Demographic Processes and Economic Crises. The Bulgarian Case

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1. Introduction

In Bulgaria we have our absolute bottom of the number of births in the last three months of 1997, nine months after the biggest socio-economic crisis in the contemporary Bulgarian history. This fact provokes research question about the relationship between the demographic processes and the crises.

In my previous research I have studied the relationship between the political situation in Bulgaria and number of births and I have concluded that "there is not convincing evidences for the presence of relationship between the reproductive behavior of the population and appearance of different events which form the political situation except the elections" (Харалампиев 2007: 136).

Thus I have covered one side of socio-economic situation – the political situation as a part of social situation. Now I will study other side of socio-economic situation – namely the economic dynamics.

As indicators of economic dynamics I will use volume indices of GDP, volume indices of the final consumption expenditure of households, volume indices of the individual final consumption expenditure of general government, indices of the numbers and hours worked of employed, employees and self-employed.

The main hypothesis is that the economic situation will affect the number of births nine months later. In the other words the economic situation affects the decisions of parents to have child, i.e. the economic situation affects the number of the conceptions.

2. Data

In Bulgaria there are data for GDP, final consumption expenditure of households and individual final consumption expenditure of general government since 1995[1]. The minimal time division is quarter. The last quarter is Q4 of 2009. These data allow us to calculate the volume indices of the three indicators in constant prices.

[1] Data source: National Statistical Institute of Bulgaria, http://www.nsi.bg/otrasal.php?otr=10

The time series of numbers and hours worked of employed, employees and self-employed starts much later – since 2000[2]. The minimal time division also is quarter. The last quarter is Q4 of 2009. These data allow us to calculate the indices of the numbers and hours worked of employed, employees and self-employed.

The last used time series is time series of the numbers of births[3]. The minimal time division is month. Since the number of conceptions is equal to the number of births nine months later[4], it is appropriate to slip the time series of births nine month backward. Since the other time series are quarterly, it is appropriate to sum the slipped number of births quarterly. After the slipping the last quarter is Q1 of 2009. These data allow us to calculate the indices of the number of conceptions.

3. Method

The method for analysis of time series data is my own modification of Bayesian spectrum analysis initially proposed by Brethorst (Naidenov, Haralampiev 2007: 127-132). There I have shown that **every** time series could be presented in the following way (Naidenov, Haralampiev 2007: 132):

$$(1) \qquad f(t_i) = \sum_{j=1}^{k} A_j.\sin\left(\frac{2\pi t_i}{T_j} + \varphi_j\right)$$

where:

A_j represents the *amplitudes* of the harmonic models;

T_j represents the *periods* of the harmonic models

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[2] Data source: National Statistical Institute of Bulgaria, http://www.nsi.bg/otrasal.php?otr=10

[3] Data source: Statistical Yearbook "Population and Demographic Processes", National Statistical Institute of Bulgaria.

[4] More precisely: the indices of the number of conceptions are equal to the indices of the number of births nine months later. This is approximately true under assumption that the number of abortions is proportional to the number of births. Thus when we take indices it follows that:

$$\frac{C_t}{C_1} = \frac{B_{t+9} + \sum_{i=0}^{9} A_{t+i}}{B_{10} + \sum_{i=0}^{9} A_{1+i}} = \frac{B_{t+9} + k.B_{t+9}}{B_{10} + k.B_{10}} = \frac{B_{t+9}(1+k)}{B_{10}(1+k)} = \frac{B_{t+9}}{B_{10}}$$

where:

C_t is the number of conceptions in the month t ;

B_t is the number of births in the month t ;

A_t is the number of abortions in the month t ;

$k = \frac{\sum_{i=0}^{9} A_{t+i}}{B_{t+9}}$ is the coefficient of proportion.

φ_j represents the *phases* of the harmonic models;

k is the number of the harmonic models.

Equation 1 could be presented also in other form:

$$f(t_i) = \sum_{j=1}^{k} A_j.\sin\frac{2\pi(t_i - t_{0,j})}{T_j} \quad (2)$$

where $t_{0,j}$ presents the start points of the harmonic models.

If the models of two time series contain harmonic models with the same periods then:

$$h_1(t_i) = A_{j,1}.\sin\frac{2\pi(t_i - t_{0,j,1})}{T_j}$$

$$h_2(t_i) = A_{j,2}.\sin\frac{2\pi(t_i - t_{0,j,2})}{T_j}$$

Then:

$$h_2(t_i) = \frac{A_{j,2}}{A_{j,1}} A_{j,1}.\sin\frac{2\pi(t_i - t_{0,j,1} + t_{0,j,1} - t_{0,j,2})}{T_j} = \frac{A_{j,2}}{A_{j,1}} A_{j,1}.\sin\frac{2\pi(t_i - \Delta_t - t_{0,j,1})}{T_j}$$

where $\Delta_t = t_{0,j,2} - t_{0,j,1}$ is the lag.

Hence:

$$h_2(t_i) = \frac{A_{j,2}}{A_{j,1}} h_1(t_i - \Delta_t) \quad (3)$$

Equation 3 shows that if the models of two time series contain harmonic models with the same periods then the later harmonic model is proportional to the earlier harmonic model. The proportion of the harmonic models is equal to the proportion of the amplitudes.

This fact allows us to express the dynamics of the number of conceptions by means of the dynamics of the economic indicators when they contain the harmonic models with the same periods and when the start points of the harmonic models of the economic indicators is earlier then the start point of the harmonic model of the number of conceptions. And this in its turn will mean that the number of conceptions depend on the economic dynamics.

4. Results

Harmonic models with the same periods as a harmonic component of the number of conceptions are[5]:

- four-quarter harmonic model of the volume indices of GDP:

(4) $h_{INC}(t_i) = 0{,}296.h_{VIGDP}(t_i - 0{,}4)$ (Figure 1);

- four-quarter harmonic model of the volume indices of the final consumption expenditure of households:

(5) $h_{INC}(t_i) = 0{,}525.h_{VIFCEH}(t_i - 0{,}2)$ (Figure 2);

- four-quarter harmonic model of the volume indices of the individual final consumption expenditure of general government:

(6) $h_{INC}(t_i) = 0{,}362.h_{VIIFCEGG}(t_i + 0{,}1)$ (Figure 3);

- four-quarter harmonic model of the indices of the number of employed:

(7) $h_{INC}(t_i) = 0{,}826.h_{INEd}(t_i - 1{,}2)$ (Figure 4);

- four-quarter harmonic model of the indices of the number of employees:

(8) $h_{INC}(t_i) = 2{,}367.h_{INEs}(t_i - 0{,}9)$ (Figure 5);

- four-quarter harmonic model of the indices of the number of self-employed:

(9) $h_{INC}(t_i) = 0{,}276.h_{INSE}(t_i - 1{,}3)$ (Figure 6);

- four-quarter harmonic model of the indices of the hours worked of employed:

(10) $h_{INC}(t_i) = 0{,}924.h_{IHWEd}(t_i - 1{,}3)$ (Figure 7);

- four-quarter harmonic model of the indices of the hours worked of self-employed:

(11) $h_{INC}(t_i) = 0{,}183.h_{IHWSE}(t_i - 1{,}2)$ (Figure 8).

[5] Legend:
INC – Indices of the number of conceptions;
VIGDP – Volume indices of GDP;
VIFCEH – Volume indices of the final consumption expenditure of households;
VIIFCEGG – Volume indices of the individual final consumption expenditure of general government;
INEd – Indices of the number of employed;
INEs – Indices of the number of employees;
INSE – Indices of the number of self-employed;
IHWEd – Indices of the hours worked of employed;
IHWSE – Indices of the hours worked of self-employed.

5. Conclusions

5.1. Equations 4-6 and Figures 1-3 show that the changes in the indicators of the economic development and the change in the number of conceptions are practically simultaneous. Since the economic development could not affect immediately, it is more likely that the number of conceptions does not depend on the economic development.

5.2. Equations 7-11 and Figures 4-8 show that the changes in the numbers and the hours worked of employed, employees and self-employed precede the change in the number of the conceptions with almost one quarter. That means that it is rather likely that the number of conceptions depends on the number and the hours worked of employed, employees and self-employed one quarter earlier.

References

Naidenov, G., K. Haralampiev. 2007. Cyclic Recurrence of Foodstuffs and Non-foodstuffs Price Level in Bulgaria during XX Century. Economic Alternatives, 2/2007

Харалампиев, К. 2007. Има ли връзка между политическата ситуация в страната и раждаемостта през периода 1990-2003 година? Годишник на СУ „Св. Климент Охридски", Философски факултет, книга „Социология", том 96-98 (**Haralampiev, K.** Is There a Correlation between the Political Situation and the Fertility during the Period 1990-2003? Annuaire de l'Universite de Sofia "St. Kliment Ohridski", Faculte de Philosophie, Livre Sociolgie, Tome 96-98)

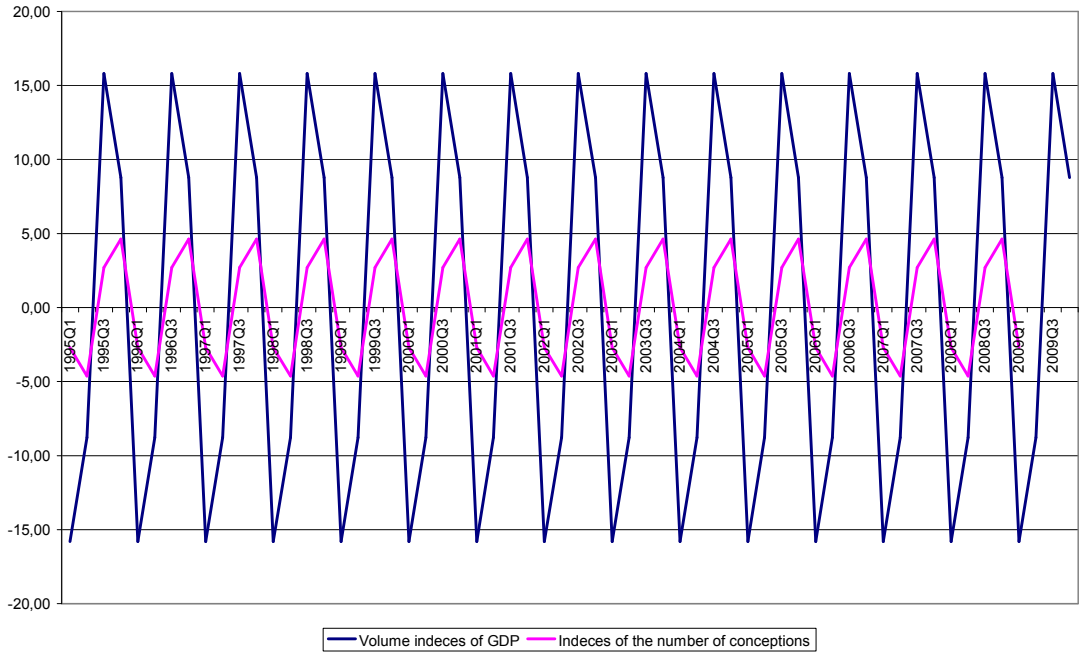

Figure 1. Four-quarter harmonic model of the volume indices of GDP and the indices of the number of conceptions

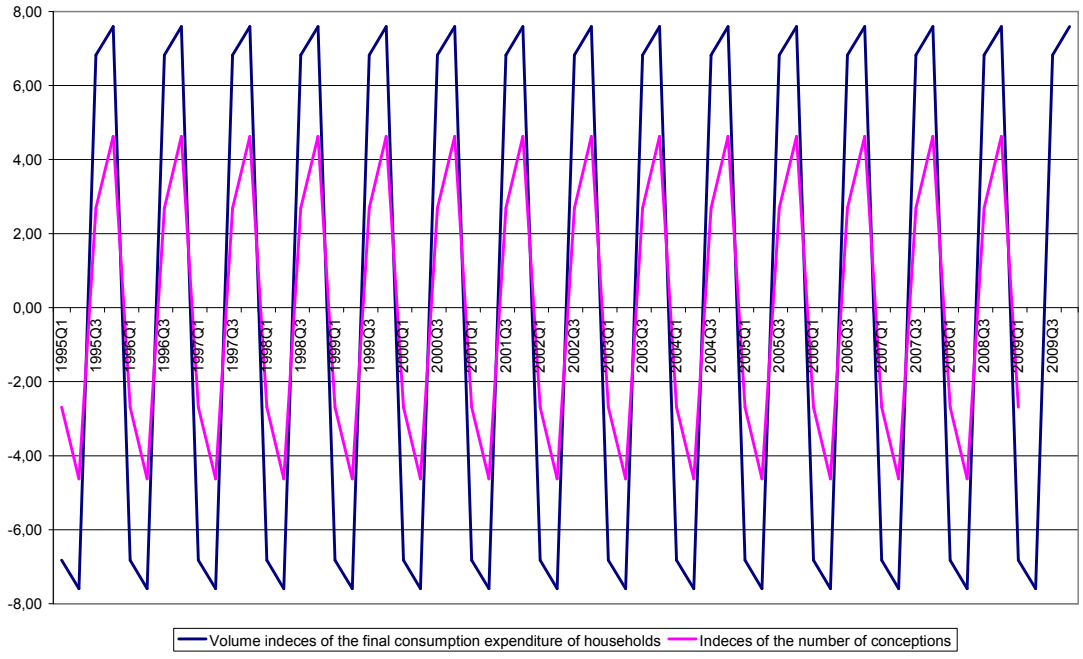

Figure 2. Four-quarter harmonic model of the volume indices of the final consumption expenditure of households and the indices of the number of conceptions

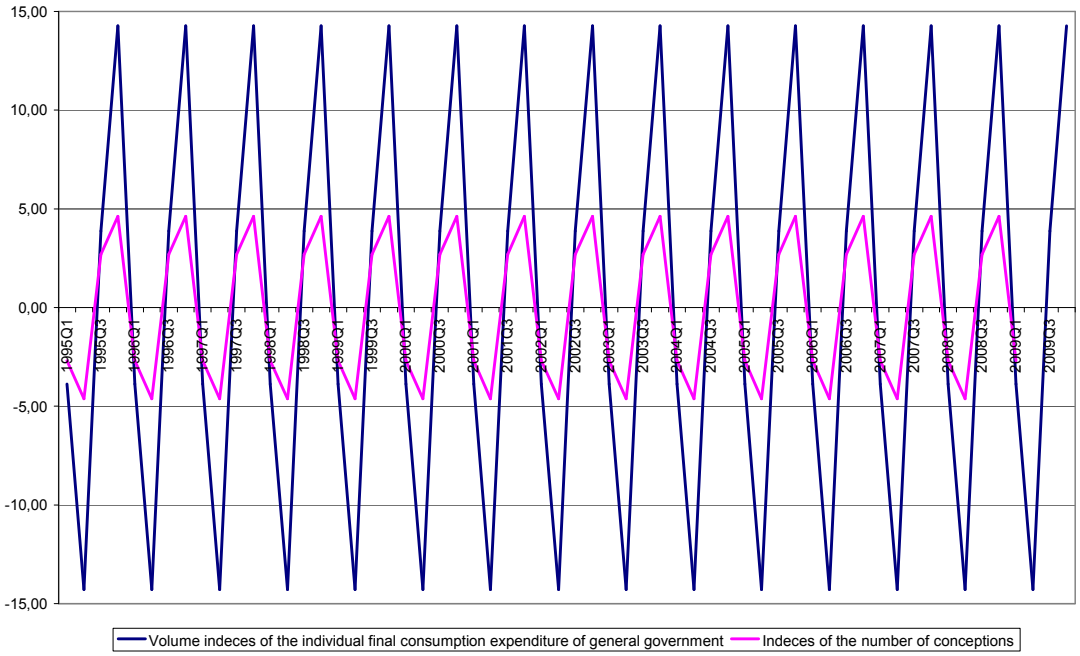

Figure 3. Four-quarter harmonic model of the volume indices of the individual final consumption expenditure of general government and the indices of the number of conceptions

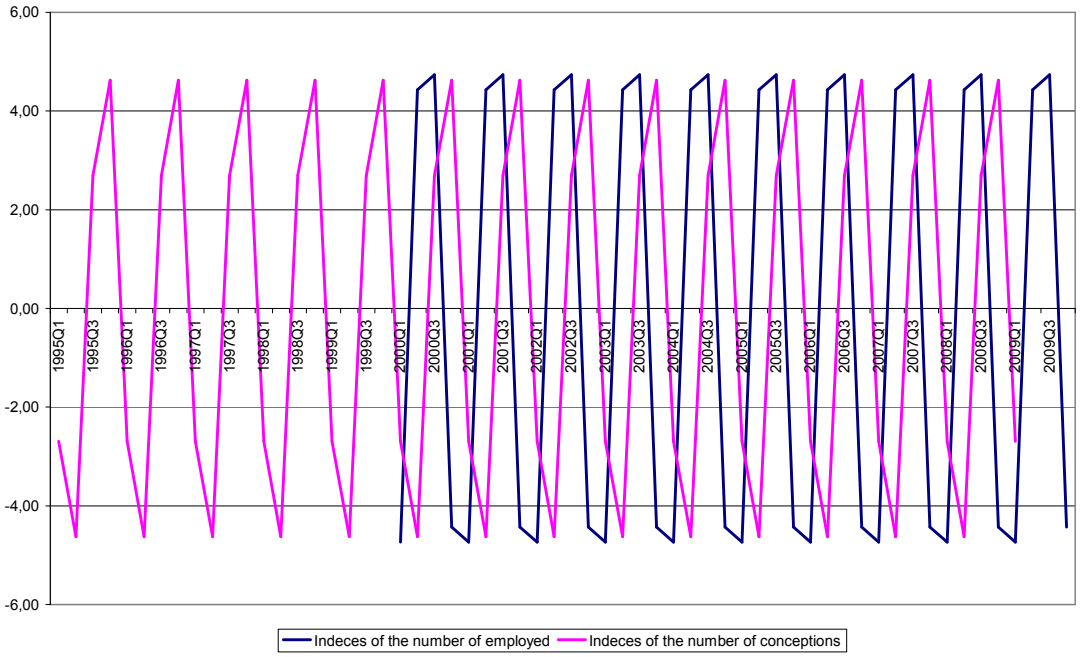

Figure 4. Four-quarter harmonic model of the indices of the number of employed and the indices of the number of conceptions

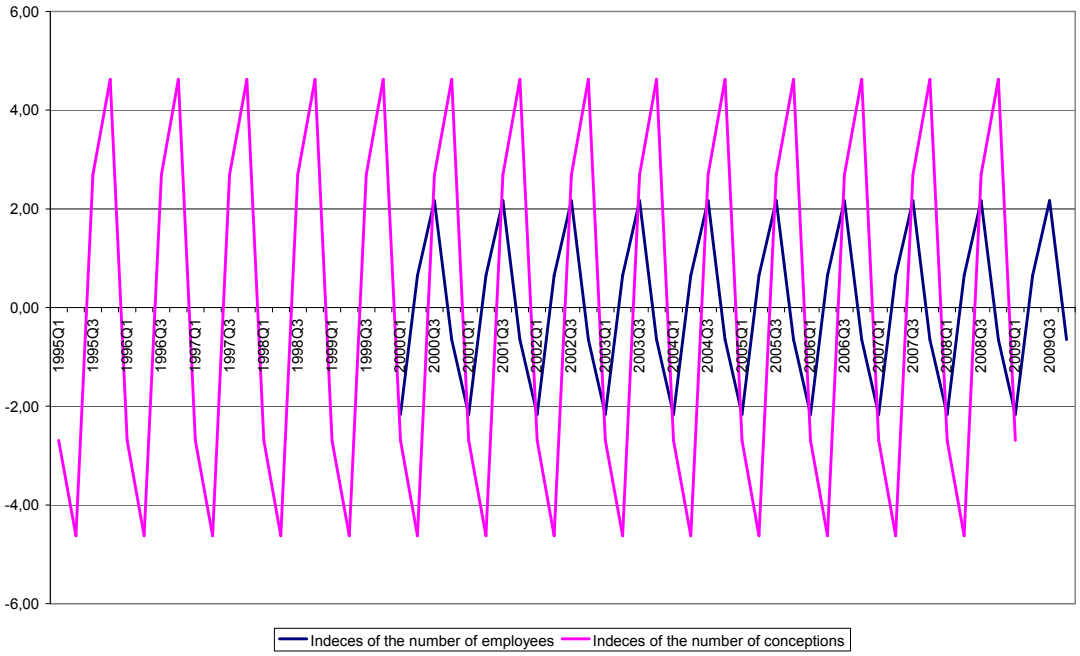

Figure 5. Four-quarter harmonic model of the indices of the number of employees and the indices of the number of conceptions

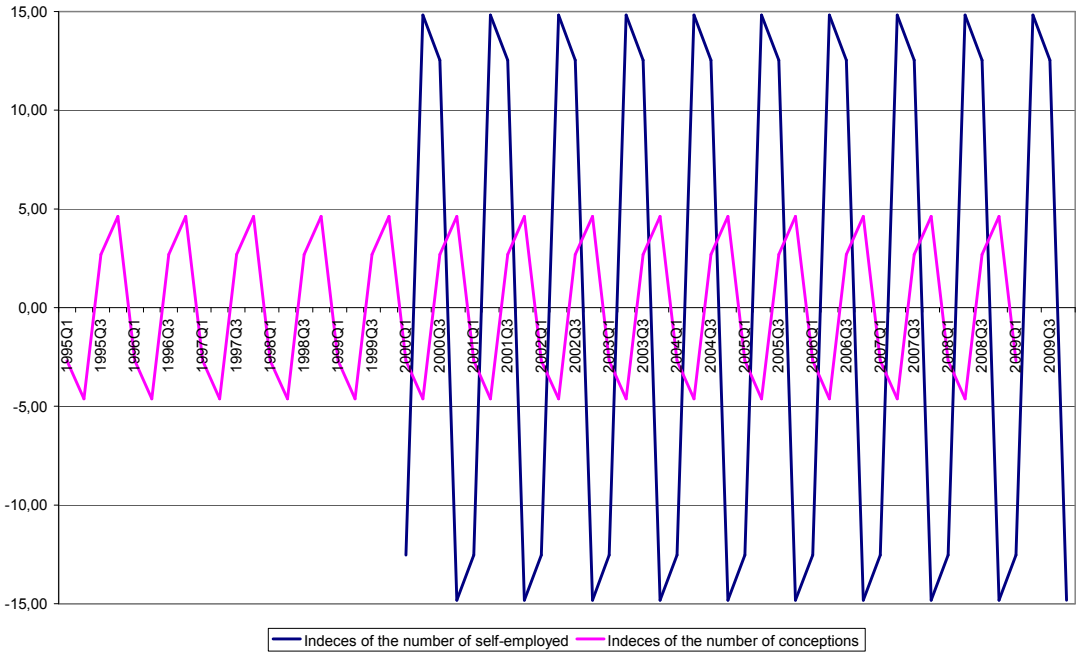

Figure 6. Four-quarter harmonic model of the indices of the number of self-employed and the indices of the number of conceptions

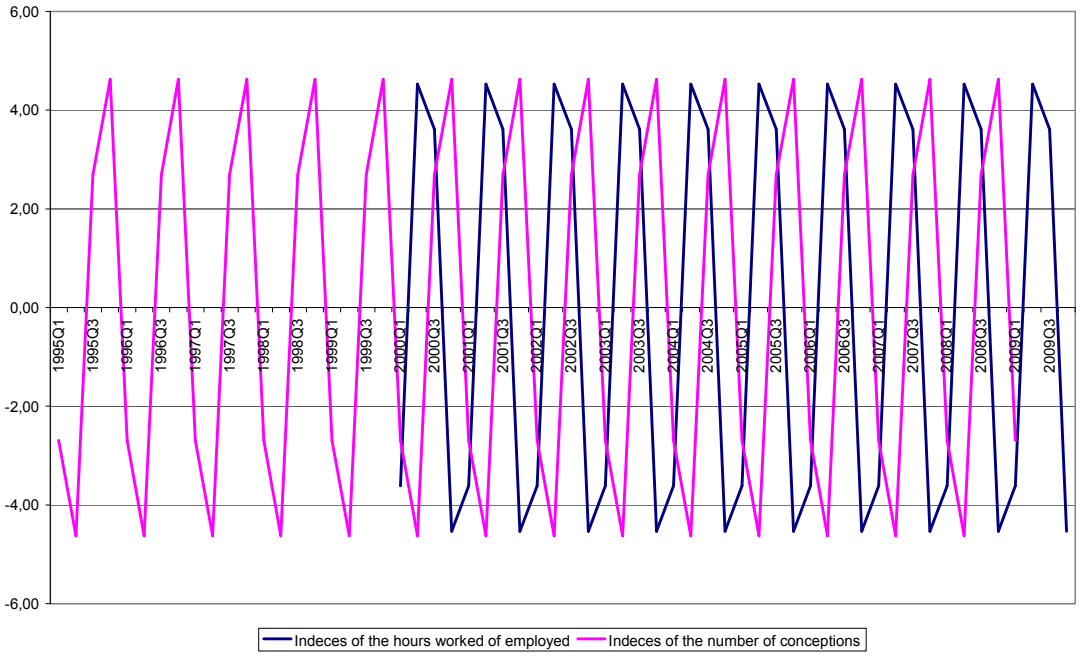

Figure 7. Four-quarter harmonic model of the indices of the hours worked of employed and the indices of the number of conceptions

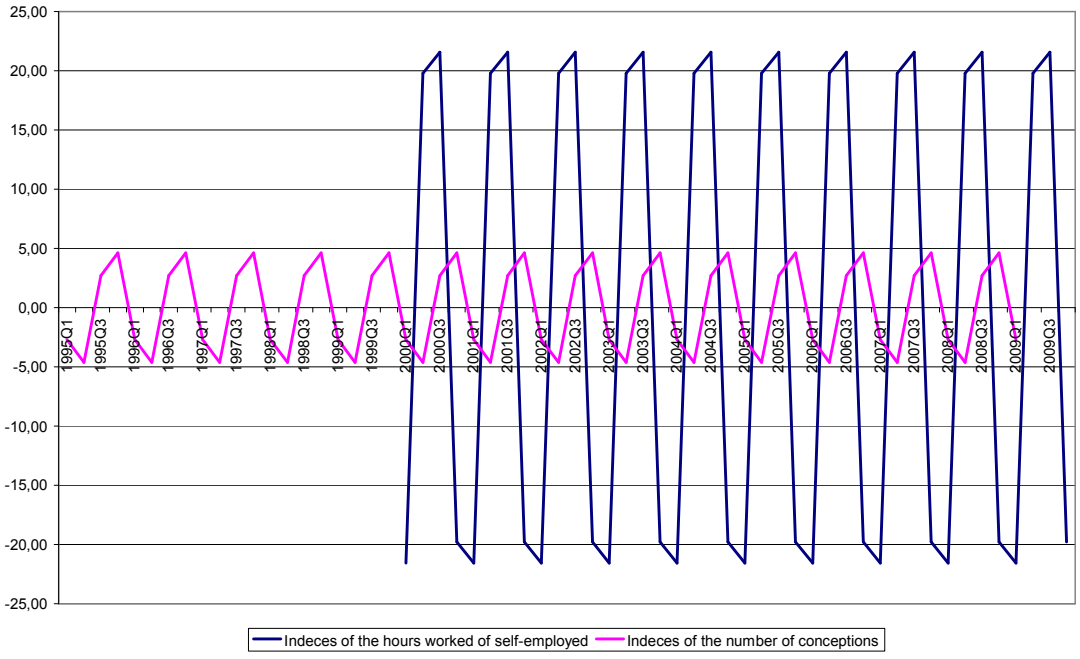

Figure 8. Four-quarter harmonic model of the indices of the hours worked of self-employed and the indices of the number of conceptions