POPULATION AGE IN THE COUNTRIES OF THE EUROPEAN UNION

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The primary purpose of this paper lies in the statistical-demographic analysis of the population age level in the 27 EU countries. The focus is not only on the analysis of the population age level of each particular country studied at one point of time but on the population aging affected by the process of the age structure change within period of time as well. Furthermore, the change of the age structure will be examined with regard to the workload of the productive population. In doing so, the ageing index will quantify the age level of a respective country, the growth coefficient will characterize the speed of ageing, the dependency coefficient will assess the workload of the productive population and finally, similarities between countries on selected indicators will be manifested by means of cluster analysis. As a result, a snapshot into the structure of the EU population may be anticipated.

Keywords: European Union, Age Structure, Old Age and Population Aging

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INTRODUCTION

In the last few decades European countries have been experiencing significant changes in the demographic development. The development was accelerated through the creation of the European Union and, in particular, through the gradual accession of the former Soviet Union countries. These changes in development have both positive and negative character. The developed countries, to which most of the European countries belong, have been exhibiting new lifestyle. Especially young generation manifests changes in demographic behavior in that they use more opportunities to travel, study abroad, and are much more interested in a general personality development. Aforementioned advantages, however, contribute to couple of negative phenomena, namely, to lower marriage rate, postpone marriages, greater divorce rate, and in particular lower birth rate. The later resulted in a decreased portion of the youngest age group and a faster population aging. With respect to the improved living and social-economic conditions the life expectancy has been prolonged, which in turn raises the share of older population. As a corollary to this, the productive population has been carrying increased workload.

OBJECTIVES OF THE STUDY

1. To perform statistical-demographic analysis of the population age level in the 27 EU countries.
2. To examine the change of the age structure with regard to the workload of the productive population.
3. To explore similarities between countries on selected indicators.

RESEARCH METHODOLOGY

The Study

The present study is exploratory in nature and based on secondary data.

The Sample

The source data were obtained from the Eurostat database, where the number of inhabitants of the respective age group (taken from the sample of the 27 EU countries) is listed. The data, related to the 01.01.2009, were subjected to analysis. In doing so, the data were transformed into

the percentage form of three basic age groups and into the form of derived indicators (Table-1). As derived indicators the dependency coefficients and the aging index were calculated. The dependency coefficient expresses the proportional representation of the age group 0 – 14 years (labeled as youth in Table-1), 65+ years (labeled as old age in Table-1), alternatively both of them (labeled as overall in Table-1), to the productive age group. Thus, they indicate how much both groups contribute to the productive population. An important demographic indicator is the ageing index to be expressed as a percentage portion of the group youth to the group old age. It is an indicator which characterizes and simultaneously quantifies the age level of the respective country.

Tools for Data Collection

The study is based on the secondary sources of information which is collected from the Eurostat database, where the number of inhabitants of the respective age group (taken from the sample of the 27 EU countries) is listed.

Tools for Data Analysis

The descriptive statistics, namely characteristics of absolute level, variability, asymmetry and kurtosis for the data sample of the 27 EU countries were carried out. In order to evaluate the relationships between indicators the correlation matrix was created. In the matrix the correlation coefficients demonstrate the level of the relationship intensity. The data sample of the EU countries is not homogenous from the age level standpoint. Hence, cluster analysis (based on the complete linkage method yielding maximum Euclidean distance between objects) forms groupings of countries whose indicators seem to be similar. To assess the changes of the age structure the growth coefficient characterizing the speed of ageing was calculated.

RESULTS AND DISCUSSION

The sample of 27 EU countries varies significantly in terms of the area and the number of inhabitants. To date 01.01.2009 there were 499 705 496 EU-inhabitants in total. More than 10 percent from all EU inhabitants was covered by 4 countries: Germany, France, United Kingdom and Italy. More than 5 percent was covered by Spain and Poland. In contrast, there is a group of 8 small countries (Malta, Luxemburg, Cyprus, Estonia, Slovenia, Latvia, Lithuania and Ireland), whose share does not even exceed 1 percent. As for the age group, it holds for all EU countries regardless of the area that population is ageing.

Figure-1: Basic Age Groups of the EU Countries Expressed in Percentage based on Data Set
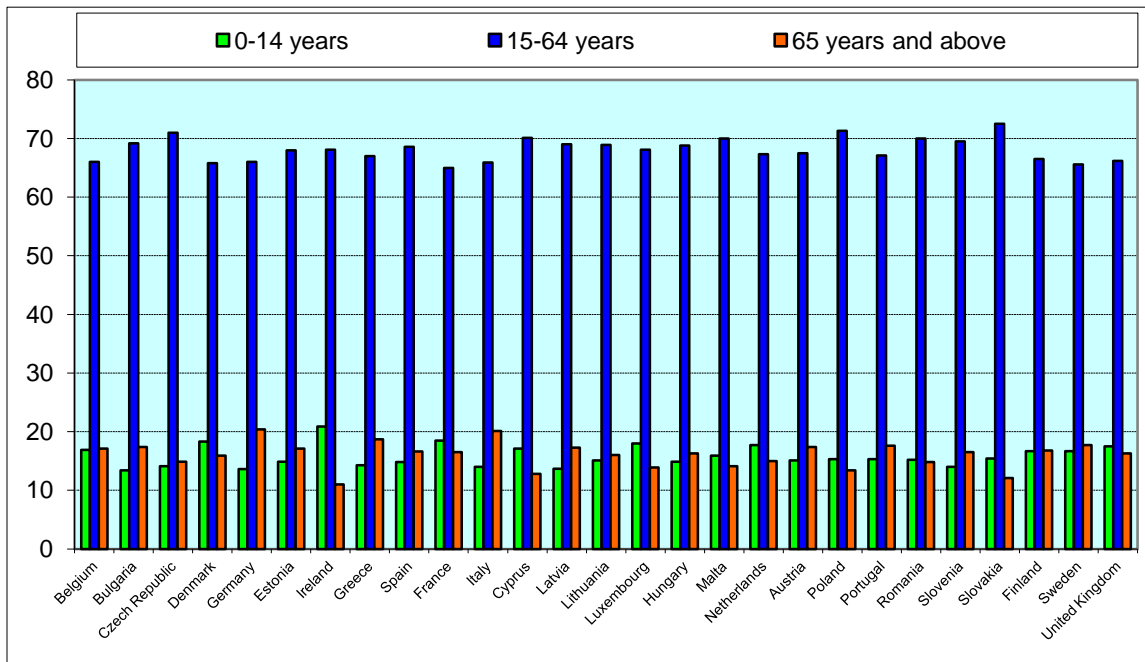
The mutual comparisons of the age group shares are depicted in Figure-2. As it turns out, the greatest share belongs to the productive group owing to its widest coverage (15 – 64 years). In the framework of the whole EU the share was 67.2 percent and in case of the single countries it falls within the range of 65.0 – 72.5 percent. The share of the youth group (0 – 14 years) was 15.6 percent and the share of the old age group (65+ years) 17.2 percent. As for the shares variability, in some cases the share of the youth group exceeds the share of the old age group and vice versa. In more than 50 percent of countries the share of old age group is above the share of the youth group to be proved likewise by the ageing indices in introductory part (their values are greater than 100 percent).

The descriptive characteristics of absolute level, variability, asymmetry and kurtosis are overviewed in Table-2. Those characteristics were calculated regardless of their size (i.e. weights) using the simple form. Therefore, the average values are different from the values of the EU as a whole. The lowest variability, that is, 3 percent shows the productive age group, the ageing index unlike shows the greatest variability with 21 percent. The greatest (left-sided)

asymmetry holds for the youngest age group (0 – 14 years) which at the same time is the most concentrated group (the highest coefficient of kurtosis).

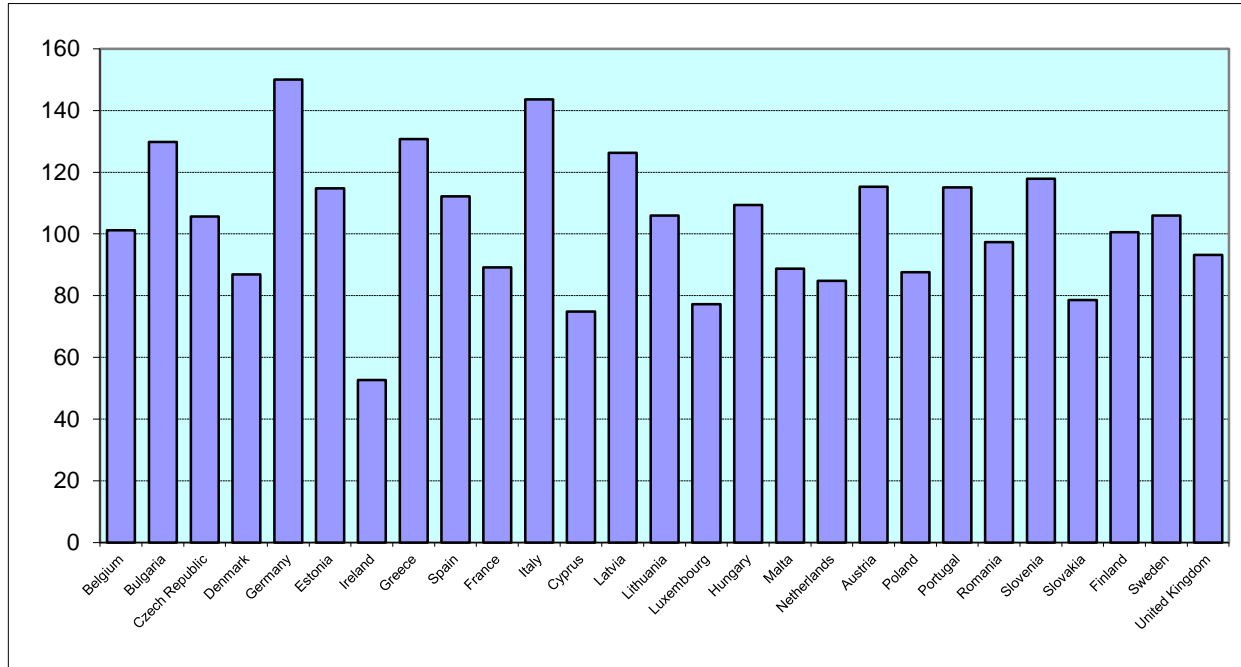**Figure- 2: Ageing Indices of the EU Countries Based on Data Sets**

Table- 3 depicts correlation matrix of relationships between aforementioned indicators. The values of correlation coefficients indicate the strength of the relationship. For instance, there is very high negative correlation (r = – 0.999) between the share of productive class (15 – 64 years) and the total dependency coefficient indicating the greater the share of age group the lower the total dependency coefficient. Shares of the youth and old age groups influence respective co-efficient in positive direction (r = 0.978 and r = 0.990). The ageing index is in positive direction affected by the share of the old age group (r = 0.908) and in negative direction in lower extent by the share of youth group (r = –0.828).

A crucial step of the analysis is to divide the sample of the EU countries into groups in a way so that countries can share common characteristics in terms of demographic indicators. In doing so, the cluster analysis, using the furthest neighbor method yielding maximum Euclidean distance between objects was performed. For this purpose, the initial data were standardized (with zero mean and variability approaching to unity). As a result, same weights for all indicators were

obtained. Based on the dendrogram results (Figure-3) – considering share of the productive population (15 – 64 years) and the ageing index – 5 clusters were formed.

Figure- 3: Dendrogram of the 27 EU Countries with Respect to Share of the Productive Population and Ageing Index

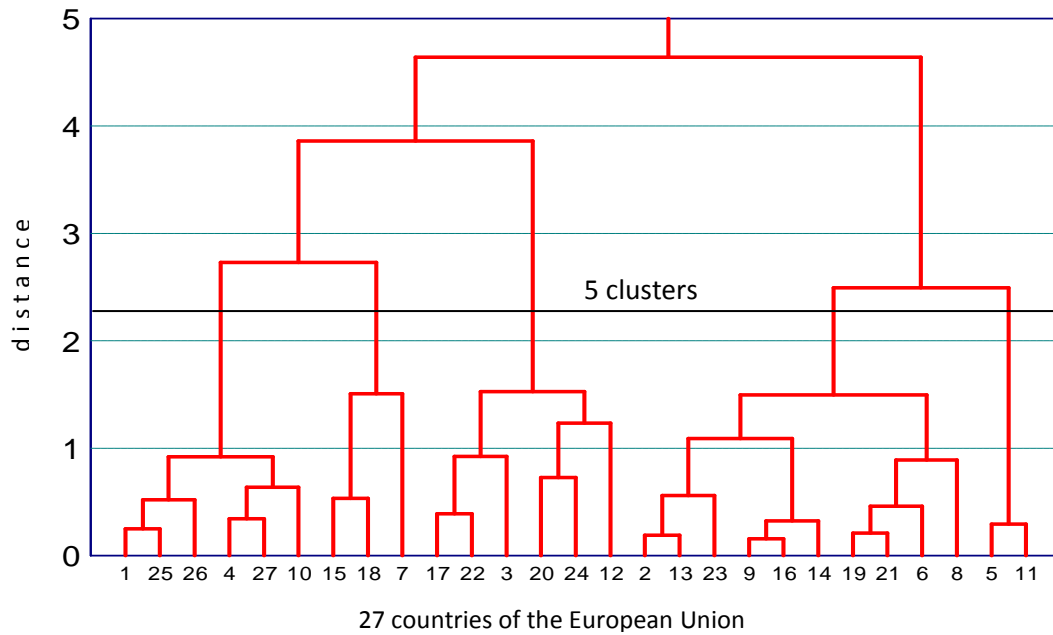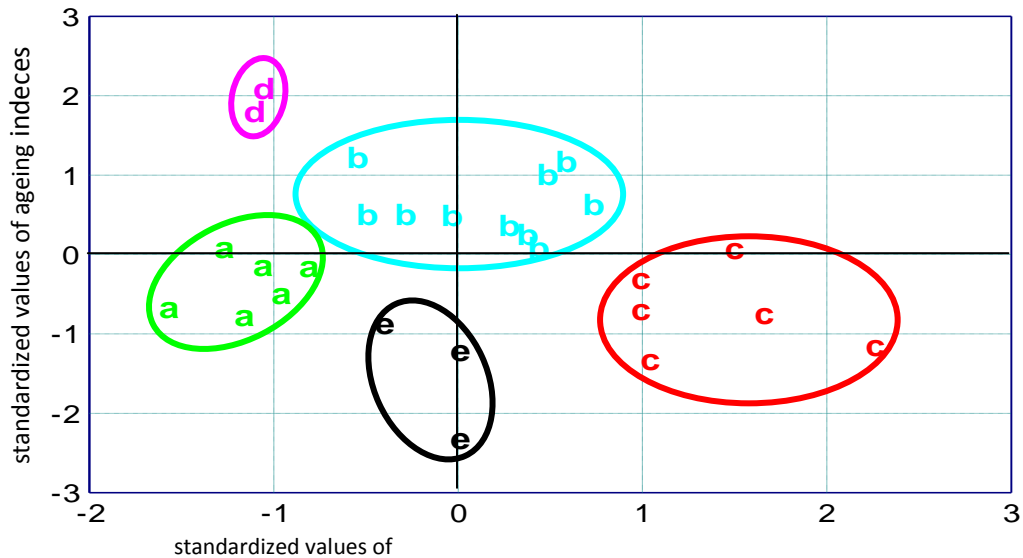

27 countries of the European Union

Figure- 4: Clusters of the EU-27 wrt. Share of Productive Population and Ageing Index

Generated clusters of the EU-27 with respect to share of the productive population and the ageing index:

***a*: 6 countries (22.22 percent)**

Below average share of productive population (15 – 64 years)

Average to slightly below average ageing index

1–Belgium, 25–Finland, 26–Sweden, 4–Denmark, 27–UK, 10–France

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***e*: 3 countries (11.11 percent)**

Average share of productive population (15 – 64 years)

Below average ageing index

15–Luxembourg, 18–Netherlands, 7–Ireland

***c*: 6 countries (22.22 percent)**

Above average share of productive population (15 – 64 years)

Average to below average ageing index

17–Malta, 22–Romania, 3–Czech Republic, 20–Poland, 24–Slovakia, 12–Cyprus

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***b*: 10 countries (37.04percent)**

Average share of productive population (15 – 64 years)

Average to above average ageing index

2–Bulgaria, 13–Latvia, 23–Slovenia, 9–Spain, 16–Hungary, 14–Lithuania, 19–Austria, 21–Portugal, 6–Estonia, 8–Greece

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***d*: 2 countries (7.41 percent)**

Below average share of productive population (15 – 64 years)

Above average ageing index

5–Germany, 11–Italy

Analogically, the EU countries were classified with regard to the dependency coefficients of youth group and old age group illustrating the workload of the productive population. According to the dendrogram (Figure- 5) the 4-cluster solution appears to be the most suitable. Graph of the formed clusters (Figure- 6) provides a snapshot of their positioning.

Figure-5: Dendogram of EU-27 with respect to the Dependency Coefficient of the Youth and Old age Group
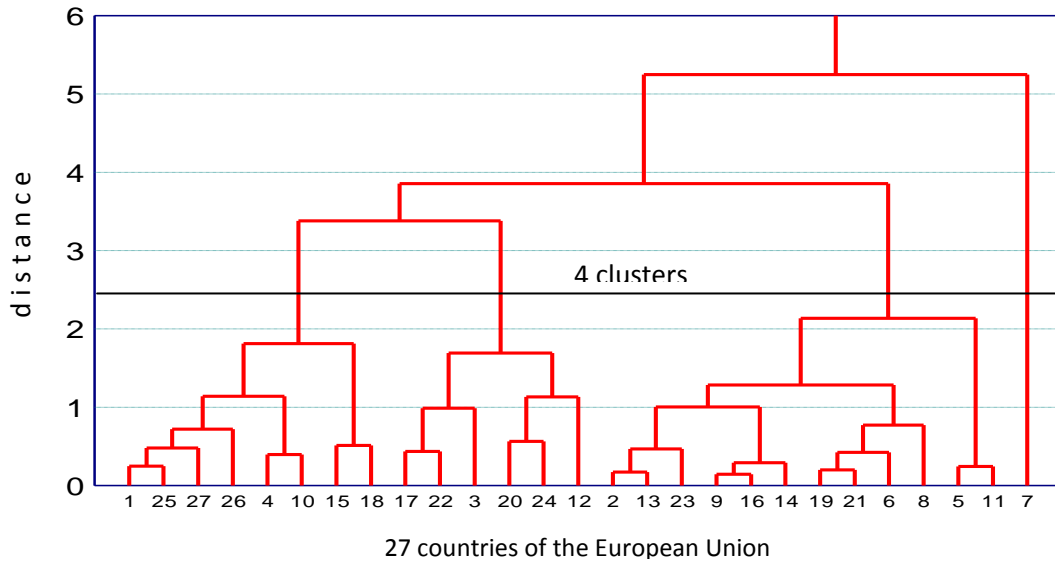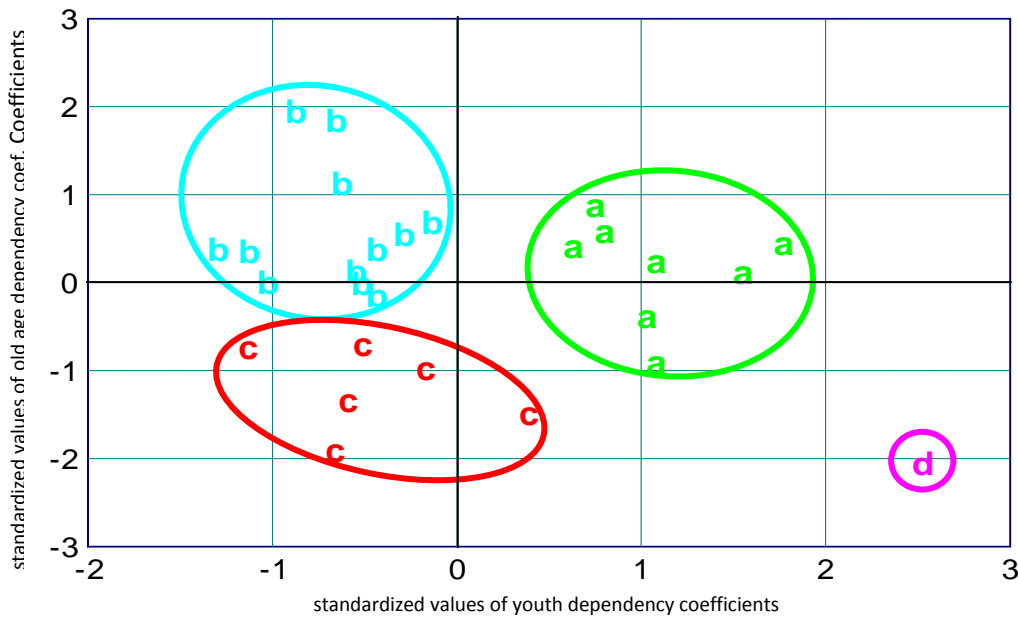

Figure- 6: Clusters of the EU-27 with respect to Dependency Coefficient of the Youth Group and the Old Age Group

Generated clusters of the EU-27 wrt the dependency coefficient of the youth group and the old age group:

***a*: 8 countries (29.63percent)**

Above average dependency coefficient of the youth group

Average dependency coefficient of the old age group

1–Belgium, 25–Finland, 27–United Kingdom, 26–Sweden, 4–Denmark,

10–France, 15–Luxembourg, 18–Netherlands

***c*: 6 countries (22.22 percent)** *B*

Below average dependency coefficient of the youth group

Average to below average dependency coef. of the old age group

17–Malta, 22–Romania, 3–Czech Republic, 20–Poland, 24–Slovakia, 12–Cyprus

***b*: 12 countries (44.45 percent)**

Average to below average dependency coef. of the youth group

Below average dependency coefficient of the old age group

2–Bulgaria, 13–Latvia, 23–Slovenia, 9–Spain, 16–Hungary, 14–Lithuania,

19–Austria, 21–Portugal, 6–Estonia, 8–Greece, 5–Germany, 11–Italy

***d*: 1 country (3.70 percent)**

Above average dependency coefficient of the youth group

*Above average dependency coefficient of the old age group*

7–Ireland

The last few paragraphs analyzed the level of population ageing in the EU countries till 01.01.2009. However, it is not our point to consider ageing of population statistically but to take into account its development. In this sense, it is customary to analyze changes in the proportional representation of the age groups, and thus, to dynamically analyze the speed of ageing. For this purpose, the coefficients of growth are to be applied (Table- 4). Figure-7 brings a graphical representation of the sample of 27 EU countries organized into a map whose axis depict growth coefficients of the youth group (x-axis) and the old age group (y-axis). Both growth coefficients span over the period 1999 – 2009. As Figure-7 indicates, all countries are accumulated in a diagonal on the left. Thus, it can be concluded that in all countries the growth coefficient of the old age group exceed coefficients of the youth group. It follows; all countries have been experiencing ageing of population. This holds even in case of Ireland (7) and Luxemburg (15)

displaying lower growth coefficients of the old age group and Denmark (4) where the ratio of youth has been slightly raised.

Taken a whole in the EU, the ratio of the youth group dropped from 17.5 percent in 1999 to 15.6 percent in 2009 as demonstrated by the growth coefficient 0.8914. Conversely, the ratio of the old age group increased from 15.4 percent to 17.2 percent. In response, the ageing index raised from 88 percent to 110.26 percent. Whereas, only 4 countries experienced the index of ageing greater than 100 percent in the year 1999, there were 16 countries in the 2009. The age level and the speed of ageing in the last decade to 01.01.2009 is shown in Figure- 8.

**Figure- 7: Map of the EU-27 where x-Axis depicts Youth Growth Coefficients and y-Axis Old Age Growth Coefficients in a Period of 2009/1999**

youth growth coefficient 2009/1999
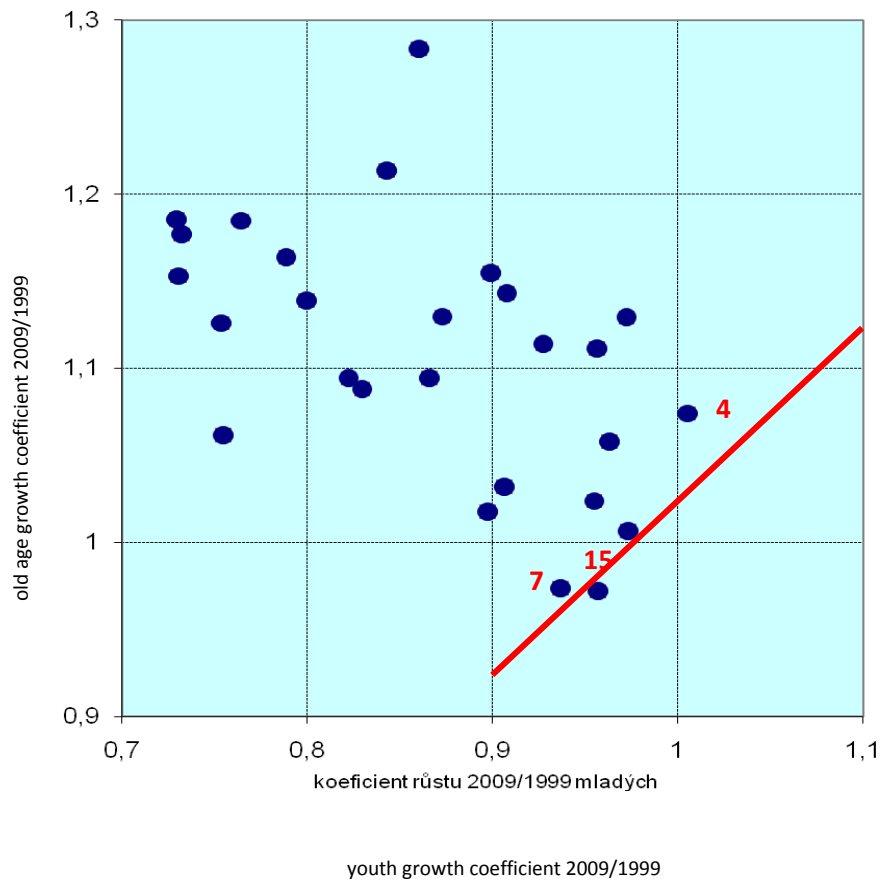
Accordingly, 7 – Ireland shows significantly low ageing index and at the same time very low growth coefficient determining low speed of ageing. 12 – Cyprus, for instance, has likewise low

ageing index though the speed of ageing is high. In contrast, 9 – Spain and mainly 11 – Italy have high level of age and simultaneously low speed of ageing. However, 14 – Latvia and 13 – Lithuania, which used to have a low ageing index, have been ageing the fastest with ageing index above 100 percent. Particularly unfavorable development is in 5 – Germany where the ageing was fast and the ageing index has overcome 150 percent - to be the highest in the EU.

Figure- 8: Age of Population and Ageing Index of the EU
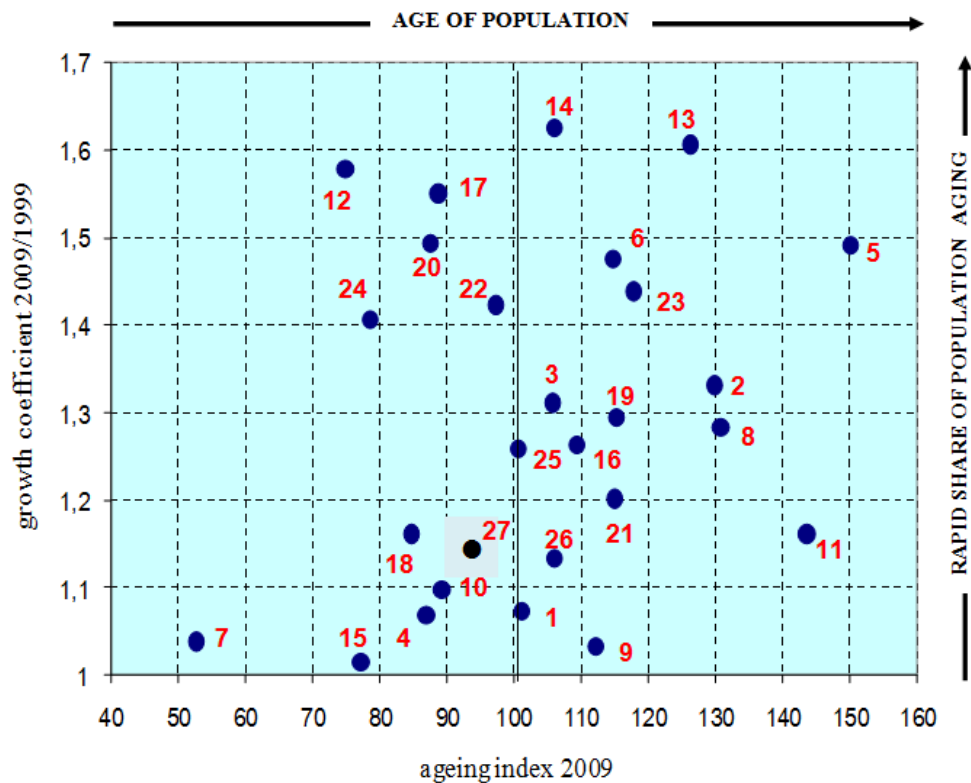
CONCLUSION

Since the human resource appears to be the critical factor within society development the demographic analysis became a part of economic-statistical analysis. The paper is concerned with issues relating to the age level and ageing of population in the sample of 27 EU countries in the year 2009. In general it can be concluded, that all countries are encountering unfavorable development towards ageing and increased productive population workload. The portion of the youth group (0 – 14 years) tends to diminish whereas, the portion of the old age group (65+) is

expected to rise. The age level is evaluated by means of ageing index and the speed of aging by means of growth coefficient. Achieved results provide very exact insight into a population structure in the EU countries. However, unfavorable demographic development calls for adoption of relevant social economic measures.

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Table- 1: Proportional Representation of the Age Group in Percentage of the EU-27 and Derived Indicators

	Country	Representation in percent			Dependency coefficient in percent			Ageing Index
		0–14	15–64	65+	youth	old age	overall	
1	Belgium	16.9	66.0	17.1	25.61	25.91	51.52	101.18
2	Bulgaria	13.4	69.2	17.4	19.36	25.14	44.51	129.85
3	Czech Rep.	14.1	71.0	14.9	19.86	20.99	40.85	105.67
4	Denmark	18.3	65.8	15.9	27.81	24.16	51.98	86.89
5	Germany	13.6	66.0	20.4	20.61	30.91	51.52	150.00
6	Estonia	14.9	68.0	17.1	21.91	25.15	47.06	114.77
7	Ireland	20.9	68.1	11.0	30.69	16.15	46.84	52.63
8	Greece	14.3	67.0	18.7	21.34	27.91	49.25	130.77
9	Spain	14.8	68.6	16.6	21.57	24.20	45.77	112.16
10	France	18.5	65.0	16.5	28.46	25.38	53.85	89.19
11	Italy	14.0	65.9	20.1	21.24	30.50	51.75	143.57
12	Cyprus	17.1	70.1	12.8	24.39	18.26	42.65	74.85
13	Latvia	13.7	69.0	17.3	19.86	25.07	44.93	126.28
14	Lithuania	15.1	68.9	16.0	21.92	23.22	45.14	105.96
15	Luxembourg	18.0	68.1	13.9	26.43	20.41	46.84	77.22
16	Hungary	14.9	68.8	16.3	21.66	23.69	45.35	109.40
17	Malta	15.9	70.0	14.1	22.71	20.14	42.86	88.68
18	Netherlands	17.7	67.3	15.0	26.30	22.29	48.59	84.75
19	Austria	15.1	67.5	17.4	22.37	25.78	48.15	115.23
20	Poland	15.3	71.3	13.4	21.46	18.79	40.25	87.58
21	Portugal	15.3	67.1	17.6	22.80	26.23	49.03	115.03
22	Romania	15.2	70.0	14.8	21.71	21.14	42.86	97.37
23	Slovenia	14.0	69.5	16.5	20.14	23.74	43.88	117.86
24	Slovakia	15.4	72.5	12.1	21.24	16.69	37.93	78.57
25	Finland	16.7	66.5	16.8	25.11	25.26	50.38	100.60
26	Sweden	16.7	65.6	17.7	25.46	26.98	52.44	105.99
27	UK	17.5	66.2	16.3	26.44	24.62	51.06	93.14
	EU	15.6	67.2	17.2	23.21	25.60	48.81	110.26

Source: Author's Calculations based on Eurostat database

Table- 2: One-Dimensional Characteristics for Demographic Indicators

Demographic indicator		Level		Variability		Skew-ness	Kurt-osis
		Arith. mean	Median	Standard deviation	Variation coefficient		
Age group	0 – 14	15.83	15.30	1.83	0.12	0.90	0.63
	15 – 64	68.11	68.10	1.95	0.03	0.37	– 0.56
	65 +	16.06	16.50	2.21	0.14	– 0.32	0.26
Dependency coefficient	youth	23.28	21.92	2.98	0.13	0.82	– 0.13
	old age	23.66	24.20	3.69	0.16	– 0.23	– 0.03
	overall	46.93	46.84	4.17	0.09	– 0.26	– 0.70
Ageing index		103.53	105.67	22.05	0.21	0.04	0.16

Source: Author's Calculations

Table- 3: Correlation Matrix of Demographic Indicators

	Indicator	2	3	4	5	6	7
1	Age group 0-14 years	–0.314	–0.548	0.978	–0.430	0.317	–0.828
2	Age group 15-64 years		0.622	–0.505	–0.722	–0.999	–0.256
3	Age group ≥ 65 years			–0.361	0.990	0.619	0.908
4	Youth dependency coef.				–0.232	0.508	–0.697
5	Old age dependency coef.					0.720	0.846
6	Overall dependency coef.						0.252
7	Ageing index						

Source: Author's Calculations

Table-4: Coefficient of Growth 2009/1999 with Respect to Share of Productive Population and Ageing Index

	EU countries	Age group			Ageing index
		0–14	15–64	65+	
1	Belgium	0.9548	1.0046	1.0240	1.0724
2	Bulgaria	0.8221	1.0206	1.0943	1.3311
3	Czech Rep.	0.8294	1.0245	1.0876	1.3112
4	Denmark	1.0055	0.9836	1.0743	1.0685
5	Germany	0.8608	0.9677	1.2830	1.4906
6	Estonia	0.7884	1.0241	1.1633	1.4756
7	Ireland	0.9372	1.0256	0.9735	1.0387
8	Greece	0.8994	0.9867	1.1543	1.2834
9	Spain	0.9737	1.0015	1.0061	1.0333
10	France	0.9635	0.9969	1.0577	1.0977
11	Italy	0.9722	0.9720	1.1292	1.1615
12	Cyprus	0.7308	1.0702	1.1532	1.5778
13	Latvia	0.7326	1.0345	1.1769	1.6064
14	Lithuania	0.7295	1.0455	1.1852	1.6247
15	Luxembourg	0.9574	1.0179	0.9720	1.0153
16	Hungary	0.8663	1.0118	1.0940	1.2628
17	Malta	0.7644	1.0417	1.1849	1.5501
18	Netherlands	0.9568	0.9912	1.1111	1.1614
19	Austria	0.8728	1.0030	1.1299	1.2944
20	Poland	0.7537	1.0516	1.1261	1.4940
21	Portugal	0.9273	0.9911	1.1139	1.2012
22	Romania	0.8000	1.0279	1.1385	1.4231
23	Slovenia	0.8434	0.9957	1.2132	1.4385
24	Slovakia	0.7549	1.0615	1.0614	1.4060
25	Finland	0.9076	0.9955	1.1429	1.2592
26	Sweden	0.8978	1.0250	1.0172	1.1330
27	UK	0.9067	1.0200	1.0316	1.1377
	EU	0.8914	1.0015	1.1169	1.2530

Source: Author's Calculations based on Eurostat database