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MODERN SOCIO-DEMOGRAPHIC TRENDS AFFECTING THE BUSINESS SECTOR OF THE ECONOMIES OF LATVIA AND UKRAINE

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Abstract. *The paper analyses and describes key social and demographic trends affecting the business in current conditions. The present research aims to establish logical coherence and feedback between economic development and basic socio-demographic indicators in European countries, including the experience of Latvia and Ukraine. The challenge of the research leads to answering the question how demographic processes affect and drive the economy and how this mechanism could be used to predict essential trends of future development. The methodology of cluster analysis, statistical and regression methods were employed for modelling. Cluster analysis was applied to depict an economic cartogram and merge some European countries in particular clusters by current socio-demographic and economic criteria. As a result, this approach allowed us to compare Latvia and Ukraine as highlighting representatives of different economic clusters and distinguish important similarities and differences. Statistical data were based on the following indicators: GDP, income, employment, age structure, gender, population aging, location, migration etc. These parameters were analysed due to their dynamic change. Regression methods allowed to establish the whole system of indicators affecting the business environment in Latvia and Ukraine. For instance, the results confirmed the explicit impact of migration trends on business and social development.*

Keywords: *cluster analysis, demographic problems, European Union, economic development, Latvia, modelling, national economy, population, trends, Ukraine.*

Introduction

It is a well-known fact that population is a vital driver of the economy, because initially each business is launched by some people to meet the variable needs of others. To be more specific, socio-demographic trends are interrelated

with all aspects of the society and, above all, with economic processes that affect the business sector of the economy of any country.

Currently, internal social and economic particularities become increasingly significant in different countries all over the world. Looking globally, this gap is especially dramatic between developed and developing countries of the planet. According to the Department of Economic and Social Affairs, about 1/4 of the world's population lives in the most economically developed countries, which are mostly located in the northern part of Earth, especially in Europe. In contrary, about 3/4 of the world's population is concentrated in the southern region, including two demographic superpowers - China and India. Despite substantial cultural, social and economic prospects, scientists envisage a gradual decline of the European population from 742 to 716 million by 2050. At the same time, Asia and Africa meet sharp population growth from 5.8 to 7.8 billion (United Nations, 2017). This trend may lead to a risky imbalance, since overpopulation in the “developing” countries occurs simultaneously with a population decrease in the “developed” countries and provokes complicated social, economic and political problems, such as population aging, migration, employment, gender issues etc. (O’Rand, 2016).

For this reasons, an investigation into the modern socio-demographic trends is vital for understanding the complex mechanism “population – society – economic development”.

In this paper the object of the research is the demographic, economic and social environments of Latvia and Ukraine, including its dynamic change. Despite some differences in the economic, political and social sphere, both these European countries are striving towards sustainable development. However, Latvia is an integral member of the EU, while Ukraine just provides reforms to join the European community.

Meanwhile, some problems are quite similar for Latvia and Ukraine. For instance, a decrease in the rate of population growth and the aging of the population weaken the reproduction of productive forces (Pavuk, 2014). This factor directly affects the development of the business sector of the economy and eventually defines the size of the GDP and national income.

The research aim leads to an analysis and a comparison the most highlighting social, demographic and economic trends of Latvia and Ukraine, establishing their place in the European community.

According to this aim, the research links to the following main tasks:

1. Classification of the EU Member States by essential economic and demographic criteria, using a methodology of cluster analysis. This task enable us to structure different countries and delineate their important characteristics.

2. Systematization of all indicators by groups (indicators of population growth and ageing, migration, life expectancy and medical care, economy and business, global international indexes) and their complex analysis.
3. Description of the contemporary trends of Latvia and Ukraine, using data analysis, methods of statistics and econometrics. The practicability of using mathematical modelling in socio-demographic research studies is confirmed in the papers (Shin, 2015; Coale, 2015).
4. Analysis of the feedback between demographic and economic indexes, using multifactorial modelling. Delineation factors of sustainable development.

On the one hand, solving these tasks contributes to understanding the question, how the demographic situation affects the economy, including the business sector. On the other hand, it allows to solve the inverse problem - how to refine demographic indicators by improving economic and social results.

Cluster analysis of EU Member States and Ukraine by economic and demographic criteria

The performance of the cluster analysis enables us to structure all the Member States of the European Union and Ukraine (objects) into particular groups (clusters). The purpose is as follows: “similar” objects should be within each group, and the objects of different groups should be as different as possible. This allows us to analyse the objects by variable criteria, including economic, demographic, social etc.

Generally, the effective application of the cluster analysis involves the following stages (Sarstedt & Mooi, 2014):

1. Object selection for cluster analysis.
2. Arranging the set of variables to evaluate the objects. The normalization of the values of indexes (if necessary).
3. Calculation of the values of the measure of similarity between the objects.
4. Application of the cluster analysis method to create groups of similar objects (clusters).
5. Presentation of the results of cluster analysis.

The Member States of the European Union and Ukraine were chosen as clustering objects. Obviously, the variables for evaluations should cover important economic and demographic indicators.

Therefore, we selected the following indicators for clustering: net migration; death rate; birth rate; ratio of population aged under 16 and over 65 per 100 population aged 16-64 years; consumer price index; GDP per capita; total

population; added value; gross earnings. These indicators were combined on the basis of scientific research studies (McAuliffe, 2017; Maier, 2017; Lutz, 2014).

Afterwards normalization was carried out in order to bring these indicators to a single unit of measurement.

The cluster analysis is performed by using the computer program “Statistica”, which implements agglomeration methods of minimum dispersion – hierarchical (tree-like) clustering and the k-means clustering method.

At first, the hierarchical clustering method was used to determine the optimal number of clusters for the set of objects (the EU and Ukraine). Ward’s method was applied to merge objects in clusters. To be more specific, according to Ward’s rule, the objective function is the error sum of squares. Actually it is the sum of squares of distances between each object and the average object in its cluster.

Ward’s method allowed us to get quite valid results for Europe’s clustering, inasmuch as it leads to the formation of clusters of approximately equal dimensions that have the form of hyperspheres. We chose Ward’s method using such a widespread metric as the Euclidean distance, which is appropriate for multidimensional systems.

The results of clustering by the hierarchical method are shown in Figure 1.

The analysis justifies that the whole set of the EU Member States and Ukraine should be divided into 4 groups. We can also notice this inference in Figure 1.

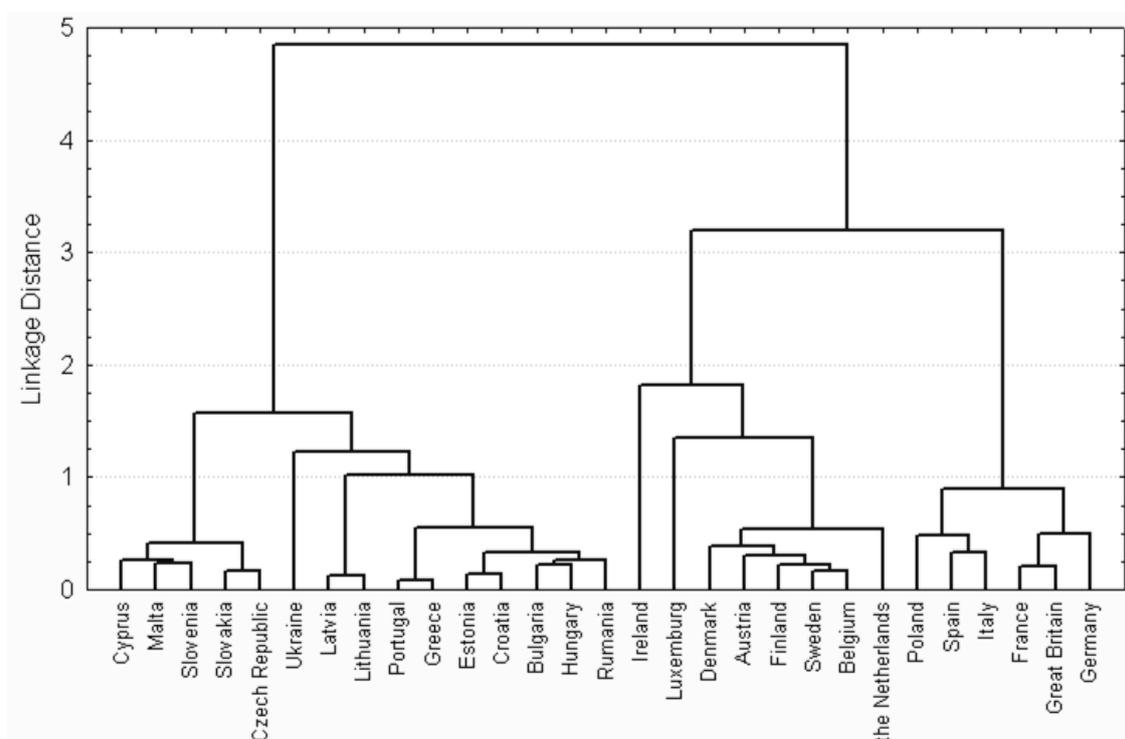


Figure 1. **Dendrogram of the EU Member States and Ukraine**
(authors’ construction, based on Ward’s method)

The dendrogram illustrates all possible allocations of the countries and the clusters they belong to. The smaller cluster, the closer link between countries in this cluster. For instance, Latvia forms the smallest cluster with Lithuania, so these countries are quite resembled by chosen economic and demographic criteria among others. Moreover, Latvia, Ukraine, Lithuania and Portugal could be evaluated as the members of a bigger cluster.

In order to determine which of the clusters belongs to a particular country, the method of k-means was applied. The approach calculates the distance from each object to the cluster's centre and assigns objects to the nearest cluster. The centres of gravity of clusters are calculated again and again, and this algorithm is repeated until the centres of gravity stop to "migrate" in space.

Clustering by the k-means method distinguished the following:

Cluster 1 – the Czech Republic, Slovakia, Ireland, Slovenia, Cyprus, Malta;

Cluster 2 – Poland, Romania, Greece, Portugal, Hungary, Bulgaria, Croatia, Lithuania, Latvia, Estonia, Ukraine;

Cluster 3 – Germany, the United Kingdom, France, Italy, Spain, Belgium, Sweden, Austria, Denmark, Finland;

Cluster 4 – the Netherlands, Luxembourg.

The results of the partitioning of the EU and Ukraine by the k-means method are represented in Figure 2.

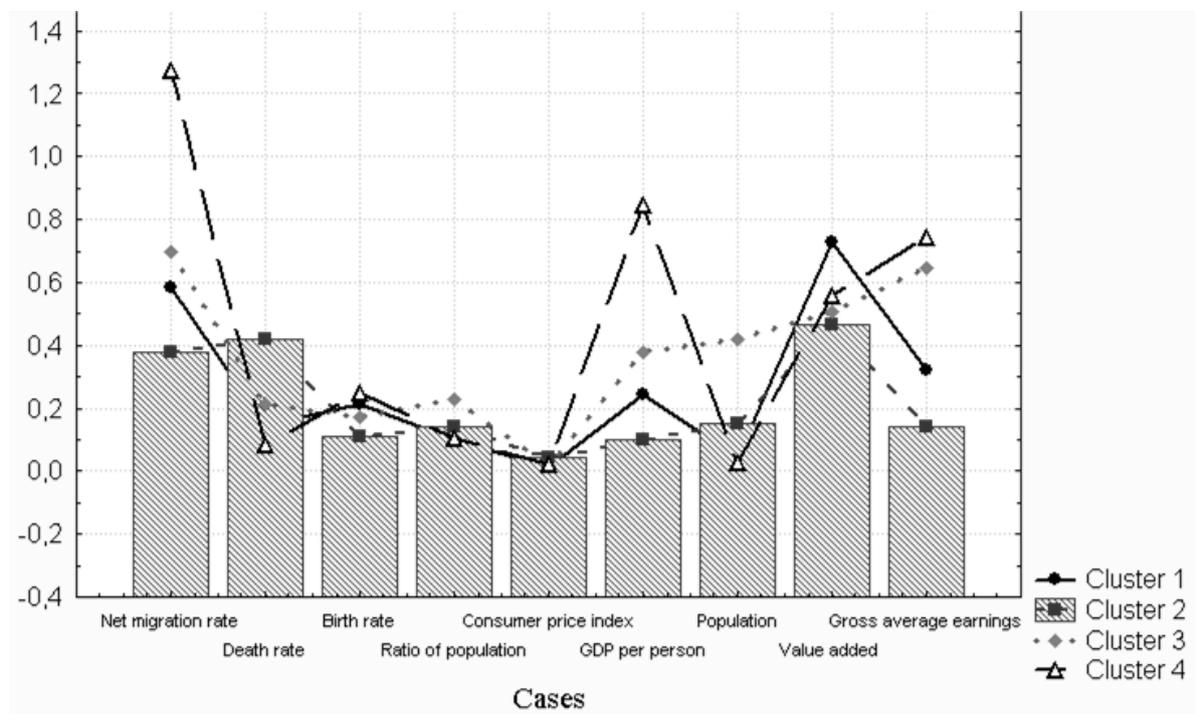


Figure 2. Clustering of the EU Member States and Ukraine (by the authors)

The diagram indicates the plot of means for each cluster.

The countries from the fourth cluster represent the best results for all the selected economic indicators (GDP per capita, earnings), despite the smallest population. At the same time, this cluster shows the highest birth rate and a low death rate.

The third cluster includes the countries with considerable populations and with high economic performance.

Distinctive features of the first cluster are the fast growth of gross added value, a low death rate, a low ratio of pensioners per economically active population in comparison with the other countries.

The second cluster is the vastest, since it consists of 11 countries, including Ukraine and Latvia. This broad cluster demonstrates quite low values of economic indicators in comparison with the other EU clusters. Average earnings, value added and GDP are lower, while the level of the consumer price index is the highest. This cluster also depicts the worst results of demographic indicators, a high death rate and a low birth rate.

Accordingly, the second cluster covers considerable part of the European community. Furthermore, eight of its members joined the EU after 2004, and that allows us to define this cluster as the youngest among the EU clusters and outline prospects for the new members. On the other hand, enlarging the EU with “less developed” countries may affect equilibrium between more and less economically developed clusters and trigger economic disturbances. Due to this reason, an investigation into modern socio-demographic trends will disclose reasonable ways to bridge the gap among the clusters.

Socio-demographic and economic trends in Latvia and Ukraine

As it was shown by the cluster analysis, Latvia and Ukraine have significant similarities and considerable differences with other EU countries, which directly determines the course of many socio-economic processes in both countries.

Performing the research tasks required an extensive database with an abundance of economic, social and demographic indicators. About 30 different indicators were collected throughout the period 2000 to 2016 and logically combined into groups. The analysis of dynamics involves the application of classical statistical approaches, in particular, the methods of correlation-regression analysis and trend analysis (Coale A., 2015). This allowed us to determine the trend's direction, an annual rate of change and its significance (Table 1, 2).

Table 1 Socio-demographic indicators of Latvia and Ukraine
(by the authors, based on official statistics)

	Indicator	Ukraine			Latvia		
		In 2016	Trend direction	annual growth rate, %	In 2016	Trend	annual growth rate, %
Indicators of population growth and aging							
1	Population, mln.	42.59	drop	-0.88	1.97	drop	-1.18
2	Economically active population, mln	29.33	drop	-0.82	1.21	drop	-0.90
3	Pensioners, mln.	6.77	fluctuation	0.60	0.46	drop	-1.14
4	Minors (under 18), mln.	7.61	drop	-2.32	0.30	drop	-2.17
5	Ratio of pensioners per 100 people aged 18-64	23	growth	1.60	38	growth	2.50
6	Birth rate, per 1000 population	9.32	slow growth	1.20	11.16	growth	1.82
7	Death rate, per 1000 population	13.7	drop	-0.71	14.52	growth	0.47
Migration							
8	Immigration, thou.	14.31	fluctuation	-0.85	8.35	fluctuation	8.79
9	Emigration, thou.	6.47	drop	-9.11	20.57	fluctuation	2.22
10	Work migration, mln.	1.32	growth	33.21	data are absent		
Life expectancy and medical care							
11	Life expectancy, years	71.68	growth	0.36	74.80	growth	0.40
12	Total expenditure on health, USD	206.00	growth	13.42	987.00	growth	11.80
13	Marriages, thou.	229.50	fluctuation	0.12	13.6	fluctuation	-3.15

Table 1 represents the trend direction for each indicator of Ukraine and Latvia. It should be noted that some indicators don't have a clearly defined trend (correlation coefficient less than 0.5) and fluctuate over the period. For such indicators, the annual growth rate was taken roughly averaged.

Eventually the following consistent pattern was revealed (Figure 3).

The diagram confirms the common trend of gradual population decline both in Latvia and Ukraine. A decrease in the economically active population with a simultaneous increase in the number of pensioners confirm negative aging trend. However, this drop is not so dramatic, inasmuch as the gap between the death and birth rate decreased gradually. A distinct difference can be traced after 2012 – in Latvia both mortality and fertility are rising, and in Ukraine both are declining, and that eventually provokes more drawbacks for Ukrainian society.

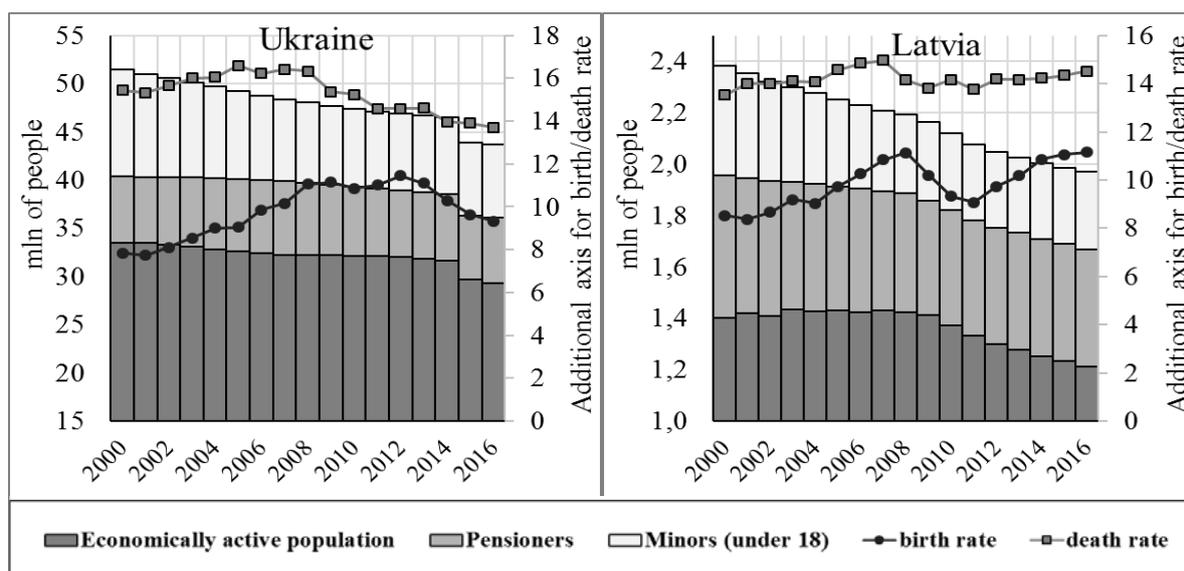


Figure 3 Population change in Latvia and Ukraine (by the authors)

Information about economic and business indicators of Latvia and Ukraine is arranged in the following table.

Table 2 Economic indicators and global international indexes (by the authors, based on official statistics)

	Indicator	Ukraine			Latvia		
		In 2016	Trend direction	annual growth rate, %	In 2016	Trend	annual growth rate, %
Economics and business							
1	GDP, thou. USD per person	2.19	growth	10.5	14.12	growth	10.73
2	Gross national income, bln. USD	93.10	growth	9.75	27.51	growth	2.91
3	Consumer price index	112.40	fluctuation	-0.13	182.0	growth	3.90
4	Business entities, thou.	1865.6	growth	6.91	114.1	growth	5.70
5	Average earnings, USD	202.9	growth	12.9	859.0	growth	9.47
6	Living wage, USD	60.43	growth	2.84	167.0	growth	2.14
7	Unemployment rate, %	9.69	slow drop	-0.61	9.64	slow drop	1.39
Global international indexes							
8	Index of economic freedom	46.8	drop	-0.06	70.4	growth	0.67
9	Ease of doing business	62.9	growth	8.28	78.6	growth	1.27
10	Global competitiveness rank	85.0	growth	2.51	49.0	growth	1.99
11	Human Development Index	0.75	growth	0.71	0.84	growth	0.89

The analysis mostly represents growth of all the economic indicators in both countries, however their level is quite moderate in comparison with developed EU Member States (4 and 3 clusters). Despite this fact, Latvian results are much higher than Ukrainian in relation to GDP, the living wage and average earnings.

Some additional conclusions could be inferred from the diagram (Figure 4).

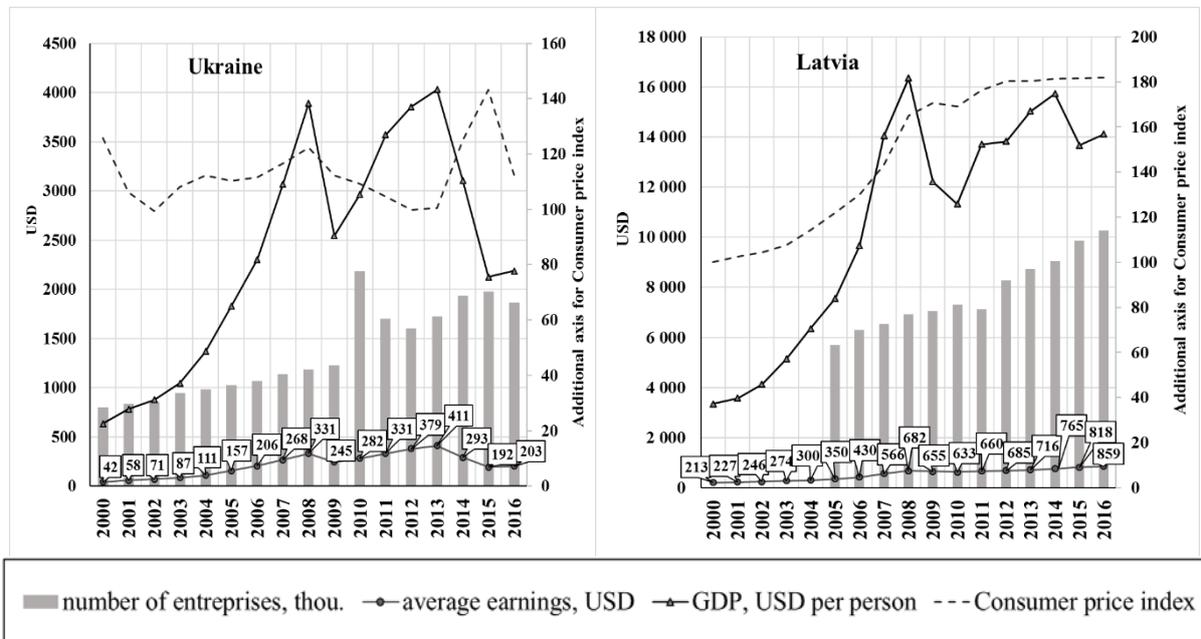


Figure 4. Dynamics of economic indicators (by the authors)

The graph depicts a positive trend of GDP, but in 2016 its level did not catch up with the peak in 2008 and 2014. The same situation is relevant for average earnings in Ukraine, which are 10 times lower than the average earnings in the EU Member States. In Latvia, all the indicators grew more steadily. The price index roughly remain stable after the peak in 2012. In contrast, the Ukrainian consumer price index fluctuates each year.

Meanwhile, the number of business entities rises significantly, but this growth does not promote employment growth. The correlation between these indicators is infinitesimal for both countries. This also may indicate that some enterprises work in the “shadow economy” and do not formalize the relations with their employees.

Feedback between economic and demographic indicators

Generally, the analysis of correlation and determination enable us to establish positive and negative trends in the demographic, social and economic spheres, as well as the logical coherences between them. The next stage of the

research study leads to the establishment of the feedback between economic and socio-demographic indicators and the elaboration of multifactorial models. For this task, multifactorial regression analysis was applied. At the first step we establish a correlation between all the indicators (Tables 1, 2). It enables us to distinguish the most important coherences and influencing factors.

As was shown earlier, in current socio-economic conditions an important task links to tackling the negative trends of population drop by increasing the natural population growth.

The analysis enables us to outline the following indicators affecting GDP and the birth rate in Latvia and Ukraine (Figure 5).

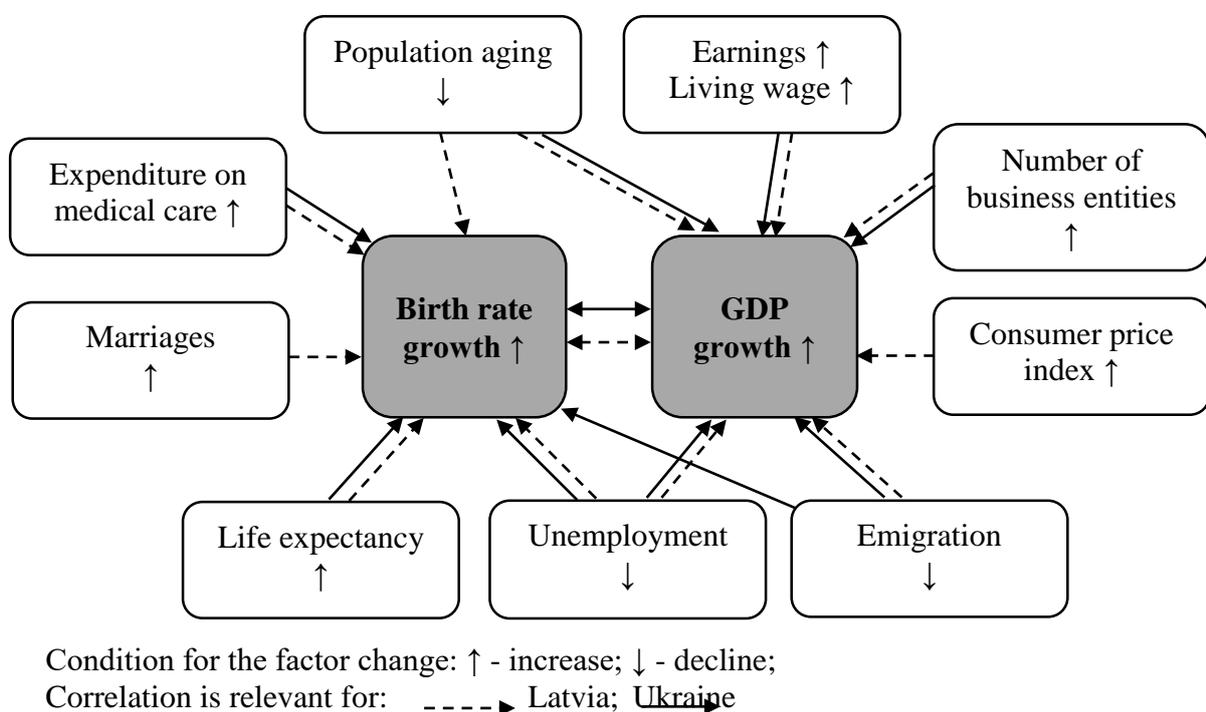


Figure 5. **Complex model for GDP and fertility growth** (by the authors)

All these factors indicated a strong correlation between GDP and the birth rate. It has been established that the growth of the birth rate and the population in Latvia and Ukraine depends on the system of indicators. Remarkably, that some indicators are considerable only for Ukraine or Latvia. For instance, the consumer price index affects GDP growth in Latvia, which is connected with purchasing power and production forces. At the same time, marriage activity increases the birth rate in Latvia, however in Ukraine there is a slight correlation between these indicators. In contrast to Latvia, the highlighting factor, affecting the birth rate in Ukraine is emigration out of the country.

The correlation-regression analysis showed that under the conditions of Latvia and Ukraine, variable factors have different influence on the GDP and the

birth rate. For this reason, the next step of research leads to multifactorial modelling to evaluate the influence of all the factors in a complex manner. The factors were integrated into the model by Student's and Fisher's test. The model's relevance was tested on the basis of an approximation error and the coefficient of multiple correlation and determination.

The multifactorial model here is an attempt to take into account the most significant factors affecting GDP and population.

Multifactor model for Latvia (compiled by the authors):

$$\begin{cases} GDP_{Lat} = 53.16 - 0.11 \cdot X1 + 0.16 \cdot X2 + 0.12 \cdot X3 - 0.61 \cdot X4 \\ BR_{Lat} = 11.78 + 0.003 \cdot X5 - 0.141 \cdot X4 - 0.004 \cdot X1 \end{cases} \quad (1)$$

Multifactor model for Ukraine (compiled by the authors):

$$\begin{cases} GDP_{Ukr} = 14.6 - 0.07 \cdot X6 + 0.014 \cdot X5 - 0.051 \cdot X4 + 0.0002 \cdot X3 - 0.18 \cdot X7 \\ BR_{Ukr} = 8.56 + 0.008 \cdot X5 - 0.014 \cdot X4 - 0.012 \cdot X8 \end{cases} \quad (2)$$

Where $X1$ - pensioners, thou.; $X2$ – consumer price index, units; $X3$ – number of business entities, thou.; $X4$ – unemployment rate, %; $X5$ – average earnings, USD per month; $X6$ - ratio of pensioners per 100 people aged 18-64; $X7$ – life expectancy, years; $X8$ – emigration, thou. people.

It should be taken into account that although some factors from the scheme (Figure 5) are not assigned to models, it does not mean that they are infinitesimal, they influence mostly indirectly.

As a result, the GDP model of Latvia shows the greatest influence of aging (pensioner ratio), the consumer price index, the number of business entities and the unemployment rate. The GDP model of Ukraine also includes average earnings. Both the unemployment rate and average earnings affect the birth rate in Ukraine and Latvia. However, the third factor in the BR model is dissimilar, since aging mostly reduce the birth rate in Latvia and emigration influences the birth rate in Ukraine.

Conclusions

In the past decades, the economic, social and demographic environments have undergone major changes. Today the most highlighting trends in Europe link with migration, the global trade market, employment issues, population aging, drop of natural population growth etc. Accordingly, there is no shortage of debate that stable growth of the business sector of the national economy requires tackling demographic, social and economic issues and preserving human capital.

The results of the cluster analysis enabled us to delineate 4 clusters of the EU Member States and Ukraine, which merge countries with strong similarities and allow us to analyse the European map by economic, demographic and social indicators. Ten Member States of the EU form a profound third cluster with considerable populations and high economic performance. In contrast, Ukraine, Latvia and other nine countries are integral representatives of the second cluster, which covers countries with low values of economic indicators and negative demographic trends.

The research confirmed a considerable correlation and feedback between the demographic and economic indicators of Latvia and Ukraine. The populations of both countries decline steadily, with gradual population aging and intensive migration processes. However, this drop is not so dramatic, inasmuch as the gap between the death and the birth rate decreases and life expectancy rises. The analysis depicts a positive trend of GDP, the living wage, average earnings, but all these indicators are much lower than analogous in the other EU Member States.

The multifactorial analysis allowed us to elaborate a model of GDP and birth rate growth for Ukraine and Latvia. The main conditions of birth rate growth today are: increase of average earnings, higher life expectancy, more marriages, expenditures on medical care; decrease of uncontrolled emigration, unemployment, extensive population aging. The GDP model illustrates that GDP growth depends on the number of business entities, the consumer price index, emigration, employment and the living wage. At the same time, GDP induces significant feedback with demographic indicators, indirectly influencing population growth.

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