Evaluation of the Uncertainties of Population Projections by Probabilistic Approach

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In the official "Population projection for Japan (2002)" by the National Institute of Population and Social Security Research (IPSS), the deterministic approach was used, and the fertility assumptions were based on three scenarios, high, medium and low variant. This is one approach to provide the uncertainties of the population projection. But in this approach, we cannot present the confidence intervals of the results. In this study, we have used a probabilistic approach and evaluated the uncertainties for population projection.

Using probabilistic approach, the distributions of the fertility or mortality assumptions are needed. There are several methods to accomplish that using such as "ex post analysis", "expert opinions","time series analysis", etc. In this study, we used the distributions of "expert opinions". "The survey about future prospects of low fertility for experts" is performed in 2001. In this survey, the life expectancy at birth in 2050 and the total fertility rates in 2025 are surveyed. These distributions (after smoothing) are used as those of assumptions. The distributions are linearly transformed taking the same mean values as official projection's assumptions at 2050 (life expectancy) or 2025 (TFR). In other points, coeffcient variances are set by linear interpolations with 2000 as 0.

It is essential that the temporal correlation of errors for fertility and mortality. In this study, temporal correlations are expressed using normal copulas. Using this method, the distribution in every year is transformed expert opinions' one and has correlation with another year.

Through these processes, we can estimate the confidence interval for total population and the age proportions of the population, and the distribution for the year that gives a peak of the total populations.

The proposed method in this study is proved to be useful since we can use it independently after we have finished with the official deterministic projection. And the results that we have got have shown many advantages of the probabilistic approach.