

# THE ANALYSIS AND FORECAST OF THE SUCEAVA COUNTY POPULATION DYNAMICS

## *abstract*

The population is one of the most complex statistical groups in terms of the variety of the recorded characteristics, of the changes affecting it and of its structure, as well as in terms of the inter-conditioning relationships between the demographic and the social-economic phenomena.

The demographic problems triggered by the declining fertility in EU countries can also be identified in Romania as well, but the rather precarious state of the Romanian economy will most likely lead to a more serious social impact in the following years.

The population of Romania has undergone significant changes in the past few decades, due, on the one hand, to the demographic transition it is undergoing and, on the other hand, to the changes affecting the political, economic and social environment, as well as people's mentalities, and influencing the demographic phenomena dynamics. The negative values of the natural growth rate and of the migration balance has caused the constant population of Romania to decline during 1992-2011 by almost 2,7 million inhabitants. The changes in the demographic behaviour of the population in terms of the average number of wanted children per family, the rather high external migration rate as well as the increased mortality rate are the demographic characteristics of Romania.

In most cases, the declining population in the area is mostly due to a constant excess of the number of deaths in relation to the number of births, accompanied by the negative balance of the internal and the external migration.

The birth rates recorded in the counties in the historic province of Moldova have always been above the average recorded on a national level, thus giving it the name of "population basin". Suceava county is one of the counties that have traditionally had a natural growth but one that had been overcome with internal and external migration rates in the past few years (Ghețău, 2012, p. 13).

The purpose of this research is to analyse the population of Suceava county by time series, in order to develop a long term forecast in terms of population growth.

In order to reach our goal with the present research, we have established a series of objectives:

1. Highlighting the factors affecting the number and the structure of the population, as well as the existing theories in the professional literature as concerns the population;
2. Presenting the system of statistical indicators used in demographic analysis as well as the forecasting methods;
3. Analysing the changes in the number and structure of the population in Suceava county;
4. Comparing the level and the development of the main demographic phenomena in Suceava county with the overall situation in Romania in order to identify any existing differences or similarities;
5. Studying the possible correlations between the demographic and the economic indicators of the county;
6. Developing forecasts on the population growth in the county.

In order to reach the set objectives we have focused on validating the following hypotheses:

1. Population numbers have different dynamics in the administrative-territorial units of the county;
2. There are significant differences between the average structure of the population in Suceava county as compared to the overall structure of the population in Romania;
3. There are significant differences in the ethnical and religious structure of the population in each administrative-territorial unit;
4. The urbanization level influences birth rates and mortality rates among the population of the county;
5. The demographic aging process, visible in the changes affecting the population age structure, directly affects the increased general mortality rate;
6. There is a direct and very close correlation between the number of live births and the number of deaths occurring under the age of 1;
7. Economic factors, particularly finding a well-paid job and the improved standard of living, are the main factors determining the migration rates of the population.

In order to validate the hypotheses established in this research, we have used the data collected at the censuses organised in Romania during 1930-2011, as well as the data provided by the records of the registry, summarised in the Statistical Yearbooks or Monthly Statistical Records, either printed or online, on the websites of the National Institute of Statistics or the County Statistical Records. The information we have collected had been processed and analysed by means of the data processing programmes Excel and SPSS.

After establishing the theoretical background of the research presented in this paper, we have made a brief description of the Suceava county, by outlining the specific features of the economy in the north-east region and in Romania. From an economic standpoint, Suceava county has had an ascending development, but is still below the general regional and national levels.

In order to know and understand the range and the nature of the changes affecting the number and the structure of the population in the Suceava county, we have first conducted an analysis of the population dynamics throughout a longer period of time (1930-2011), based on the indicators of the time series.

The population structure analysis has started by calculating the statistical indicators understood as relative sizes of structure and/or coordination. In order to assess the concentration of the population in urban areas we have resorted to the Lorentz curve and the Gini concentration index. In order to describe the population structure and the structural changes, we have used methods based on parametric and non-parametric tests.

The population structure was identified in the county, by comparing it with the population structure on a national and regional level, and also in the field, in each of the 144 locations (municipalities, towns and villages) in the county.

The results arrived at after calculating the indicators of the demographic structure of the population of Suceava county, during 1966-2011, have highlighted important changes in the age and sex group structures.

In terms of important age groups, the weight of young population declined gradually from 30,03% in 1966 to 19,26% in 2011, while the weight of the aged population increased from 6,64% in 1966 to 15,94% in 2011. The adult population has slightly increased, as the generations born after 1966 have also joined this category.

These mutations in the age group structure reveal a population aging process. The aging levels of the population during 1966-2011 have been measured by calculating several indicators,

namely: the ratio of the aged to the young, the dependency degree of the aged, the dependency degree of the young, the average, median and modal age.

The analysis of the population structure per each environment reveals the nature of the economic and social development, as well as the consequences on the population flows. The urbanisation degree in the Suceava county has been measured by means of the urbanisation rate, which has highlighted an increase of the degree of urbanisation, from 16,55% in 1948 to 41,3% in 2011. As compared to the urbanization degree on a national level, we have identified a time delay of about four decades that has not had positive effects in the Suceava county.

The changes affecting the political and economic environment in the 90's, the lowering of the standard of living and the difficulties of living in urban areas have also reversed the direction of the migration, from urban to rural areas and thus, during 1992-2002, the urban population has declined by 2134,8 individuals on average per year, namely, by an average annual rate of 1%. Alternatively, the administrative reorganisation of certain villages into towns during 2002-2011 has resulted into an increase of the population in urban areas.

In order to understand the inter-dependence between the social-economic and the demographic factors, we have looked at the population structure in terms of the social and economic characteristics. The calculated indicators have shown that in 2011, almost half (46%) of the employed population was engaged in agriculture, forestry and fishing. A comparison with the year 2000 has revealed a reorientation of the population towards other activities of the national economic sectors, such as: industry, especially manufacturing, constructions, wholesaling and retailing, vehicle repairs, hotels and restaurants, as well as education.

As concerns the population structure in terms of education and training, half of the stable population of 10 years and older in Suceava has a low level of education (primary, secondary or no degree), while only 9,27% of the population has higher education degrees.

The importance of knowing the ethnic and religious structure of the population has required the approach of these aspects as well, especially since the population of the Suceava county has been highly various in terms of ethnicity, language and religion. The data collected in the 2011 census has shown that, apart from Romanians, there is a percentage of about 2% of Romani people in Suceava county. Percentage points of under 1% of the total population include Ukrainians, Poles, Russian Lipovans (Old Believers), Germans and Hungarians. A number of 20.000 people wouldn't state their ethnic origin.

The ethnic structure of the Suceava county population has undergone significant changes during 1966-2011. The Romani population has increased by about 60 times during the period under consideration, while the number of Ukrainians has declined to about a half. Important changes have also occurred in the structure of the German and Hungarian inhabitants. The German population declined by about 4 times, while the number of Hungarians has diminished by about 3 times.

Based on the available data, we have also tried to identify the possible changes occurring in the population structure by religion. The analysis conducted for the period 1992-2011 revealed a declining trend in the structure of the Orthodox population, from 90,56% in 1992 to 87,25% in 2011. The number and the weight of the Roman-Catholic and Greek-Catholic population has also constantly declined during the period under analysis. On the contrary, the number of people who have stated they were of Pentecostal faith has greatly increased during the period under consideration.

In order to establish whether there are significant differences between the structure of the county population and the population of Romania, we have used the  $\chi^2$  test of adjustment that has entailed the matching of the observed and the expected frequency distributions. The results arrived at after applying the  $\chi^2$  test of adjustment have confirmed that there are significant differences between the population structure of Suceava county and the population structure of Romania, according to various group characteristics (age, sex, environment, training or ethnicity groups).

In order to analyse the changes in the population structure in the administrative-territorial units of Suceava county during 2002-2011, we have applied the t test for pairing samples, by means of the SPSS programme. We have considered the population structure in terms of sex, ethnicity and religion.

The results have confirmed there are significant differences between the weights held by the Romani and Ukrainians in 2011, as compared to the year 2002. The conducted measurements have shown that the differences are also significant in terms of the weights held by the Orthodox and Pentecostal population, in all the locations of the county after the two censuses.

The main aspects we have taken into consideration in order to analyse the natural movement of the population, were: the birth rates dynamics, identifying the changes occurring in the fertility of the population and the effects of the influence factors on the changes in the mortality rates. The migration rates were approached as internal and external migration.

An important aspect in the analysis of the birth rates was the study of the seasonality of this demographic phenomenon. In order to define seasonality in the population birth rates we have considered the number of live births per months of the year during 2007-2012. The conducted analysis has revealed that most births have occurred in July, August and September. The general monthly average for this period was of 683 live births.

The graphical method (the chronogram and the polar diagram) and the measurement of the seasonality indices based on the arithmetic average have been used in the statistical analysis of the birth rate seasonality. The conducted measurements have revealed that the average number of live births in December amounted to only 87,5% of the general monthly average, while the number of live births in July amounted, on average, to more than 12,9% than the general monthly average. Based on the seasonality indices, we can say that birth rates have had a seasonal development.

The changes in the demographic behaviour of the population are also made visible by the decline in the average number of children per family. Thus, after 1989, the declining birth rates were attributed to the declining number of live births of all ranks, and especially upper ranks (3<sup>rd</sup> and more).

The measurement of the changes occurring in demographic behaviours has been conducted by calculating the average rank indicator of the live births. The obtained results reveal a gradual decline of the average rank of live births during 1990-2011, from values of over 2,5 to values approaching 2. However, we can state that families with two or three children are more common in Suceava county.

A similar measurement conducted for Romania on the data recorded in 2011 has led to a 1,86 average rank of live births, actually confirming the national orientation of the population towards a more compact family model with one or two children.

There are large differences among birth rates in different areas, with locations where there are recorded values of under 7 live births to 1000 inhabitants and locations with birth rates of over 20‰.

In order to account for these variations of the birth rates in each area, we have started from the assumption that the ethnical and religious structure of the population in these areas of the Suceava county influence the birth rates. In order to test these hypotheses, we have applied the Spearman coefficient by means of the SPSS programme.

The obtained values have revealed a direct and average intensity correlation ( $r = 0,601$ ) between the birth rate and the weight of the Romani population. As concerns the analysis of the correlation between the weight of the Romanian population to the total population in each location and birth rates, we have revealed a reversed and low intensity relation.

Based on the analysis of the correlations between the birth rates per location and the weight of the population according to religious criteria, we have found a reversed and average intensity correlation between the birth rate and the weight of the Orthodox population. In the case of the Pentecostal population, the connection is direct and of average intensity.

In order to analyse the dynamics of the population fertility rates, we have resorted to the dynamics statistical indicator system, which encompasses the absolute and the relative changes in this phenomenon. Thus, we have noted that the declining number of live births in 2011, as compared to 1990, is mainly due to the specific fertility rates per age groups, whose gradual decline in time was rather severe. The age group allocation of the fertile female quota also had a negative effect but with a lower intensity.

The analysis of the population matrimonial structure was directed at several aspects: the evolution of the number of marriages during 1990-2012, the structure of marriages for each sex and age group of the spouses in 1990 and 2012, as well as the seasonality of marriages based on the monthly data for a period of 5 years (2007-2012).

The comparison with the situation we had in 1990, has allowed us to highlight a series of various aspects. We have noted an important decline in the number of females getting married at ages below 20 and an increased number of those who decide to get married between 25 and 29 years of age. As concerns the male population, we have also noted some significant changes as well. If in 1990, most men (58,7%) who got married were in the age group 20-24, most of them were in the age group 25-29 in 2012. The weight of the men over 30 who decide to get married doubled during 1990-2012.

The analysis of the mortality rate in Suceava county focused on: the population mortality rates dynamics in time, identifying the effects of the influence factors, as well as an analysis of the seasonality of the mortality phenomenon.

The mortality rates dynamics based on the number of deaths and on the general mortality rate has revealed an ascending trend. The changes in the general mortality rates in 2011, as compared to 2000 are mainly due to structural factors, highlighted by the increased weight of the aged population with specific higher mortality rates.

The monthly analysis of the population mortality rates during 2007-2012, has revealed the fact that the highest values are recorded in winter months, i.e. December and January, while the minimum values are in summer months: July and August. There has been an average monthly number of 626 deaths in Suceava county. The intensity of the relation between mortality rates and the ratio of the aged population to the total population has been measured based on the Spearman coefficient. The value arrived at ( $r = 0,713$ ) highlights the fact that there is a strong connection between the two variables.

One aspect that raises particular interest is the analysis of the population mortality rates among those aged below 1. The declining number of live births was also accompanied by a declining number of children dying below the age of 1. The intensity of the connection between

the number of live births and the number of deaths below 1 during the period 1990-2012 has been measured by means of the Pearson correlation coefficient. The value arrived at was 0,908, thus showing that there is a strong connection between the two variables under consideration.

An important element of the population dynamics is the migration rate. It has direct effects on the number and structure of the population. The available statistical data in the county do not cover the population migration rates in the county. The highest number of people leaving the county was recorded in 1990. The main cause was the removal of the restrictions related to the access to larger towns. After this period, the volume of the migration flow decreased, and thus, the number of those leaving tends to equal the number of arrivals.

The Population and Dwellings Census was an attempt to measure the actual size of the external migration. Thus, two categories of individuals were found to be absent from each location: temporarily absent and those who had left for longer periods of time.

The results have shown that the current trend of departures abroad is mainly to be found among the population aged between 26 and 40, while the propensity for migration in the other age groups is lower. More than 80% of those who migrate are aged under 40, thus triggering negative effects on the workforce and also on the birth rates, as this group also includes a part of the feminine quota with high fertility rates.

In terms of the country of destination, more than half the population of Suceava county that has emigrated is to be found in Italy. High ratios to the total immigrants include countries such as: Spain, the United Kingdom of Great Britain and Northern Ireland and Greece.

In order to develop forecasts of the population of Suceava county, we have applied the methods based on extrapolating the trend and regression based methods. The data collected at the Census of Population and Dwellings conducted after 1989 have shown a declining trend in the numbers of the stable population in Suceava county.

Assuming that there will be a linear development in the following period, the population was measured based on the annual average rate of change method. According to this method, the stable population forecasted for the year 2020 comprises 603064 inhabitants, declining by 31746 individuals, as compared to the numbers recorded at the census in 2011.

If we admit the assumption that, in the following period, the population might continue to decrease geometrically, with a ratio dependent on the annual average index identified during 1992-2011, the number the population will reach in the following years was identified based on the annual average variation index. The population forecast for 2020, based on this method, has reached a number of 605336 inhabitants for the year 2020, higher than that resulting from the assumption of a linear progress. We can guarantee, with a 95% probability, that the confidence interval for the value forecasted for 2020 ranges between 528470 and 682201 inhabitants.

In order to conduct the forecast for age and sex groups, we have used the methods based on extrapolating the evolution trend identified during the period that preceded the forecasted one, and the established forecasting horizon was of 5 years.

In order to conduct the population forecast for each age group, based on regression, we have taken into account as dependent variables the population per important age groups (under 15, between 15 and 64 and 65 years of age and more) and, as independent variables: “the number of live births”, “the number of deaths per age group”, “the number of mostly privately owned dwellings” and “the average number of employees” for the period 1990-2012.

The selection of the independent variables was based on the gradual evolution of these variables in time that has revealed a certain degree of interdependence. The time dynamics shows that there is a direct relation between the population number per age groups and the

independent variables (number of live births and number of deaths). The instability of the economic environment, the living conditions that are below the expectations of the population, the lack of a place to live or of a well-paid and safe job have direct consequences on people's decision to have a child. The negative economic aspects also influence the decision to migrate in search of a job that meets their expectations.

The results arrived at in the population forecast per important age groups, both by trend models and by regression, have shown that the population under 15 years of age will decline, while the adult and aged population will follow an ascending trend within a 5 year forecasted interval.

The enlightening results in terms of the scientific findings of the present research are:

- Highlighting the specific features in the population dynamics in time and space by mean of both the traditional and more modern statistical methods of measuring the population;
- Identifying the factors influencing the population dynamics in the county;
- Explaining the population dynamics in terms of the natural and migratory movement of the population;
- Presenting the similarities and the differences between the population structure of Suceava county and that of Romania;
- Developing correlations between the demographic indices and the population structure in each of the administrative units of the county;
- Developing forecasts in terms of the number and structure of the population per sex and age groups, based on trend and regression methods;

We agree that the conducted research has not exhausted all the analysis prospects and we can indicate new possible directions and courses of action:

- The longitudinal analysis of the county population which would allow for a more precise identification of the determining factors and of the existing correlations;
- Expanding the research in the North-East region by making comparisons that would encompass the counties in the region;
- Identifying the factors that influence the natural and the migratory movement of the population by means of a survey based inquiry that would also include the migrating population.

A retrospective look at the overall research conducted in this paper allows us to hope that the obtained results will join and complete the existing research in the field under analysis, contributing with additional information and knowledge for those who are interested in understanding the interdependency and correlations in population dynamics.