in order to measure their level of uncertainty. Recently, researchers have incorporated Bayesian Probabilistic Theory in order to include the uncertainty in the estimation of the basic demographic indicators of fertility and mortality used in the projections. In this project, we studied the Total Fertility Rate (TFR) Model and the Life Expectancy Model proposed by Adrian Raftery and his colleagues to adopt the deterministic models suggested by the United Nations Population Division. We carefully choose the data to be used in order to justify possible scenarios for the population of Puerto Rico using recent information about different countries from the World Population Prospects 2017. We considered three scenarios for the Total Fertility Rate, two scenarios for Life Expectancy and some variations of the Net Migration's assumptions used by the U.S. Census Bureau, to produce population projections employing the cohort component method. R packages bayesLife, bayesTfr and bayesPop were used to obtain the corresponding projections and to verify the convergence of the MCMC simulations to get the posterior distributions of the parameters. Other demographic measures are shown, like the Potential Support Ratio, in order to see the future implications of our results due to the age-structure of the population. According to this study, the population of Puerto Rico will decline to 2.14 million by 2050 bounded by the 95% confidence interval (1879.3,2406.2).

Keywords: Total Fertility Rate, Bayesian Probabilistic Models