ANALYSIS OF STRUCTURAL AND AGE DEFORMATIONS OF POPULATION - REGIONAL ASPECT

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Abstract

Structural-age-related changes of the population of Ukraine on the example of the graphic of deformation of a pyramid 2001 year are considered. It is established that considerable scales of structural deformations: negative deviations in age pyramids, are connected by considerable losses of the population and the corresponding demographic waves. The technique of the quantitative analysis of gender and age pyramids is developed and approved. The reasons of negative and positive deformations both in Ukraine as a whole and in its regions are analyzed. Regions on intensity and amplitude structurally-age deformations are systematized. Three main groups are allocated and as an example one region from each group are characterized. The analysis of structural deformations of the population of Ukraine and its regions is carried out.

Keywords: geodemographic processes, structural deformations, demographic waves, gender and age structure, regional differences.

АНАЛІЗ СТРУКТУРНО-ВІКОВИХ ДЕФОРМАЦІЙ НАСЕЛЕННЯ - РЕГІОНАЛЬНИЙ АСПЕКТ

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Анотація: Розглянуто структурно-вікові зрушення населення України на прикладі графіка деформації піраміди 2001 р. Визначено, що значні масштаби структурних деформацій: негативні відхилення у вікових пірамідах, пов'язані з катастрофічними втратами населення та відповідними демографічними хвилями.

Розроблена і апробована методика кількісного аналізу статево-вікових пірамід. Проаналізовані причини негативних і позитивних деформацій в Україні в цілому та у кожному окремому регіоні. Систематизовано регіони за інтенсивністю та амплітудами структурно-вікових деформацій, виділено три основні групи та як приклад охарактеризовано по одному обласному регіону з кожної групи Здійснений аналіз структурних деформацій населення України та її регіонів.

Ключові слова: геодемографічний процес, структурні деформації, демографічні хвилі, статево-вікова структура, регіональні відмінності.

Actuality: The public request for geodemographic researches is caused by large-scale and deep political and social and economic transformational processes which nowadays proceed in Ukraine. In the conditions of deep social and economic crisis the country was included into a stage of the general depopulation [2]. The age structure and the level of reproduction of the population of Ukraine define social and economic structure of the country [5]. Studying of features of changing modern age structure of the population of Ukraine is important for creation of effective regional population policy.

The purpose of work consists in searches of methodical approaches in the accounting of structural deformations and demographic waves in regional geodemographic processes (GDP).

Main contents. In national geography of the population the GDP usually analyze by quantitative indices of the movement of the population - natural and mechanical [3]. The qualitative characteristics of the population connected with gender and age structure of societies and its dynamics remain unaddressed [4]. This work aims to actualize this direction on the example of the GDP of the country and its regions.

Let's consider dynamics of gender and age structure of the population of the country and its influence on emergence of structural demographic deformations. In the figure 1 gender and age pyramids of the population of Ukraine at an interval of 1 year for 2001 are shown. General "abnormality" of a

pyramid, existence of numerous "declines" and "excesses" of individual groups of the population is evident.

Translational movement of a certain age group of the population (a cohort), one age gradation in others we call a demographic wave. For the majority of demographic waves the noticeable deformations in gender and age structure of the population connected with considerable losses of the population or its immigration inflow act as reference points. Deformations of the first type generate negative demographic waves, another - positive. The quantitative analysis of diverse gender and age pyramids allows to reveal structural deformations of the population and to quantitatively characterize the corresponding demographic waves to points of their emergence.

Considering the most significant historical events which caused shifts in the total number of the population and deformation of its gender and age structure, we divide the GDP of the country into the following stages and phases (Table 1).

Table 1

Stages and phases of geodemographic processes of Ukraine

Stages GDP		Phases GDP	
I	GDP Stage between two world wars (1917-1941 yy)	I.1	The loss of population in time of formation of the Soviet system and the Civil War (1917-1921 yy)
		I.2	The New Economic Policy (NEP) 1921-1929 yy.
		I.3	Population growth phase of the first industrialization of the country (1929-1931(32) yy)
		I.4	Loss of Great Famine (Holodomor) and repressions phase (1932-33 yy) (1936-37 yy)
		I.5	Growth accelerated phase before the war militarization (1937-1941 yy)
II	Stage of World War II and post-war rebuilding (1941-1950pp)	II.1	Population loss phase of war (1941-1945 yy)
		II.2	Population growth phase of post-war rebuilding (1945-1950 yy)
III	Population growth (1950-1989/91 yy)	III.1	Recovery of the population (1950-1959 yy)
		III.2	Accelerated population growth (1959-1979 yy)
		III.3	Delayed population growth (1979-1991 yy)
IV	Reducing population 1991-2011 yy	IV.1	Intensive depopulation (1991-2001 yy)
		IV.2	Delayed depopulation (2001-2011 yy)

The general methodical scheme of typology of regional GDP has to cover the following questions and the directions:

a) factors of dynamics of the population of the region: indicators of the natural and mechanical movement of the population and their ratio; systematics of regions by natural population movement factors;

b) quantitative indices of the GDP of the region: the general direction of dynamics (growth / decrease), amplitude of the GDP by population; the rate of population dynamics; tendencies of dynamics of the population at different stages of the GDP;

c) quality indicators of the GDP of the region: structural deformations of gender and age distribution of the population; the general indicators of such deformations by their quantity and deviations of number of gender and age groups; systematization of regions by structural deformations of the population;

d) analysis of statistical distributions of regional charts of GDP: scope and variation of GDP - as a whole and its separate stages; types of statistical distributions and their mathematical and statistical approximation; systematics of regional GDP by the types of statistical distributions and their parameters;

d) structural features of regional GDP: their division into stages and phases; sequence, duration and ratio of different structural units; systematics of regional GDP on the composition and ratio of stages and phases;

e) general trends and changes in regional GDP: prognostication of further transformations of the regional GDP; systematics of regional GDP by trends of development.

Typological approach to regional ODS for these areas are aimed to justify integrated GDP types that are synthesized to individual values and characteristics. Methodological difficulties of typification caused by fact that into regional GDP combined and imposed the nonsimultaneous quantitative and qualitative parameters with their chronological sequence [1]. Typological characteristics of GDP could significantly change on its various stages, and at the same time the distribution of GDP by stages should be considered as an objective combination of specific subtypes, varieties of whole process, as a holistic regional GDP.

Demographic waves in different regions have different amplitude, in the Dnipropetrovsk region it reaches 100-160 thousand persons, in Luhansk region -

60-110 thousand persons, in Crimea - 50-100 thousand persons, in Vinnytsia region - 30-70 thousand persons, in Ivano-Frankivsk region - 10-25 thousand persons. The overall conclusion: in agricultural regions the dynamics of gender and age structure of the population is much weaker. Regions differ by the ratio of negative (loss of population) or positive (population inflow) demographic waves. For industrial Dnipropetrovsk and Lugansk regions with their few times industrialization is characteristic corresponding inflow of population that formed the positive demographic wave. Several times was observed inflow of population in the Crimea, along with the mass deportations of the population. In agricultural regions of Vinnytsia and Ivano-Frankivsk, positive demographic waves a little bit, and they are significantly weaker. By comparing the spectra of demographic waves of different regions, we note that they have certain similarities negative waves (1915-1920 yy., 1932-1936 yy., 1942-1946 yy.). However, each region has a "structural and demographic" code that distinguishes it from other regions and can be used for geodemographic taxonomy and typology of regions.

Prominent role in GDP play structural and age deformations of population. They could be find by methods of quantitative analysis of gender and age pyramids by the following method:

1. on the pyramid of sex and age structure of the population, composed with an interval of one year, visually set the "pit" - the age groups with small population, and the "maximums" - age groups with relatively higher population (Figure 1);
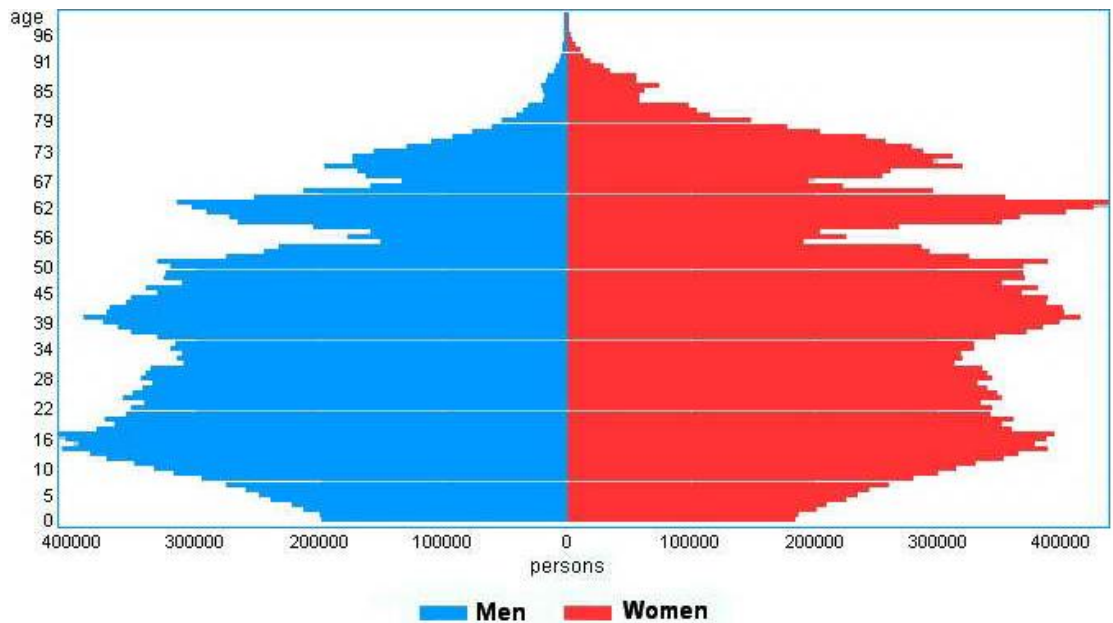
Figure 1. Gender-age structure of population of Ukraine (2001)

2. by the statistical distributions of population in the pyramids define control age groups representing these minimums (pits) and maximums, also for each group set its alternative - adjacent age group of the same duration of years;

3. calculate the number of people in each control group and its adjacent alternative, the difference between them show the difference between them shows the relative population loss (negative deformation) and relative population excess (positive deformation);

4. establish the causes of negative and positive deformations in Ukraine as a whole and in each region;

5. for the country and the regions draw up graphics of structural-age deformations (Figure 2), which further are subject to comparative analysis and can be used for technological groupings of regional GDP.
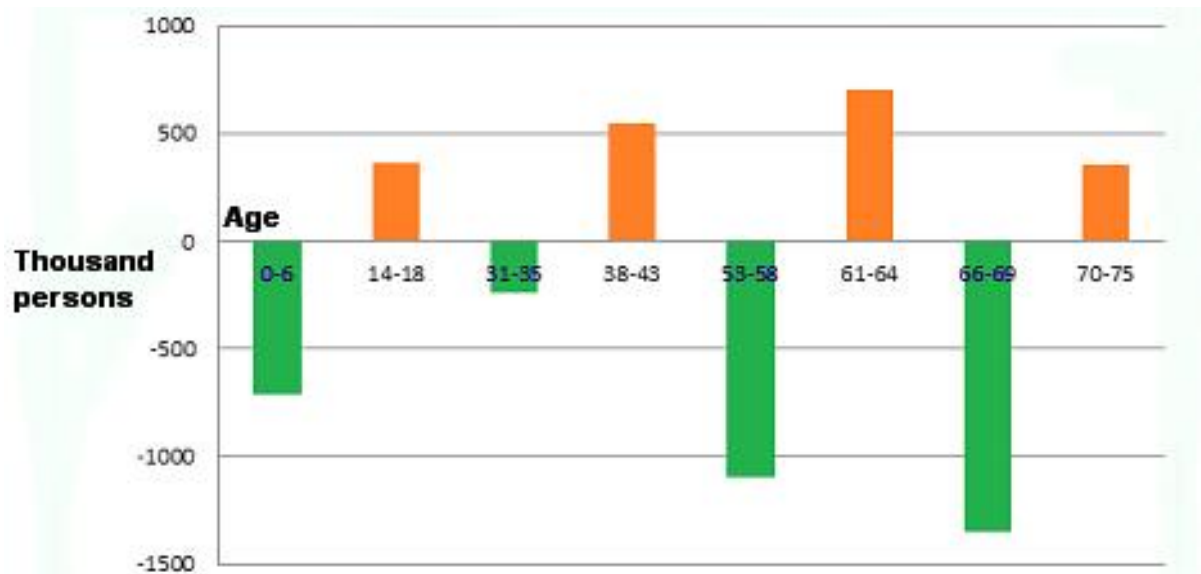
Figure 2. Structural deformations of population of Ukraine

If necessary, this methodological scheme can be expanded also for analysis of structural-age deformation by consideration in each age group the ratio of men and women.

Consider structural-age shifts in population of Ukraine by example of graphic of deformation of pyramid on 2001 year (Figure 2). Particular attention is drawn to large scale structural deformations: negative deviations in the age pyramids associated with catastrophic loss of population and relevant demographic waves reach 1,1-1,35 million persons; positive deformations due to the population inflow from other regions of the former USSR are reached only 350-693 thousand persons.

Negative deformations in population structure caused by Great Famine (Holodomor) in Ukraine (1932-1936 yy) and on graphic (Figure 2) are presented by its second wave in group of the population at the age of 65-69 years. Further, the demographic wave is blurred. Another such deformation is observed in the age group of 54-58 years. It is connected with the second wave of population losses in World War II (1943-1947 yy) and this cohort gradually blurred on the relative population loss.

Powerful deformation structure of Ukraine's population formed in younger age groups: relative "shortfall" of population cohort "0-6 years" is 710 thousand persons. We emphasize that this deformation will continue the

negative impact concerning reproduction of the population in the next generations with a log of 20-25 years: its manifestations will be notable in 2021-2026 and 2041-2046 yy.

Positive structural deformations of population associated with the inflow of people from other regions of the former Soviet Union at the time of accelerated industrialization of Ukraine (1926-1931 yy), its intensive militarization (1937-1940 yy), and postwar rebuilding programs of and realization large-scale programs of hydraulic engineering construction and irrigation farming (1959-1963 yy., 1984-1987 yy.). Unlike negative deformations that are always causing significant deterioration gender and age structure of the population of Ukraine, positive deformations caused by migration inflow population improved the gender and age structure of the population and demoreproductive processes.

Let's analyze regional differences of structural demographic deformations of the population of Ukraine, some of its regions and Crimea. In figures 2-6 graphs of structural-age deformations of the population of certain regions are submitted. Their visual comparison demonstrates notable distinctions between them, which later can be used for different groupings and typification of regional GDP. In particular, the graphics of structural-age deformations of regional GDP differ by:

- number and frequency of deformations;

- deformations amplitude;

- overload and the ratio of positive and negative deformations;

- availability of cross- deformations which are specific for national GDP, such as manifested in all regional GDP, and special deformations in regional GDP;

- deformations which have no continuation in the following demographic waves, and deformations which can have continuations in close prospect

Consider by these criterias the regional GDP and systematize regions by intensity and amplitude of structural-age deformations, as an example we will describe one regional area from each group (Figure 3).
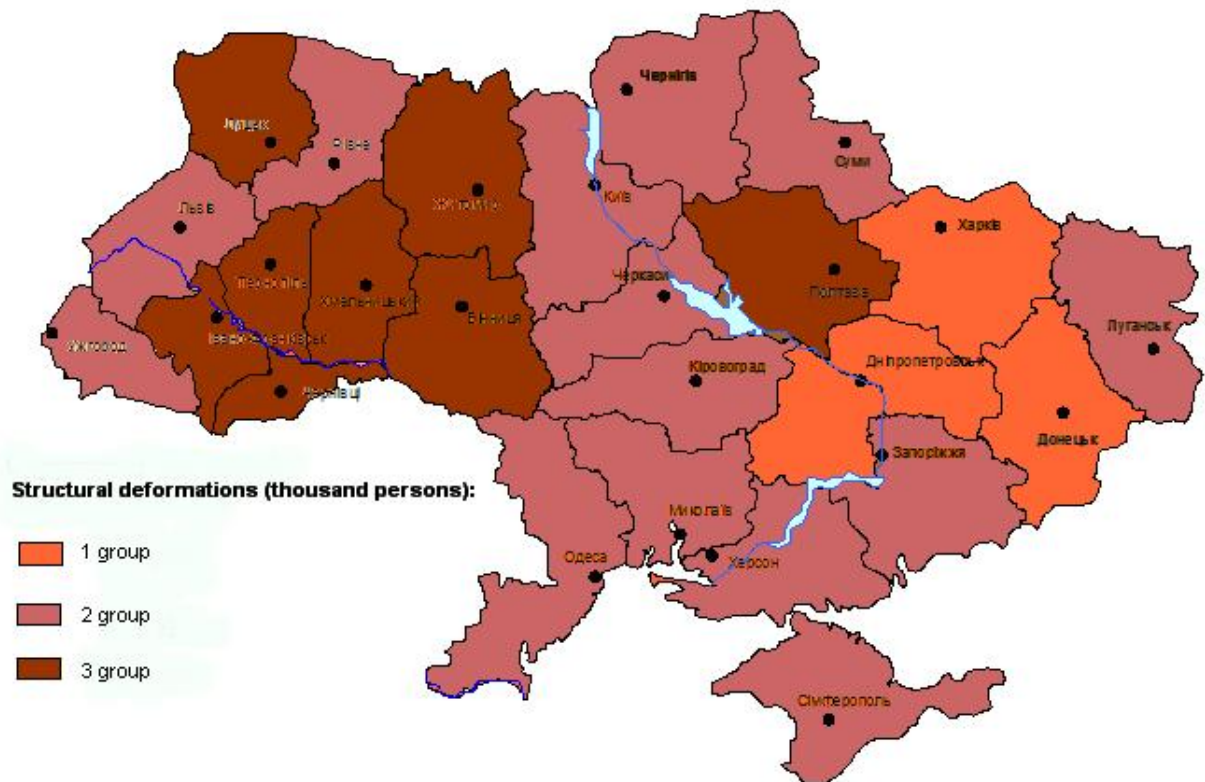
Figure 3. Grouping of regions by intensity of age structural deformations

The first group consists of regional areas with maximum deformations of the age structure of the population - Donetsk, Dnipropetrovsk, Kharkiv. They are characterized by major fluctuations in the age structure of the population that reach 100-300 thousand persons and a large number of positive deformations that have scope to 50-140 thousand persons. These regions have the most disturbed age structure of the population which must be taken into account in forecasts of population. Demographic waves from relative losses of the population in the youngest group of the population (0-6 years) will be notable in gender and age structure with a demographic lag in 20-30 years in close and average prospect -2025-2030 yy and 2050-2075 yy. Such deformation for the Donetsk region will be especially noticeable, where relative losses of number of children at the age of 0-6 years in 2001 year came nearer to 300 thousand. Noticeable influence on structure of the population for the next 10-15 years will be had by positive deformations on graphs of the GDP of the specified regions in age groups "13-20 years". Prediction of population for close and average prospect is the most difficult as needs a certain accounting of the specified structural deformations and the corresponding demographic waves.

The second group that unites regions with a medium level of structural-age deformations include Crimea, Lugansk, Zaporizhia, Zakarpattia, Lviv, Kyiv, Odesa, Mykolaiv, Kherson, Rivne, Kirovohrad, Cherkasy, Chernihiv, Sumy

regions. The amplitude of deformations in this group reached 50-70 thousand persons.

The third group of regions with weak structural-age deformations of population create Vinnytsia, Volyn, Ivano-Frankivsk, Khmelnytsky, Ternopil, Zhytomyr, Poltava and Chernivtsi regions. They are characterized by small (up to 15-25 thousand persons) amplitude of negative and especially positive deformations. New deformations associated with the overall demographic crisis, also have moderate amplitude.

The characteristic of demographic deformations of certain regions is given below. The lowest intensity of deformations of gender and age structure of the population has Ivano-Frankivsk region (Figure 6). For the Crimea, Luhansk, Kharkiv, Zaporizhzhya, Odesa and Lviv regions show positive structural-age deformation associated with the inflow of people from other regions. Briefly characterize structural and demographic deformation of individual regions. As an example we give the characteristic of regions from different groups by the level of structural deformations.

Kharkiv region is one of the regions in which structural-age deformation of population was shown most intensively. Strong negative deformations of population structure observed in the age groups "55-58 years" and "66-69 years". They represent demographic waves of the Holodomor of 1932-1935 yy with relative losses of the population in this age cohort of nearly 90 thousand persons and military losses - 76 thousand persons (Figure 4).
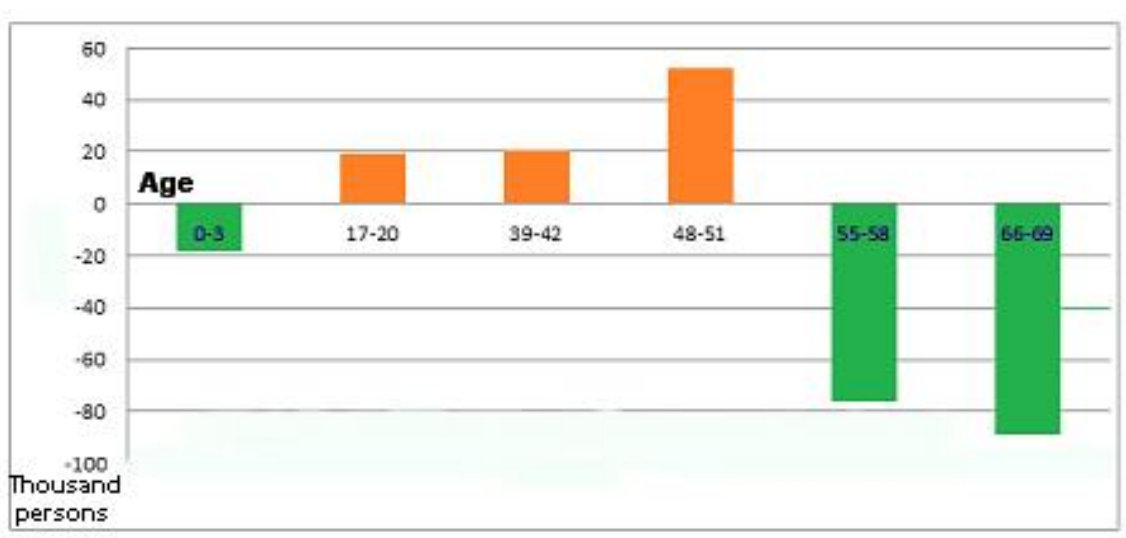

Figure 4. Structural deformations of population of Kharkiv region

Features of contemporary demographic situation of region is relatively weak deformation in the youngest age group (0-3 years), where the relative loss of population close to 18 thousand persons. The demographic wave of such deformation will display in demoreproduction processes in 1920-1925 years.

Positive deformations of age structure of the population of the region are few in number but significant in quantitative terms. The largest relative increase in the population (about 52 thousand persons) is observed in the age group "48-51 years". It is caused by intense rebuilding of Kharkiv in the postwar period. Significant positive deformations at the relative growth of about 20 thousand persons appeared in the age groups "39-42 years" and "17-20 years" (Figure 4).

Odesa region is a region with a predominance of negative deformations of gender and age structure of the population with an average amplitude for Ukraine that reach 37-50 thousand persons relative loss of population in the age groups "66-69", "55-58" and "0-3 years" (Figure 5).
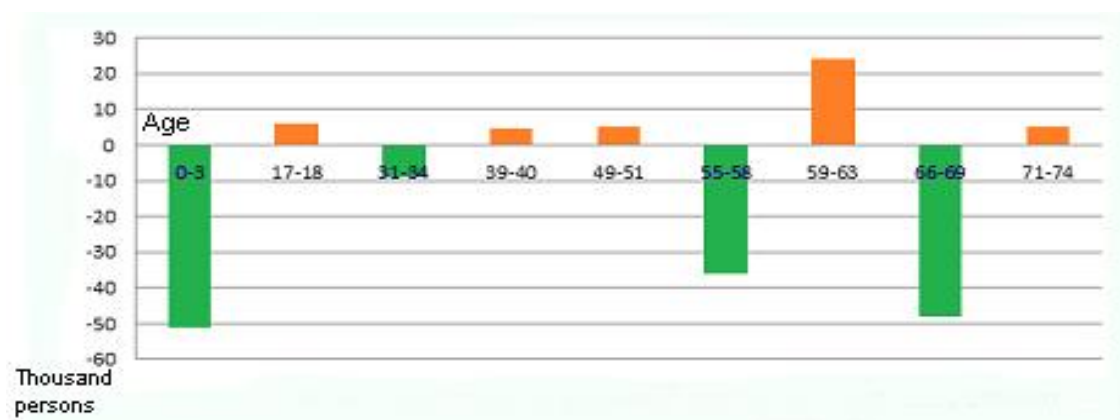

Figure 5. Structural deformations of population of Odesa region

The first two deformations - is an echo of Holodomor and war. This deformations repeat the geodemographic situation of most regions of the country by magnitude of manifestation. The latest negative transformation of relative loss of population over 50 thousand people will be noticeable in the reproduction of population of the region since 2025 year.

Positive deformations in the population of the region is weak: the relative excess of population is visible to age group "17-18 years" (more than 6 thousand persons), "39-40 years" (about 4,5 thousand persons), "49-51 years" (over 5 thousand persons) and "72-73 years" (5,6 thousand people). Only in the age group "9-63 years" remains obvious demographic wave (+ 24 thousand persons) due to the development of port and industrial complexes of Odesa region in the prewar period (1938-1941 yy).

Khmelnytsky region represents a region in which the structural-age deformations weak and their demographic waves are hardly noticeable. In the region the all-Ukrainian deformations connected with world war and Holodomor

are shown. Amplitude of losses of the population caused by such deformations is less noticeable, than in the majority of regions of the country, and makes 12-13 thousand persons (Figure 6).
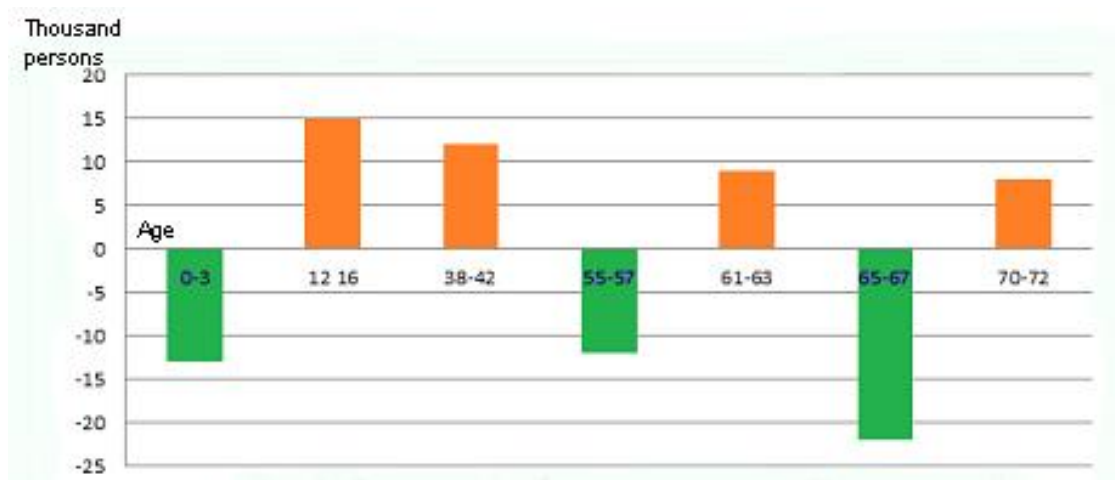

Figure 6. Structural deformations of population of Khmelnytsky region

The latest negative deformation generated in the age group "0-3 years" in today's depopulation. Its participation in the GDP can be expected in 2020-2025, and influence on a geodemographic situation will be insignificant.

Positive structural deformations at the level of 9-15 thousand persons observed in the age groups "12-16", "38-42", "61-63", "70-72 years" (Figure 6) and have little impact on improving the gender and age structure of the population of the region.

Ivano-Frankivsk region is a region of Ukraine with minimal deformation of the age structure of the population. The most negative deformations caused by the loss of population in the war and postwar years (1943-1947 yy) - 22,4 thousand persons. Negative deformation in age group "82-85 years" which is close to 16 thousand persons is noticeable (Figure 7).

Only one positive deformation in the age structure of the population of the region is observed in the age group "34-42 years", which were born in 1959-1964. The relative growth of about 17 thousand persons can be explained by return of the repressed in the postwar time population to their homeland.
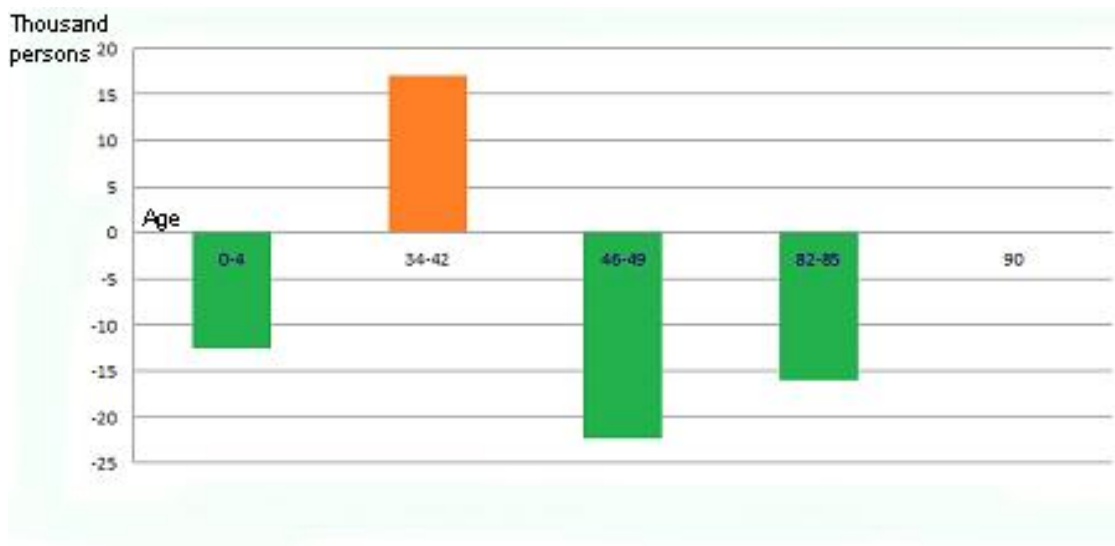
Figure 7. Structural deformations of population of Ivano-Frankivsk region

Consequently, under the minimum structural deformation prediction of prospective population by simple approximations give satisfactory results.

Conclusion: As a result we made the first methodical attempt to systematize regions of Ukraine by structural-age deformations of population. If necessary, this methodological scheme can be expanded also on the analysis of gender and age deformations. For this purpose it is enough to consider in addition in each age group a ratio of men and women

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