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# DEMOGRAPHIC DETERMINANTS OF DEVELOPMENT OF WARSAW SUBURBAN ZONE COMMUNES

## *DEMOGRAFICZNE UWARUNKOWANIA ROZWOJU GMIN STREFY PODMIEJSKIEJ WARSZAWY*

**Key words: demographics, local development, Warsaw suburban zone**
*Słowa kluczowe: demografia, rozwój lokalny, strefa podmiejska Warszawy*

**Abstract**. The paper presents characteristics of selected demographic factors of development of 30 communes (urban-rural and rural) located in the suburban zone of Warsaw. The level of demographic development of the communes was determined by Hellwig's development measure. The analyses revealed significant differences in the demographic potential of the suburban zone communes, which is one of the most important determinants of local and over-local development. The proximity of Warsaw does not guarantee a favourable demographic structure or existence of favourable trends in population growth and migration.

## Introduction

A special feature of the population phenomena in terms of demography is their unique, biological and social nature as well as determinants. Basic events, due to reproduction of population - births and deaths – are biological events. The biological mechanism is the essence of two main structural features of population – gender and age [Okólski 2005].

An age structure of inhabitants of a commune provides information about a potential for its further growth or stagnation. However, an analysis of population by age and gender is basic for evaluation of the demographic potential, allowing prediction of future trends of natality and mortality. It is essential that population processes are taken into account at a local level, especially during planning investments in infrastructure – transport links, roads, sewers, schools, health facilities, etc. [Czapiewski 2010].

These result in popularity of demographic issues, which are used widely in construction of socio-economic development measures using various statistical methods by many authors [Gralak 2005, Sobala-Gwosdz 2005, Babuchowska, Kisiel 2006, Heffner, Stanny 2007, Wojewódzka 2007, Drejerska 2009, Pomianek 2010].

## Materials and methods

The aim of the paper is to characterize demographic determinants of development of 30 communes (urban-rural and rural) located in the suburban zone of Warsaw. The communes were characterised with the figures for the years 2004 and 2010, obtained from the Local Data Bank (LDB) of the Polish Central Statistical Office (CSO). The paper has been performed within studies in the project entitled "Economic and social determinants of rural areas development of the Mazovia region in the suburban and external zone of Warsaw", No: N N114 145240.

Some potential features, important in terms of content, could not be included in a group of analyzed variables, as the CSO LDB does not collect some data on the level of communes (LAU 2), such as a education level of inhabitants or fertility of women (except national censuses).

The level of development was determined with a taxonomic measure [Hellwig 1968]. Preliminary data analysis included elimination of quasi-constant variables using coefficient of variation. As the critical value there was adopted $V^* = 0.10$. Then a strength of association between other variables was examined, using Pearson correlation coefficient. For all variables, a correlation matrix was constructed. The critical value of correlation coefficient was adopted as $r^* = |\,0{,}75\,|$. As a result, a set of five variables was received (Tab. 1).

Based on the derived variables, synthetic indicators were calculated which allowed to divide communes into four classes differ in the level of demographic development. The taxonomic measure of

**Table 1. Diagnostic variables accepted in the research**
***Tabela 1. Zmienne diagnostyczne przyjęte w badaniach***

| Symbol/ *Index* | Diagnostic variable/*Zmienna badana* | Type of variable/ *Rodzaj zmiennej* |
|---|---|---|
| $X_1$ | population per 1 km$^2$ (population density)/*gęstość zaludnienia na 1 km$^2$* | stimulant/ *stymulanta* |
| $X_2$ | birth rate per 1,000 population/*liczba urodzeń na 1000 mieszkańców* | |
| $X_3$ | balance of international migration in persons per 1,000 inhabitants/ *saldo migracji wewnętrznych na 1000 mieszkańców* | |
| $X_4$ | balance of international migration in persons per 1,000 inhabitants/ *saldo migracji zagranicznych na 1000 mieszkańców* | |
| $X_5$ | retirement age population per 100 inhabitants in pre-working age/*ludność w wieku poprodukcyjnym na 100 mieszkańców w wieku przedprodukcyjnym* | destimulant/ *destymulanta* |

Source: own study
*Źródło: opracowanie własne*

$d_i$ takes values from the interval [0, 1]. The more characteristics of a commune are similar to the pattern, the higher is its development level, and the more remote – the lower.

For the classification of communes according to the level of development, two parameters of the taxonomic measure were used: arithmetic mean and standard deviation. It identified the following class intervals:

- class 1 (high development level) $d_i > \overline{d}_i + s_{d_i}$
- class 2 (medium development level) $\overline{d}_i < d_i \leq \overline{d}_i + s_{d_i}$
- class 3 (low development level) $\overline{d}_i - s_{d_i} < d_i \leq \overline{d}_i$
- class 4 (very low development level) $d_i \leq \overline{d}_i - s_{d_i}$

where:
$d_i$ *– value of Hellwig's development measure for a commune,*
$\overline{d}_i$ *– arithmetic mean of* $d_i$,
$S_{d_i}$ *– standard deviation of* $d_i$.
Calculations and analyses were done with: Microsoft Office Excel 2010 and MapInfo Professional 10.5.

## Demographic characteristics of the communes

Information on population density per 1 km$^2$ of a commune proves its level of urbanization and attractiveness of settlement. In 2010, the highest population density characterized Michałowice (481 persons per km$^2$) and Raszyn (464 persons per km$^2$). The largest increase in the index in 2010 compared with 2004 was registered in Lesznowola (app. 66 people to a level 286 persons per km$^2$), Jabłonna (app. 63 people to a level 224 persons per km$^2$) and Michałowice (app. 49 persons/km$^2$). The lowest population density per 1 km$^2$ characterized Kampinos (50 persons per km$^2$) and Puszcza Mariańska (59 persons per km$^2$). The average value of the index rose from 134 in 2004 to 150 in 2010. Population density in rural areas has been increasing because of the expense of the largest urban agglomerations, in this case – Warsaw. This is particularly evident on the outskirts of major metropolitan areas, where just beyond the administrative boundaries of the city are settling out people connected professionally with the urban center [Rakowska 2011].

In 2004, in three rural communes (Mińsk Mazowiecki, Puszcza Mariańska and Sochaczew) men slightly outnumbered women (99 women/100 men). In 2010, the situation improved and unfavorable value of the index was held only in Sochaczew. In the analyzed years, in Nieporęt, Prażmów, Puszcza Mariańska and Radziejowice, the number of women per 100 men increased by 3, while in Celestynów, Izabelin, Jaktorów, Nadarzyn, Pomiechówek and Serock number of women per 100 men decreased by 1. The average value of the examined communes in the analyzed period was 104. Numerical superiority of women over men points to the immigration nature of the suburban communes, since under the law of Ravenstein in streams of migrant women predominate [Corbett 2012, Janicki 2007]. The emigration nature and the shortage of women are characteristic for peripheral areas [Pomianek 2009].

In 2004, the lowest birth rate characterized Puszcza Mariańska (-5.2). Although in 2010, this ratio improved (to -3.8), it was still the lowest among the examined communes. The highest values of birth rate in 2004 were observed in Radziejowice (3.0) and Sochaczew (3.5), while in 2010 – in Jabłonna (9.0) and Lesznowola (8.9). In the analyzed years the most significant improvement in population growth occurred in Wieliszew (8.1 from -2.9 to 5.2), as well as in Jabłonna, Lesznowola and Żabia Wola.

The attractiveness of settlement is also a result of a positive balance of migration. In 28 communes in the analyzed years a positive balance of internal migration remained. Only Celestynów and Zakroczym

were exceptions in 2010. In 2004, the highest balance characterized Jabłonna (760), Lesznowola (566) and Stare Babice (393). In 2010, in relation to 2004, the largest reduction occurred in Jabłonna (-272) and Stare Babice (-163). The largest increase was recorded in the balance of Lesznowola (229) and Wiązowna (224). In 2010 the largest internal migration balance characterized Lesznowola (795), Jabłonna (488) and Wiązowna (380). The average value of the index for 30 communes amounted to 182 persons (in 2010) in relation to 175 persons in 2004. Moreover, the highest international migration balance in 2004 characterized Raszyn (22), while in 2010 – Lesznowola (11). The negative balance was recorded only in 2010 in Puszcza Mariańska, Nadarzyn and Radziejowice.

Another indicator significantly affecting the socio-economic situation of a territorial unit is the age dependency ratio, calculated as a number of non-working age population per 100 persons of working age. The socio-economic situation of a territorial unit is the most favorable, the lower is the ratio value. In 2004, in 9 communes the ratio value exceeded 60 persons (even 66 in Kampinos), while in only 1 commune it remained at less than 50 people (Lesznowola). The average for the examined communes was 59 people. In 2010, the situation improved, and only in Kampinos the ratio value slightly exceeded 60. In Wieliszew and Jabłonna the ratio amounted to less than 50 people. The average for the 30 communes amounted to 54 persons of non-working age per 100 persons of working age. In the studied years, the most significant improvement was noticed in Radziejowice (decrease by 8 people).

Furthermore, the analysis of retirement age population per 100 inhabitants in pre-working age proves that the suburban communities are aging. Celestynów and Izabelin, characterized by an average birth rate, the ratio value increased by 22 and 17 people respectively in the examined years, which in the case of Izabelin was evidenced by the inflow of immigrant people of retirement age from Warsaw, while in the case of Celestynów (with a negative *migration balance) of increasing participation rate of retirement aged persons in the population. In 2004, the largest ratio value was recorded in Puszcza Mariańska (84), Pomiechówek (76) and Michałowice (75), while the lowest (and therefore the best) in Lesznowola (47) and Jabłonna (49). In 2010, the highest number of population of retirement age per 100 persons in pre-working age characterized also Puszcza Mariańska (90), Michałowice (89) and Pomiechówek (87), while the lowest –again Lesznowola (48) and Jabłonna (49). The average ratio value for 30 communes amounted to 63 in 2004 and increased to 72 in 2010.

## Demographic development level of the communes

Based on the five variables (Tab. 1) the taxonomic measure was constructed, which allows dividing the communes into four classes of varying levels of development. The group of high development level consists of two communes – Lesznowola and Jabłonna, while the weakest group has the three municipalities: Pomiechówek, Radziejowice and Puszcza Mariańska. The numbers of communes in other groups amounted to 13 and 12 municipalities. Full ranking was shown in table 2.

**Table 2. Ranking of the communes regarding Hellwig's measure of development**
***Tabela 2. Ranking badanych gmin pod względem poziomu rozwoju wg miary rozwoju Hellwiga***

| Rank/ *Miejsce* | Commune/ *Gmina* | Measure value/ *Wartość miernika* | Class of development/ *Klasa rozwoju* |
|---|---|---|---|
| 1 | Lesznowola | 0.814 | 1 |
| 2 | Jabłonna | 0.497 | 1 |
| 3 | Michałowice | 0.416 | 2 |
| 4 | Wiązowna | 0.393 | 2 |
| 5 | Serock | 0.380 | 2 |
| 6 | Halinów | 0.367 | 2 |
| 7 | Prażmów | 0.361 | 2 |
| 8 | Nieporęt | 0.355 | 2 |
| 9 | Raszyn | 0.345 | 2 |
| 10 | Wieliszew | 0.344 | 2 |
| 11 | Nadarzyn | 0.327 | 2 |
| 12 | Stare Babice | 0.321 | 2 |
| 13 | Jaktorów | 0.316 | 2 |
| 14 | Mińsk Mazowiecki | 0.307 | 2 |
| 15 | Żabia Wola | 0.297 | 2 |
| 16 | Izabelin | 0.273 | 3 |
| 17 | Dębe Wielkie | 0.269 | 3 |
| 18 | Klembów | 0.260 | 3 |
| 19 | Celestynów | 0.237 | 3 |
| 20 | Sochaczew | 0.229 | 3 |
| 21 | Leszno | 0.210 | 3 |
| 22 | Tarczyn | 0.209 | 3 |
| 23 | Baranów | 0.187 | 3 |
| 24 | Czosnów | 0.181 | 3 |
| 25 | Teresin | 0.180 | 3 |
| 26 | Zakroczym | 0.175 | 3 |
| 27 | Kampinos | 0.164 | 3 |
| 28 | Pomiechówek | 0.131 | 4 |
| 29 | Radziejowice | 0.105 | 4 |
| 30 | Puszcza Mariańska | 0.002 | 4 |

Source: own study
*Źródło: opracowanie własne*

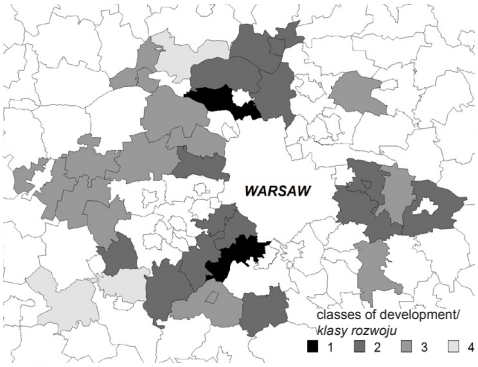


**Figure 1. Warsaw suburban zone communes divided into 4 classes of Hellwig's measure of development**
***Rysunek 1. Gminy strefy podmiejskiej Warszawy w podziale na 4 klasy miary rozwoju Hellwiga***
Source: own study based on the CSO data
*Źródło: opracowanie własne na podstawie danych GUS*

A choropleth map shows spatial distribution of 30 communes of Warsaw suburban zone according to the 4 classes of Hellwig's measure of demographic development (Fig. 1).

The best two communes – Lesznowola and Jabłonna had the highest rates of birth and migration, resulting in high population density and with the lowest values of the age dependency ratio, calculated as a number of non-working age population per 100 persons of working age and participation rate of retirement aged persons in the population. Basing on these values it can be concluded that these two communes have the highest demographic potential for local development.

Lesznowola provides more working places than any other of 30 analysed commune, as – according to the CSO data – relation of people arriving to Lesznowola to work in comparison to people leaving (most of them working in Warsaw) amounted to 2.30 (almost four times more that the average for the sample) in 2006. It proves attractiveness of this commune for migrants and it can be expected that positive migration trends will remain at similar levels in future.

The weakest class included three communes: Pomiechówek, Radziejowice, and Puszcza Mariańska. All of them have been affected by ageing population structure, low or negative birth rate, and low or decreasing migration rate. These relatively unfavorable demographic factors may result in slowing local development in these communities. Local governments should take up some actions leading to increase of attractiveness of settlement especially for young couples with children, providing access to affordable housing, child care and early education as well as convenient connections for commuting to the Warsaw labour market.

## Conclusions

As it is shown by numerous researches [Wojewodzka 2007, Rosner 2007], Mazovian Voivodeship is characterized by strong internal differentiation in terms of socio-economic development, whereas Warsaw as the capital city is a driving force for the whole region. However, the studies have shown significant differences in the demographic potential of the suburban zone communes, which is one of the most important determinants of local and over-local development. The proximity of Warsaw does not guarantee a favorable demographic structure. The main problem at the European, national and local levels concerns an ageing population. Local authorities should take up actions to improve the demographic structure of communes, on the one hand creating incentives to settle down for young and working population of Warsaw. These step can be for example in the form of favourable housing conditions, access to market services and education, convenient commuting options enabling work in Warsaw as well as for investors in order to extend the employment offer in the local market. Above all, these issues concern communes of negative or low rate of births (Puszcza Mariańska, Radziejowice, Leszno), negative or low migration rate (Zakroczym, Celestynów, Baranów, Teresin) and disadvantageous demographic structure (Puszcza Mariańska, Pomiechówek, Raszyn, Radziejowice).

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## *Streszczenie*

*W artykule przedstawiono charakterystykę wybranych uwarunkowań demograficznych rozwoju 30 gmin (miejsko-wiejskich i wiejskich) zlokalizowanych w strefie podmiejskiej Warszawy. Do określenia poziomu rozwoju demograficznego gmin wykorzystano miernik rozwoju Hellwiga. Przeprowadzone analizy wykazały istotne różnice w poziomie potencjału demograficznego gmin strefy podmiejskiej, będącego jedną z najważniejszych determinant rozwoju lokalnego i ponadlokalnego. Bliskość Warszawy nie gwarantuje bowiem korzystnej struktury demograficznej ani zaistnienia bądź utrzymania korzystnych tendencji w zakresie przyrostu naturalnego lub migracji.*

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