

## SELECTED DETERMINANTS OF DEMOGRAPHIC SAFETY

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**Abstract.** The article presents, in a simplified manner, selected theories of population to explain the current trends of population development in Poland and throughout the world. The aim of the article is to present the demographic threats that have emerged in the last eighty years. Prognosticated age structures have also been predicted. Significant differences between the structure of the population now and the future have been indicated, particularly regarding the ageing of the population. Against the background of global transformations analyzes of changes in Poland have been conducted. The comparison shows that changes in Poland are highly analogous to transformations around the world, such as declining birth rates and increasing life expectancy. These changes cause ageing of the population, which could result in the collapse of the functioning of the labor market and the pension system as it currently exists.

**Key words:** demographic transition, age pyramid of population, old age rates, life expectancy

## INTRODUCTION

The concept of national security is made up of military aspects and social affairs, also political security and economic aspects, technological and environmental policy in the range of demography. Demographic security is a feature of social security. Proper population changes are an essential element of social-economic security. In recent years these changes have taken an undesirable direction, from the point of view of social development. The biggest problem is a constantly decreasing population and changing its age structure.

These changes are generated by a decreasing number of births, which in turn leads to ageing of the population. Additionally, in Poland mass emigration that took place in the transition period also had a great influence on the state of the population. During this period more than 2 million people emigrated from Poland. Therefore, it obviously changed the age structure of the population because decisions about emigration were made by young people, most of whom were educated.

The consequence of a decreasing number of births can be already noticed much more than demographic decrease in apparent shutdown of primary schools and dismissing teachers. Gradually, than it will be going in the direction of secondary schools and higher education. The influx of new workers to labour market will be reduced significantly. Finally after several (at least twenty years) pension system will collapse.

Poland is not isolated in their problems. Problems are connected with the breakdown of population trends in most of the EU countries. This situation should not be surprising, since it results from the general theory of human development.

## SELECTED THEORIES OF HUMAN DEVELOPMENT

There are several theories of population growth (Cieślak, 1992; Rosset, 1975). One of the well-known and best documented is the theory of demographic transition. It describes the dependencies between the socio-economic and demographic phenomena.

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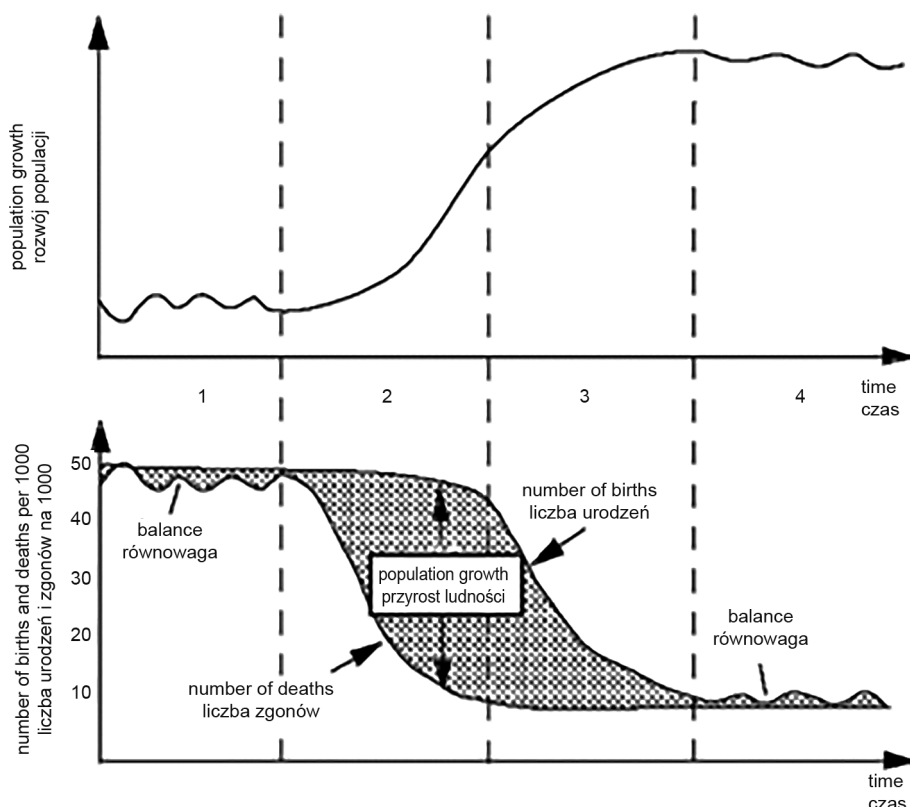
According to this theory procreation of population takes the form of consecutive phases, wherein in the first phase, the balance between the number of births and deaths occurs at high levels in both birth and death, but in the last stage of a low level of births and deaths. There are many models of demographic transformation which vary in the number of transitions phases.

Four-phase model of demographic transition developed by AJ Coal is the most commonly discussed one in literature. According to this model, the first transition phase is characterized by a large number of births and also a large number of deaths. Fertility and mortality processes remain on a constantly high level. Population growth equals zero. Deviations from zero level are caused by random factors such as for example epidemics. The fertility rate (number of children born to a woman in her lifetime) is 6 and the average lifetime

does not exceed 45 years. It is a natural phase of development in which natural processes of reproduction take place. This phase is characterized by a progressive century pyramid.

In the second phase, the process of birth remains on the level of phase one (a natural level), whilst the number of deaths is decreasing rapidly. This occurs as a result of higher living standards reflected in a better access to health services, as well as in improvement of hygienic life conditions of the population. As a result of the process of births and deaths, population is growing rapidly. In this phase, fertility rate is at level 4, 5–6, 0, however, life expectancy is increased by 10 years on an average.

The third phase is characterized by the fact that the number of births decreases rapidly (measures of birth control are used), decreasing the number of deaths, but not as quickly as in the second phase. It results in



**Fig. 1.** Four phase model of demographic transition

Source: Demografia, n.d.

**Rys. 1.** Czterofazowy model przejścia demograficznego

Źródło: Demografia, b.d.

a decline in population growth. The fertility rate drops to Level 3 at the end of this phase, population growth stabilizes at a level close to zero.

In the final, fourth phase, both births and deaths are on the same, low level. This is due to the use of birth control as well as further improvement of medicine. Fluctuations in population growth around zero are caused by random factors.

Finally, the fourth phase makes both birth and deaths at the same low level. This is the result of using birth control, as well as further progress of medicine. Fluctuations in population growth around zero are caused by random factors.

In 1947, an English demographer C.P. Blackerna, developed five-phase model of human population development, observing the European societies.

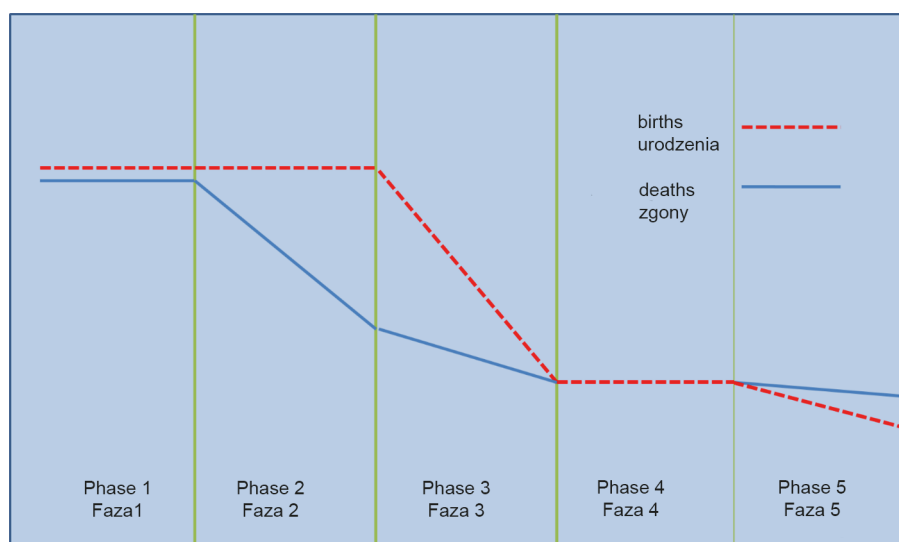
The following phases of demographic development have been called as follows:

- high stationary level
- early expansion phase
- late expansion phase- low stationary phase
- regression stage.

As it can be seen in five-phase transformation model, there is a new transformation phase unexpected in

theory, which is called a regression phase. In regression phase the level of birth rate is lower than the mortality rate. Such a situation can very quickly lead to depopulation. Such trends can be observed at present. It is surprising that the five-phase theory was created in the period when most European countries were in the second or early third stage of demographic transition, that is when the level of the population grew rapidly and disaster overpopulation was the source of concerns.

Much later, in 1972, a report titled *Limitations of Growth*, was developed by researchers from the Roman Club (Meadows et al., 1973) who then conducted an analysis of the future of the world in the light of the population growth and dwindling food resources as well as raw materials. The authors of the report referred to the general theory of population (Cieślak, 1992) for the first time formulated in 1798 by an Anglican clergyman T.R. Malthus (1766–1834). T.R. Malthus developed his theory by assuming that the population was growing exponentially (doubling every 25 years) and livelihoods in arithmetic progression. The report by the Roman Club is based on slightly different assumptions, namely that the population is growing exponentially and natural resources remain constant.



**Fig. 2.** Five-phase model of demographic transition

Source: Demografia, n.d.

**Rys. 2.** Pięciofazowy model transformacji demograficznej

Źródło: Demografia, b.d.

On the model WORD3 built by the scientists, they have conducted experiments on the basis of which they came to the following conclusion: “If the current growth trends in the world population, industrialization, pollution, food production and consumption of resources are maintained in the next hundred years, the limits of growth for the planet will be reached. The most likely result will turn out as more violent and uncontrollable decline in both population and industrial production”.

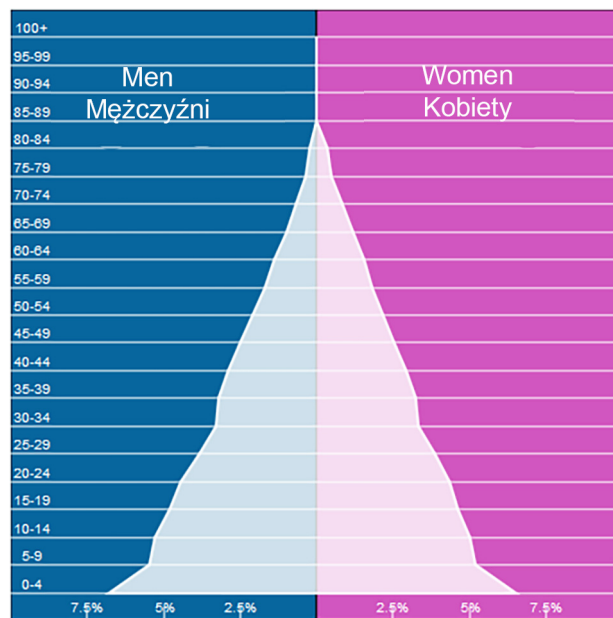
At the moment, we know that the population decline has already taken place and it happened for other reasons. It is known that one of the reasons are drastically declining birth rates. In 1986, a new term was introduced to demography “second demographic transition”. The authors of this term, Lesthaeghe and van de Kaa, interpret it as one way to change the demographic behaviour with respect to “the sphere of marriage and fertility”. According to the theory of demographic transition, such changes should not have happened. The authors try to explain why it happened, what the source of these changes was. They believe that in Western Europe (because that is what the problem concerns) there is a reevaluation of family. Parents, instead of investing in the future of their children, are focused on self-realization.

In detail they formulate the factors that led to the decline in fertility in major extent. According to the authors the causes are (Drugie..., n.d.):

- generalization of premarital sexual intercourses
- delay of the age of marriage
- diversification and generalization of alternative relationships
- the increase of permanent celibacy strengthening (living without any relationships)
- increase of divorce rate
- generality of childless families
- multiplicity and diversity of partnerships within one individual’s life
- reduction of proportions among individuals in formal marriages
- decrease in the average number of children per family
- disappearance of numerous children
- increase of voluntary childlessness
- generalization of contraceptives
- delay of procreation age
- the process of fertility decline remaining at a constant mortality rate that leads to a significant decline in population.

The second of these processes affecting the population, namely mortality, is associated with conditions of living. Improving those conditions can reduce mortality. From the standpoint of demographic security of society, not only population is important but also its structure according to sex and age. The structure of population, according to sex and age, can be described by age pyramids. Figure 3 shows world’s age pyramid in 1950 and Picture 4 the forecast age pyramid 100 years later, in 2050.

The changes that have occurred in the distribution of the population are the result of changes in the processes of births and deaths. Pyramid in Figure 3 shows the progressive structure of a population characterized by a large number of births, but also a large number of deaths. Such a pyramid could characterize the distribution of the population in the first phase of demographic transition. Age pyramid from year 2050 shows the population stagnation, which is characterized by the fact that the proportion of people of all age groups is approximately the same. The process of transition of population structure is called the ageing of the population.

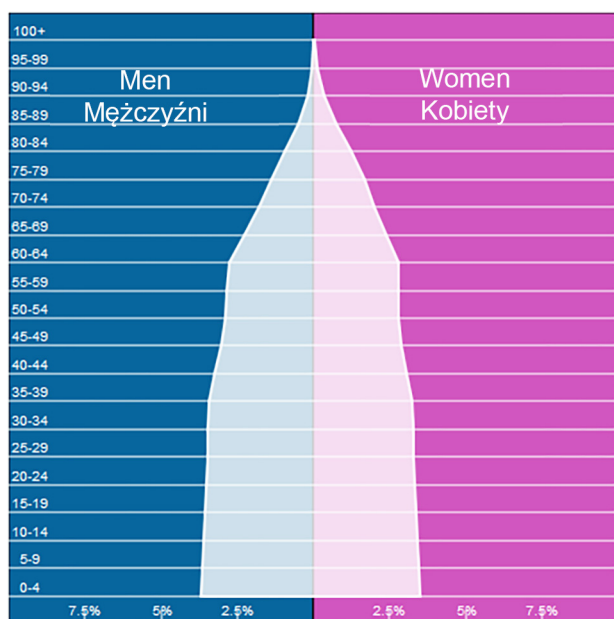


**Fig. 3.** Population Pyramid of World in 1950

Source: Population... (n.d.), <http://populationpyramid.net/world/1950/>.

**Rys. 3.** Piramida wieku ludności świata w 1950 roku

Źródło: Population... (b.d.), <http://populationpyramid.net/world/1950/>.



**Fig. 4.** Population Pyramid of World in 2050  
Source: Population..., n.d., <http://populationpyramid.net/world/2050/>.

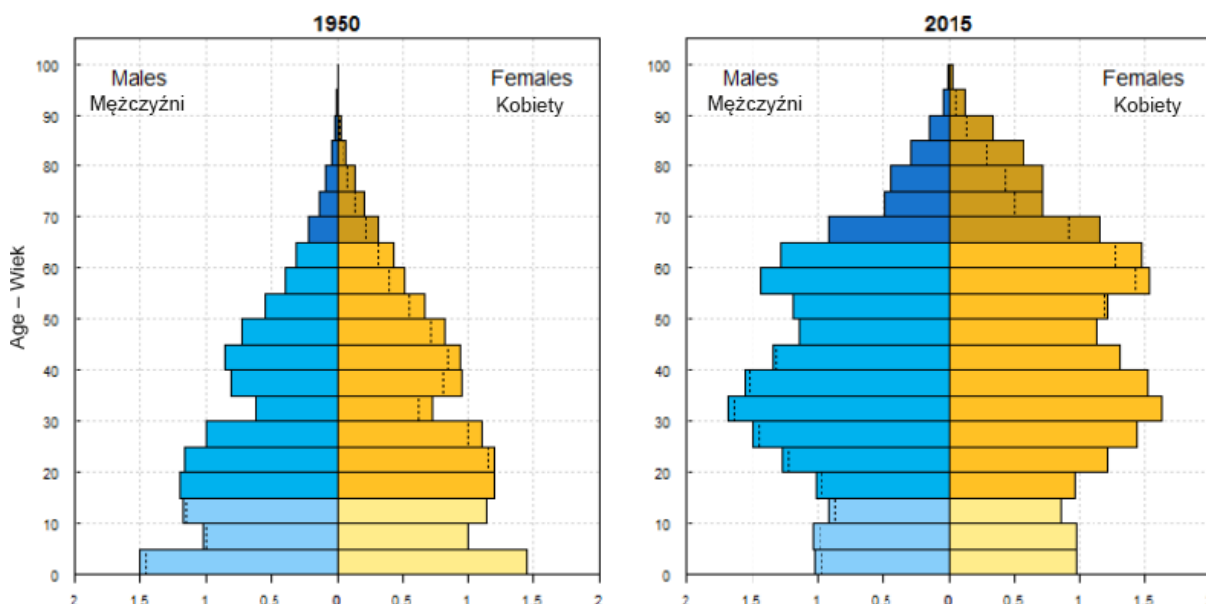
**Rys. 4.** Piramida wieku ludności świata w 2050 roku.  
Źródło: Population..., b.d., <http://populationpyramid.net/world/2050/>.

The measure of ageing of the population OAR (old-age-rate) is defined as the share of the population aged 65 years and older in the total population number. For the World population in 1950, OAR ratio was 5.1%, whilst the population in 2050 will be equal to 15.5%. Presently, that is for 2015, the rate is 8.3% which means that for every 100 people who currently live, 8 of them are aged over 65. For Western Europe the index of old age presently equals 19.5% (basing upon data by United Nations, Department of Economic and Social Affairs, Population Division).

### DEMOGRAPHIC CONDITIONS IN POLAND

Number and structure of population in Poland in 2015 is shown in Figure 5.

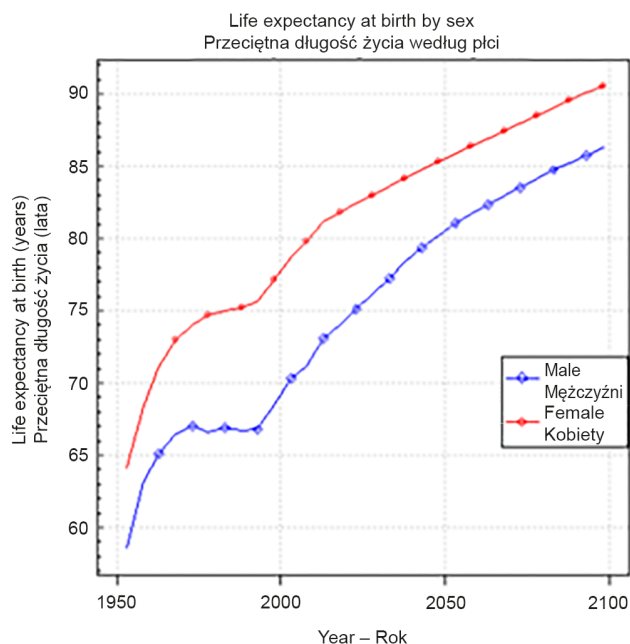
Observing the process of births, one will notice that since the beginning of 90s, the birth rate continued to decline. Perhaps the reason for this is that Poland was in the period of the Second transformation. Literature provides us with two types of factors ([www.demografia.uni.lodz.pl/dlastud/urodzenia\\_zgony\\_reprodukcja.pdf](http://www.demografia.uni.lodz.pl/dlastud/urodzenia_zgony_reprodukcja.pdf)).



**Fig. 5.** Population Pyramids of Poland in 1950 and 2015  
Source: ESA, n.d., <https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/>.

**Rys. 5.** Piramida wieku ludności w Polsce w 1950 i 2015 roku  
Źródło: ESA, b.d., <https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/>.

Demographic factors which include the structure of the population according to sex and age are (excess of male mortality, ageing women) late marriages, migration and also economic factors such as professional activity, the desire to educate, difficult living conditions. It is also known that Poland has never promoted pro-natal policies. Tax policy is also not family friendly in case of large families. Until 2015 the only two tax reliefs available for families were an option of filling a joint tax return for married couples and single parents and a small tax deduction per dependent child (approximately 1000 PLN). Existing government monthly cash assistance in the amount of 500 PLN per second and each additional child is definitively a financially better option for families. Up until this year the government limited its help to emergency assistance to the most needy families through activities of social welfare centers. Solving the problem of population may be helped via proper immigration policy. However, the proposal of such a solution to the problem would raise a lot of controversy at the moment.



**Fig. 6.** Life expectancy at birth man and women in Poland  
Source: ESA, n.d., <https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/>.

**Rys. 6.** Przeciętna długość życia mężczyzn i kobiet w Polsce  
Źródło: ESA, b.d., <https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/>.

However, one can see, that at the end of 2014 the number of births increased to a level higher than the number of births in 2013. It is probably due to availability of longer maternity leaves. This would mean that Polish families somehow respond to pro-natal policies.

Health condition of Polish society is continually improving and it leads to lengthening of the average duration of life of the society (Ostasiewicz, 2000). Figure 6 shows a graph presenting the average life expectancy of men and women in 1960–2100.

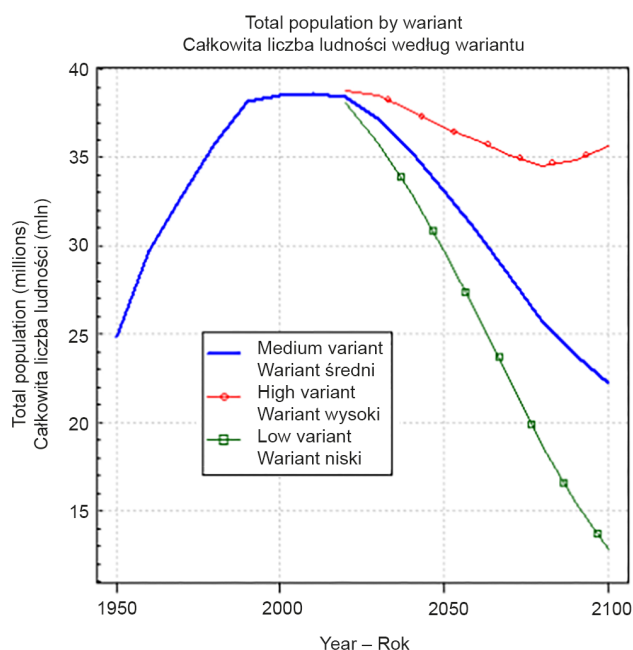
As can be seen, life expectancy, for both men and women, is steadily increasing. Unfortunately, the average life expectancy for men is about 10 years shorter than the average life expectancy for women. This is not a Polish phenomenon, there is a similar trend in majority of the developed countries. Average life expectancy in Poland in 2015 was 81.6 for women and 73.5 for men. On average, the longest living population in the world is Japanese. In 2015 the life expectancy was 88.26 and 81.40 for women and men respectively.

It is in the best interest of any given person to live the longest life; however from the society's point of view the matter looks slightly different. A large number of elderly people, such as retirees, causes many economic and social complications.

Longer average life expectancy is unquestionably a positive change. However, a longer life does not necessarily mean a healthier life. We face the problem of handicapped population. Due to the advances in medicine we have treatments for many diseases, however patients are often left physically and/or mentally disabled. They require long term specialistic care not readily available in Poland. Polish health care system is not prepared for population becoming steadily older. In 2015 there were only 321 geriatricians in Poland, which translates into 0.8 geriatrician per 100 thousand citizens. During the same year in Slovakia that indicator was 3.1; and in Sweden there were 8 geriatricians per 100,000 citizens.

In Figure 7 three variants of Polish populations are shown. Each variant forecasts decrease of population, but at a various pace.

If the number of births is low, and an average lifetime is long, then the age pyramid is regressive. For the population in 1975 ageing rate OAR was 13.5 and the rate characterizing the ratio of the number of people at retirement age per population of working age was equal to 14.3. If the 2050 forecast population pyramid coefficients are respectively equal to 14.3 and 55.8 it means



**Fig. 7.** Number of people in Poland according to different variants of forecast

Source: ESA, n.d., <https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/>.

**Rys. 7.** Liczba ludności w Polsce według różnych wariantów prognozy

Źródło: ESA, b.d., <https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/>.

that in 1975 there were 100 workers per 14.3 pensioners, and according to the forecast for 2050, the number will grow up to 55.8 pensioners.

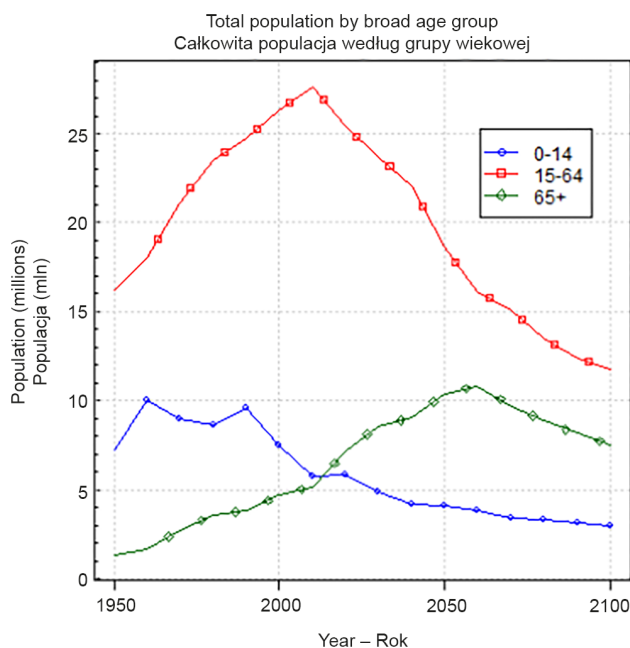
The system of superannuations is based on the principle of intergenerational solidarity (Pas-As-You-Go). Premiums of currently working people are used (in the range of the first pillar) to pay out pensions and retirement pensions. Intergenerational Pension Entitlement Capital calculated for every insured person is only a record/entry because accumulated money is already spent on current payments (Kośny, 2013). The idea associated with Insurance Pillar II as well proved to be unsuccessful in Poland. Poland as a country does not have the tradition of individual insurance policies (the so-called Third pillar). In this situation, Poles can mainly rely on pensions which will be paid from the first pillar.

In Poland obligatory retirement age, which was in force, was 65 years for men and 60 for women. Two years ago the system was reformed. The reform was based on

a gradual levelling of retirement age, for women and men to up to the age of 67. The changes would reduce the ratio of pensioners to the number of employees. Currently, under election campaign, a bill restoring the previous retirement age has been submitted to the parliament. However, it seems that in our demographic situation enacting of such an act would be very irresponsible.

Scrutinizing Figure 8 a very worrying fact can be seen: if population processes in Poland proceed as it has been so far, then around 2020 the number of people at pre-procreation and post-productive age will be equal. In the following years the number of people at retirement age will constantly be increasing compared to the population of pre-procreative age. One might start wondering how pension system will work.

There is no doubt that the average human life expectancy has been increasing. However, the prolonged life



**Fig. 8.** Number of people in Poland divided by age (working age, pre-working age and post-working age)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision*.

**Rys. 8.** Liczba ludności w Polsce z podziałem na grupy wiekowe (wiek produkcyjny, wiek przedprodukcyjny i wiek poprodukcyjny)

Źródło: United Nations, Department of Economic and Social Affairs, Population Division (2015). *World Population Prospects: The 2015 Revision*.

expectancy of people who are old and sick comes down to prolonging the period of disease and infirmity. Health situation of the younger population is also important. The health safety of the population can be inferred on the basis of population survival functions determined by the probability that a person aged  $x$  will live at least another  $t$  years. In literature this function is called  $S_x(t)$ . The problem is not the focus of this publication.

## CONCLUSION

The decline in birth rate and emigration taking place in recent years have a big impact on the population of Poland. The emigrating, well educated people, leave behind them an ageing society process is rapid. This process of depopulation may be threatening and in turn a very rapid collapse of the pension system may take place. What should we do to stop this process? Of course, the best solution is to increase the number of births. Social policy of the state should go this direction, which is not particularly difficult due to the fact that economic factors that influence the number of births are commonly known.

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## WYBRANE DETERMINANTY BEZPIECZEŃSTWA DEMOGRAFICZNEGO

**Streszczenie.** W prezentowanym artykule przedstawiono w uproszczony sposób wybrane teorie ludnościowe, aby na ich gruncie wyjaśnić aktualne tendencje rozwoju ludności w Polsce i na świecie. Celem artykułu jest prezentacja zagrożeń demograficznych, które pojawiły się w ostatnich osiemdziesięciu latach. Analizowano też prognozowane struktury wieku. Wskazano na istotne różnice w strukturze ludności obecnie oraz w przyszłości, szczególnie na procesy starzenia się ludności. Na tle przemian światowych dokonano analizy sytuacji w Polsce. Porównanie wskazuje na to, że przemiany w Polsce mają analogiczny przebieg jak te dokonujące się na całym świecie, a są to: zmniejszająca się liczba urodzeń i wydłużające się przeciętne trwanie życia. Zmiany te powodują starzenie się ludności, co może doprowadzić do załamania się rynku pracy i funkcjonującego systemu emerytalnego.

**Słowa kluczowe:** transformacja demograficzna, piramida wieku ludności, wskaźnik starości, oczekiwane trwanie życia

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