EUROPEAN POPULATION CONFERENCE
Vienna, 1-4 September 2010

Title: Accuracy assessment of the Czech population forecasts produced after the split of Czechoslovakia

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Session 42: Modeling partner search and household formation

EXTENDED ABSTRACT:

The future of any population is inherently uncertain however it is essential to a wide range of both public and private sectors' planning and policymaking issues to know the future. Population forecasts underpinned by a set of assumptions have traditionally been the source of such knowledge however the assumptions made about the future course of fertility, mortality and migration trends are inevitably subject to uncertainty due to different reasons.

Hoem (1973) and Keyfitz (1977) grouped the various sources of inaccuracy in population forecasts into three types, which are first of all, relate to errors in registrations and estimations i.e. in any registration system even of highly developed societies there are always some differences between the de facto and de jure population This gives rise to a series of sources of error that are registration errors give defective data for the parameter estimates and errors in size and composition of the initial population which are afterwards propagated through the entire forecasting period.

Secondly go errors due to random fluctuations in vital rated. Such natural and social phenomena as droughts, epidemics, revolutions, economic depressions, changes in legislation, break-throughs in medical techniques and the like may lead to the erroneous trends in mean vital rates and the difficulty of predicting such changes with sufficient accuracy represents a further source of uncertainty in the forecasts.

Thirdly, due to the fact that none of the parameters of the forecasting model are certainly known to the forecaster there is a real possibility that some important factors may get left out or could be specified quite incorrectly which can result in serious model misspecifications.

The accuracy of population forecast can only be assessed after the fact (Preston et al, 1998). There are many measures that can be found in the relevant literature and in our case we use the next three:

(1) $$\text{Mean Percent Error (MPE)} = \frac{\sum \text{PE}_t}{n}$$

The MPE is a measure accounting for population size by focusing on percent errors rather than numerical errors, in which positive and negative values do not offset each other. The MPE shows the average of all the percentage difference between forecasted and actual populations.

Sometimes it is important to use error measures that give more weight to large errors than to small errors; for example, when a large error has a disproportionately large impact on the cost of being wrong (Smith et al, 2002). In these situations, the following measure can be used:

(2) $$\text{Root Mean Squared Percent Error (RMSPE)} = \sqrt{\frac{\sum (\text{PE}_t)^2}{n}}$$

Another error measures is the Theil's U_2 which measures the difference between errors produced by a formal forecasting method and a naïve alternative, such as the assumption that no change will occur. This statistic squares the errors so that large errors are given heavier weights than small errors (Theil, 1966).

(3) $$U_2 = \frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T-1}\left(\frac{f_{t+1} - y_{t+1}}{y_t}\right)^2}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T-1}\left(\frac{y_{t+1} - y_t}{y_t}\right)^2}}$$

This paper is aimed to analyse the accuracy of the Czech population forecasts produced after the split of Czechoslovakia. Since 1993 with the interval of 2 years the Czech Statistical Office started to produce separate population forecasts for the Czech Republic giving traditional tree projection scenarios – labeled High, Medium and Low. Apart from the Czech Statistical Office there are several other institutions producing forecasts for the country and in this

study we consider both the official as well as forecasts of the private vendors. Using above mentioned measures we will analyse the trends in errors of total population size, fertility, mortality, age structure and migration.

Keywords: population forecasts, accuracy, errors, the Czech Republic

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