# Dynamics of Demographic Processes in Bulgaria

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Special thanks to Dr. John Grego, University of South Carolina, USA, for his help with the R code for the Alberola-Lopez and Martin-Fernandez test.

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Motivation

This work was motivated by the existence of some unusual and interesting tendencies and dynamics of the demographic processes in Bulgaria. There was a need to apply more rigorous econometric techniques in order to test for differences between different dynamics. There was the hypothesis about the relationship between the economic growth and demographic processes which had to be tested econometrically.

Data

The primary demographic data for the period 1960-2008 were collected by the National Statistical Office (NSI) of Bulgaria. The fertility rates and the distributions' characteristics (means, standard deviations, etc.) were calculated by the first author.

The Total Fertility Rate (TFR) was used as summary measure of the fertility. It was calculated as sum of the age-specific fertility rates (ASFR) by each of the age intervals (sum over i=15 to 49). TFR shows the average number of children which one woman could have during her productive life if she is following the age-specific fertility coefficients for the respective calendar year. Zero mortality was assumed at cohort level.

ASFR are specific measures of the birth intensity by age of the mother. They are calculated after arranging the population of newborns in groups by the age of the mother and the current population of the women in fertility contingent.

$$n_i = \frac{N_x}{\bar{S}_x^w}, \text{ where } x = 15,16,...,49.$$

$N_x = \text{birth density per year}$

$\bar{S}_x^w = \text{ average fertile female population}$

ASFR shows the average number of children born by woman at age x for one calendar year.

The Gross Domestic Product (GDP) data are in constant 1990 USD, and are transformed into indexes (1913=100). Data are due to Rangelova (2006).

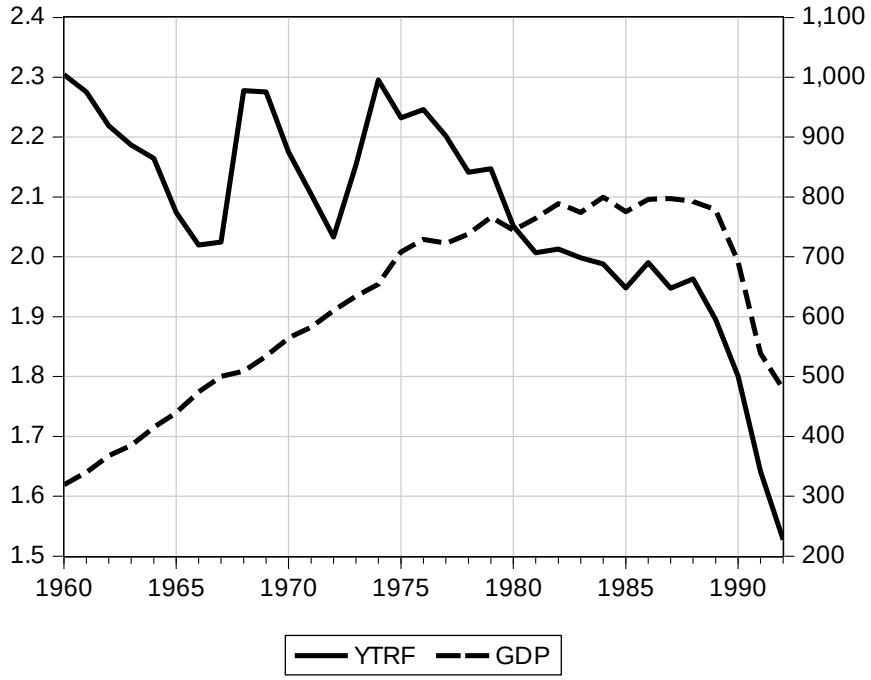
Methods

For the purpose of the analysis the Johanssen cointegration test and the Granger-cause test (Brooks, 2008 and Brockwell & Davis, 2002) were applied. For the difference of dynamics the Alberola-Lopez and Martin-Fernandez (2003) test was used.

Dynamics of Fertility and GDP

The two dynamics are presented in Figure 1.

**Figure 1. Fertility and GDP**



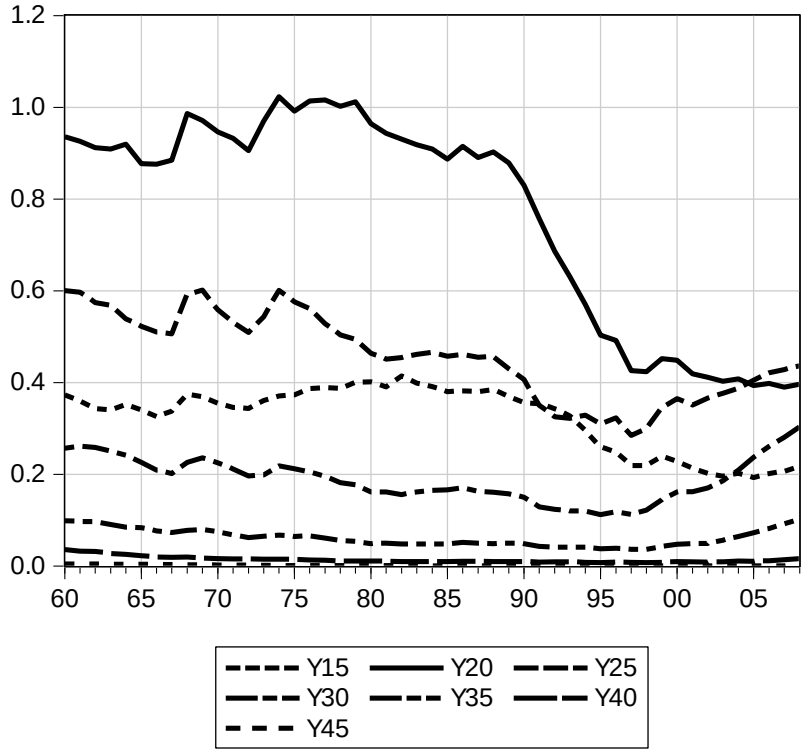

Where YTRF is the TRF.

Econometric testing showed that fertility and GDP are cointegrated of first order or are CI(1). Fertility is a Granger-cause for GDP and GDP is a Granger-cause for fertility as well.

Age-Specific Fertility Rates

The dynamics is presented on Figure 2.

**Figure 2. Age-Specific Fertility Rates**



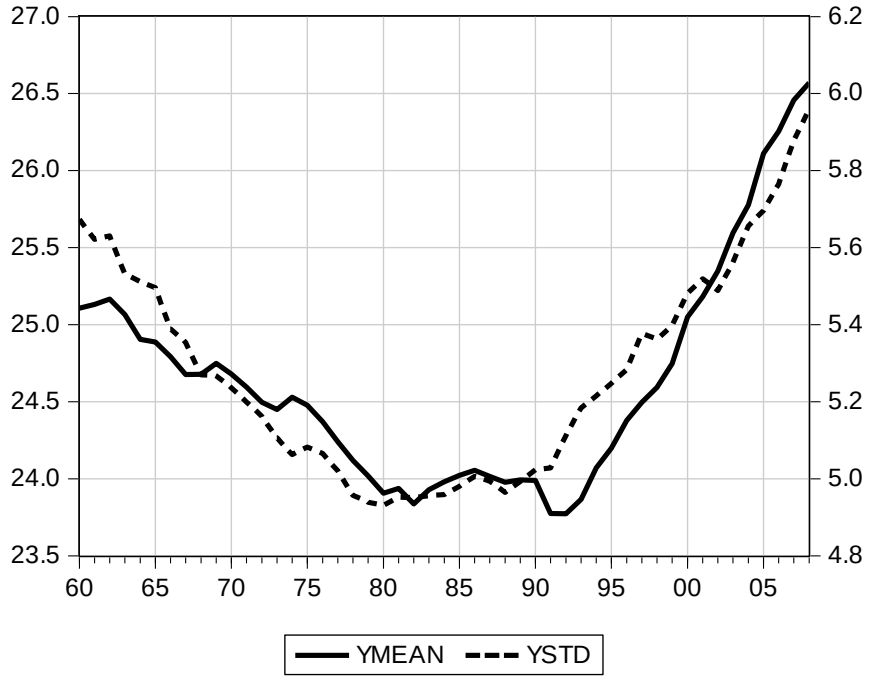

Where Mother's Age Groups are as follows:
Y15: Age 15-19; Y20: Age 20-24; Y25: Age 25-29; Y30: Age 30-34; Y35: Age 35-39; Y40: Age 40-44; Y45: Age 45-49;

The Alberola-Lopez & Martin-Fernandez test showed that only Y20 (solid line, TFR for mothers aged 20-24) time series is statistically different ($p<.05$) from the rest of the series. There is no statistically significant difference between the rest of the time series.

Dynamics of Mean and Variance of Mother's Age

Their dynamics is presented on Figure 3.

**Figure 3. Dynamics of Mean and Variance of Mother's Age**



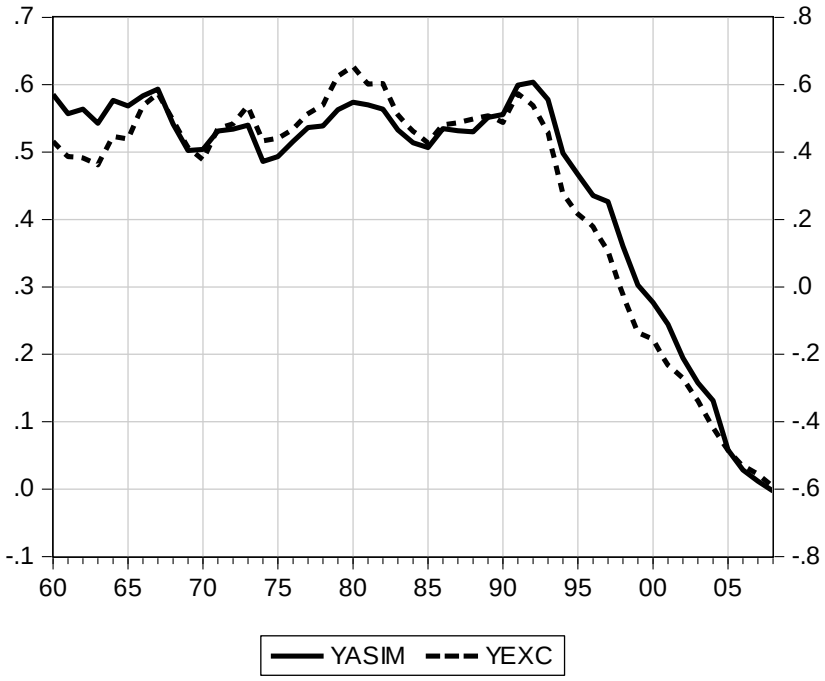

Where YMEAN is the mean mother's age and YSTD is the standard deviation of the mother's age.

The mean is measured by the arithmetic mean and the variance is measured by the standard deviation. We observe a clear downward trend from 1960 to 1980s and clear upward trend from 1990s to 2008. Econometric tests showed that the two time series are cointegrated of first order or are CI(1). The time series of the mean is a Granger-cause for the variance while the variance is not a Granger-cause for the mean.

Dynamics of Asymmetry and Excess of Mother's Age

Asymmetry and excess are measured by their respective moment's coefficients. Their dynamics is presented on Figure 4.

**Figure 4. Dynamics of Asymmetry and Excess of Mother's Age**




Where YASIM is the moment coefficient of asymmetry and YEXC is the moment coefficient of excess.

Asymmetry and excess are not cointegrated or are CI(0). Excess is a Granger-cause for asymmetry while asymmetry is not a Granger-cause for excess.

## Conclusion

The most important findings in this paper are as follows:

1. There is convincing econometric evidence that major demographic processes (e.g. fertility) are strongly related to the economic growth of the economy, measured by the GDP. The knowledge of the economic growth may be used to assess the demographic processes and vice versa.
2. The dynamics of specific demographic processes (e.g. age-specific fertility rates) varies by age groups of the mothers but most of the differences are not statistically significant. The stand-out group is the group of mothers of ages between 20 and 24. For all the other age groups the differences are not statistically significant.
3. There are interesting tendencies in the dynamics of demographic (mother's age) distribution's statistical characteristics, like means, standard deviation, asymmetry and excess. The mean and standard deviation of mother's age have a downward trend for the 1960-1980s period and upward trend for the period 1980s-2008. The shape of distribution (e.g. asymmetry and excess) stays unchanged for the period of 1960-1990s and is rapidly changing from 1990s on.

In conclusion it seems to be very beneficial to implement more rigorous econometric techniques in the area of demographic analysis. The dynamics of major demographic processes is an interesting phenomenon by itself but the analysis has to be aided by solid econometric testing. This is necessary in order to be more useful and definitive to help the decision process of the social policy makers and improve the research in this area.

## Cited Literature:

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