

DEMOGRAPHIC TRANSITION AND ECONOMIC GROWTH IN ROMANIA

Abstract

In Romania, the phenomenon of demographic transition has been present since the second half of the last century, having certain features also met in the developed countries: the drop in fertility, the increase in life expectancy, the decrease in infant mortality. After 1990, the phenomenon of demographic transition has been emphasized by the effects of society's transition from the communist model to the market one. Besides the two coordinates which are specific for the demographic transition, the drop of fertility and infant mortality, the demographic behaviour of Romania also presents features encountered only in the countries from the former communist bloc: the increase in mortality and decrease in natality, which have led to a negative natural growth, the registration of a negative migration increment, the decrease in nuptiality. All these have triggered the continuous population decline from one year to another and the accentuation of the phenomenon of demographic ageing. The crisis of demographic transition in Romania has important economic and social consequences, both in the present and in the future. The goal of this paper is to highlight the determinants of demographic transition in Romania and to assess its effects on economic development by means of an econometric model.

Keywords: *Demographic transition, fertility, infant mortality, economic growth, econometric model*

1. Introduction

The economists and specialists from the social sciences have long debated over the demographic changes and economic development (N. Birdsall, C.A. Kelley, and S.W. Sinding, eds., 2001). Three possible scenarios have been preferred in this respect: demographic migrations promote, restrict or are independent from economic growth. Demographic changes particularly aim at the structure and size of population as well as at the evolution of basic demographic phenomena: birth rate, mortality, migration etc. According to the three possible scenarios, three theories were developed regarding the relationship between demography and economy: the pessimistic theory (firstly formulated by Malthus in 1798), the optimistic theory (S. Kuznets, 1976, J. Simon, 1981, E. Boserup 1981) and the neutral theory.

As a general rule, the results of the research on fertility and mortality conducted both by economists and demographers highlighted the existence of a relationship between these demographic phenomena and economic development. The fundamental hypothesis which could be inferred from these studies is that the total birth rate and the infant mortality rate are negatively correlated with economic growth, while the population growth rate is positively correlated, still without much impact on economic growth.

An important direction of research of the relationship between demography and economy is represented by the design of growth models that take into consideration the demographic transformations at the level of a country or a region. The specialty literature contains such models which rely on the economic growth models (a synthesis about these models can be met in Baro 1995): exogenous (Solow, 1956), endogenous (Romer, 1990), semi-endogenous (Jones, 1995).

Starting from these models, it was attempted to build models of population and of economic growth, meaning growth models where the demographic component appears as an exogenous, endogenous or semi-endogenous factor (L. Weber, 2010). As a rule, these are theoretical models which have not been empirically tested for their most part. In literature, there are also cases when these models were applied to real economic and demographic situations (Altăr 2008, Barlow 1994, Savaş 2008).

¹ Assoc. Prof.Ph.D. "Al.I. Cuza" University of Iași, Faculty of Economics and Business Administration

The most significant dynamics of population at European and global level occurred in the second half of the XXth century, a phenomenon which is called by specialists the demographic transition (Notestein 1945). This phenomenon can be noticed in the change of population growth rates, of the structure by age groups of the population and in the dynamics of main demographic phenomena. The demographic transition has two major components: an initial decline in infant mortality and a subsequent significant drop in fertility. In Romania, this phenomenon has made its debut since the communist period, despite the pro-birth policies of the respective regime.

Certain empirical studies on demographic transition and economic growth show that for the industrialized economies with reduced mortality rates, a long-term decrease in infant mortality is accompanied by a decrease in fertility, having as a consequence the economic growth, under certain conditions of economic performance and of the labour market. The studies also show that an increase in the real wages determines economic growth, concurrently with a decrease in nuptiality and fertility (Hondroyiannis and Papapetrou 2002, 2003).

In the Central and Eastern European countries, demographic transition entered a crisis stage, disregarding the theoretical models established for this phenomenon in the developed countries or in the countries with emergent economies (Cornia and Panicià). Moreover, in these countries, as it is also the case for Romania, aside from the decrease in fertility and infant mortality, an important increase in mortality and a decrease in nuptiality are registered. In these countries the economic growth is also fluctuant, circumstantial, with irregular, difficult to anticipate variations.

In this paper we analyse the main determinants of demographic transition phenomena and the correlations between demographic variables and economic growth in Romania for the period 1990-2010, using descriptive statistics and econometric modelling method. The main idea of the paper is to test empirically a few assumptions of the demographic transition theory. We expect that for Romania should not be met the hypotheses of demographic transition theory and of economic growth, as they were developed in the literature, especially in relation to the developed countries. We would also like to analyze whether within the demographic transition phenomenon the evolution of mortality is important as well as its effect on economic growth. At the same time, we consider that the understanding of the demographic transition mechanism under these crisis circumstances is very important in the decision making process for the future social and economic development strategies.

After a short literature review presented in this section, the next one deals with a brief statistical analysis of demographic transition and economic growth in Romania. In the next section are presented some methodological issues. The presentation of results of econometric modelling process comes next, exploring the correlations between demographic variables and economic growth in Romania. The paper ends with concluding remarks and references.

2. Demographic transition coordinates and economic development in Romania

In compliance with the specialty literature, the phenomenon of demographic transition has two significant coordinates: a decline in infant mortality and an important reduction of fertility. We will analyze these elements for Romania, using the official statistical data starting with the year 1975 in order to better underline the evolution trends of demographic phenomena. Moreover, in our analysis we will consider the evolution of population and mortality growth rate. The dynamics of economic growth is rendered by means of the GDP growth rate. In the analysis we will also take into account the evolution of the labour force growth rate, the real wage index and the net investment rate during 1990-2010.

a. The evolution of infant mortality

Infant mortality is not only an indicator of the demographic situation of a country, but also of its level of economic and social development. The decreasing trend of this indicator in EU is correlated with economic growth and improvement of life conditions, with the increase in medical and social care and technological progress. The reduction of this indicator is also correlated with the birth rate evolution, the risk of deaths under the age of 1 year being lower and the number of live births registers a general downward trend.

In Romania, infant mortality has registered a continuous decreasing trend while in the last 35 years there has been an almost linear downward trend, with certain fluctuations towards the end of the '80s (Figure 1.). This process is correlated with a higher level of urbanization and industrial development.

The rate of 10 deaths for children under 1 of age per one hundred live births represents the lowest infant mortality rate in Romania, but it is the highest rate in the European Union in 2010, being two times higher than the EU average. This decreasing trend meets the basic hypothesis of the demographic transition phenomenon, but in Romania it is caused by the specific conditions of a former communist society.

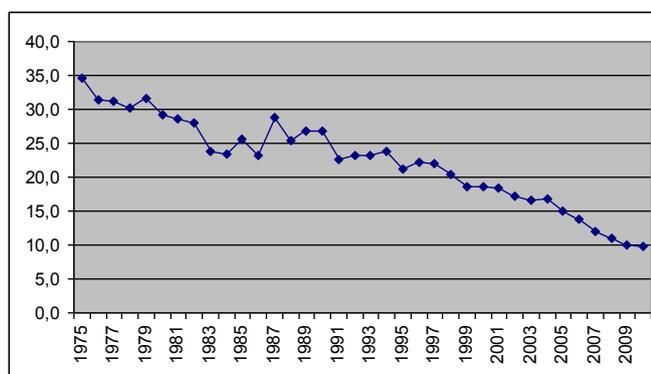


Figure 1. The infant mortality rate in Romania between 1975 and 2010
Source: Done by the authors according to the data provided by EUROSTAT, 2011

Romania registered the highest infant mortality rate in the EU throughout the period 1990-2010, with Bulgaria having values closer to our country. This situation is obviously correlated with the economic and social evolution of Romania in the last 20 years and particularly with the strong natality downfall. Since 1992, Romania has registered a negative natural growth while the crude birth rate has continuously decreased and after 2000, it has registered slight fluctuations around the value of 10 births per 1000 inhabitants.

b. The evolution of total fertility rate

As it can be noticed from Figure 2., after 1990 Romania has reached the negative demographic situation when the old generations cannot be replaced by the new ones anymore, having a total fertility rate of below 2.1 children born by a woman.

The crude birth rate has decreased from 13.9 in 1990 to approximately 10 newborns per one thousand inhabitants in 2010. It is important to underline that comparatively with 1990, in 2010 the newborn generation is one third smaller, decreasing from 310 thousand to approximately 210 thousand live newborns.

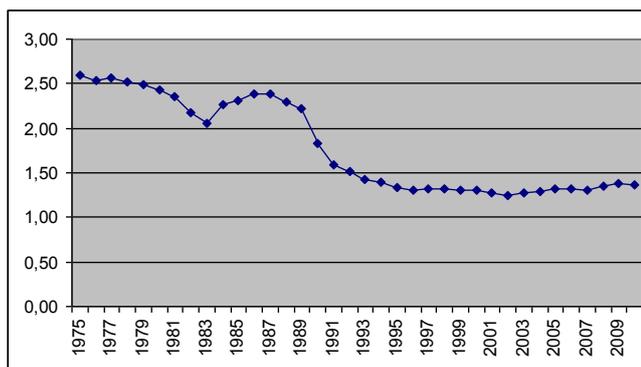


Figure 2. Total fertility rate in Romania between 1975 and 2010

Source: Done by the authors according to the data provided by EUROSTAT, 2011

In line with the decreasing trend of fertility rate after 1990, in Romania there is an increasing trend of crude mortality rate. This will exceed the crude birth rate starting with the year 1992 (this year the birth rate decreased to 11.4 while the mortality rate increased to 11.6 deaths per one thousand inhabitants), leading to a negative natural growth that will be preserved until the present. This mortality increase is explained in the specialty literature by means of some risk factors specific to the post-communist societies, especially factors that increase the risk of diseases and deaths in middle-aged persons.

c. The evolution of population growth rate and occupation rate

In 2007, the year of adherence to the EU, Romania was a country with 21.5 mil inhabitants and ranked 7th by effective population size, of the total of the 27 countries that compose the EU. If the current decreasing trend of population and the negative natural growth continues, Romania will lose this advantage and in the next 30 years the estimated average population will be of 16 mil inhabitants.

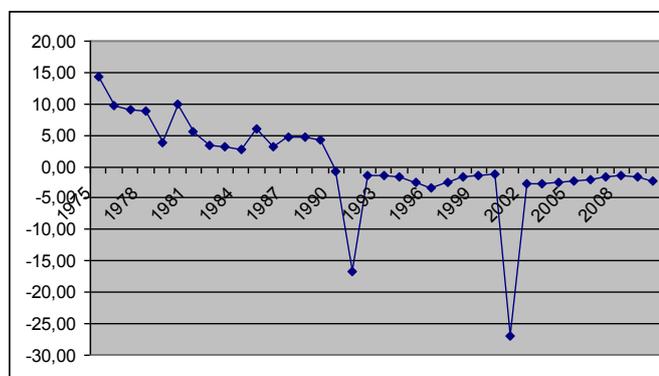


Figure 3. The growth rate of the population in Romania between 1975 and 2010

Source: Done by the authors according to the data provided by EUROSTAT, 2011

On a whole, since 1975 until the present, the population growth rate in Romania is decreasing, which represents a sign of the demographic transition started during the communist period. Besides the natality shock caused by the abortion law enacted in 1966, Romania's natality goes through a continuous downward trend since the beginning of the XXth century. This trend is noticeable in the continuous decrease in the population growth rate until it stops and reverses its direction.

The population growth rate is negative starting with the year 1990 from at least two reasons: the migration increment is negative and the natural growth is also negative. Romania's demographic decline admits features specific to other countries belonging to the former communist bloc. In these countries, the transition period of the entire society accelerated the process of demographic transition and accentuated the negative development

of certain demographic phenomena such as migration, natality, mortality and nuptiality. The effects of population decrease have in the first stage an economic impact through the increase in the degree of demographic and economic dependence.

d. The evolution of economic growth rate and activity rate

In Figure 4 it can be observed that after 1990 the economic development in Romania is fluctuant, with rapid changes from negative growth rates to positive ones and the other way round.

A relatively stable period was during the years 2000-2008, but it is well known that these high rates of GDP increase were not strongly determined by a real growth of the Romanian economy. The global economic crisis dramatically affected Romania as well, with a strong variation of growth rate in 2009 and a slight rebound in 2010 as a consequence of anti-crisis measures.

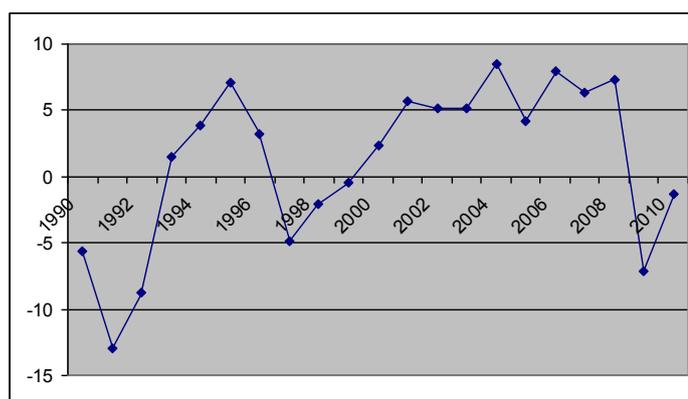


Figure 4. The GDP growth rate in Romania between 1990 and 2010

Source: Done by the authors according to the data provided by EUROSTAT, 2011

As it can be noticed in Figure 5, the active population growth rate does not register a trend, but fluctuations reflecting the social and economic situation of Romania during certain shorter periods of time. The positive values of the rate are registered at the beginning and the end of the period under analysis, and during 1994-2005 the rate has negative values. Between 1992 and 1996 we witness a strong decrease in the occupied population growth rate, due to migration and economic changes caused by the transition process Romania has gone through after the fall of the communist regime.

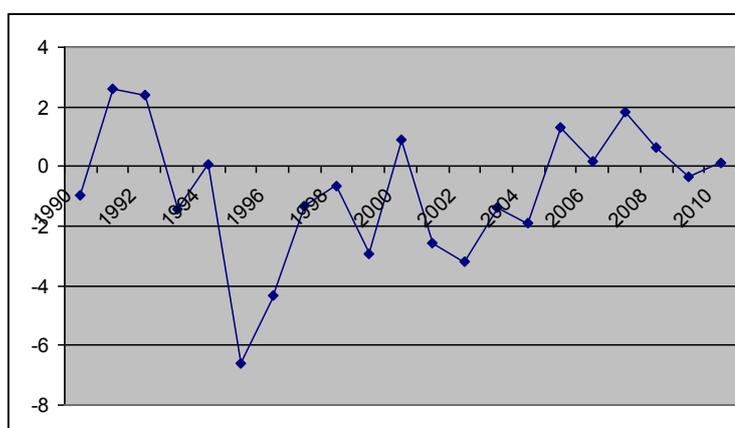


Figure 5 The active population growth rate in Romania between 1990 and 2010

Source: Done by the authors according to the data provided by INS, 2011

As a rule, the basic hypothesis for this variable is that the increase in the active population rate does not lead to economic growth unless it is absorbed on the labour market.

For the transition countries, this can be difficult and a significant increase in the active population growth rate could have a negative impact on economic growth.

3. Statistical variables and methodological issues

In order to analyze the impact of demographic transition on economic growth, we use an econometric model where the dependent variable is economic growth rate, and the independent variables are: the total fertility rate, the infant mortality rate, total population growth rate, active population growth rate, mortality rate, real wage index and net investment growth rate. The model is estimated by means of official statistical data provided by the National Institute of Statistics and by Eurostat for the period 1990-2010.

As the modelling is conducted by means of time series, the first step of the analysis is to test the stationarity of data series. To this purpose, we use the Dickey-Fuller test that offers us the following results:

For the independent variables:

- the total fertility rate (fertility_rate, X_1) is stationary;
- the infant mortality rate (infant_rate, X_2) is non-stationary;
- the total population growth rate (pop_rate, X_3) is stationary;
- the active population growth rate (activ_pop, X_4) is non-stationary;
- the mortality rate (mort_rate, X_5) is non-stationary;
- the real wage index (wage_rate, X_6) is non-stationary;
- the net investment growth rate (inv_rate, X_7) is stationary.

For the dependent variable (gdp_rate, Y) the result of the unit root test indicates that the series is stationary and should not be transformed in order to be used in the regression model.

The change of non-stationary series is performed by means of the difference operator of first order and the process of stationary testing is restarted. By applying the Dickey-Fuller test for the non-stationary variables the following results were obtained:

- the variables Y, X_1, X_3, X_7 are stationary;
- the variables X_2, X_4, X_5 și X_6 are non-stationary.

Using the difference operator, the non-stationary variables are transformed and the results from table 2.1 are obtained, confirming that:

- the variables X_2, X_6 are integrated of order 2;
- the variables X_4, X_5 are integrated of order 1.

Table 1

Augmented Dickey-Fuller Unit Root Test

Variable	Test	Risk	t-Statistic	Prob.
DIFF(infant_rate,2)	Augmented Dickey-Fuller test statistic		-8.201531	0.0000
	Test critical values:	1% level	-4.667883	
DIFF(wage_rate,2)	Augmented Dickey-Fuller test statistic		-5.641	0.0014
	Test critical values:	1% level	-4.57	
DIFF(activ_pop,1)	Augmented Dickey-Fuller test statistic		-6.46	0.0003
	Test critical values:	1% level	-4.53	
DIFF(mort_rate,1)	Augmented Dickey-Fuller test statistic		-4.12	0.022
	Test critical values:	5% level	-3.69	

Source: Done by the authors using E-Views 7

4. Results

To test the hypothesis that demographic transition has effect on economic growth a multiple linear regression model was built in which the non-stationary variables are changed by means of the difference operator of first and second order. The model has the equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 \Delta^2 X_2 + \beta_3 X_3 + \beta_4 \Delta X_4 + \beta_5 \Delta X_5 + \beta_6 \Delta^2 X_6 + \beta_7 X_7 + \varepsilon.$$

The modelling results, obtained by means of the SPSS program, are presented in the table below.

Regression model results

Table 2

		Coefficients ^a				
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	85,048	15,955		5,330	,000
	DIFF(activ_pop,1)	-,956	,288	-,499	-3,325	,007
	DIFF(mort_rate,1)	-1,210	1,790	-,088	-,676	,513
	DIFF(infant_rate,2)	,962	,440	,351	2,187	,051
	DIFF(wage_rate,2)	,002	,074	,003	,024	,981
	pop_rate	,137	,119	,154	1,154	,273
	invest_rate	,171	,036	,683	4,722	,001
	fertility_rate	-62,860	11,889	-,767	-5,287	,000
2	(Constant)	85,061	15,267		5,572	,000
	DIFF(activ_pop,1)	-,957	,270	-,499	-3,548	,004
	DIFF(mort_rate,1)	-1,215	1,704	-,088	-,713	,490
	DIFF(infant_rate,2)	,965	,407	,352	2,374	,035
	pop_rate	,137	,113	,154	1,210	,249
	invest_rate	,171	,029	,685	5,984	,000
	fertility_rate	-62,872	11,373	-,767	-5,528	,000
	3	(Constant)	85,670	14,952		5,730
DIFF(activ_pop,1)		-,905	,255	-,472	-3,553	,004
DIFF(infant_rate,2)		,868	,376	,317	2,310	,038
pop_rate		,144	,111	,161	1,294	,218
invest_rate		,170	,028	,681	6,073	,000
fertility_rate		-63,344	11,137	-,772	-5,688	,000
4		(Constant)	77,132	13,738		5,614
	DIFF(activ_pop,1)	-,769	,237	-,401	-3,238	,006
	DIFF(infant_rate,2)	,747	,372	,273	2,004	,065
	invest_rate	,168	,029	,671	5,861	,000
	fertility_rate	-57,256	10,335	-,698	-5,540	,000

a. Dependent Variable: GDP_rate

Source: Done by the authors using SPSS

Using the method of successive exclusion from the model of the statistically non-significant variables, the following aspects were considered:

- the variable population growth rate does not have a significant influence on the economic growth rate. This result is also confirmed by other studies, and in Romania the variations of the population growth rate are not so much important during the analysed period.

- the mortality rate, even if it registered an increase between 1990 and 2010, the irregular fluctuations between 10 and 12 deaths per one thousand inhabitants do not have a significant influence on economic growth. Thus, the hypothesis of certain implications of demographic transition crisis through the increase and variation of crude mortality rate is not confirmed.

- the variation of the real wage index has not had a significant impact on the economic growth rate in Romania in the last 20 years;

- lastly, the variation of infant mortality rate, for a risk of 5% is not significantly correlated with economic growth, and a possible positive influence for a 10% risk is not consistent with the theory of demographic transition.

In order to validate the model 4 in Table 2, an analysis of the residual component was conducted. The results in Table 3 confirm the lack of error autocorrelation. The Kolmogorov test also confirms their normality hypothesis.

Table 3

Correlogram of the residuals

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
. * .	. * .	1	0.161	0.161	0.5263	0.468
. ***.	. ***.	2	0.378	0.361	3.5955	0.166
. .	. * .	3	-0.059	-0.184	3.6753	0.299
. ** .	. * .	4	0.277	0.212	5.5833	0.233
. .	. .	5	-0.038	-0.037	5.6212	0.345
. * .	. ***.	6	-0.146	-0.395	6.2494	0.396
. * .	. .	7	-0.197	-0.011	7.4980	0.379
. ** .	. ** .	8	-0.287	-0.216	10.449	0.235
. * .	. .	9	-0.122	-0.042	11.050	0.272
. ** .	. * .	10	-0.213	0.118	13.142	0.216
. .	. .	11	-0.058	-0.033	13.325	0.273
. * .	. .	12	-0.125	0.029	14.333	0.280

The significant influences on economic growth are offered by only three of the variables used in the model:

- the total fertility rate has a significant negative impact on economic growth, in compliance with the theory of demographic transition. A future decrease in fertility rate might favour economic growth..

- the active population growth rate also has a significant negative impact on the economic growth rate. This situation could be partially explained by the transition of the Romanian economy and by the incapacity to absorb the entire labour force.

- the net investment growth rate has a significant positive impact on economic growth. This aspect is not surprising and meets both the hypotheses formulated in economic theory and those of demographic transition.

5. Conclusions

The analysis of demographic transition determinants and their impact on economic growth enables the shaping of several conclusions.

Firstly, the analysis of the main demographic phenomena which characterize the demographic transition suggests that during 1990-2010 in Romania there are concrete signs regarding the manifestation of this type of demographic behaviour. The infant mortality is in a continuous process of decrease while the total fertility rate has a similar trend, still during the entire period the variations are not very important. On a long run, this decrease placed Romania, after 1990, below the rate of generation replacement. Concurrently with these two demographic trends, Romania registers a negative population growth rate, with a slight decreasing trend, while the crude mortality rate also registers a long-term downward trend, with values above the crude natality rate. When these results are considered together, we obtain a demographic picture specific to the countries from the former communist bloc, space where demographic transition takes a peculiar form, different from that of the developed countries.

The economic analysis focused on testing some hypotheses from the specialty literature, as well as some specific ones pertaining to the Romanian circumstances. Mainly, the hypothesis stating that the decrease in fertility has a positive impact on economic growth is verified. This aspect should be also correlated to the fact that in Romania the demographic behaviour entered a crisis period and the trend of fertility decrease might not have a positive impact on economic growth in the future. If for the period under analysis the mortality's

evolution does not have a significant impact on economic growth, as we might have expected, in the future, it may contribute to the negative effect of the crisis of demographic transition on economic and social development of Romania. It is fairly obvious that for the economic growth the investment rate must increase, while the active population variation might be transformed into an ally of economic growth, provided new jobs and a higher absorption on the labour market are ensured. In the future, taking into account the present demographic trend, Romania will face problems regarding its active population due to demographic ageing. The decrease in infant mortality is a sign of social and economic progress, but for the analyzed period we cannot speak about a significant correlation with economic growth in Romania. This decrease is not sufficiently significant, considering Romania has the highest rate in the EU.

References

1. Altăr, M., Necula, C. and Bobeică, G., (2008). "Modelling the Economic Growth in Romania. The Role of Human Capital", *Romanian Journal of Economic Forecasting* 3, 115.128
2. Barlow, R., (1994). "Population Growth and Economic Growth: Some More Correlations", *Population and economic Review* 20, 153.165
3. Barro, R.J. and Sala-I-Martin, X. (1995). *Economic Growth*. McGraw-Hill, Inc.
4. Birdsall, N., Kelley, C.A. and Sinding, S.W. eds. (2001). *Population Matters: Demographic Change, Economic Growth, and Poverty in the Developing World*. Oxford University Press
5. Boserup, E. (1981). *Population and Technological Change: A Study of Long-Term Trends*. Chicago University Press
6. Cornia, G.A. and Paniccia, R.(1996)."The Transition's Population Crisis: an Econometric Investigation of Nuptiality, Fertility and Mortality in Severally Distressed Economies", *MOCT-MOST* 6, 95.129
7. Guellec D. and Ralle P. (2001). *Les Nouvelles Théories de la Croissance*. Paris: Ed. La Découverte
8. Hondroyiannis, G. and Papapetrou, E. (2002). "Demographic Transition and Economic Growth: Empirical Evidence from Greece." *Journal of Population Economics* 15, 2, 221.242
9. Jemna, D.V. (2009). *Econometrie*. Iași: Sedcom Libris
10. Jemna, D.V. and Asandului, M., (2010) "The Impact of Demographic Ageing on the Economic Development in Romania", *Metalurgia International* 15, 2, 61.66
11. Jones, L. (1997) *Population and Ideas: A Theory of Endogenous Growth*. Chambridge: National Bureau of Economic Research, working Paper nr. 6285
12. Kuznets, S. (1976). "Population and economic growth", *Proceedings of the American Philosophical Society* 111, 170.193
13. Lucas, R.E. (1988). "On the Mechanics of Economic Development", *Journal of Monetary Economics* 22, 3.42

14. Notestein, F.W. (1945). "Population: The long view". In: Schultz T.W. (ed.), *Food for the World*. University of Chicago Press, 36.57
15. Pearce, F. (2010). *The Coming Population Crash*. Boston: Beacon Press
16. Rausch, S. (2009). *Macroeconomic Consequences of Demographic Change*. Springer
17. Rebelo S. (1991). "Long run policy analysis and long run growth", *Journal of Political Economy* 99, 500.521
18. Romer, P.M. (1989). *Human Capital and Growth. Theory and Evidence*. Chambridge: National Bureau of Economic Research, working Paper nr. 3173
19. Romer, P.M. and Rivera L.A. (1990). *Economic Integration and Endogenous Growth*. Chambridge: National Bureau of Economic Research, working Paper nr. 3528
20. Savaş, B. (2008). "The Relationship Between Population and the Economic Growth: Empirical Evidence from the Central Asian Economies", *OAKA* 3, 6, 161.183
21. Solow, R.M. (2000). *Growth Theory: An Exposition*. Oxford University Press
22. Thirlwall, A.P. (2002). *The Nature of Economic Growth*. Edward Elgar Publishing
23. Weber, L. (2010). *Demographic Change and Economic Growth*, Physica Verlag – Springer
24. Wise, D.A. (2009). *Developments in the Economics of Aging*. The University of Chicago Press