Wiadomości Statystyczne. The Polish Statistician, 2023, *68*(3), 1–21 DOI: 10.59139/ws.2023.03.1
Statystyka w praktyce / Statistics in practice
Zgłoszony/submitted: 14.06.2022, poprawiony/revised: 23.02.2023, zaakceptowany/accepted: 6.03.2023

Impact of the ageing of populations on local government revenues and expenditures

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Abstract. Ageing populations are a challenge for public finances. The problem is recognised better at country than at local level. This study aims to analyse the impact of the ageing of populations on the revenues and expenditures of Polish municipalities, as well as on their most important components. The author performed an econometric analysis (fixed effects regression) of panel data for 2,414 municipalities between 2004 and 2019. The data for the study was obtained from budgetary statements of Polish municipalities collected by the Ministry of Finance. It was preceded by an international literature review and an analysis of demographic changes in municipalities. The demographic data came from the Local Data Bank of Statistics Poland.

The study positively verified the hypothesis that if the proportion of elderly citizens in a municipality increases, the local budget shrinks. A decrease in revenues and spending *per capita* was observed, which could mean that in ageing municipalities, citizens receive fewer and/or lower-quality public services. Since public services are in greater demand among lower-income and less self-supporting citizens, they will be influenced by the cutting of local budgets to the largest extent. The study showed that ageing municipalities tend to spend less on care homes than those where the proportion of the elderly is smaller, even though this form of care is particularly needed in ageing communities. It means that the ageing problem might deepen horizontal inequalities between municipalities. Preventing this from happening requires effective local strategies in addition to a well-devised central policy.

Keywords: ageing population, municipal budgets, decentralised public finance
JEL: H71, H72, H73

Wpływ starzenia się ludności na dochody i wydatki samorządów

Streszczenie. Starzenie się ludności jest wyzwaniem dla finansów publicznych. Problem ten lepiej rozpoznano na poziomie państwa niż na poziomie jednostek samorządowych. Celem badania omawianego w artykule jest ocena wpływu starzenia się mieszkańców na dochody i wydatki gmin ogółem oraz na ich najważniejsze części. Przeprowadzono analizę ekonometryczną (regresję z efektami stałymi) danych panelowych dla 2414 gmin za lata 2004–2019, które pochodziły ze sprawozdań budżetowych zbieranych przez Ministerstwo Finansów. Poprzedzono ją przeglądem literatury międzynarodowej i analizą zmian demograficznych w gminach opartą na danych z Banku Danych Lokalnych GUS.

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Pozytywnie zweryfikowano hipotezę, że w przypadku wzrostu udziału osób starszych w populacji budżet gminy się kurczy. Zaobserwowano również spadek dochodów i wydatków per capita. Może się to przekładać na niższą jakość usług publicznych oferowanych przez starzejącą się gminę lub ich mniejszą dostępność, co w największym stopniu dotknie osoby niesamodzielne i uboższe, które częściej niż inni korzystają z lokalnych usług publicznych. Jak wykazano w badaniu, gminy z przewagą ludzi starszych wydają mniej na domy opieki społecznej niż gminy z mniejszym odsetkiem seniorów, chociaż właśnie ta forma wsparcia jest szczególnie potrzebna w starzejących się gminach. Problem starzenia się ludności może zatem pogłębiać nierówności horyzontalne między gminami. Przeciwdziałanie temu zjawisku wymaga nie tylko odpowiedniej polityki centralnej, lecz także opracowania strategii lokalnych.

Słowa kluczowe: starzenie się ludności, budżety gmin, zdecentralizowane finanse publiczne

1. Introduction

There is a clear trend of the ageing of populations in many developed and developing countries. The effect of these changes on the economic stability and development, with a special focus on their impact on public finances, is the subject of intense scientific debate. However, the majority of scientific work on this subject is devoted to the issue of the financial stability of countries challenged by a growing cost of the pension and healthcare systems, as well as the impact of demographic changes on the structure, quality and cost of selected public services (e.g. literature on intergenerational conflicts).

Relatively few analyses have been concerned with the impact of ageing populations on the finances of local governments (Andrews & Dollery, 2021), while demographic changes analysed at the national level do not show the variety and complexity of local processes. Populations of different regions age at a different pace, because the regions vary in terms of the intensity of the occurrence of the basic causes of demographic changes, i.e. reduced fertility rates and changing life expectancy. In addition, migration trends – including those related to internal migrations – are not the same for all regions. Young people migrate most often, which results in the growing proportions of the elderly in the populations they leave. Therefore, budgets of individual regions, municipalities, etc. are affected by demographic changes to different degrees, which, in turn, contributes to the deepening of horizontal inequalities between regions.

The strength of the impact of demographic changes on the finances of local governments also depends on the structure of the local income and expenditure system and the broader relationship between local and central finances (Colin & Brys, 2019). In decentralised public finance systems, the ageing of populations might lead to vertical inequalities, e.g. the inadequacy of local government revenues in relation to decentralised expenditure (Hofmann et al., 2013; Seitz & Kempkes, 2007). It should be emphasised that the knowledge of the impact of these changes on

the budgets of local governments in a system of decentralised public finance is the basis for the conscious shaping of the system.

The aim of this study is to analyse the impact of the ageing of populations on the revenues and expenditures of Polish municipalities, as well as on their most important components. The literature review presented below allowed the formulation of the main hypothesis, namely: if the proportion of old-age citizens in a municipality increases, the local budget shrinks. This hypothesis was verified in the empirical study.

Having accounted for the characteristics of the revenues and tasks of Polish municipalities, the main hypothesis was supplemented by three specific hypotheses:

H1. A municipality's total revenues and all the main components of its own revenue decrease as the proportion of post-working-age citizens in this municipality increases.

H2. If the proportion of old-age citizens in a municipality increases, the spending on (a) education and (b) social care decreases, but the spending on (c) care homes rises.

H3. The growing proportion of old-age citizens in a municipality causes total spending and operational spending to decrease.

2. Literature review: Why and how does the ageing of a population influence local finances? Theory and foreign experience

Colin and Brys (2019) noted that analysing the impact of ageing populations on the financial situation of local governments requires the assessment of how sensitive local revenues and expenditures are to these changes. It is possible to distinguish between the direct and indirect impact of demographic changes on both the revenues and expenditures of local government budgets. The direct impact concerns the categories of expenses and income, which are directly related to the demographic structure of a population, and, more precisely, to different age groups within this population. The indirect impact relates to changes in the local economy resulting from the ageing of a population. The direct impact is far more obvious and therefore easier to diagnose and fix (by introducing changes to the local financial system). The indirect impact is more difficult to identify, but, as will be shown, can nevertheless lead to significant changes in the local income and expenditure. Therefore, recognising the indirect impact and understanding its source is particularly important when planning changes to local financial systems.

Public services can be divided according to which age group they are dedicated to (Cruz, 1995). Changes in the age structure of inhabitants, i.e. an increase (or a decrease) in the number of inhabitants belonging to a certain age group translates

into changes in the demand for certain types of public services. This, in turn, has a direct impact on the volume of related expenses. Whether or not, and if yes, to what extent this affects local finances, will largely depend on the scope of a local government's tasks. If obligatory service provision by local governments require the strict following of central regulations, changes in demand might be measured by analysing changes in the number of potential clients. Literature on fiscal federalism asserts, on the other hand, that in the case where the provision of local services is not strictly regulated at the central level and local authorities thus have considerable autonomy in deciding about the structure and volume of expenditure, the demand depends on citizens' preferences (Oates, 1972; Tiebout, 1956). When analysing these preferences, the problem of intergenerational conflict has to be taken into consideration. In ageing societies, such conflict may lead to a decrease in spending on services dedicated to young people and an increase in spending on services for the elderly. However, studies on intergenerational conflict do not provide any definite conclusions; they rather suggest that characteristics of local communities other than the age structure might influence preferences related to public spending (Goerres & Tepe, 2010; Hess et al., 2017).

The largest part of public outlays on retirement-age inhabitants is consumed by pension systems. This is the reason behind significant reforms of these systems in recent years. Most often, pension-related expenses do not burden the budgets of local governments directly. However, analyses from Germany show that the general increase in expenses of this type might lead to a reshuffle of fiscal responsibilities beetwen the central and local authorities, and thus force changes in the distribution of public revenues between them (Kluge, 2013; Seitz & Kempkes, 2007).

The second type of public expenditure that increases as the population becomes older is healthcare. Research by the Organisation for Economic Co-operation and Development (OECD, 2016) showed that expenditure on healthcare per inhabitant starts growing noticeably from the age of 50 onwards, and healthcare spending on people aged 85 and over is six times higher than healthcare outlays incurred by inhabitants under 60. Unlike pension-related tasks, healthcare tasks are often decentralised. Therefore, in countries with a decentralised healthcare system, one could expect that local governments in municipalities where the proportion of elderly inhabitants is relatively high would spend more on healthcare services than local governments in municipalities where this proportion is lower.

Another public task is social assistance, which is also frequently decentralised. Older people, especially those of poor health, require social assistance much more often than young people. The extent to which local budgets are burdened by social welfare expenses for the elderly depends on whether those inhabitants live alone or with families who can take care of them. In this context, it is worth mentioning that one of the reasons for the growing proportions of older people in municipalities is

the migration of young people. The direction of migration is similar in many countries (including Poland): young people migrate from rural areas and towns to cities, and from cities to suburban areas (Główny Urząd Statystyczny [GUS], 2021). This means that older people are often left alone with no family support, which results in the growing demand for public services in the field of social assistance (Hlebec, 2017).

Education is an important public task, which again is often decentralised. Since it is dedicated to children and adolescents, it seems natural that as their number shrinks, expenditure on education will decrease. However, the results of research on this topic are equivocal (Busemeyer & Lober, 2020; Harris et al., 2001). In the literature on intergenerational relationships it is argued that older people can support spending on education (e.g. due to altruistic motives, family ties, the positive relationship between investment in schools and the quality of the local economy, including local real estate prices, etc.), and that the demand for education does not decrease despite the number of young people falling. Such a phenomenon is possible in countries where local governments have a relatively large autonomy in defining education-related tasks. Another explanation may be the fact that expenditure per pupil/student increases as the number of students decreases (the phenomenon of economies of scale), while spending on education decreases disproportionately to the decrease in the number of children.

Similar analyses can be performed for the revenues of local governments, where it is especially important to investigate local taxes and tax sharing arrangements. In most cases, the taxpayers whose contribution to the local budgets is the largest are working people. Therefore, a decline in their number in a population translates into lower tax revenues (Lee & Mason, 2011). In an OECD study (Colin & Brys, 2019), particular attention was paid to the income of local governments obtained from personal income tax. Income from this tax depends on the number of taxpayers and the volume of their income. Since pensions are usually lower than salaries, tax revenues from the former are lower than those from the latter. In the case of taxes paid by all taxpayers, regardless of their age (e.g. property tax), the problem may be the shrinking number of taxpayers due to death. For example, in Japan in 2018, approximately 13.6% of residential properties had no legal owners (taxpayers) due deaths of the former owners (Miyazaki & Drew, 2021). We can also observe the indirect impact of ageing populations on property tax revenues, which will be discussed further in the paper.

The age structure of a population impacts the economic situation of a municipalicity, thus indirectly affecting local finances. The ageing of a population is reflected in the size of the local labour market as well as in the age structure of working people (Gregory & Patuelli, 2015). Fewer young, innovative employees leads to limited development of local businesses, which, in turn, discourages external

companies from investing in the region. There might occur a negative feedback loop, i.e. a situation where the ageing trend in a population accelerates due to the departure of young people in search of work. Such local economic stagnation is bound to negatively affect the housing market, i.e. cause property values to decline. Lower property values, in turn, result in lower revenues from property tax (if the tax is based on the value of a property). This might be an additional factor discouraging investment in municipalities with ageing populations (Carbonaro et al., 2018). Another example of an indirect impact of ageing populations on local expenditure is the maintenance of infrastructure. Although the demand for some services (e.g. education, sports) might decrease as local inhabitants become older, the local government has to maintain the infrastructure built during the period of higher demand. Therefore, expenses are not reduced.

As shown above, the impact of ageing populations on local finances seems to be a universal phenomenon that potentially endangers the sustainability of local economies and the smooth performance of tasks belonging to the public sector. The extent to which ageing populations affect local finances depends on the structure of the local finance system in a given country. This article focuses on the analysis of this phenomenon in Poland.

3. Research method

To analyse the impact of changes in the age structure of local populations on local government budgets, an econometric analysis – panel data model – has been used in this study. The fixed effects model was chosen because it estimates the 'within effects' by exploring the relationship between dependent and independent variables within an entity (here: a municipality). This is why it helps to answer how changes in the age structure of citizens influence local budgets (Arellano, 2013, p. 14; Bell & Jones, 2015). The basic form of the analysed model is:

$$y_{it} = \sum_k \beta_k x_{k,it} + \alpha_i + \varepsilon_{it},$$

where:

y_{it} – a dependent variable representing different categories (listed below) of the local budget for municipality i in year t,

$x_{k,it}$ – an independent variable representing the k demographic and control variables (listed below) for municipality i in year t,

β_k – parameters of interest,

α_i – an unknown time-invariant intercept for each municipality i,

ε_{it} – the error term.

The dependent variables in the study are municipal revenues and expenditures and their main components. The independent variables represent the demographic and economic indicators describing the local community, with a particular focus on the proportion of people in the post-working-age group. Below, we briefly explain the basic concepts and problems associated with these categories as applicable to the Polish local government.

The study analysed data for the years 2004–2019. This is 16 years, i.e. a relatively long period with no major changes to the law regulating local finances in Poland. The study does not take into consideration the year 2020 and onwards, because local budgets were then affected to a large extent by the COVID-19 pandemic, which is not related to our research.

The data for the study was extracted from budgetary statements of Polish municipalities collected by the Ministry of Finance.[1] Demographic data was sourced from the Local Data Bank of Statistics Poland.[2]

3.1. Expenditure and revenue of Polish local governments and their main components – description of dependent variables

Sub-sovereign government in Poland is divided into three levels. Municipalities (gminas: 2,411 units[3]) represent the local level, counties (poviats: 314 units) the intermediate level, and regions (voivodships: 16 units) the regional level. 66 largest cities operate as municipalities and poviats. Sub-sovereign governments decide on approximately 30% of public expenditure.

This study focuses on the local level. Municipalities are the most important sub-sovereign level in Poland (from the point of view of the volume and scope of their statutory tasks), whose budgets constitute approximately 50% of the total sub-sovereign budget. It is important for our study and the chosen method of analysis that the scope of tasks and revenues of municipalities (as defined by law) is the same for all units. For this reason, the largest cities were not included in the analysis. These cities, in addition to the tasks and revenues of municipalities, also have tasks and revenues of poviats. Therefore, they cannot be compared with municipalities.

Municipalities in Poland levy several local taxes and charges. The revenues from these taxes constitute approximately 18% of total local revenues. Among all local taxes, the property tax yields most substantial revenues, i.e. 40% of the total revenues from local taxes and charges. Property tax depends on the area of the real estate (Act of 12 January 1991 on local taxes and charges; Pol. Ustawa z dnia 12 stycznia 1991 r. o podatkach i opłatach lokalnych). Local governments grant tax relieves and

[1] See: https://www.gov.pl/web/finanse/sprawozdania-budzetowe.
[2] See: https://bdl.stat.gov.pl.
[3] The number of units changed in the analysed period. In 2004, there were 2,414 municipalities in Poland, and in 2019 – 2,411.

determine and differentiate local tax rates. However, maximum tax rates cannot exceed the highest permissible statutory rate.

Maximum rates of property tax are different for households and enterprises, i.e. are relatively low for households and high for enterprises. Therefore, over 70% of the total revenue that municipalities obtain from this tax comes from enterprises. Local government revenues from property tax are not directly affected by the ageing of populations. We can expect, however, that this phenomenon will impact them indirectly – as the number of firms willing to operate in ageing municipalities declines.

Another substantial part of municipal revenue comes from shared taxes (approximately 18% of the total local revenue). Local governments receive approximately 39% of personal income tax levied on taxpayers residing in their municipality and 6.7% of corporate income tax levied on firms located in their municipality (Act of 13 November 2003 on revenues of local government units; Pol. Ustawa z dnia 13 listopada 2003 r. o dochodach jednostek samorządu terytorialnego). As pensions in Poland are relatively low compared to the average salary – in 2018, the net pension replacement rate in Poland was 35% (in the OECD – 53%; OECD, 2021) – we can expect that ageing populations will have a direct negative impact on local revenues both from personal and corporate income tax. Notably, local governments have no fiscal autonomy with regard to these taxes.

The most significant part of local budgets consists of transfers from the central government. They include the general educational grant (calculated on the basis of the number of students and teachers), which constitutes approximately 16% of the municipal revenue, and equalisation subsidies for less affluent and less densly populated municipalities, which constitute on average approximately 6% of the municipal revenue. There are also specific grants (29% of local budgets), the most important of which (in operation since 2016) is the subsidy for the governmental programme for children. Thus, although ageing municipalities receive fewer grants related to young citizens, this may be at least partly compensated by equalisation subsidies.

Municipalities are responsible for several vital social and communal services. Spending on schools and kindergartens is the most significant section of municipal budgets. During the 2004–2019 period, spending on education constituted on average 36% of total municipal outlays. The second most important area of spending was social care services, which accounted for approximately 16% of the total local spending. As regards healthcare in Poland, this system is financed centrally (through the National Health Fund), so local government tasks related to healthcare are only supplementary. Overall, spending on healthcare in recent years has constituted less than 1% of municipal budgets.

Local government responsibilities in the education sector involve the management of school property and the employment of teachers and school staff (Act of 7 September 1991 on the Education System; Pol. Ustawa z dnia 7 września 1991 r. o systemie oświaty). Local governments have relatively little autonomy in the field of education, although they retain some prerogatives in this area (Herbst et al., 2009). They approve and fund work plans of municipal schools, determine the number of teachers and other school employees as well as the rates of their salaries, define the necessary school maintenance work and determine its cost, and define the amount and determine the cost of learning and teaching aids. School programmes have to comply with the national curriculum for a given level and type of school. The largest part of local government spending related to education is assigned to salaries of school employees (mostly teachers). This is also the least flexible part of local outlays on education. Teachers' work is regulated by the Teachers' Charter – a special legal act dedicated only to this profession. It defines the base salary for teachers, obligatory additional salary for teachers working in rural areas, the conditions for teachers' retirement, the maximum number of working hours, etc. (Act of 26 January 1982 – Teachers' Charter; Pol. Ustawa z dnia 26 stycznia 1982 r. – Karta Nauczyciela). Municipalities finance education-related tasks from their local revenues and the aforementioned educational subsidy. In practice, the educational subsidy covers approximately 70% of all local spending on education.

In the field of social assistance, the tasks of Polish municipalities include the payout of social benefits to people in need (i.e. the least-affluent and/or disabled inhabitants, large families) and the provision of direct support in the form of services (e.g. social work, shelters for the homeless, feeding children, providing social housing and organising care benefits). Unfortunately, there are no exact data that would show the structure of the municipal spending on social care by beneficiaries' age, except for benefits for families with children. The latter have received substantial support from the central budget since 2016 (in the form of the 'Family 500+' programme; Ministry of Family and Social Policy, 2017) and were also granted a special budget classification heading. However, no such support has been extended to local governments to help the elderly. This can be seen as an example of an inconsistent policy towards the elderly in Poland (Iwański, 2019).

In order to fulfill the aim of this article, a detailed study of local government expenditure on social assistance for the entire analysed period will be performed further in the paper, as well as a separate one for the period until 2015 (before the introduction of the 'Family 500+' programme). Additionally, we will analyse the local government spending on care homes. It constitutes only about 2% of the social assistance expenditure, but at the same time, it is the type of expenditure that the elderly need most. As previous analyses for Poland demonstrate, the number of

available places in care homes has been insufficient. The demand for them will be growing as the populations will age, so we can expect increases in municipal spending in this field (Bobrowska & Maciejasz-Świątkiewicz, 2016; Krzyszkowski, 2018).

3.2. Population size and proportion of elderly people in Polish municipalities – as main independent variables

Poland has experienced very dynamic demographic changes in recent years. In 2000, the proportion of post-working-age inhabitants was 15% of the whole population, while two decades later it amounted to 22.3%. According to forecasts by the Local Data Bank, in 2050, the post-working-age people in Poland will constitute nearly 37% of the whole population. As in other countries, these changes stem from a decline in fertility and longer life expectancy. Eurostat data shows that the ferility rate in Poland in 2019 stood at 1.43, so was one of the lowest in the EU (1.53 on average). Poles' life expectancy in 2019 was slightly below the EU average, i.e. 78 years (81.3 years in the EU). These trends overlapped with some phenomena specific to Poland (Okólski, 2010). Firstly, the demographic situation in Poland has been subject to cyclical lows and booms resulting from a significant decrease in the population during the Second World War. Additionally, after Poland joined the EU in 2004, a large group of (mainly young) Poles emigrated to Western Europe. It is estimated that in 2019, approximately 2.5 million Poles remained outside the country (GUS, 2020).

These national trends have various dynamics in different regions and municipalities. As in other countries, inhabitants of rural areas and smaller centres migrate to large cities, while those from large cities leave for suburban areas (GUS, 2021). Since it is mainly young people who emigrate, the proportion of the elderly is the highest in the largest cities and peripheral rural areas, and the smallest in the suburbs of large cities. Table 1 shows considerable spatial differentiation of the proportion of post-working-age inhabitants in the whole population. In 2019, in the 'youngest' municipalities (the proportion of the elderly in the whole population below the 10th percentile), people of post-working-age constituted 16% or less of the whole population. In the 'oldest' municipalities (above the 90th percentile), 25–40% of inhabitants were at the post-working-age.

Table 1. The proportion of elderly citizens in cities and municipalities of different kinds in 2019

Specification	Minimum	10th percentil	Median	90th percentil	Maximum
	in %				
Big cities	19.1	21.7	24.3	26.6	32.1
Urban municipalities	12.8	20.1	23.7	26.6	31.6
Rural municipalities	11.4	16.1	19.3	23.2	39.3
Mixed municipalities	12.7	17.8	20.7	23.9	32.6
Total	11.4	16.6	20.2	24.4	39.3

Source: author's calculation based on data from the Local Data Bank.

It should be emphasised that the ageing of local populations is also related to the depopulation of municipalities. Within 2004–2019, the population of Poland increased by only 0.5%. As shown in Table 2, there were places where the number of inhabitants shrank by as much as over 30%, and places where this number increased by 30%. Such vast differences in the scale of changes affecting the demographic situation of Polish municipalities confirm the importance of the aim of this study.

Table 2. Changes in populations of cities and municipalities of different kinds between 2004 and 2019

Specification	Minimum	10th percentil	Median	90th percentil	Maximum
	in %				
Big cities	–12.8	–10.9	–5.5	1.5	23.4
Urban municipalities	–21.2	–9.0	–3.6	5.5	62.5
Rural municipalities	–32.9	–9.6	–0.1	16.3	129.7
Mixed municipalities	–33.5	–8.1	–1.8	8.4	79.9
Total	–33.5	–9.1	–1.3	13.3	129.7

Source: author's calculation based on data from the Local Data Bank.

4. Empirical study

Table 3 presents a list of dependent variables in the study and the basic statistics for these variables. To make them more comparable with each other while considering the fact that the number of citizens vary among municipalities, we analysed values *per capita*.

Table 3. Basic information and statistics on dependent variables used in the analysis of the impact of the changes in the age structure of populations on local government budgets

Variable	Variable description	Mean	Medium	Minimum	Maximum	Coefficient of variation
rev_pc	all revenue *per capita*[1] in PLN	3,503.84	3,216.03	1,410.47	55,201.93	0.43
revown_pc	all revenues of a municipality (including shared taxes) *per capita*[1] in PLN	1,398.95	1,200.15	241.75	52,767.74	0.92
loctax_pc	local taxes *per capita*[1] in PLN	561.02	467.81	–278.62	24,788.31	1.14
PIT_pc	revenue from personal income tax (shared tax) *per capita*[1] in PLN	435.30	365.75	59.91	3,997.81	0.66
transf_pc	general and specific transfers *per capita*[1] in PLN	1,927.91	1,858.29	450.40	21,507.37	0.37
TDI	transfer dependency indicator (proportion of transfers in all local revenues)	0.56	0.59	0.02	0.90	0.26
spend_pc	all spending *per capita*[1] in PLN	3,551.49	3,283.82	1,436.02	73,012.89	0.42
spend_oper_pc	all operational spending *per capita*[1] in PLN	2,888.50	2,667.46	1,120.60	33,147.89	0.35
educ_pc	operational spending on education *per capita*[1] in PLN	1,144.42	1,125.49	473.72	5,189.27	0.22
social_pc	operational spending on social assistance *per capita*[1] in PLN	752.28	593.00	0.00	16,603.87	0.59
swh_pc	operational spending on care homes *per capita*[1] in PLN	14.02	7.40	0.00	453.74	1.38

1 Logarithm in the model.

Source: author's calculations based on budgetary statements of municipalities and data from the Local Data Bank.

The most important categories of revenue were analysed, including municipalities' total revenue and municipalities' own revenue, while at the same time distinguishing between municipalities' own (local) taxes, the share of personal income tax assigned to them, and transfers (general and specific). To assess how changes in the age structure of citizens influence the level of the local revenue autonomy, the indicator of transfer dependency was proposed. Notably, the size and structure of revenue are the main determinants of the development of local governments. According to fiscal federalism theories, adequate and autonomous revenues of local governments are conditional to their effective fiscal policies and the advancement of local development (Oates, 1999, 2008; Tiebout, 1956; Weingast, 2009).

As regards expenditure, the total spending and the operational spending were analysed separately. Within the operational spending, we analysed operational expenditure on education, social assistance and care homes. All variables were the approximations of the quantity and quality of public services received by citizens.

The most important independent variable in the study was the proportion of post-working-age citizens in a municipality. According to the data from the Local Data Bank, the post-working age was 60 for women and 65 for men. The number of citizens, the unemployment rate and the type of municipality were adopted as control variables. In Poland, there are three types of municipalities: rural (no town), urban (cities and towns) and mixed (a town and the surrounding rural area). This distinction is important because the type of municipality influences the size and structure of local revenue and spending and often corresponds with the type of the local economy. The year effect is also controlled for in the model (but is not presented with the results for clarity purposes). Basic statistics and information about these variables are presented in Table 4.

Table 4. Basic information and statistics on independent variables used in the analysis of the impact of the changes in the age structure of populations on local government budgets

Variable	Variable description	Mean	Medium	Minimum	Maximum	Coefficient of variation
pop	number of citizens (logarithm in the model)	10,651	7,310	1,286	127,566	0.94
post_pop	proportion of post-working-age citizens in a municipality	0.17	0.17	0.06	0.44	0.20
unemp	unemployment rate in %	8.94	8.20	0.60	36.40	0.53
rural	dummy variable representing rural municipalities (equal to 1 if the municipality is rural and to 0 otherwise), with urban municipalities being the reference variable for our model					
mix	dummy variable representing mixed (urban-rural) municipalities (equal to 1 if the municipality is mixed and to 0 otherwise), with urban municipalities being the reference variable for our model					

Source: author's calculations based on budgetary statements of municipalities and data from the Local Data Bank.

The results of the econometric models are presented in Table 5 for revenues and Table 6 for expenditures. All analyses were performed using STATA 14 software and xtreg, fe command.

Table 5. Results of the analysis of the impact of changes in the age structure of populations on local government revenues

Independent variable	ln rev_pc	ln revown_pc	ln loctax_pc	ln PIT_pc	ln transf_pc	TDI
ln pop	–0.054***	–0.280***	–0.422***	0.139***	0.236***	0.104***
	(0.014)	(0.021)	(0.021)	(0.014)	(0.012)	(0.007)
post_pop	–0.551***	–2.463***	–1.181***	–3.791***	0.950***	0.751***
	(0.051)	(0.079)	(0.077)	(0.054)	(0.046)	(0.025)
unemp	0.002***	–0.004***	–0.005***	–0.007***	0.008***	0.003***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
rural	0.063**	0.050	0.080*	–0.024	0.064**	–0.001
	(0.030)	(0.046)	(0.042)	(0.031)	(0.027)	(0.014)

Table 5. Results of the analysis of the impact of changes in the age structure of populations on local government revenues (cont.)

Independent variable	ln rev_pc	ln revown_pc	ln loctax_pc	ln PIT_pc	ln transf_pc	TDI
mix	0.027	0.047	0.035	–0.009	0.008	–0.014
	(0.028)	(0.042)	(0.039)	(0.029)	(0.025)	(0.013)
_cons	8.156***	9.544***	10.383***	4.709***	4.639***	–0.504***
	(0.127)	(0.196)	(0.195)	(0.133)	(0.113)	(0.061)
R^2_within	0.86	0.76	0.58	0.93	0.89	0.29
n-groups	2,414	2,414	2,414	2,414	2,414	2,414
n-observations	38,487	38,487	36,095	38,487	38,487	38,487

Note. Variable significant at the level of: *** – 1%, ** – 5%, * – 10%. Standard errors are in parentheses.

Source: author's calculations using STATA 14 software based on budgetary statements of municipalities and data from the Local Data Bank.

Table 6. Results of the analysis of the impact of changes in the age structure of populations on local government spending

Independent variable	ln spend_pc	ln spend_oper_pc	ln educ_pc	ln social_pc		ln swh_pc
				2004–2019	2004–2015	
ln pop	–0.008	0.094***	0.379***	0.111***	–0.885***	–0.082
	(0.017)	(0.009)	(0.010)	(0.017)	(0.024)	(0.108)
post_pop	–0.605***	–0.581***	0.945***	–3.302***	–3.143***	–0.989**
	(0.062)	(0.034)	(0.036)	(0.064)	(0.093)	(0.403)
unemp	0.002***	0.004***	0.006***	0.020***	0.010***	–0.020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
rural	0.075**	0.065***	0.047**	0.092**	0.096	1.267***
	(0.036)	(0.020)	(0.021)	(0.039)	(0.084)	(0.235)
mix	0.052	0.043**	0.002	0.026	0.072	1.341***
	(0.033)	(0.018)	(0.019)	(0.035)	(0.075)	(0.216)
_cons	7.756***	6.618***	3.099***	4.722***	13.800***	0.051
	(0.154)	(0.085)	(0.089)	(0.159)	(0.229)	(0.998)
R^2_within	0.81	0.94	0.82	0.94	0.80	0.57
n-groups	2,414	2,414	2,413[a]	2,413[a]	2,413[a]	2,413[a]
n-observations	38,487	38,487	38,469	38,444	28,798	38,469

a Due to the lack of data for one municipality, in four models 2,413 municipalities were analysed.

Note. As in Table 5.

Source: author's calculations using STATA 14 software based on budgetary statements of municipalities and data from the Local Data Bank.

According to the information presented in the tables, 2,414 municipalities (*n*-groups) were analysed and, due to the relatively long period of analysis (16 years), there were almost 38.5 thousand observations (*n*-observations) in the models. The exception was the social care expenditure for 2004–2015, where the analysis period was 12 years and the number of observations was therefore smaller. Due to occassional data gaps for some models, the number of observations in subsequent analyses slightly varied.

Changes in the analysed explanatory variables largely explain the changes in the municipal income and expenditure – as evidenced by high values of the R^2_within index. Only in the case of the indicator for the proportion of grants and subsidies (TDI) in local budgets the value was significantly lower. This may be due to the fact that the variables affected the numerator (transfers) and denominator (total income) of this indicator to different extents – as confirmed by the coefficients of the variables in the models for total income and transfers, respectively.

In almost all models, the most important variables analysed in the study, i.e. the population size and the proportion of post-working-age inhabitants to the whole population, proved to be statistically significant (except for the population variable in the case of expenditure on care homes). The strongest impact of demographic changes on the analysed revenues was observed in the case of municipalities' own tax revenues, and the weakest in the case of municipalities' total revenues. A 1%-increase in the size of a population led to a 0.42%-decrease in local taxes *per capita*, and to only a 0.05%-decrease in the total revenue *per capita*. This is mostly due to the differences in the volume of these revenues. As regards expenditure, changes in the population size had the strongest impact on social expenditure and the least significant impact on the total expenditure. This again is related to the volume of the particular types of expenditure, and also to the fact that social care (and likewise education) benefits only a part of a population.

An increase in the proportion of older people in the population had the strongest impact on the municipal revenues from personal income tax and on the social care expenditure. A 10%-increase in the proportion of the elderly led to a 0.38%-decrease in the personal income tax *per capita* and a 0.33%-decrease in the social welfare expenditure.

The unemployment rate (the control variable) also proved significant in all models. However, the coefficient value of this variable was very small, so its impact on the analysed explanatory variables was marginal.

The result with regard to the types of municipalities is interesting. As mentioned before, a fixed-effects model was analysed, so the variables show the impact of the change of a municipality type. According to the results, from the point of view of municipalities, it is beneficial to become a rural municipality, as some of its income and expenditure categories increase then.

5. Discussion of the results

As was expected, an increase in the proportion of people of the retirement age in the total population led to a decrease in the *per capita* income and spending of local governments. The main hypothesis of shrinking local budgets due to the ageing of populations was thus confirmed.

The study also supported the H1 hypothesis, namely that the municipality's total revenues and all the main components of its own revenue decrease as the proportion of post-working-age citizens increases. We did not formulate a hypothesis related to subsidies and transfers because, as mentioned before, it would be difficult to see if, and if yes, in what way, a decrease in grants related to children was compensated by equalisation grants. The results of this study also demonstrate that the system of transfers at least partly helps ageing municipalities (by increasing their income). However, the fact that we noted an overall decrease in their total income means that the increase in transfers did not fully compensate for the reduction in their other revenues. Furthermore, our study indicates that ageing populations not only cause a decrease in the total income of Polish municipalities, but also lead to their diminished income autonomy (i.e. a situation where the transfer dependency indicator increases).

Results regarding the impact of the ageing of a population on local spending are interesting. The fact that the total spending and operational spending *per capita* decrease as the population ages supports the H3 hypothesis. We can thus conclude that as inhabitants of a municipality age, they receive fewer public services from the local government.

However, we have to take into consideration the fact that the demand for public services is greater among lower-income and less self-supporting citizens. As such, older and less affluent people will be affected by the cutting of the local revenue *per capita* to the largest extent. This is compliant with the findings of the UK-based study on elderly citizens' unaddressed needs related to long-term care (Iparraguirre, 2020). In that study, the author notes that: 'In view of demographic projections – of proportions of older people, [...] unpaid long-term care will lag increasingly behind the needs of the older population; further budgetary reductions are likely to negatively affect particularly older people on low incomes'.

Regarding expenditure on social care – an important responsibility of municipal budgets partly dedicated to families and children, it was expected to decrease due to the ageing of populations. Our study confirmed these expectations, thus supporting the H2b hypothesis. What is interesting is the fact that the strength of this effect was similar both in the case of the analysis of the period including the sub-period of the 'Family 500+' programme payout and the analysis of the period excluding that sub-period.

The result regarding expenditure on care homes was suprising. The study shows that as the elderly population increases, the *per capita* expenditure on these institutions decreases. Thus, the H2c hypothesis has been falsified. Some explanation for this phenomenon could be the scale effects – as the number of people in care homes rises, the unit cost of running them falls. However, as Bobrowska and Maciejasz-Świątkiewicz (2016) show in their study, there is a shortage of care homes in Poland, so it is difficult to talk about scale effects here. The decrease in the local

government expenditure on care homes per resident might also be caused by the fact that the residents tend to pay increasing amounts for staying in those institutions themselves. However, this has not been the subject of our study and therefore a detailed analysis of the total income and expenditure of those establishments is necessary. If the total expenditure (both public and private) on care homes decline in ageing municipalities, this means that these municipalities have fewer resources to support their old residents. If the level of the total expenditure remains unchanged, but the share of residents' own contributions increases – it raises the question of the availability of care homes for residents with lower incomes. Thus we can see that regardless of the direcion of changes in the total expenditure per resident of a care home, a decrease in the public outlays on these homes leads to limiting the less affluent citizens' access to public services.

As regards education, the results of the study differed from the expectations, i.e. the H2a hypothesis has not been confirmed. In ageing municipalities, spending on schools *per capita* increases. Perhaps this is the result of the lowering economies of scale. Another explanation might be little flexibility regarding teachers' employment and the obligatory maintenance of school infrastructure, as a result of which municipalities have to continue employing teachers and maintaining school buildings despite the falling number of children.

6. Conclusions

The aim of this study was to analyse the impact of the ageing of populations on the revenues and expenditures of Polish municipalities, as well as on their most important components. The literature review presented in the paper allowed the verification of the main hypothesis, i.e. that local government budgets are shrinking as local populations age. It showed that the ageing of populations is a vital problem for decentralized public finances, because it can lead to growing inequalities between municipalities. Facing this issue requires a good understanding of the relationship between the age structure of populations and local government finances. However, this might be difficult, because it is not always possible to speak of a direct impact in the situation where the number of older people directly affects the source of local income and expenditure. This impact is often indirect, i.e. related to the deteriorating economic situation of a municipality or declining economies of scale (when the number of younger residents, or the number of residents in general, shrinks). However, this problem has not yet been sufficiently recognised in the literature. Our study tries to fill this gap.

As already mentioned, the main hypothesis of this study was empirically positively verified. As regards the three specific hypotheses formulated at the beginning of the study, namely:

H1. A municipality's total revenues and all the main components of its own revenue decrease as the proportion of post-working-age citizens in this municipality increases;
H2. If the proportion of old-age citizens in a municipality increases, the spending on (a) education and (b) social care decreases, but the spending on (c) care homes rises;
H3. The growing proportion of old-age citizens in a municipality causes total spending and the operational spending to decrease,

the empirical study confirmed the H1, H3 and the H2b hypotheses. In contrast to the expectations, the educational spending in ageing municipalities turned out to be rising, and spending on care homes falling – so the H2a and H2c hypotheses had to be rejected.

Our study proved that both the local revenue and spending decreased in ageing municipalities. Another important finding was that the reduction of local budgets had both direct and indirect causes. The budgets shrank due to the reduction in the tax base and because of the influence of the ageing of populations on local economies. It has to be emphasised that we analysed revenues and spending *per capita*, and noticed a decrease in these values due to demographic changes. This implies that budgets of ageing municipalities are smaller than budgets of municipalities where there are fewer elderly people, and that citizens in the former receive less and/or lower-quality public services. This is especially alarming because it may hinder equal access to public services and deepen horizontal inequalities between municipalities.

The above problem might be partly reduced by a well-constructed system of intergovernmental transfers. As the study shows, Polish ageing municipalities receive larger transfers from the central government than the municipalities where the proportion of the elderly is smaller, which is a positive development. However, even these increased resources fail to make up for the losses in the ageing municipalities' own revenues and shared taxes. Thus, changes in the transfers system are required, which, however, does not necessarily mean larger grants for local governments of ageing municipalities. Instead, there is a need to rethink grant formulas to help the municipalities most affected by demographic changes. Changes in transfers or local revenues need to be accompanied by additional policies.

An example here might be merging municipalities, successfully introduced in many countries over the recent years. Ageing is correlated with the depopulation of municipalities. Notably, the maintenance of smaller municipalities is relatively costly due to scope and scale effects. Mergers seem to be a good solution when authorities look for savings in public finances and want to make local finances more equal in

horizontal terms, which, in turn, is necessary to guarantee equal access to public services to everyone.

It is worth mentioning that equal access is not only fundamental to the welfare state, but also necessary for preventing inhabitants from 'voting with their feet', i.e. migrating to places where they could receive public services of a better quality. Such migration creates a negative feedback loop, i.e. the acceleration of ageing trends in a population due to the departure of young people. However, the most important goal is finding a way to help local economies develop and sustain their job markets – even in areas affected by the ageing of their populations to a large extent. This is a difficult goal that will require a close collaboration between the policies of the central and local governments.

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