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# Demographic Determinants of the Changes in the Student Population of the Lubelskie Voivodship

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**Abstract**

*Demographic processes are one of the fundamental factors determining the number of students. This article presents the analysis of the demographic processes' influence on the current and future number of students in the Lubelskie Voivodship — a region of the NUTS 2 level, located in eastern Poland, bordering on Byelorussia and Ukraine. We used the auto-regression model to produce the forecast which indicates that through the year 2035 we will be experiencing drastic, permanent decline in the numbers of Polish students in the Lubelskie Voivodship, caused by the predicted significant decrease in the number of high school pupils.*

## Introduction

Demographic processes, understood as changes in the number and structure of the population, are especially in the long run one of the key factors determining the education system (its structure and size), including the higher education system. The current and future (within the next several years) number of students was demographically determined by the population processes which range from those that date back twenty years to those that occurred just a few years ago. The aim of this paper is to analyze the influence of demographic processes on the number of students in the Lubelskie Voivodship — a region of the NUTS 2 level, located in eastern Poland, bordering on Byelorussia and Ukraine. In order to make the forecast we used the auto-regression model which takes into account the population forecasts in particular for the age groups between 19 and 44.

## 1 Demographic changes in the Lubelskie Voivodship in years 1999–2011

The Lubelskie Voivodship started functioning within its current borders on 1999.01.01. Thirteen years is too short a period to capture all the characteristics of demographic processes. Although some demographic categories have been assessed retrospectively by the Central Statistical Office since 1995, this may turn out to be insufficient, therefore we will also use the national data in order to better present the current phase of demographic processes in the voivodship.

### 1.1 Natural increase rate

Scientists observed a drastic fall in births in the area of the Lubelskie Voivodship, which lasted from 1985 to 2002, the negative effects of which will be strongly felt in the future. Beginning in 2003 we can observe a slight increase in the number of births, an "echo" of the demographic high from the beginning of the 1980s. However, the above-mentioned high did not last long (around 5 years),[1] therefore its influence on the currently observed increase in the number of births will not last long, either. Nevertheless, in 2008, 23 thousand babies were born in the Lubelskie Voivodship, which is 2200 more than in 2002 and this is comparable to the level observed at the beginning of

* Voivodeship — Polish administration region on the NUTS 2 level. Poland is divided into 16 voievdeships.

1. The high of 1980s was the "echo" of the 1950s high. The current growth in the number of births is therefore the 'echo of the echo', and each consecutive echo is always quieter.

the century. In 2009–2010 the number of births was only slightly lower (23 000([2]) in 2009 and 22 600 in 2010).[3]

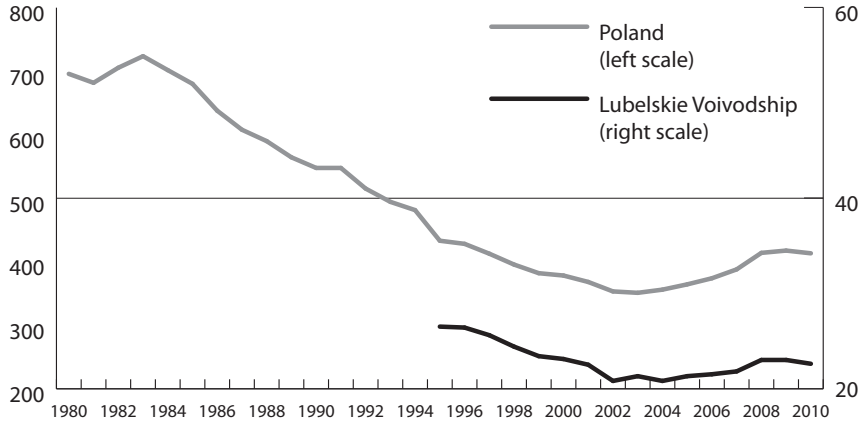


**Fig. 1.** Changes in the number of births in Poland and Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration on the basis of data from Central Statistical Office

The fall in the number of births in the 1990s was caused by both the unfavorable changes in the age structure of women (women born during the demographic low of the 1970s entered the peak birth-giving age) and by the fall in fertility ratios which represent women's inclination to have babies. In the area of the present Lubelskie Voivodship, just like all over Poland, we have observed a strong decline in population reproduction rates since the mid-1980s. In Poland, 1988 was the last year when extended reproduction was observed. Starting in 1989, narrowed reproduction has been taking place, while synthetic reproduction rates reached their bottom values in 2003. It should be emphasized that the difference between the net and gross reproduction rates is diminishing. While in 1980 the net rate constituted 96,8% of the gross rate, in 2010 its value was 99,7% of the gross rate. This means that 99,7% of girls reach the age of their mothers when they gave birth to them. And this is the consequence of a significant reduction in the death rate among women aged under 25.

More favorable changes have been observed in the mortality rate. Whereas in 1995, 24 100 people died in the area of the present Lubelskie Voivodship, in 1997 the figure was 24 600 people

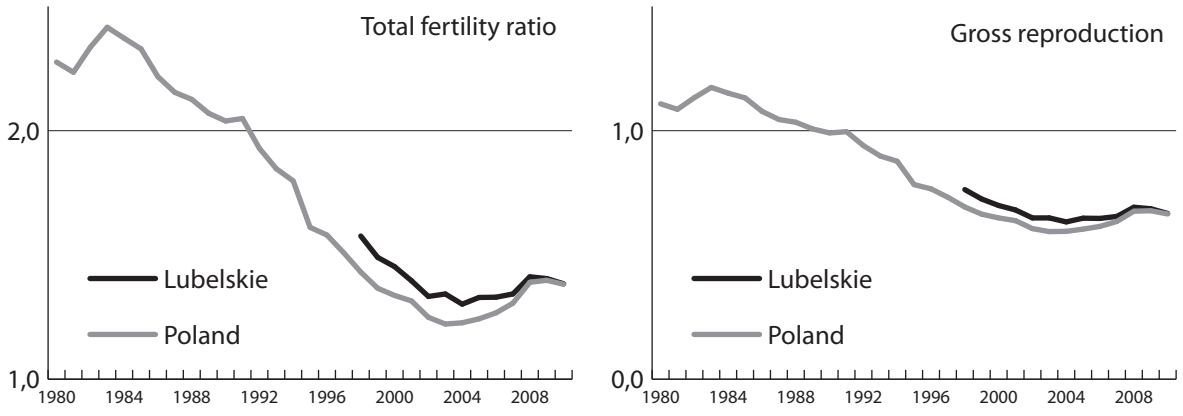


**Fig. 2.** Changes of reproduction ratios in Poland and Lubelskie Voivodship

*Source:* Own elaboration on the basis of data from Central Statistical Office

2. [In the journal (in both Polish and English texts) European practice of number notation is followed that is, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style). Furthermore in the International System of Units (SI units), fixed spaces rather than commas are used to mark off groups of three digits, both to the left and to the right of the decimal point.]

3. If the source of data are not otherwise quoted in this paper, they come from the Demographic Yearbooks published every year by the Central Statistical Office or from the Statistical Yearbooks of the Lubelskie Voivodship published every year by the Statistical Office in Lublin and from reports entitled: *Population, Natural Movement and Migrations in the Lubelskie Voivodship.*

and in 1999 — 23 600 people. At the beginning of the century the number of deaths oscillated below 23 100 per year, reaching its minimum of 22 700 people in 2006. In 2010 23 000 people died in the Lubelskie Voivodship.

We should also pay attention to the considerable fall in the infant mortality rate, which is considered to be one of the vital measures of the social and economic development of a region (country) (Cieślak 1984, 161). While in 1995 391 infants died in the area of the present Lubelskie Voivodship, in 2010 this figure was nearly four times lower (106 deaths). The infant mortality rate[4] in this time decreased from 14,7 in 1995 to 4,7 in 2010.

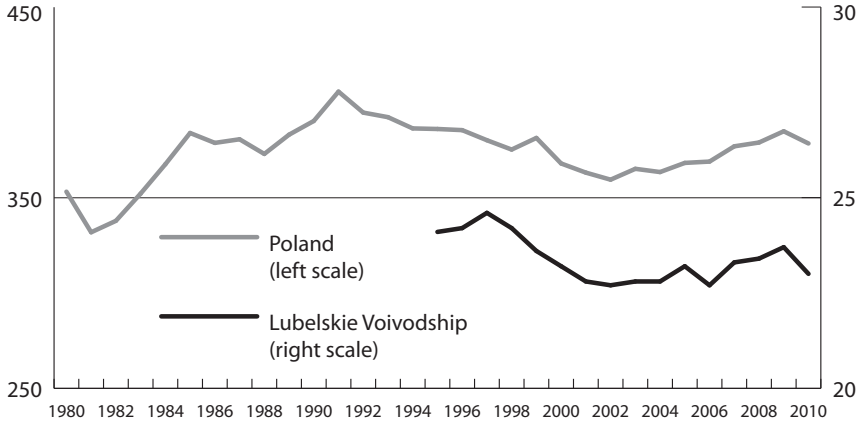


**Fig. 3.** Changes in the number of deaths in Poland and Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration on the basis of data from Central Statistical Office

It should be emphasized that the fall in deaths is not only restricted to infants, but concerns all age groups, though to a different degree. This means that just like all over Poland, since the beginning of the 1990s we have been observing the growth in the value of a synthetic measure describing the length of life as life expectancy of a new-born baby ($e_0$).

Women in the Lubelskie Voivodship live on average longer than women throughout Poland, while men live shorter and the gap between their life expectancy and the average life expectancy in Poland is widening. Average life expectancy for women in the Lubelskie Voivodship increased in the period 1995–2010 by 3,8 years and reached 81 years in 2010 (80,6 years is the national average).[5] Men's life expectancy increased similarly (by 3,7 years) and reached 71,2 years in the Lubelskie Voivodship in 2010 (compared to 72,1 years in Poland).

The level of education is also of vital significance for the health and mortality of the society. The health survey showed that the percentage of people from poorly educated circles who considered their health as good or very good was half the percentage of people with higher education who claimed so. Standardized death ratios also confirm lower mortality among people with higher education (especially men). For example: in 2002 this ratio for men with elementary education was 2,8 times higher than for men with higher education (Wróblewska 2006)[6]. And in the past decade the level of education of the region's inhabitants improved considerably, just as it did throughout Poland.

This unquestionable progress, though, cannot hide the ugly truth that the average life expectancy of Polish people (including inhabitants of the Lubelskie Voivodship) is still much lower than in the most developed countries. In spite of these favorable changes in mortality, especially due to the regressive demographic structure with a relatively large share of older people, we have seen deaths outnumber births from the very beginning of the present voivodship, which accounts for the negative natural increase rate; in 1999–2001 this was a relatively small phenomenon (below 380 deaths more than births), but expanded in 2002–2007 (from 1200 to 2000 deaths more than births), while in 2008–2010 this was limited to approximately minus 500.

4. The quotient of infant deaths among 1000 babies born alive.

5. At this time life expectancy of Polish women increased by 4,2 years. Since 1990, women's life expectancy grew by 5,1 years, while men's life expectancy, after the stagnation which lasted till mid-1960s, grew by 5,6 years.

6. Quoted after Waligórska (2009, 45).

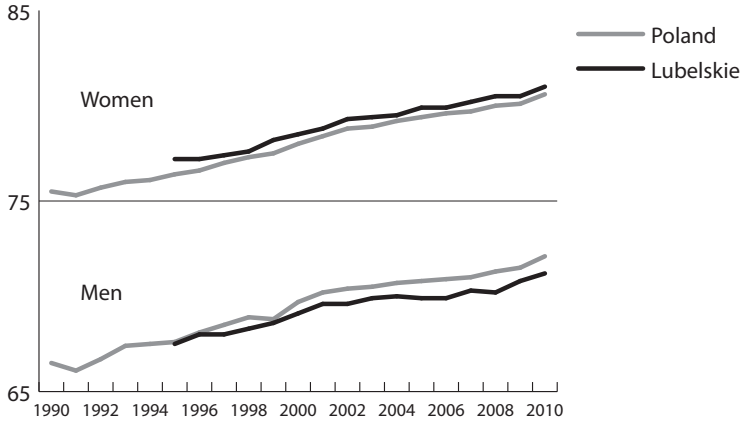


**Fig. 4.** Changes in life expectancy at age 0 ($e_0$) in Poland and Lubelskie Voivodship

*Source:* Own elaboration on the basis of data from Central Statistical Office

## 1.2 Migrations

The area of the Lubelskie Voivodship was in the entire post-war period an area losing population as there were more people emigrating than immigrating to it.[7] In the period since the voivodship was created, the general annual number of registrations for permanent stay (inflow) has varied considerably, but it has always been significantly lower than the general annual number of official movements out of the region (outflow). As a result, the migration balance has always been negative.

In 1998–2006 the negative balance increased, reaching its peak value in 2006 — minus 6 600 people. In the next four years the surplus of the outflow over inflow slightly decreased (especially during the recession of 2009). Until 2007 the migration turnover (mobility) — the sum of inflows and outflows, also grew. It was in 2008 that the spatial mobility of the inhabitants of the voivodship slowed down: compared to 2007, in the next years the migration turnover fell by around a quarter. It is hard to find a clear explanation for such a situation, but it is possible that it is an economic phenomenon related to considerable reduction of economic activity both in Poland and abroad, connected with the current recession. This hypothesis is in line with the migration transformation theory (Zelinsky 1971), which says that spatial mobility of the population is related to the level of social and economic development.[8] In 2006 migrations abroad particularly influenced the negative balance. This is probably also the effect of Poland's accession to the European Union and the possibility of legalizing foreign stays of the people who had emigrated abroad earlier. In the next two years the negative balance of migration was considerably lower. However, the migration turnover in the Lubelskie Voivodship is dominated by internal migrations. The highest share of migrations abroad in the migration turnover of the voivodship was observed in 2006, but it only accounted for 3,5% of migrations.[9]

Another category of spatial mobility, resulting from, inter alia, movement of students, are migration for temporary stay (until 2005 — above 2 months, since 2006 — above 3 months). These migrations are related to studies as well as temporary work (also abroad). In 2000–2009, on average 40 thousand people (around 1,8% of inhabitants) stayed temporarily in the voivodship. Among those registered temporarily, slightly over 6% are people coming from abroad. Thus the percentage of foreigners in the population of the Lubelskie Voivodship is rather marginal.[10] On the other hand,

7. The area that was particularly threatened with de-population was the area that formed the Zamość region in 1975–1998 (Kowerski 1987, 1988, 1990b, 1990a, 1991a).

8. An attempt at applying this theory to explaining and predicting changes in migration processes in the Zamość Voivodship was made by Kowerski (1991b, 21–32).

9. This statistically completely valid thesis, however, is biased with the fact that many voivodship inhabitants emigrate abroad for a long period of time and do not officially register out from their permanent stay or even from their temporary stay. Thus statistically they are actually voivodship inhabitants.

10. It should be emphasized once again that we describe here the people who fulfilled their registration obligation. These are probably mainly students and people who start work in accordance with legal regulations (legal work). People who did not fulfill this obligation, even if they have lived permanently for a long time in the Lubelskie

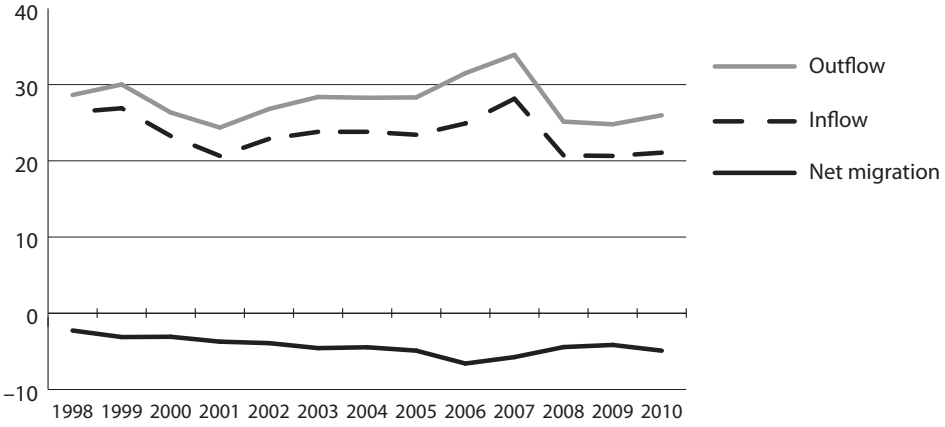


**Fig. 5.** Migration of population of Lubelskie Voivodship for permanent residence (thousand persons)

*Source:* Own elaboration on the basis of data from Central Statistical Office

more people registered for permanent stay in the voivodship temporarily stayed outside its borders. According to statistics, an overwhelming majority of these people stayed in other regions of Poland. It must be admitted, though, that the number of people who register out of their stay temporarily do so because they go abroad. Obviously, we should be aware of the fact that only a small number of people who go to work abroad formally register out of their stay in the voivodship.

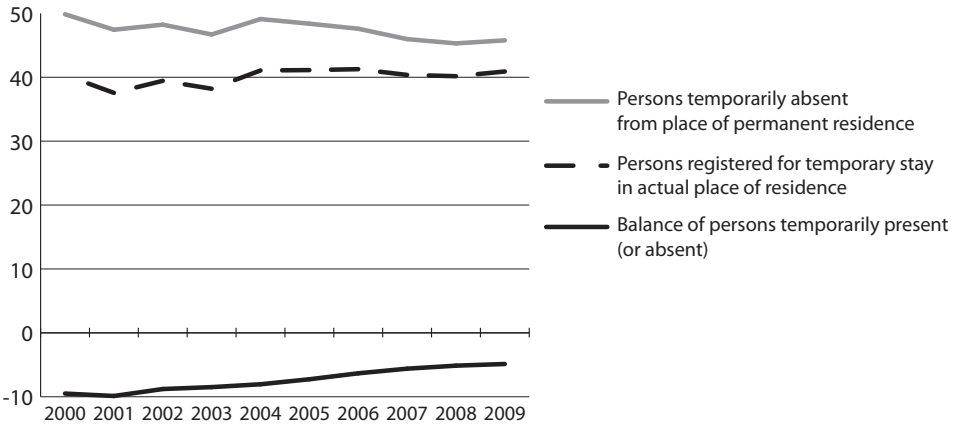


**Fig. 6.** Migration of population of Lubelskie Voivodship for temporary stay (thousand persons)

*Source:* Own elaboration on the basis of data from Central Statistical Office

However, the number of people who are temporarily absent shows some slight downward trend. As a result, the negative balance of temporary migrations is decreasing, too. In 2009 the number of people who registered out of their stay in the voivodship temporarily was higher than the number of people who registered temporarily here by 4 900 people.

## 1.3 Changes in the population number

The Lubelskie Voivodship was inhabited by 2 151 900 people at the end of 2010, which constituted 5,7% of Poland's population. The negative natural increase rate and negative balance of migration for permanent and temporary stay accounted for the fact that the number of inhabitants systematically decreased in the Lubelskie Voivodship. The most negative influence on the change (fall) in the voivodship population was exerted by a high negative balance of migration for permanent stay. In 2000–2010 the population of the voivodship decreased by 57 200 people (that is by 2,6%). At the same time the population of Poland decreased by 0,3% and the Lubelskie Voivodship was one of the regions with the highest fall in the population size.

Voivodship remain 'invisible' in this system of registration.

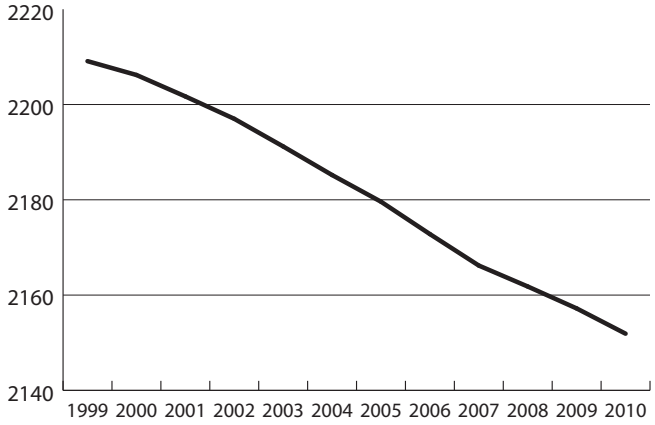


**Fig. 7.** Changes in the number of population of Lubelskie Voivodship (thousand persons)
*Source:* Own elaboration on the basis of data from Central Statistical Office

### 1.4 Changes in the age structure of the voivodship population

The interchanging demographic highs and lows, whose effects overlapped one another with various degree of force in different periods causing changes in the processes of fertility and mortality as well as migrations — have all affected the dynamic changes of structures of population in various age groups.

In the history of the voivodship in its present shape the following processes have been observed:

- Abrupt fall in the number of people in pre-production age, which is attributed mostly to a large decrease in the number of births observed since the mid-1990s. At the end of 2010 the number of people in pre-production age compared to the end of 1998 decreased by 185 thousand (30,9%).
- Growth in the number of people in production age, which consisted in retirement from production age by people born during WWII and replacing these scanty generations with numerous generations of the baby boom of the 1980s. As a result, the number of people in production age at the end of 2010 increased by 69 thousand (5,4%) compared to 1998.
- Growth of the post-production population, which was the consequence of longer life expectancy. The number of people in post-production age at the end of 2010 exceeded that at the end of 1998 by around 28 thousand (7,9%).

As far as the subject matter of this paper is concerned, it is worth paying attention to the changes in the number of people in pre-production age and in production mobile age. The influence of the fall in the number of births on the number of students can be confirmed by the following numbers. In 2010 22 600 children were born in the Lubelskie Voivodship. At the same time 23 100 students were admitted to the first year of studies. Even if we take the foreign students in account (around 400 people), more people were admitted to universities than were born. Obviously, mostly people who were born in 1992 were admitted as well as people born earlier. In 1992 over 30 000 children were born in the area of the present Lubelskie Voivodship. In 2002–2005 there were on average 21 000 births and recently 23 000. Even without making any detailed calculations we can see that the fall in the number of students in the future will be significant.

## 2 The demographic forecast through 2035

At present the most valid demographic forecast for Poland divided into voivodships is the forecast for the years 2009–2035 prepared in 2009 by employees of the Demographic Survey Department of the Central Statistical Office (Waligórska et al. 2009). Although three years have passed since the forecast was prepared, its verification for years 2009–2011 and other assessments made by the author bring us to the conclusion that it is still a forecast which reflects the basic demographic tendencies that may take place in the Lubelskie Voivodship in the future through the year 2035.[11]

11. The analyzed forecast assumed for 2009–2010 a slightly bigger negative balance of migration, which caused a higher than actual decline in the number of inhabitants. However, the reduction of the negative balance of mi-

## 2.1 The assumptions concerning the forecast for the population of the Lubelskie Voivodship

Assumptions concerning basic parameters of natural and migration movement, current trends and structures of population divided by various demographic, social and professional features were taken into account.

### 2.1.1 The assumptions concerning the natural movement of the population of the Lubelskie Voivodship

It was assumed that in the forecasted period of time the fertility ratio in the Lubelskie Voivodship will be minimally higher than the average for the country and that fertility ratios will grow in the cities while in the rural areas they will remain practically unchanged. However, the forecasted values of fertility ratios will be significantly below 2, which means that in the next 23 years we will see narrow reproduction both in the Lubelskie Voivodship and in the whole country.

Low values in the fertility ratio have overlapped with an accelerating decrease in the number of women of child-bearing age. In 2035 there will be 32,3% fewer women than in 2007, the fall in the cities will reach 38.8% while in the rural areas 25,8%. The consequence of very unfavorable changes in the number and age structure of women, accompanied by slight improvement in fertility ratios (limited only to cities) will be a significant decline in the number of births in the voivodship, accelerating in 2015–2032. It is predicted that in 2035 39,5% fewer babies will be born than in 2010.

**Tab. 1.** Forecasts of the number of women of child-bearing (15–49 years old) (thousand persons)

| Actual data | Forecasts | | | | |
|---|---|---|---|---|---|
| **2010** | **2015** | **2020** | **2025** | **2030** | **2035** |
| 523,7 | 492,5 | 464,3 | 436,2 | 405,2 | 364,0 |

*Source:* Waligórska (2009)

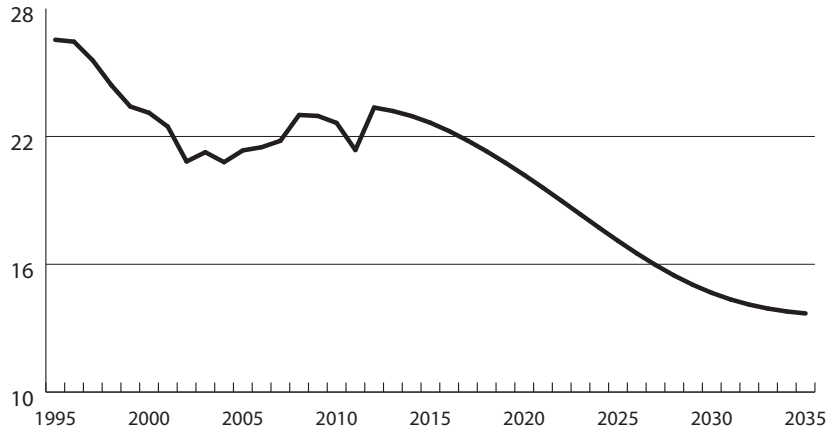


**Fig. 8.** Changes in the number of births in the years 1995–2010 and the forecasts of births until 2035 in Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration based on (Waligórska et al. 2009)

The activities aiming at improving society's health, and reducing premature deaths allow us to conclude that the mortality ratios in Poland will continue to show a downward trend, though their decline will not be as rapid as in the 1990s. It is assumed that the life expectancy of voivodship inhabitants will continue to grow, in the case of men this growth may even be slightly faster than

gration was of economic nature, and was connected with the recession, which had likely not been predicted by the authors. After the economic situation improves, probably the spatial mobility of voivodship inhabitants will grow and migration processes will be joined by at least some of the people who 'put off' migration until the end of the recession. It will be possible to correct this forecast after the publication of final results of the National Census 2011. The author believes, though, that the verified forecast will not differ considerably from the current one.

the average growth in Poland. It is also assumed that the growth for men will be twice the growth for women.[12] It is also forecasted that the average life expectancy of a male infant in 2035 will be 76,7 years (77,1 years on average in Poland), while for a female infant it will reach 83,2 years (average for Poland — 82,9 years). As a result the phenomenon of extensive mortality among men

**Tab. 2.** Forecast of life expectancy at age 0 ($e_0$) and men's overmortality in Poland and Lubelskie Voivodship

| Year | Men | | Women | | Men's overmortality | |
|---|---|---|---|---|---|---|
| | Poland | Lubelskie | Poland | Lubelskie | Poland | Lubelskie |
| 2010 (actual data) | 72,1 | 71,2 | 80,6 | 81,0 | 8,5 | 9,8 |
| 2015 | 72,3 | 71,7 | 80,2 | 80,7 | 7,9 | 9,0 |
| 2020 | 73,4 | 72,9 | 80,8 | 81,3 | 7,4 | 8,4 |
| 2025 | 74,6 | 74,1 | 81,5 | 81,9 | 6,9 | 7,8 |
| 2030 | 75,8 | 75,3 | 82,2 | 82,5 | 6,4 | 7,2 |
| 2035 | 77,1 | 76,7 | 82,9 | 83,2 | 5,8 | 6,5 |
| Change 2011–2035 | 5,0 | 5,5 | 2,3 | 2,2 | –2,7 | –3,3 |

*Source:* Own elaboration based on (Waligórska et al. 2009)

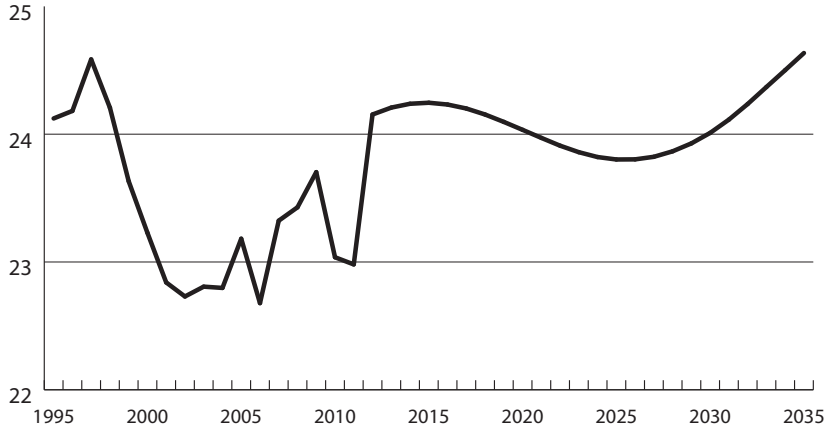


**Fig. 9.** Changes in the number of deaths in the years 1995–2010 and the forecasts of deaths until 2035 in Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration based on (Waligórska et al. 2009)

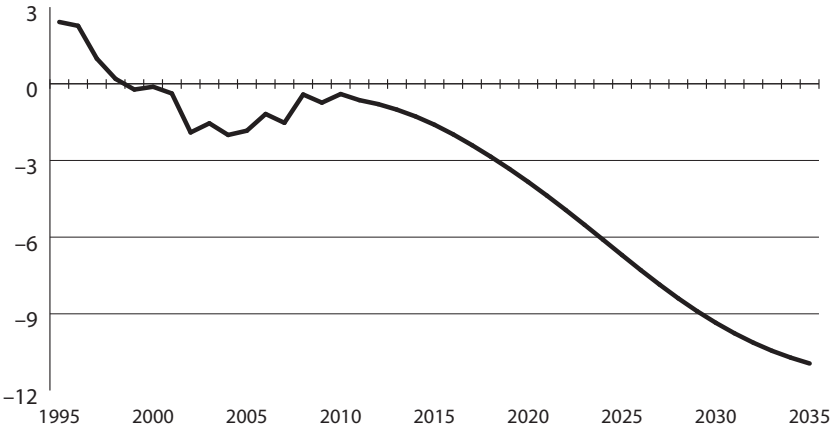


**Fig. 10.** Changes of natural increase (result of subtraction of births and deths) in the years 1995–2010 and the forecasts of natural increase until 2035 in Lubelskie Voivodeship (thousand persons)

*Source:* Own elaboration based on (Waligórska et al. 2009)

12. It is a very beneficial and desirable phenomenon, but the realization of this assumption will require special concentration of regional and national health policy on men's health.

will not only be stopped but also reduced. The difference in average length of life between men and women should fall from 9,8 years in 2010 to 6,5 years in 2035.

The limitation of partial mortality ratios, due to the unfavorable age structure, will not ensure a limitation in the absolute number of deaths. It is forecast that the number of deaths will grow slowly: in 2035 6,9% more people will die than in 2010. The consequence of the above-described forecast changes in the number of births and deaths will be a very quick growth of the negative value of the natural increase rate.

### 2.1.2 Assumptions concerning the migration movement of the Lubelskie Voivodship population

Migrations are a phenomenon determined by various factors related mostly to changes in the social and economic situation in the country, migration policy of the government, and in case of migrations abroad, they also depend on the policies applied by other countries. They mostly depend on the job market situation; the opening of many markets after Poland's accession to the European Union created new opportunities in this respect. Decisions to migrate are also affected by factors related to family situation and material conditions of a household. Therefore it is very hard to predict migrations, especially in the long-term period (Kowerski 1991b).

The forecast for the voivodships reflects the current regional differentiations of departures abroad and arrivals to Poland. Also we took into account the development of individual voivodships as a factor attracting immigrants and hampering emigration, as well as gradual depletion of emigration potential in voivodships where the biggest number of people have departed abroad. According to the assumptions adopted in the forecast, practically from 2009 the negative balance of migration for permanent stay in the Lubelskie Voivodship should decrease. This assumption is based on the changes in the age structure (aging of the society), as it is also assumed that young people will show more inclination to migration. It was assumed that the negative balance of foreign migrations for permanent stay will be decreasing from 2010 and in 2020 it will reach a minimal positive value and will stabilize on this level until the end of the forecasted period.

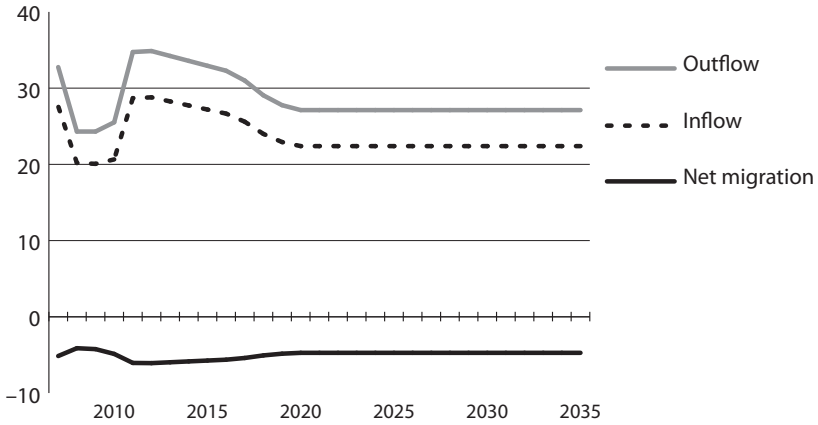


**Fig. 11.** Forecasts of internal migration of population of Lubelskie Voivodship for permanent residence until 2035 (2007–2010 actual data)

*Source:* Own elaboration based on (Waligórska et al. 2009)

### 2.1.3 Birth rate and migration balance

While since the beginning of the voivodship in its present shape migration movement (total negative migration balance) have influenced the changes in population more than the negative natural increase rate, according to the assumptions in the future (starting in 2022) these relationships will reverse and the negative natural increase rate will mainly shape the changes (decline) in the population of the voivodships.

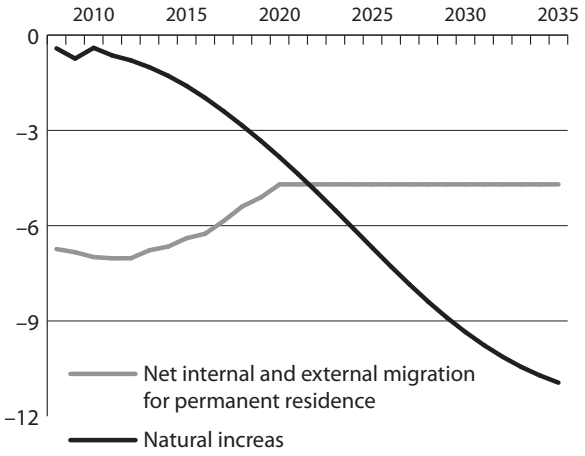


**Fig. 12.** Forecasts of natural increase and total net internal and external migration for permanent residence until 2035 in Lubelskie Voivodship (2008–2010 actual data)

*Source:* Own elaboration based on (Waligórska et al. 2009)

## 2.2 Results of the demographic forecast for the Lubelskie Voivodship through 2035

### 2.2.1 The forecast of population changes in the Lubelskie Voivodship in 2012–2035

In 2035 the Lubelskie Voivodship will have 1 871 100 inhabitants, that is 280 800 (13,0%) fewer people than at the end of 2010.

### 2.2.2 The forecast of changes in the demographic and economic age groups of the voivodship inhabitants

In the forecast period significant changes in the number and structure of population divided into biological groups will take place. The number of children aged under 14 will fall, most rapidly after 2020, the same will be observed for people aged 15–64, while the number of inhabitants aged over 64 will grow, especially those aged over 79. At the end of 2035 there will be 29,9% fewer children under 14 than at the end of 2010, while the number of people aged 15–64 will fall by 21,7%. On the other hand, the number of people aged over 64 will grow by 46,6%, and those aged over 79 by 66,8%. As a result, the share of people aged over 64 will grow from 14,5% at the end of 2010 to 24,4% at the end of 2035.

The forecast period will also witness systematic and accelerating decrease in the number of people in pre-production age. At the end of 2035 there will be 29,6% fewer people in pre-production age than at the end of 2010. A particularly significant fall will be observed in the group of people in production mobile age, while in the case of production immobile people, after a slight fall in 2011–2030, the size of this group will return to its 2010 value. The group of people in post-production age will grow particularly dynamically. At the end of 2035 there will be 37,5% more of them than at the end of 2010. The share of the post-production age group will grow from 17,7% at the end of 2008 to 27,9% at the end of 2035. Additionally, the demographic burden of non-production people felt by production age people will increase, with almost the entire growth attributed to the larger population in post-production age. Great changes will also be visible in population structure divided into education groups. They will mainly consist in decreasing numbers of children and youth.

In the case of pre-school children, their minimum number was observed in 2008. Beginning in 2009 the number has grown and it is expected that the growth will continue until 2015 and then, from 2016, it will fall again, this time more abruptly than at the beginning of the century. Similar changes will affect children in primary school age; their maximum number is expected to be reached in 2020. The population of secondary school youth will be declining through 2020. Then we will witness its growth until 2028. Again, starting in 2029 the number of secondary school youth will be decreasing and in 2035 it will reach the level of 2019. The number of youth in higher education age will be falling very quickly until 2025 (compared to the situation in 2008, a decrease of 45,5%), and then it will slightly grow. The changes in the number of children and

**Tab. 3.** Population forecasts by educational age groups in Lubelskie Voivodship (thousand persons)

| Age | 2010 actual data | 2015 | 2020 | 2025 | 2030 | 2035 | 2035 2010 = 100 (%) |
|---|---|---|---|---|---|---|---|
| 0–2 | 67,6 | 67,8 | 61,5 | 52,5 | 44,6 | 40,9 | 60,5 |
| 3–6 | 82,9 | 90,6 | 87,1 | 77,3 | 65,2 | 56,4 | 68,0 |
| 7–12 | 129,1 | 124,3 | 134,2 | 129,0 | 114,5 | 96,8 | 75,0 |
| 13–15 | 75,9 | 62,6 | 61,8 | 67,2 | 63,9 | 56,1 | 73,9 |
| 16–18 | 88,0 | 69,7 | 60,0 | 65,4 | 66,6 | 61,2 | 69,5 |
| 19–24 | 202,8 | 167,1 | 133,9 | 118,3 | 127,2 | 128,1 | 63,2 |

*Source:* Waligórska (2009)

youth that took place in the past (up to 20 years ago) as well as the predicted number of children have influenced and will continue to influence demographically the number of students.

From the perspective of our topic it is worth considering the changes in the number of young people aged 19 (the age when people start studying) and the 19–24 age group (the age of the highest intensity of studying). Since the beginning of the voivodship the number of people aged 19 has grown, reaching its peak value in 2002 (41 200 people) — these are people born in the peak of the baby boom of the 1980s (in 1983). It should also be observed that in order to obtain the above number of 19-year-olds, around 42 thousand children had to be born. Since 2000 we have had around 22–23 thousand births per year in the voivodship, which is 45–48% fewer. These people will be the potential students starting in 2019, which demonstrates the potential fall in the number of students. At the end of 2010 the number of people aged 19 was lower than the maximum number by 8 800 people, the forecasts show further decline in this respect: to 25 000 people in 2015, 20 500 people in 2020 and the minimum value in 2023 (19 500 people). In the next years we should observe a slight growth (between 1 000 and 3 000 people).

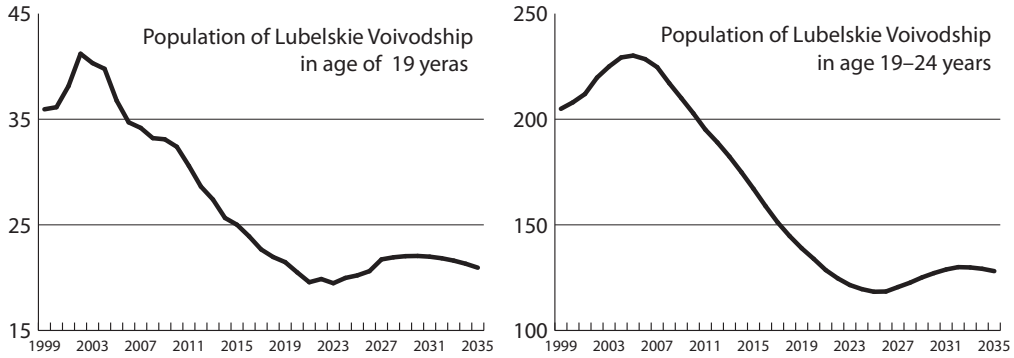


**Fig. 13.** Changes in the number of population at the age 19–24 in the years 1999–2011 and forecasts until 2035 in Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration on (Waligórska et al. 2009)

Obviously, one year does not determine the future scale of changes. The situation can be better illustrated with the change in the number of youth aged 19–24. The population of this group grew until 2005, when it reached the maximum value (230 100 people), and then began decreasing. After five years, in 2010, the number of people aged 19–24 was 202 800, which constitutes a decrease of 27 300 people. The forecast indicates that this rapid decrease will continue: in 2015 there will be 167 000 people in this age group, in 2020 — 134 000 and in 2025 — only 118 000, the lowest value, which is only half of the number from 2005. Just as in the case of 19-year-olds, after reaching the minimum value, the number of people aged 19–24 will slightly increase, but the growth will not exceed 10 000 people. The number of students (especially part time) in the future may be affected by changes in the number of consecutive age groups. According to the principle of aging, these years have reached or will reach their maximum values later than for the group of people aged 19–24.

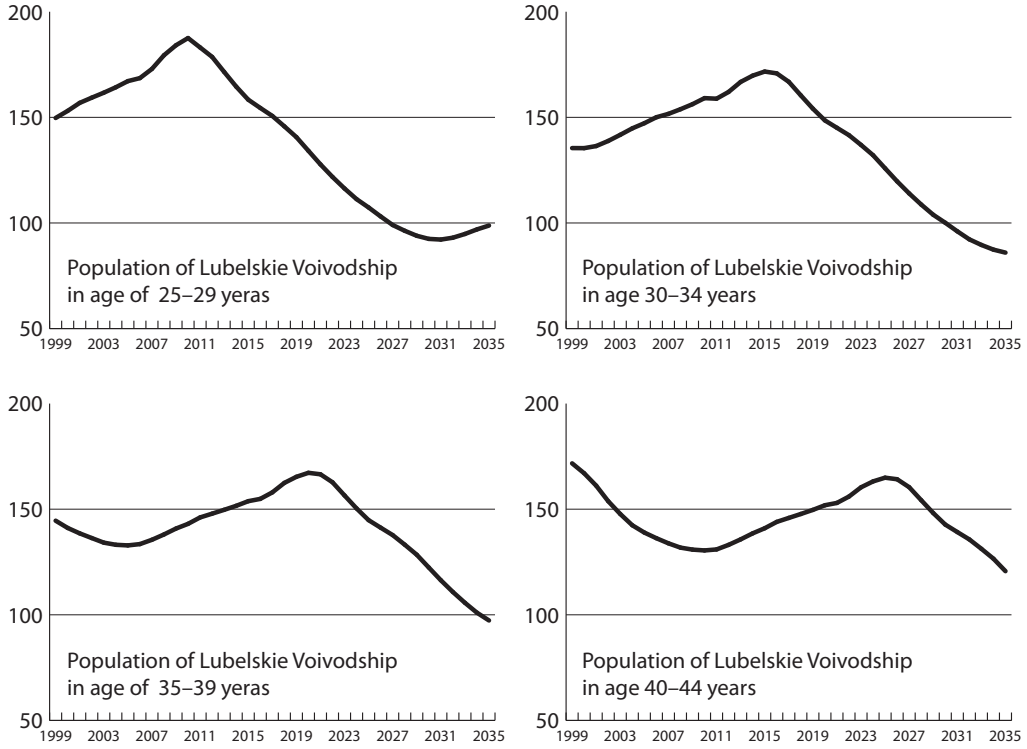


**Fig. 14.** Changes in the number of population at the age 25–44 in the years 1999–2011 and forecasts until 2035 in Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration based on (Waligórska et al. 2009)

## 3 Higher education schools in the Lubelskie Voivodship

In 1999 there were 11 higher education schools in the Lubelskie Voivodship. The next years saw this number grow to 20 in 2004, in 2007 the number decreased by one, in 2010 by yet another one, so at the end of 2011 there were 18 higher education schools (4% of all higher education schools in Poland), of which 7 were public schools (4 universities and 3 state higher schools) and 11 were non-public. Moreover, there are 4 branches (external departments) of the schools which have their headquarters outside the voivodship (2 public and 2 non-public). As far as the number of students is concerned, the biggest schools are public universities and the non-public Catholic University Pope John Paul II of Lublin (KUL). Around 88% of students study in Lublin. Others study in six other towns.[13]

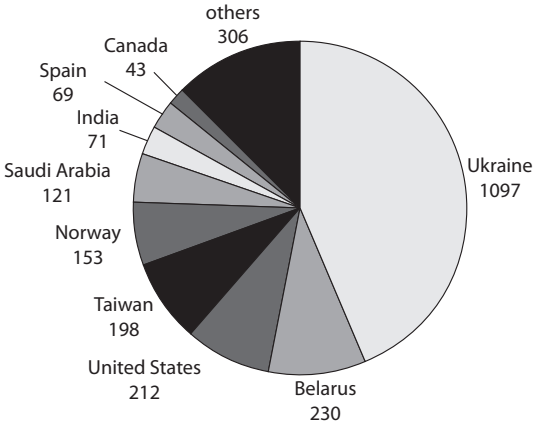


**Fig. 15.** Foreign students in Lubelskie Voivodship as of 2011.11.30
*Source:* Local Data Bank, Central Statistical Office, www.stat.gov.pl

13. It should be noticed that students were "assigned" to the headquarters of the university. In fact, there are slightly fewer students in Lublin, as for example the Department of Agricultural Science of the University of Life Sciences in Lublin is located in Zamość, while Maria Curie Sklodowska University has its colleges in Biłgoraj and Kazimierz Dolny.

A noticeable fact is that foreign students account for only 2,6% of all students. What is more, as many as 39% of them study at the Medical University of Lublin. If we compare the number of foreign students to the number of all students of a particular university, the biggest share of foreigners can be observed in the State Higher Vocational School in Zamość, where a quarter of all students come from abroad (they are Ukrainian citizens). At the Medical University of Lublin foreigners account for 13,3% of all students, while at other universities this share does not exceed 2%. In Zamość, one in nine students is a foreigner, while in Lublin one out of 47. Most foreign students (43,9%) come from Ukraine. The next two countries of student origin are Byelorussia and the USA.

## 4 Changes in the number and structure of students in the Lubelskie Voivodship in 1999–2011

On 30 November 1999, 79 100 students studied in the Lubelskie Voivodship.[14] In the next years we witnessed rapid growth in the number of students, which lasted until 2005, when the peak number of 108 200 students was reached. Since 2006 we have been observing a decline in the number of students, in 2006–2009 — quite slowly (by around 750 people each year), in 2010–2011 — rather steeply (3 640 people in 2010 and 5 350 in 2011). The number of first-year students grew until 2004 and then began to decrease. It is also worth noticing that a significant fall in the number of students in 2010–2011 only partially resulted from the decreased number of first year students (by 2 370 people in 2010 and further 830 people in 2011). The decrease in the number of students was the consequence of the fact that the last numerous years of students were 'leaving' universities (graduating) and they were "replaced" by less numerous years beginning their studies. This process will last for the next 4–5 years. Even if the number of students admitted to the first year of studies does not change, the total number of students will fall. This phenomenon will be aggravated due to the decreasing numbers of first year students.

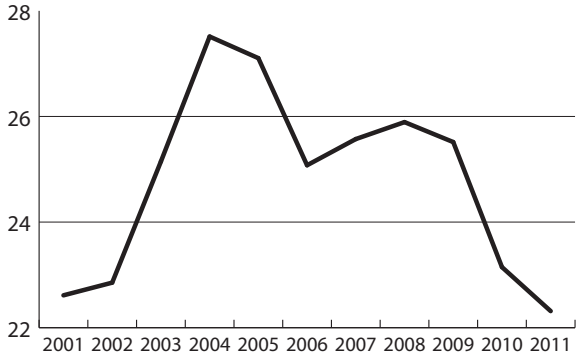


**Fig. 16.** First year students in the years 2001–2011 in Lubelskie Voivodship (thousand persons)

*Source:* Own elaboration based on Local Data Bank of Central Statistical Office and Yearbooks of Lubelskie Voivodship

The second remark concerns the pace and direction of changes, which were very similar to those all over the country. The maximum number of students studied in 2005, while the share of students in the region in the total number of people studying in Poland in this century was very stable and evolved around 5,5%. The share of non-public university students is a few percentage points higher in the region than throughout the country. In 2011 it amounted to 35%, the national average being 30%. However, this higher share can be attributed to the fact that the Catholic University Pope John Paul II of Lublin is classified as a non-public university, which is fully justified from the ownership point of view, but as the university is financed from the state budget, it should be analyzed separately. If we exclude KUL, in 2011 the share of non-public university students in

14. The numbers quoted in this point and in subsequent points also cover students of branches and outer departments, thus they are slightly higher than the numbers of students of the universities which have their registered offices in the area of the voivodship. As of 2011.11.30 in universities which had their registered offices in the voivodship, there were, as indicated in point 3, 94 745 students, while in branches and outer departments there were 1 442 students, which gives the total figure of 96 187 people.

**Tab. 4.** Schools of higher education in the Lubelskie Voivodship as of 2011.11.30

| University (college) | Students | | % of foreigners in total | Graduates |
|---|---|---|---|---|
| | total | foreigners | | |
| Maria Curie Sklodowska University in Lublin | 25 192 | 270 | 1,1 | 8 795 |
| Lublin University of Technology | 10 100 | 72 | 0,7 | 2 125 |
| University of Life Sciences in Lublin (Agricultural University) | 10 762 | 17 | 0,2 | 3 086 |
| Medical University of Lublin | 7 358 | 977 | 13,3 | 1 603 |
| State Higher School Pope John Paul II in Biala Podlaska | 3 296 | 164 | 5,0 | 1 148 |
| State Higher Vocational School in Chełm | 2 396 | 38 | 1,6 | 481 |
| State Higher Vocational School Szymon Szymonowic in Zamość | 990 | 255 | 25,8 | 174 |
| Catholic University Pope John Paul II of Lublin | 15 734 | 253 | 1,6 | 5 312 |
| College of Enterprise and Administration in Lublin | 2 207 | 47 | 2,1 | 778 |
| University Vincent Pol in Lublin | 3 105 | 97 | 3,1 | 1 011 |
| High School of Economics and Innovation in Lublin | 8 609 | 32 | 0,4 | 2 590 |
| Higher School of Social Sciences in Lublin | 683 | 0 | 0,0 | 211 |
| Higher School of International Relations and Social Communication in Chełm | 808 | 144 | 17,8 | 268 |
| College of Business and Administration in Łukow | 266 | 0 | 0,0 | 106 |
| Puławy Higher School | 366 | 1 | 0,3 | 203 |
| Lublin Higher School in Ryki | 437 | 2 | 0,5 | 211 |
| University of Management and Administration in Zamość | 1894 | 131 | 6,9 | 1 043 |
| Humanistic-Economic Higher School in Zamość | 542 | 0 | 0,0 | 249 |
| Total | 94 745 | 2 500 | 2,6 | 29 394 |

*Source:* Local Data Bank, Central Statistical Office, www.stat.gov.pl

the total number of students equaled 18,7%, whereas the national average was 28,9%. This points at weak development of non-public higher education in the Lubelskie Voivodship and a relatively strong position occupied by public universities and KUL.

In the analyzed period the changes in the number of students of particular groups of universities varied considerably. The number of public university students in the Lubelskie Voivodship grew until 2004, when it reached its peak of 70 752 people, and in the next years it fell to 62 510 people in 2011 (11,4% below the maximum value). The number of KUL students grew to reach the maximum in 2005 (20 654 students) and then fell to 15 734 people (23,8% below the maximum value). The number of students in the remaining non-public schools increased until 2009, when it reached the level of 21 425 people. In the next two years we witnessed a decline — particularly steep in 2011 — to 17 943 people (16,3% below the maximum value).

## 5 Correlations between the number of students and the size of particular age groups

Further considerations and calculations will only refer to Polish students who study in the Lubelskie Voivodship. According to the adopted research hypothesis, one of the most important factors determining changes in the number of students are demographic changes reflected in changes of the size of those age groups that show the highest inclination to taking up studies.

As we could predict, the strongest positive and statistically significant were the relations between the number of students and the number of youth aged 19–34. That is why we also calculated correlation coefficients between the size of particular age groups and the number of students. We only took into consideration students who were Polish citizens, as Polish demographic processes do not influence the decisions of foreigners to study in the Lubelskie Voivodship.

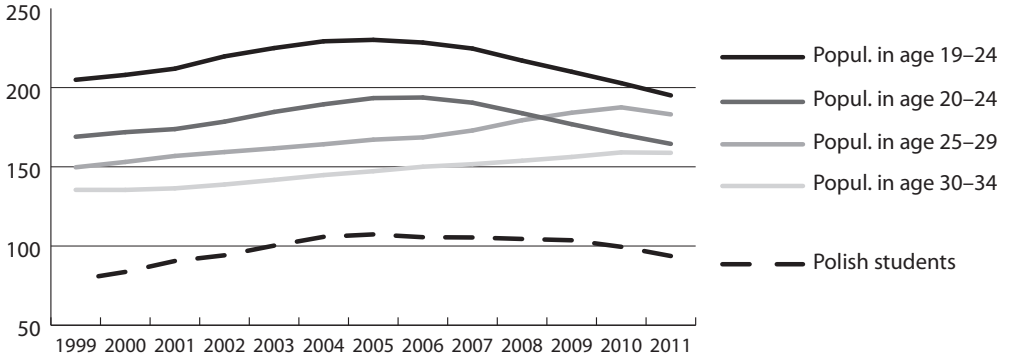


**Fig. 17.** Changes in the number of Polish students and the population of Lubelskie Voivodship by the chosen age groups in the years 1999–2011 (thousand persons)

**Tab. 5.** Correlation matrix of the number of Polish students and the population of chosen age groups in the years 1999–2011

| | Students | L19 | L19–24 | L20–24 | L25–29 | L30–34 | L35–39 | L40–44 |
|---|---|---|---|---|---|---|---|---|
| **Students** | 1 | | | | | | | |
| **L19** | −0,0846 | 1 | | | | | | |
| **L19–24** | **0,6405** | **0,5667** | 1 | | | | | |
| **L20–24** | **0,7643** | 0,3208 | **0,9622** | 1 | | | | |
| **L25–29** | **0,5899** | **−0,7257** | −0,2325 | −0,0272 | 1 | | | |
| **L30–34** | **0,6131** | **−0,7624** | −0,1815 | 0,0436 | **0,9818** | 1 | | |
| **L35–39** | **−0,6576** | **−0,5959** | **−0,9857** | **−0,9361** | 0,2084 | 0,1762 | 1 | |
| **L40–44** | **−0,8284** | 0,5506 | −0,1251 | −0,3259 | **−0,9254** | **−0,945** | 0,143 | 1 |

*Note:* Students — the number of Polish students in Lubelskie Voivodship; L19 —population of the people at the age of 19 in Lubelskie Voivodeship; L19–24 — population of the people at the age of 19–24, and so forth.

Bold — 5% critical value (two-tailed) = 0,5529 for n = 13

## 6 Forecast for the number of students in the Lubelskie Voivodship through 2035

We applied the methods of econometric forecasting in order to make the forecast for the number of students in the voivodship (Cieślak 2001, 104–139). We took the number of Polish students as the forecasted variable (StudenciPOL), whereas potential independent variables were the sizes of particular age groups (L19, L19_24, L20_24, L25_29, L30_34, L35_39, L40_44). The statistical models estimated by means of the least square method did not give satisfactory forecasts. Therefore we examined the series of auto-regression of the dependent variable in order to apply dynamic econometric models.

**Tab. 6.** Autocorrelation function for variable Polish students (StudenciPOL)

| Lag | ACF | PACF | Ljung-Box Q | *p*-value |
|---|---|---|---|---|
| 1 | 0,7028 | 0,7028 | 8,0262 | 0,005 |
| 2 | 0,3774 | −0,2302 | 10,5513 | 0,005 |
| 3 | 0,1120 | −0,1097 | 10,7957 | 0,013 |
| 4 | −0,1499 | −0,2443 | 11,2824 | 0,024 |
| 5 | −0,3240 | −0,1071 | 13,8412 | 0,017 |
| 6 | −0,3802 | −0,0526 | 17,8675 | 0,007 |
| 7 | −0,3502 | −0,0338 | 21,8529 | 0,003 |

Using the "top-bottom" method and comparing particular values of PACF with the critical value we established that the auto-regression lag for the StudenciPOL variable is 1. Therefore we proposed the autoregressive model for predictions, in which apart from variables describing the population size of particular age groups, there is a one-year delayed variable describing the number of students. Potential independent variables turned out to be so strongly correlated that we were able to propose a model in which only one of them was used: namely the size of the population aged 19–24 (L19_24). Thus the proposed autoregressive model has the following form:

$$\text{StudenciPOL}_t = \alpha_0 + \alpha_1 \text{L19\_24}_t + \alpha_2 \text{StudenciPOL}_{t-1} \tag{1}$$

As this is an autoregressive model, there is a correlation between the lag dependent variable and the error term, which accounts for the fact that the application of the least squares method may lead to obtaining biased estimators of structural parameters; therefore we used the double least squares method for estimation (Gruszczyński, Kuszewski, and Podgórska 2009, 227), taking other potential independent variables as instrumental: L20_24,L25_29,L30_34,L35_39, L40_44. From the estimated model we can conclude that the population of youth aged 19–24 had an essential, positive influence on the number of Polish students in the voivodship. The model explains the variation of the dependent variable in 96,22%. The applied estimator is consistent (the Hausman test). All instruments are valid (the Sargan test). There is no heteroskedasticity of error terms (Peseran-Taylor test), the error terms have a normal distribution (test $\chi^2_{(2)}$), there is no autocorrelation of error terms of the first order or ARCH effect (test LM). The above indicators confirm that the estimated model seems to be a good tool for forecasting the number of Polish students in the Lubelskie Voivodship.

The estimated autoregressive model was used to develop the forecast for the number of Polish students in the Lubelskie Voivodship through 2035, the values of the L19_24 variable (population of youth aged 19–24) came from the demographic forecast presented in point 2.2.2.

The developed forecast assumes a quick decline in the number of Polish students in the Lubelskie Voivodship. As early as in 2015 the number of Polish students may be lower than in 1999, when it was 78619 people and will be lower than in 2011 by nearly a fifth. The fall will continue. In 2020 the number of students may be lower than in 2011 by as much as 45%. Only around 2027 the decline may be stopped, but the number of students then will only constitute 38% of the number from 2011. At the end of the 2020s there might be a slight increase in the number of Polish students.

**Tab. 7.** The results of estimation of prognostic model of number of Polish students (StudenciPOL) in Lubelskie Voivodship. Two-stage least squares

| Specification | Coefficient/ statistic | *p*-value |
|---|---|---|
| Constant | –17698,5 | 0,0347 |
| L19–24 | 0,2556 | < 0,00001 |
| $\text{StudenciPOL}_{t-1}$ | 0,6287 | < 0,00001 |
| R-squared | 0,9622 | |
| Adjusted R-squared | 0,9538 | |
| Test F<br>Null hypothesis: Coefficient R non valid; test statistic: $F_{(2,9)}$ | 192,36 | < 0,00001 |
| Hausman test<br>Null hypothesis: OLS estimates are consistent; asymptotic test statistic: $\chi^2_{(1)}$ | 2,19 | 0,1385 |
| Sargan over-identification test<br>Null hypothesis: all instruments are valid; test statistic: LM | 5,93 | 0,2044 |
| Test for normality of residual<br>Null hypothesis: error is normally distributed; test statistic: statistic $\chi^2_{(2)}$ | 0,13 | 0,9369 |
| Pesaran-Taylor test for heteroskedasticity<br>Null hypothesis: heteroskedasticity not present; asymptotic test statistic: $z$ | 0,48 | 0,6306 |
| LM test for autocorrelation up to order 1<br>Null hypothesis: no autocorrelation; test statistic: LMF | 0,01 | 0,9453 |
| Test for ARCH of order 1<br>Null hypothesis: no ARCH effect is present; test statistic: LM | 2,99 | 0,0836 |

*Source:* Own calculation with GRETL (Kufel 2011)

**Tab. 8.** Forecast of the number of Polish students in Lubelskie Voivodship through 2035

| Year | Forecast | Standard error of forecast (%) | 95% interval | Year | Forecast | Standard error of forecast (%) | 95% interval |
|---|---|---|---|---|---|---|---|
| 2012 | 89 522 | 1,79 | 86 386,2 – 92 656,9 | 2024 | 38 703 | 5,32 | 34 671,1 – 42 734,9 |
| 2013 | 85 187 | 2,22 | 81 483,5 – 88 890,6 | 2025 | 36 883 | 5,58 | 32 851,4 – 40 915,2 |
| 2014 | 80 568 | 2,47 | 76 662,4 – 84 473,3 | 2026 | 35 769 | 5,75 | 31 737,0 – 39 800,8 |
| 2015 | 75 661 | 2,69 | 71 678,6 – 79 643,4 | 2027 | 35 607 | 5,78 | 31 575,0 – 39 638,8 |
| 2016 | 70 485 | 2,90 | 66 473,0 – 74 497,8 | 2028 | 36 034 | 5,71 | 32 002,3 – 40 066,1 |
| 2017 | 65 268 | 3,15 | 61 243,9 – 69 292,3 | 2029 | 36 943 | 5,57 | 32 910,6 – 40 974,4 |
| 2018 | 60 325 | 3,41 | 56 295,9 – 64 353,6 | 2030 | 38 036 | 5,41 | 34 003,9 – 42 067,7 |
| 2019 | 55 742 | 3,69 | 51 711,0 – 59 772,4 | 2031 | 39 159 | 5,25 | 35 126,7 – 43 190,5 |
| 2020 | 51 579 | 3,99 | 47 547,9 – 55 610,8 | 2032 | 40 150 | 5,12 | 36 117,9 – 44 181,6 |
| 2021 | 47 603 | 4,32 | 43 571,7 – 51 635,1 | 2033 | 40 735 | 5,05 | 36 702,9 – 44 766,7 |
| 2022 | 44 101 | 4,66 | 40 068,8 – 48 132,4 | 2034 | 40 940 | 5,02 | 36 907,9 – 44 971,7 |
| 2023 | 41 092 | 5,01 | 37 060,1 – 45 123,9 | 2035 | 40 786 | 5,04 | 36 753,8 – 44 817,6 |

*Source:* Own calculation with GRETL (Kufel 2011).

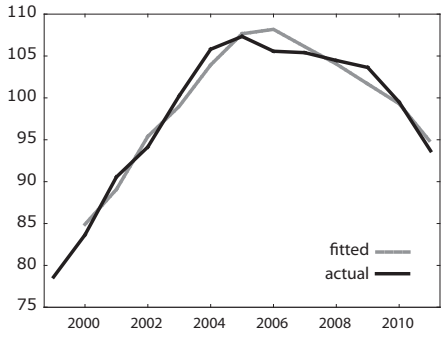


**Fig. 18.** Actual and fitted values of variable Polish students in Lubelskie Voivodship in prognostic model (thousand persons)

Obviously, we should be aware of the fact that the forecast error grows together with the length of the period covered by the forecast. The relative error of the ex ante forecast for 2012 did not exceed 2%, for 2013–2017 it is below 3%, for 2017–2020 it does not exceed 4%, but for the next years it is higher than 4%, which means that in the case of the 2020s and 2030s we can only talk of the foreseeing rather than the forecast.

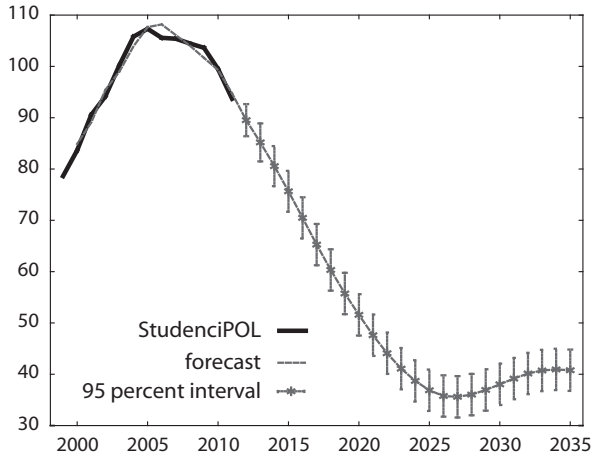


**Fig. 19.** Forecast of the number of Polish students in Lubelskie Voivodship through 2035

## Conclusions

The conducted analysis shows a very strong relationship between the number of people studying in the Lubelskie Voivodship in the first decade of the century and the population size and demographic structure. The significant growth in the number of students at the end of the 1990s and in the first half of the first decade of the century mainly resulted from the fact that the age for higher education was reached by the people born in the period of the demographic high of the second half of the 1980s.[15] On the other hand, the decline in the number of students at the turn of the first and second decade of the century is a result of the decreasing number of people in the higher education age. However, the current decline in the number of young people (aged 19) has a secular nature and, according to demographic forecasts, may continue until 2021, with the number of people aged 19 lower than in 2011 by over a third. In the 2020s the number of young people should grow, but still compared to 2011 there will be 28% fewer of them. It will also be difficult to count on older people to start their studies, as the 'postponed demand' seems to be running out while the delay of the decision to start studying is not longer than 3 years.

The forecast presented in point 6, though properly made and fulfilling basic formal requirements, seems too pessimistic to the author. Even if we treat it as such and the future turns out to be slightly brighter, there is no doubt that the Lubelskie Voivodship will experience a drastic reduction in the number of Polish students.

A simple consequence of the above forecast is the liquidation of some fields of studies, restructuring of public schools and limiting or even finishing the activities of some non-public universities. Of course, a smaller number of students equals higher quality of studies provided that, in case of public universities, higher unit costs will be covered by the state budget and in non-public universities — by the students themselves.

15. There were probably other factors causing the increased number of students, which were not the subject of this paper and which, in the author's opinion, require deeper analysis. The first one is difficult to measure — this is the growing belief that completion of studies will make it easier for the graduate to function in the market economy and in the job market. The second is the development of non-public schools, located closer to students' homes and the accessibility it brought. The third is the slowly increasing wealth of the society which encouraged some people to finance their studies. The fourth, related to the previous, is the so-called "postponed demand" — some older people who did not have a higher education diploma, decided to start their studies.

The presented analysis encourages us to think that universities should prepare for a significantly smaller number of Polish students studying in I and II degree programs and in uniform Master's studies. Although this is not the main topic of this paper, we can indicate some activities aiming at this, such as:

- increasing the number of foreign students, who now account for only 2,6% of all students
- development of PhD studies
- development of post-graduate studies and other forms of education for adults who have already graduated from university
- shifting the main weight of the activity from didactics to scientific research and deep cooperation with the economy

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