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POPULATION CHANGE AND FERTILITY DECLINE IN INTERWAR POLAND: SPATIAL PERSPECTIVES



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*„It is better to be approximately right
Than preciselly wrong”
John Maynard Keynes*

PLAN OF THE PRESENTATION

- ✓ Introductory remarks
 - The objectives of research,
 - Sources of statistical data
 - Methods of analysis,
 - Socio-economic determinants of demographic processes in Poland in the years 1918-1939
- ✓ Changes in the state and structure of the population
- ✓ Changes in fertility
- ✓ Changes in mortality
- ✓ Natural increase of the population. Reproduction of the population..
- ✓ Spatial diversification of vital statistics of population. Identification of differences between groups of provinces (between the western and eastern)
- ✓ Spatial diversification of female fertility measured by the Princeton European Fertility Project indices,
- ✓ Conclusions



THE OBJECTIVES OF RESEARCH

- ✓ Presentation of population changes in interwar Poland .
- ✓ The location of changes in fertility, mortality, reproduction of the population in the context of the concept of the first demographic transition
- ✓ In particular, determination of phases of demographic transition.
- ✓ Determination of the population explosion (maximum of natural increase),
- ✓ Consideration of disparities between particular provinces of Poland (groups of voivodships) in demographic processes due to economic and socio-psychological consequences of different rules of partitioners (Prussia, Austria and Russia) and hence diversity of socio-economic development of Polish provinces.
- ✓ Identification of differences in demographic processes between particular Polish provinces – an attempt to determine demographic development lagging in a given province in relation to others
- ✓ Diversity of female fertility based on the Princeton European Fertility Project indices – spacial perspectives.



DATA SOURCES

The sources of figures:

- ✓ official data published by the Central Statistical Office (CSO), including
 - The results of the Polish census of 1921 (30 September) and the census of 1931 (9 December) –
 - basic information about the size and the structure of the population,
 - data on the current registration of population vital statistics,
 - the balances of the size and population structure as of 1.01,
- ✓ and also data from analytical studies like S. Szulc, M. Kędeliski, S. Borowski, E. Vielrose, K. Zamorski

Note 1

Full comparability of data is limited because different areas were covered by particular censuses (for example, the census of 1921 did not cover Upper Silesia and Vilnius Land; the census of 1931 covered the whole territory of Poland in borders from 1931)

Note 2

In opinion of many demographers in the interwar period data regarding the vital statistics of population were not satisfactory. Shortcomings of registrations were territorially differentiated. The most accurate registration of the vital statistics was in the western provinces, and the least in the eastern provinces and slightly better in the central provinces. This was due to inappropriate registration of demographic facts among the Jewish population. This fact was reflected in the official publications of the CSO.

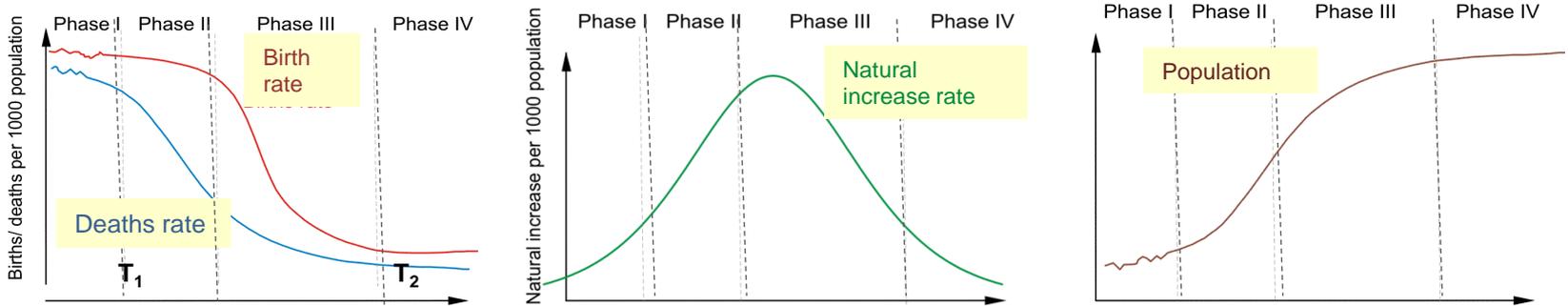


DATA ANALYSIS METHODS

The analysis of the process of demographic transition presented in the paper is based on the four-phase model..

Phase of demographic transition

phase I - high stationary, phase II - early expanding, phase III - late expanding, phase IV - low stationary



However, this analysis (in terms of changes in the rate of births and deaths) can be done from the second phase because the time series of the natural movement in the Second Polish Republic are too short.

In order to determine the **beginning and end** of the "right" demographic transition (beginning of the phase II and IV), in the case of raw fertility and mortality rates, **the non-linear regression - approximation by the anti-logistic function** - $y(t)$ in combination with a method of simple substitution were used. (look B.Radzikowska*)

$$\hat{y}(t) = c - \frac{a}{1 + be^{-dt}}$$

The process of demographic transition (the process of displacement of one technology by a new one) according to JC Fisher and RH Pry method of a simple substitution on fertility (mortality) occurs when the value of anti-logistic function is equal to 10% of the maximum level - point T_1 , and ends at 90% of the maximum level - T_2 .

The approximation of **the exponential function** was used in order to determine the population explosion (maximum population growth). "Population Explosion" is a period in which there are maximum values of the rate of birth – in the time of interval from turning point of phases II and III to the moment in which decreasing tendency of fertility is falling (for example: inflection point of fertility trend) 245.

*B. Radzikowska, „Płodność w Polsce w kontekście teorii przejścia demograficznego. Modelowanie i prognozowanie”, Wrocław, 1995

SOCIO-ECONOMIC DETERMINANTS OF POPULATION PROCESSES IN POLAND IN THE YEARS 1918-1939

Selected socio-economic determinants of demographic processes in Poland in the years 1918-1939:

- ✓ Consequences of the war:
 - economic losses- war destructions caused by the war and robbery economy of occupants; broken economic ties with the former partitioners of Poland after 1914,
 - demographic losses - loss of population, and disturbances of demographic processes: intensive migration movements, and changes in the population structure, distortions of trends of vital statistics of population.
- ✓ difficulties in merging lands of three partitions -differences in the economic and social structure in different parts of the country – groups of voivodeships,
- ✓ structure of the economy - agricultural character of the Polish lands (in 1929, <http://en.wikipedia.org> agricultural production accounted for about 68% of the total value of production), including the unfavorable structure of agriculture (in 1931 – farms up to 5 ha accounted for approximately 64% of all farms, and farms with an area of 50 hectares or more - 0.5% and 45% of the land),
- ✓ large economic fluctuations,
- ✓ social problems (such as illiteracy, unemployment, overcrowding of villages)
- ✓ complicated national-religious structure of the population.

SOCIO-ECONOMIC DETERMINANTS OF POPULATION PROCESSES IN POLAND IN THE YEARS 1918-1939.

Difficulties in merging lands of three partitions

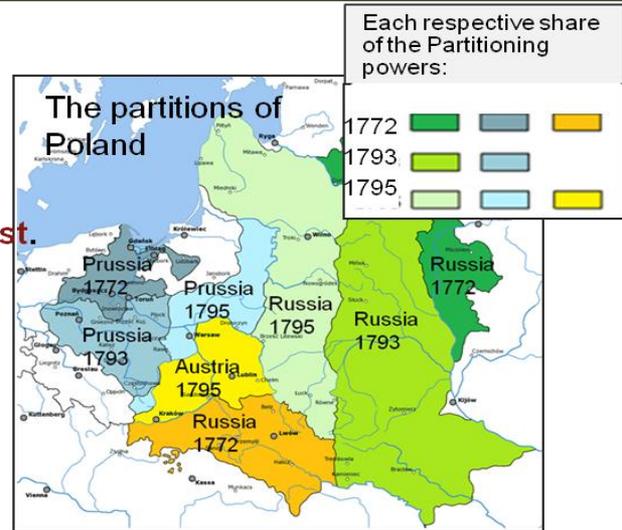
THE PARTITIONS OF POLAND (Austria, Prussia, Russia)

1772 - first partition

1793 - second partition (Austria did not participate)

1795 - third partition of Poland

With this partition, the independent Polish state ceased to exist.



Specification	Cumulative division of the Commonwealth territor			
	To Austria	To Prussia	To Russia	Total annexed
Area in thous. km2	128,9	141,4	463,2	733,5
in %	14.6	19.3	66.2	100,0%

[Atlas historyczny Polski, B. Gediga 1996, s. 18.]

<http://en.wikipedia.org>

1914-1918 The First World War

the Second Polish Republic



M.Paździora, <http://pl.wikipedia.org/>

1939-1945 The Second World

AREA AND ADMINISTRATIVE DIVISION OF POLAND

After the demarcation in 1923 the area of the Second Polish Republic was 388.6 thousand km², of which land of former Russian partition was approximately 69% of the territory, Austrian partition - 20%, Prussian partition - 11%.

Change in the Polish area in 1939 resulted primarily from the joining of Trans-Olzia Silesia (about 906 km²) and minor border areas near the border with Czechoslovakia in October 1938. Moreover, boundaries of Silesian and Cracow voivodships were changed. For administrative purposes, Poland was divided into voivodships, powiats and gminas. There were 16 voivodships, and Warsaw as a city with the rights of the voivodship.

The census of 1931 showed that the population of Polish was about 31.9 million. Most people lived in the central district (the largest area among others) - 13.4 million. **Eastern** and **western** districts are particularly interesting. The smallest one (in the sense of area and population) was western district. Its area was 2.5 times smaller than the area of the eastern one. However density of population in the West of Poland was over twice as much as in the eastern district.

Area and population of Poland based on census 1931

Specification	Area		Population		
	in thous. of km ²	in %	in thous.	in %	per 1 km ²
Poland total	388,6	100,0	31942	100,0	82
Groups of voivodships					
Central	137,8	35,5	13390	41,9	97
East	124,4	32,0	5548	17,4	45
West	47,2	12,1	4499	14,1	95
South	79,2	20,4	8505	26,6	107

Source: *Mały Rocznik Statystyczny 1939, GUS, Warszawa*



AREA AND ADMINISTRATIVE DIVISION OF POLAND

The reconstruction of the Polish state after World War I.



Voivodships of the Second Polish Republic - administrative division as 1.IV.1932



Source: own analysis based on "Atlas Historyczny Polski", Państwowe Przedsiębiorstwo Wydawnictw im. E. Romera, Warszawa, 1987, pp. 42-44.

In the interwar Poland was divided into groups of voivodships corresponding more or less to former partitions, which were different in respect to economy, culture, customs, law.

Particularly strong differences emerged between the Russian partition areas - the eastern lands and the western lands of the Prussian partition.



STRUCTURE OF POPULATION OF POLAND BY DECLARED RELIGIOUS DENOMINATIONS AND NATIONALITY

The first census of 1921 included questions about both nationality, mother tongue and religion. The census of 1931, contained questions only about the mother tongue and religion, there was not a question about nationality

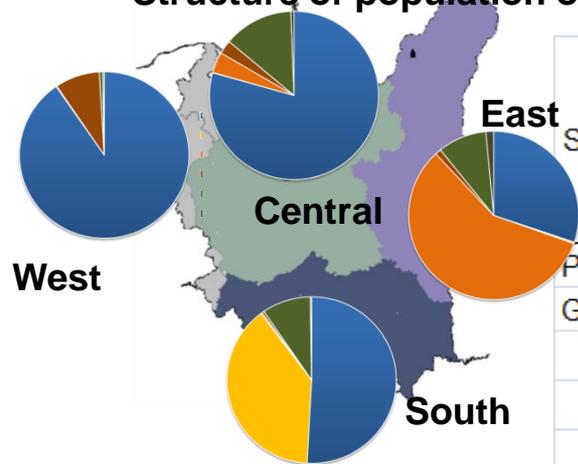
Nationality

According to the census of 1921 the total number of Polish population declared Polish nationality was **69.2%** of the total. In the post-war Poland, the population structure according to a national declaration was studied in the census of 2002 (Polish nationality was declared by **96.7%** of the total population) and in 2011 (homogeneous Polish national identity was declared by **93.9%**).

Confession. Religion

Religion, according to the census form explanations is a confession to which a person "formally belonged" regardless of its religious belief. Non-confessional is a person who does not belong to any religious connection. According to censuses, in 1921 and 1931 Catholic religion (75%) dominated in Poland. Believers of the Orthodox and the Jewish formed relatively large groups.

Structure of population of Poland by declared religious denominations (1931)

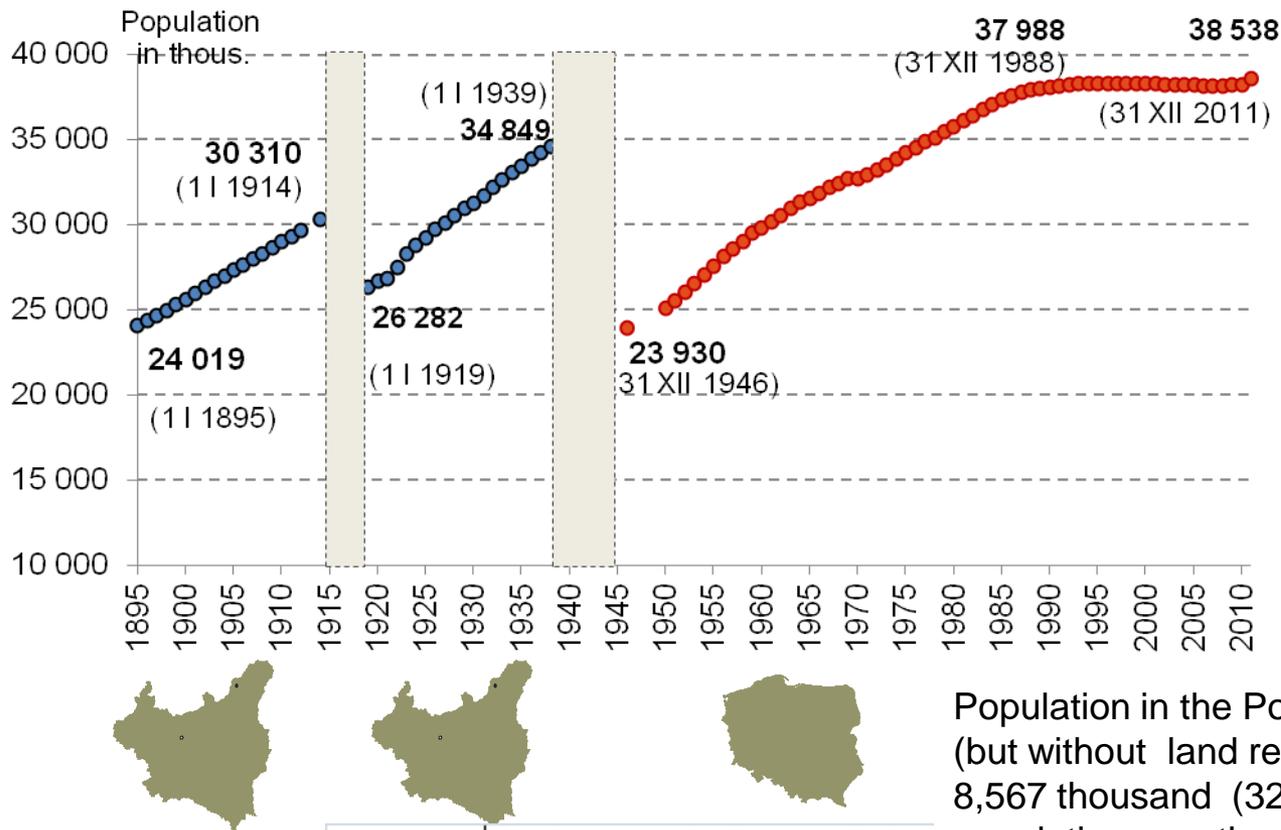


Specification	Declared religious denominations					
	roman catholic	greek catholic	orthodox	protestants	jewish	other
	in %					
Poland	64,8	10,5	11,8	2,6	9,8	0,6
Groups of voivodships:						
central	79,4	0,1	4,0	2,6	13,3	0,6
east	30,2	0,3	57,6	1,1	9,3	1,5
west	90,4	0,1	0,1	8,5	0,7	0,3
south	50,9	38,9	0,3	0,4	9,3	0,2

The data indicate a difference in the population structure by declared religious denominations in the analyzed groups of voivodships.

CHANGES IN THE SIZE AND DISTRIBUTION OF POPULATION

Population of Poland for years 1895-2011



The graph shows the dynamics of the population on Polish territory in the years 1895-1939 (in Polish borders of interwar period) and in the years 1946-2011 (in present Polish borders).

The consequence of the First World War was the loss of about 4.028 million of population, approximately 13.3% of population before the war. In 1927, 8 years after the war, the Polish population reached a level from 1914.

Population in the Polish state within borders from 1939 (but without land regained in 1938) increased by 8,567 thousand (32.6%). The average annual population growth was 428 thousand of people, while in the period 1895-1914 only 331 thousand. For comparison, in the decade 1950-1960 in Poland (in contemporary borders) annual population growth of 381 thousand persons was recorded.

Nowadays a stabilization of the population number is observed. The average annual population growth for the period 1990-2010 was only 6.4 thousand people

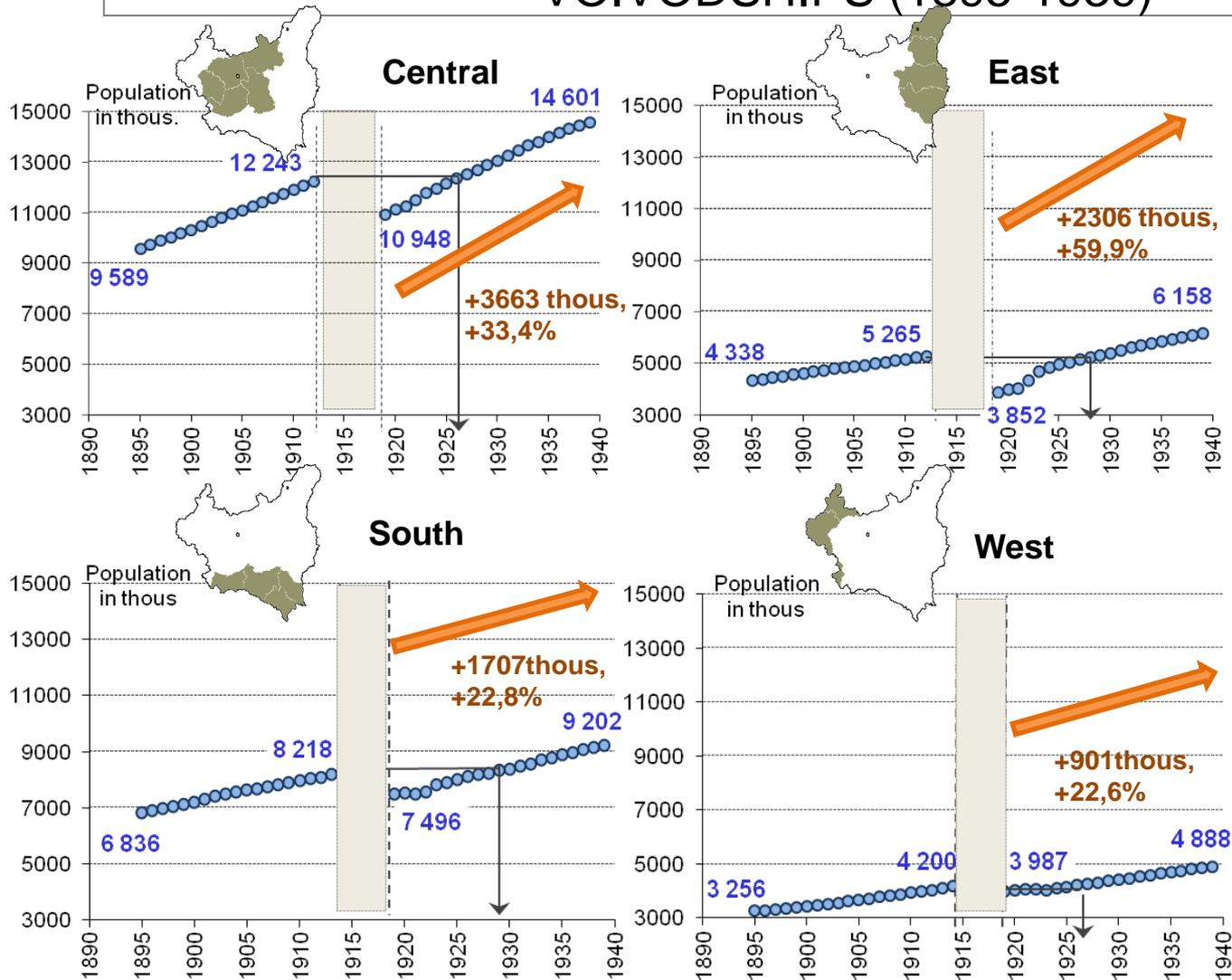
Interval	The increase in the population		
	in thous.	in %	average yearly
1895-1914	6291	26,2%	331,1
1919-1939	8567	32,6%	428,3
1950-1970	7623	30,4%	381,2
1970-1990	5415	16,6%	270,8
1990-2010	127	0,3%	6,4

Source: *Wiadomości Statystyczne* 1931, 1939, GUS, Warszawa, *Mały Rocznik Statystyczny*, 1939, GUS Warszawa, Szulc S. (1936), „*Ruch naturalny ludności w Polsce w latach 1895—1935*”, www.stat.gov.pl.

S. Bartosiewicz, E. Stanczyk, „*Niektóre aspekty historii społeczno-gospodarczej Polski w latach 1918-2011 (na podstawie badań GUS)*”, Wrocław, 2012

Rostock, 11.12.2012

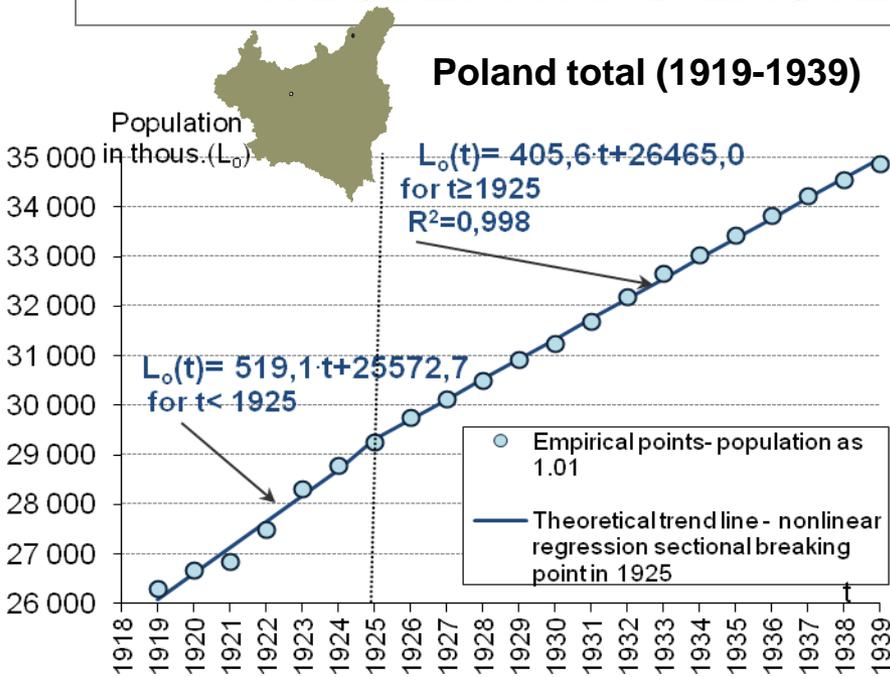
CHANGES IN THE POPULATION OF POLAND BY GROUPS OF VOIVODSHIPS (1895-1939)



In the interwar period, there were large disparities in the population dynamics of the individual Polish districts. Eastern districts had the largest population dynamics. In the years 1919-1939 the number of people increased by 2,306 thousand, which was 59.9% of the population from 1919.

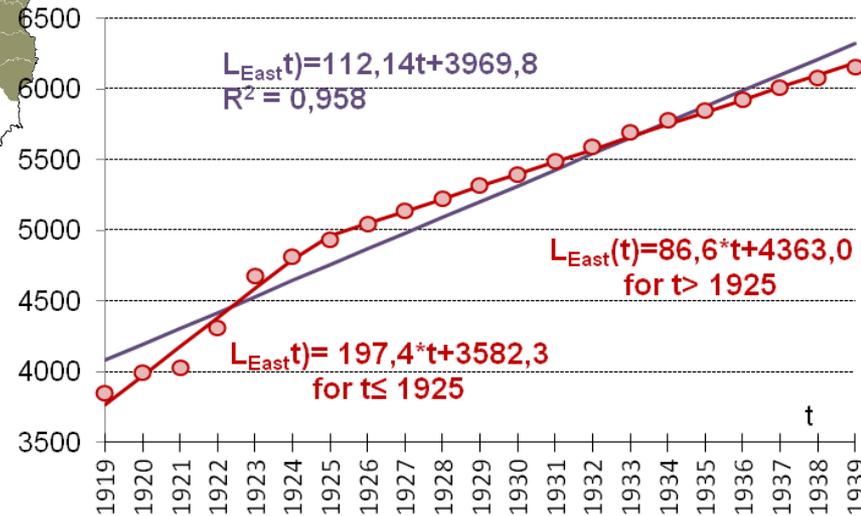
- High population growth also occurred in the central district - population increased by 33.4%.
- In the years 1919-1939 the smallest increases in population occurred in remaining districts of Poland.
- In the western provinces population increased only by 901 thousand, i.e. 22.6% in relation to the beginning of 1919

POPULATION TREND IN THE SECOND POLISH REPUBLIC. WESTERN AND EASTERN DISTRICT IN 1919-1939



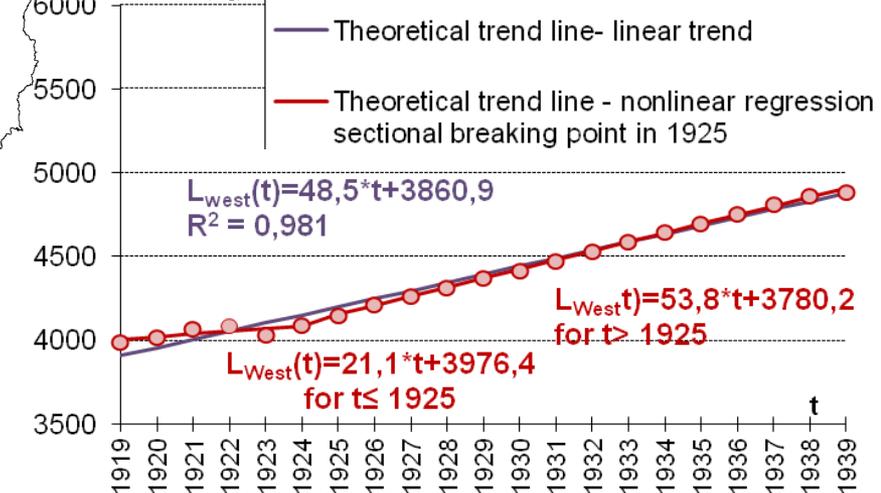
East

Population in thous. (L_0)



West

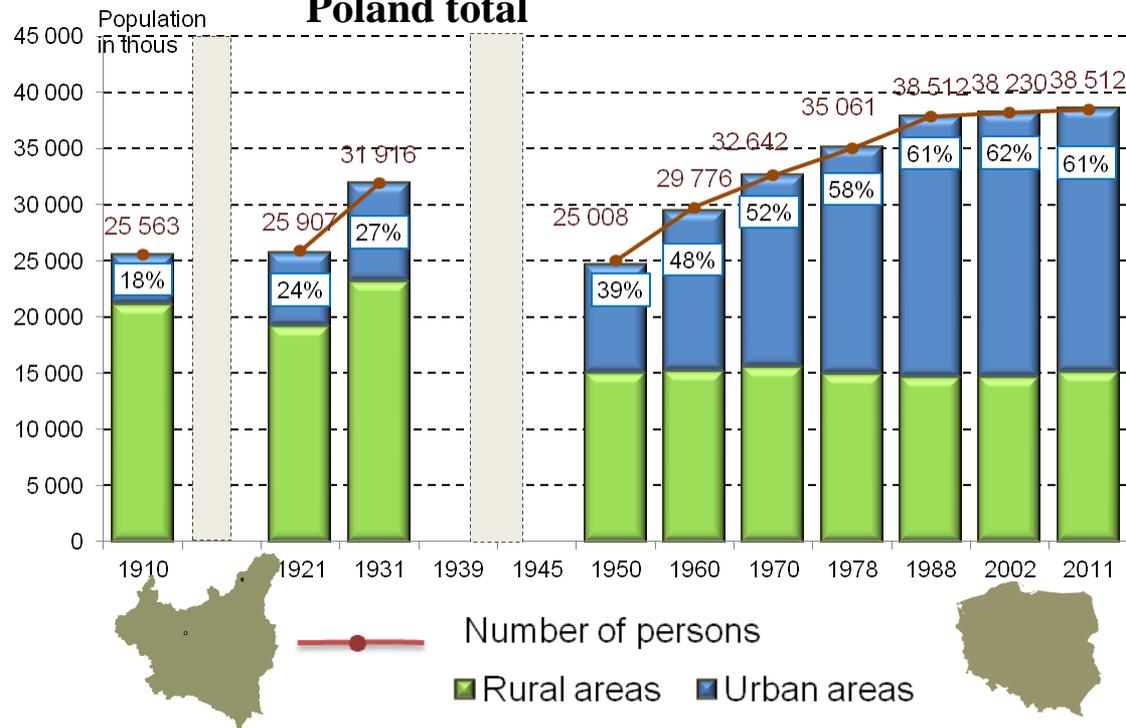
Population in thous. (L_0)



- In the period 1919-1938 the population trend of Polish territory was linear. The largest deviations from the trend line occurred in the early post-war years.
- From the model of two separate linear regression of trend one obtains that the rate of population growth in Poland was higher before 1925 (519 thousand persons / year) than in subsequent years (406 thousand persons / year).
- A similar situation took place in the central, southern and eastern districts, while in the western districts - the rate of population growth was lower in the first years after the war (21 thousand persons / year) than in subsequent years (54 thousand persons / year).

POPULATION OF POLAND IN URBAN AND RURAL AREAS

Poland total



In the interwar period more people lived in rural areas (73% in 1931) than in cities (27%).

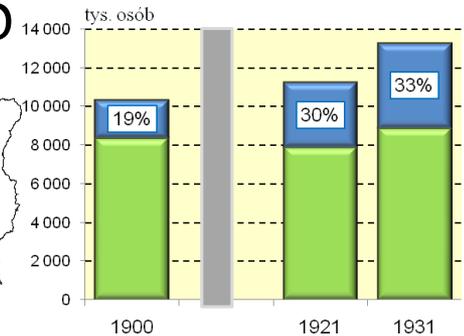
A western district is characterized by the greatest degree of urbanization (35% in 1931), then central (33%), and the smallest – eastern (14%).

Dynamics of changes in size of population in urban and rural areas is clearly visible in the graphs.

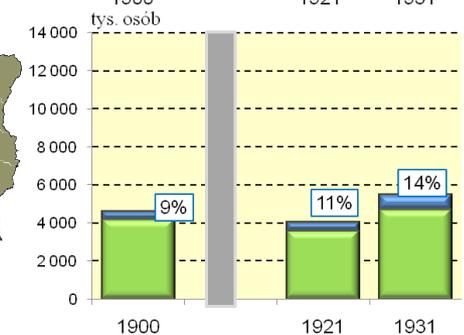
Urban population has been increasing and stabilizing proportionally to the increase and stabilization of population in recent years.

Rate of population was higher in urban areas than in rural areas. The largest urban population growth was in the eastern districts, and the lowest in the central.

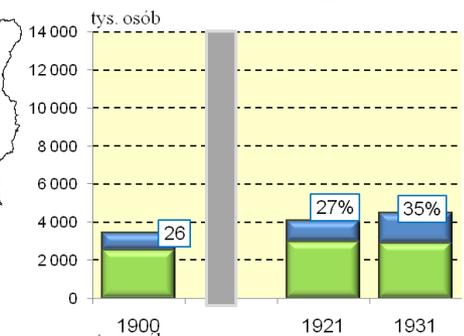
Central



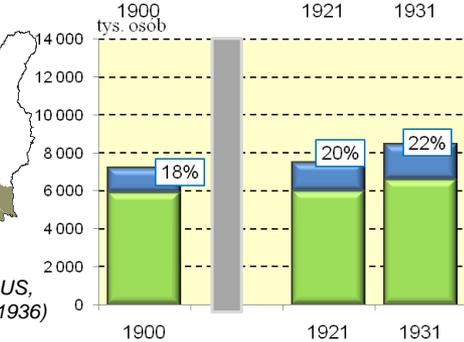
East



West



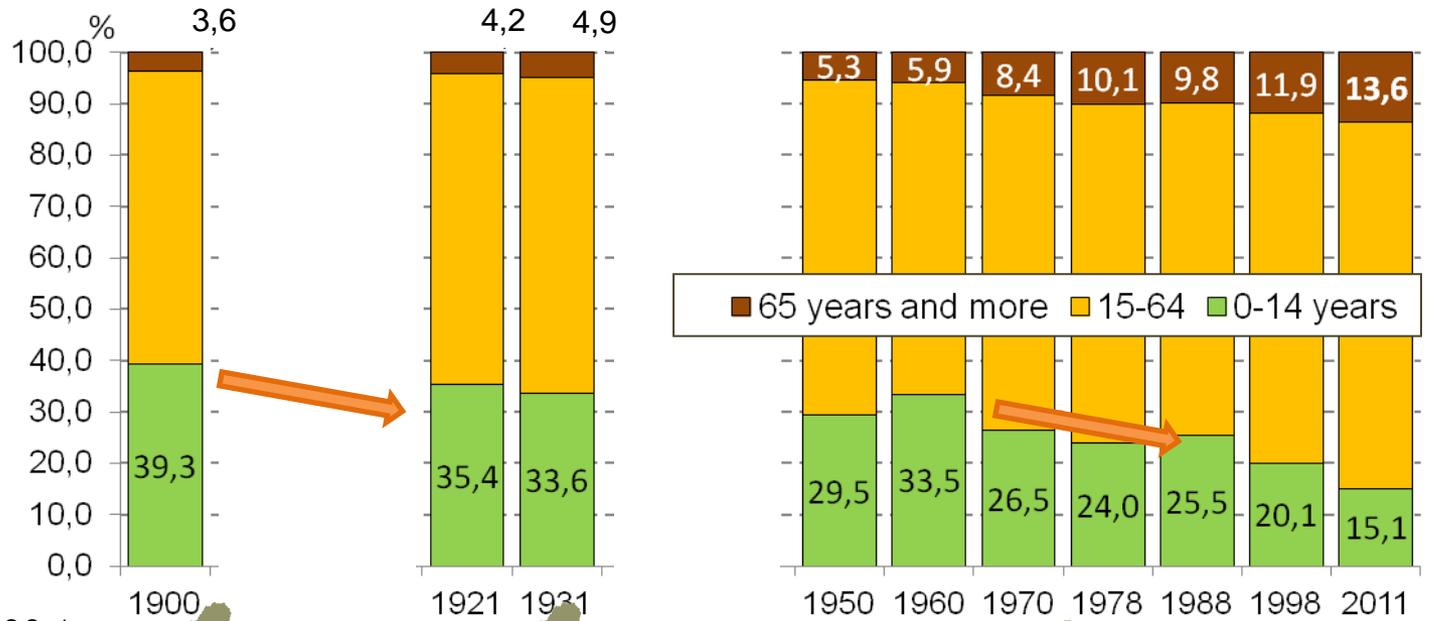
South



Source: Mały Rocznik Statystyczny, 1939, GUS, Warszawa, Szulc S. (1936) www.stat.gov.pl

POPULATION BY BIOLOGICAL AGE GROUPS

Structure of population of Poland by age on the basis of national population census

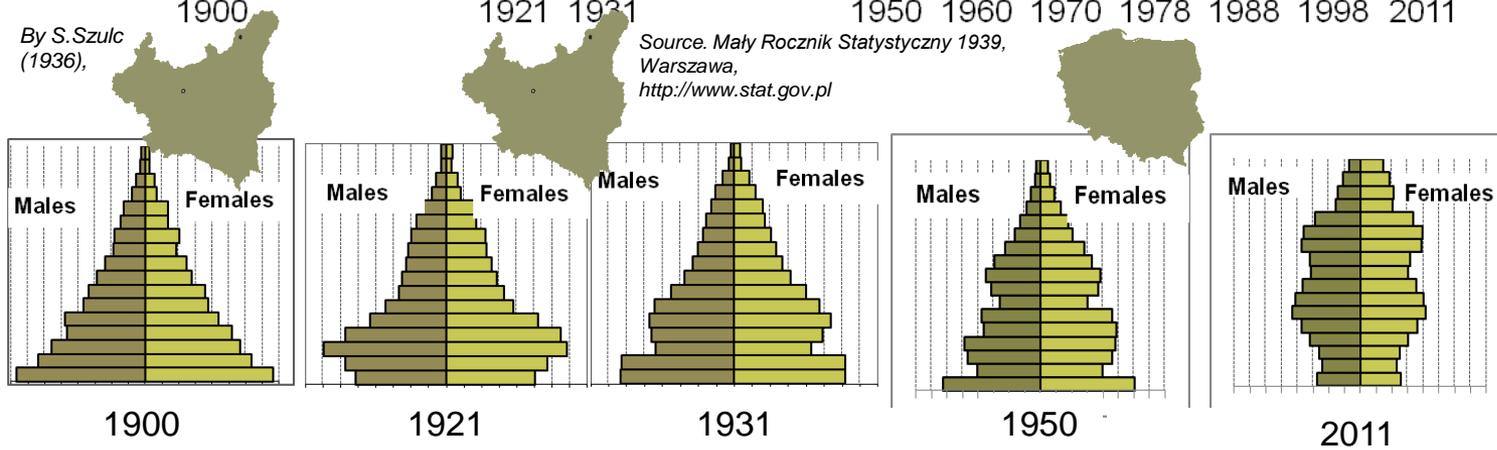


In the chart three basic age groups are distinguished: 0-14 years - children, aged 15-64 - the potential labour force and 65 years and over – seniors.

The chart shows process of population aging. The proportion of the population composed of children (0-14 years) is declining and the proportion of the population that is elderly (aged 65 years and over) is rising.

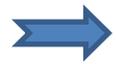
By S.Szulc (1936),

Source: Mały Rocznik Statystyczny 1939, Warszawa, <http://www.stat.gov.pl>



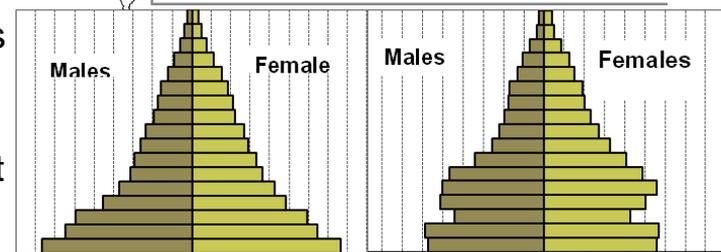
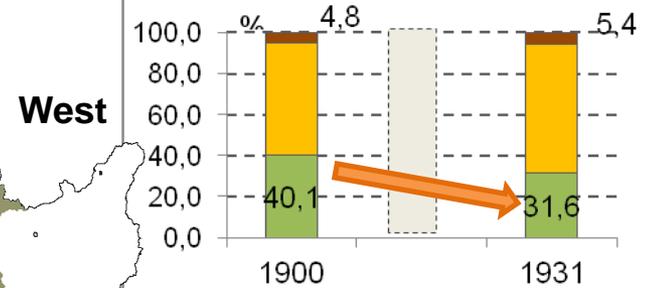
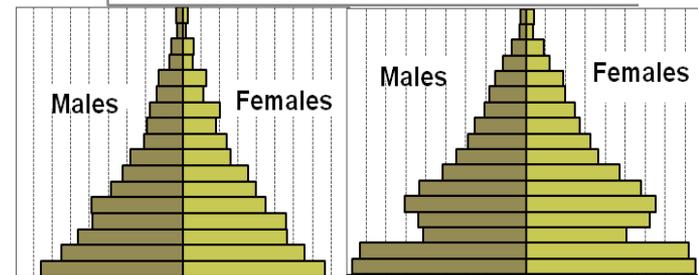
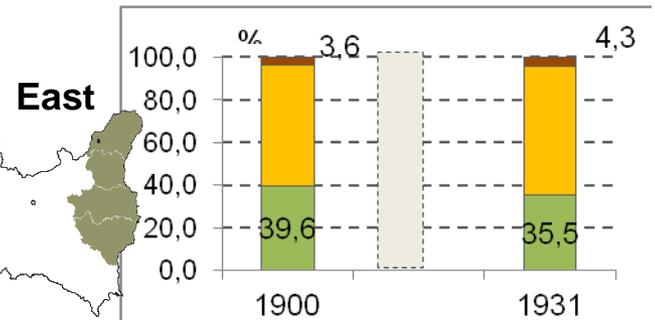
Biological age groups:

- 0 – 14 — children (demographic youth),
- 15 – 64 — adults excluding elderly people, 65 and more — elderly people (demographic old age).



POPULATION BY BIOLOGICAL AGE GROUPS

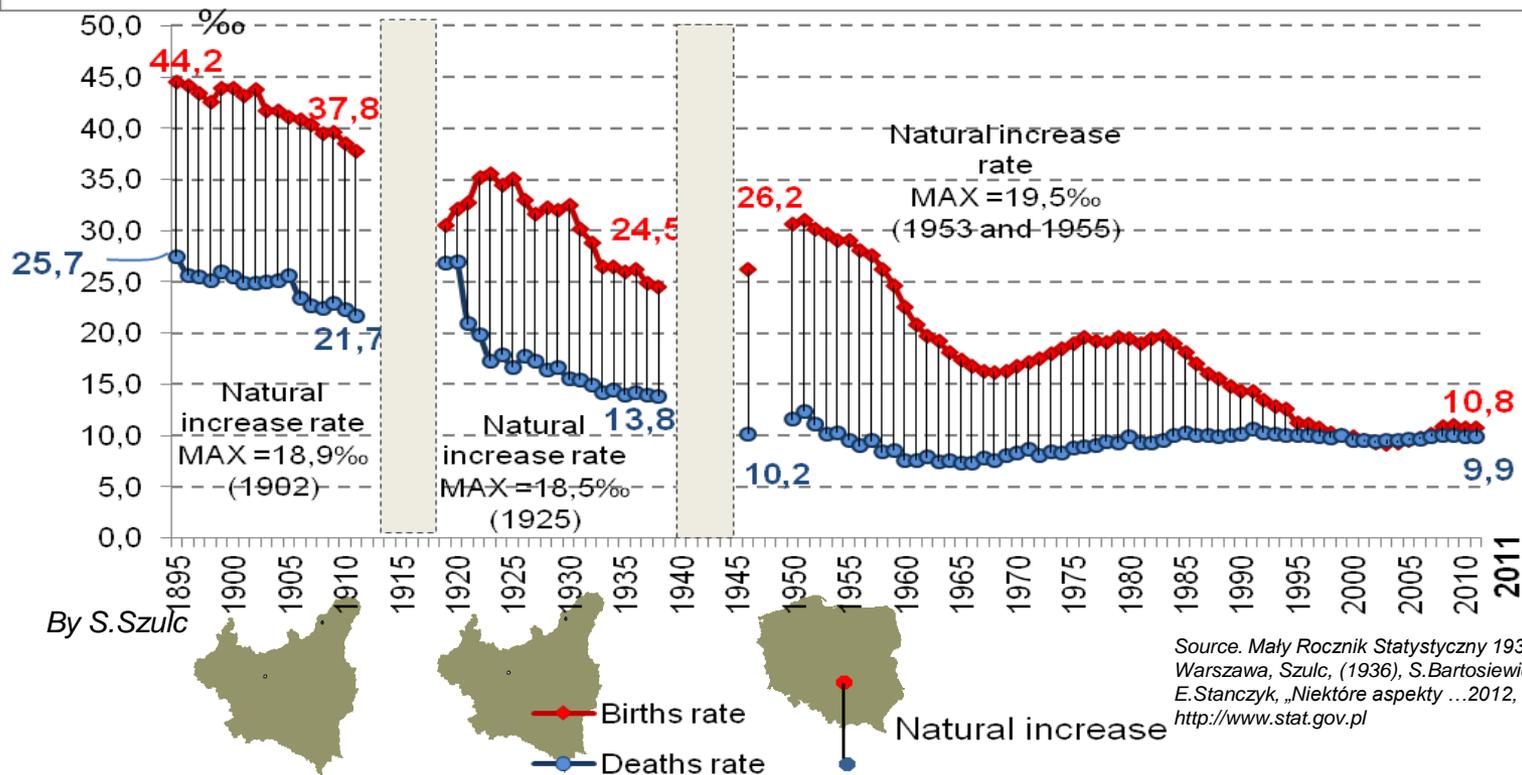
Specyfication		Percent of		Age dependency ratio	
		children (0-14 years)	elderly people (65 years and more)	the ratio of children to persons aged 15-64 years	the ratio of elderly persons to persons aged 15-64 years
Poland	1900	39,3	3,6	68,8	6,3
	1921	35,4	4,2	58,7	7,0
	1931	33,6	4,9	54,8	8,0
	urban areas	28,0	4,9	41,7	7,3
	rural areas	35,8	4,9	60,3	8,3
Groups of voivodships:					
central	1900	39,2	3,6	68,4	6,2
	1931	34,1	5,0	55,9	8,1
east	1900	39,6	3,6	69,8	6,3
	1931	35,5	4,3	58,9	7,2
west	1900	40,1	4,8	72,8	8,7
	1931	31,6	5,4	50,1	8,5
south	1900	38,9	3,2	67,1	5,5
	1931	32,8	5,1	52,9	8,2



The aging population is illustrated by the gradual increase in the dependency ratio of the population aged 15-64 by the elderly (65 years and over) and the decrease in the dependency ratio by children (0-14 years) - particularly evident in the lands of the West.

In 1931, the western regions were characterized by the lowest interest of children and the highest interest of the seniors.

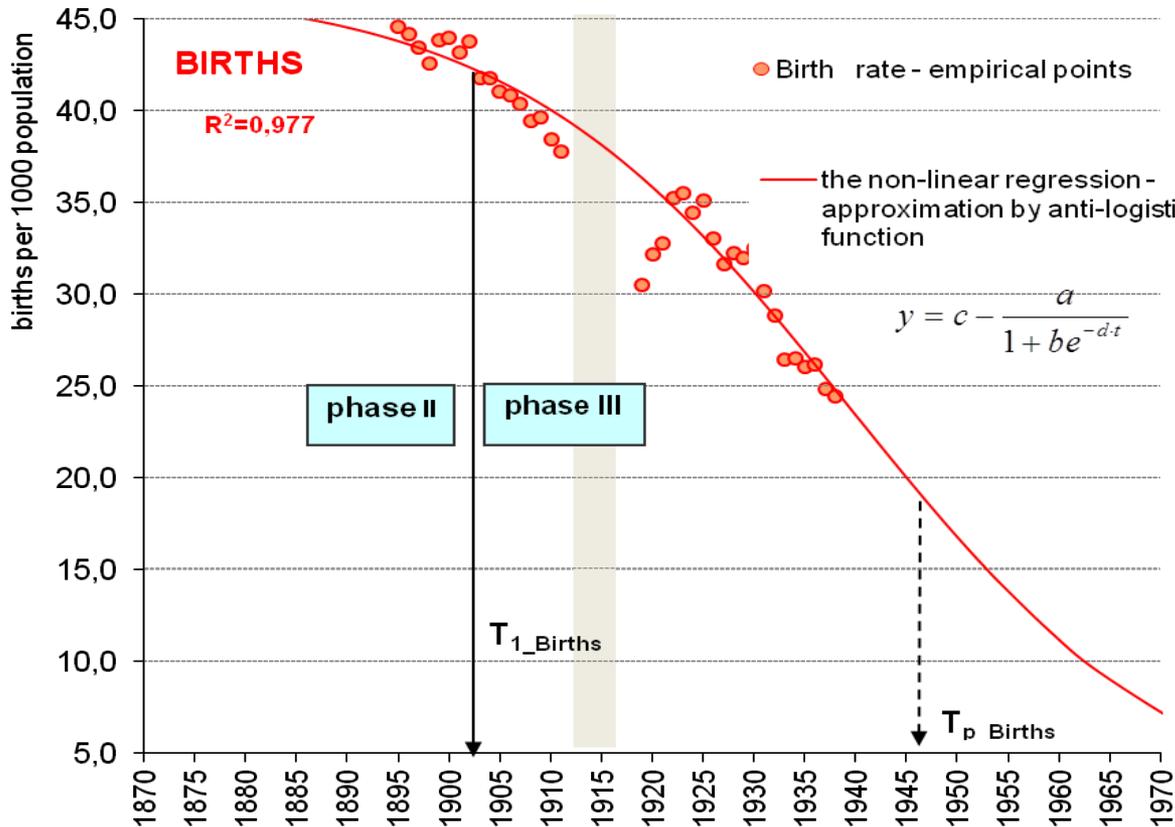
VITAL STATISTICS OF POPULATION IN THE YEARS 1895-2011



The chart presents the vital statistics of the population in Poland. In almost every year of the period a significant excess of births over deaths was observed. Hence population natural increase was positive (negative values occurred only in the years 2002-2005). Before the First World War, as well as in the interwar period, Poland compared to other European countries had high natural increase rate. Annual average natural increase rate in Poland was 16.4 ‰ in the years 1909-1912 whereas in Europe 12.1 ‰. Despite a significant reduction in population natural increase (years 1925-1938) values of the coefficient were in Poland still relatively high compared to the most European countries

CHANGES IN INTENSITY OF BIRTH . POLAND TOTAL

Birth rate and the phases of demographic transition



Source: Own work based *Wiadomości Statystyczne* 1931,1939,GUS, Warszawa, Szulc S. (1936), „Ruch naturalny ludności w Polsce w latach 1895—1935”, E. Stańczyk, „Rodność i umieralność na ziemiach polskich w kontekście teorii przejścia demograficznego”, *Wiadomości Statystyczne* GUS, Warszawa, 2009

Based on empirical data (the number of births for the years 1895-1911 and 1925-1938) the parameters of anti-logistic function , which fit to the data best ($R^2 = 0.977$) were estimated. Using method suggested by B. Radzikow-ska (1988) - a combination of anti-logical function approximation and the method of simple substitution, one can specify:

the beginning of Phase III - T_{1_BIRTHS}
the beginning of the Phase IV- T_{2_BIRTHS}

Due to insufficient data the estimation of the number of anti-logical function parameters is only indicative.

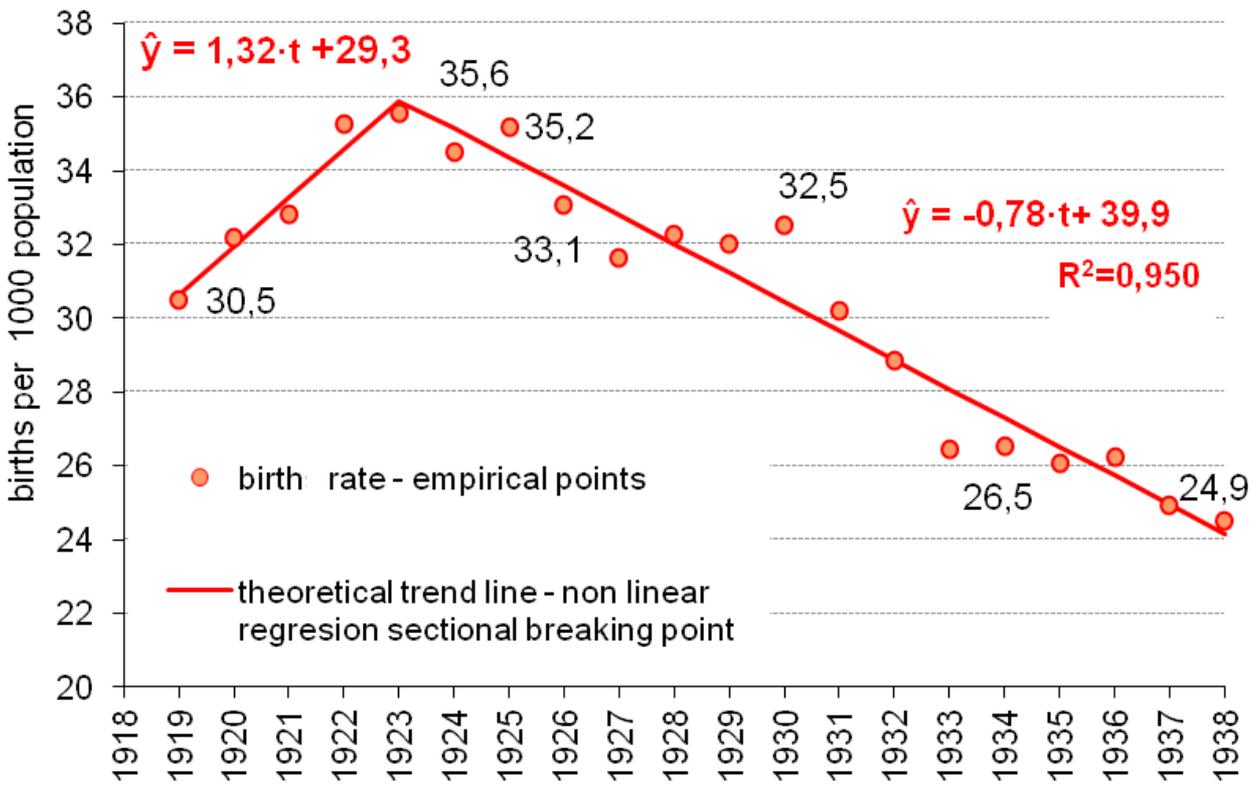
Thus the following were obtained: $a = 46.14$, $b = 15.06$, $c = 46.8$, $d = 0.06$,

$$T_{1_BIRTHS} = 1903 \text{ and } T_{2_BIRTHS} = 1977.$$

This function has a point of inflection (change in convexity) for $T_{p_BIRTHS} = 1940$, i.e. after 1903 there was a significant decrease in fertility - to 1940 fertility decreases sharply, and after 1940 – it falls slightly, until the stabilization of intensity of birth is reached.

CHANGES IN INTENSITY OF BIRTH . POLAND TOTAL

Because of in the previous chart it was hard to see the change in the trend of birth rate in the years 1919-1938, so additionally dynamics of birth rate was described for that period. The model of non-linear regression with the crease for the independent variable (the crease in 1924) was used.



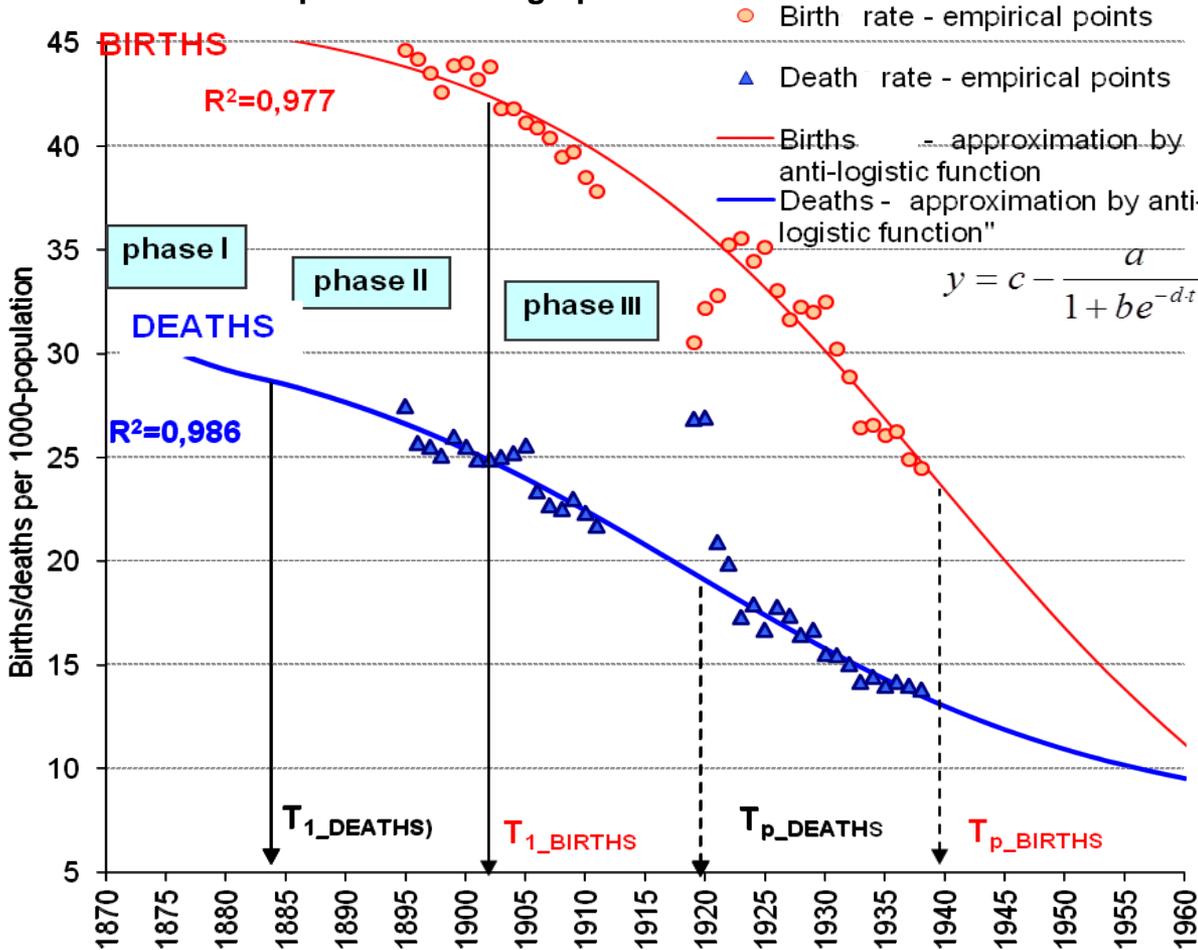
In the first years after the war there was a positive trend, and in subsequent years - with some variations, the negative trend.

The phenomenon of a strong increase in the frequency of births in the early post-war years (from 30.5 ‰ in 1919 to 35.6 ‰ in 1923) can be regarded as a period of compensation in relation to the period of the war, characterized by low levels of intensity of births



CHANGES IN MORTALITY. POLAND TOTAL

Death rate and the phase of demographic transition



Based on empirical data - deaths rates in the years 1895-1911 and 1925-1938 (data for the years immediately after World War I were omitted) the parameters of anti-logistic function, which fit to the data best ($R^2 = 0.986$) were estimated.

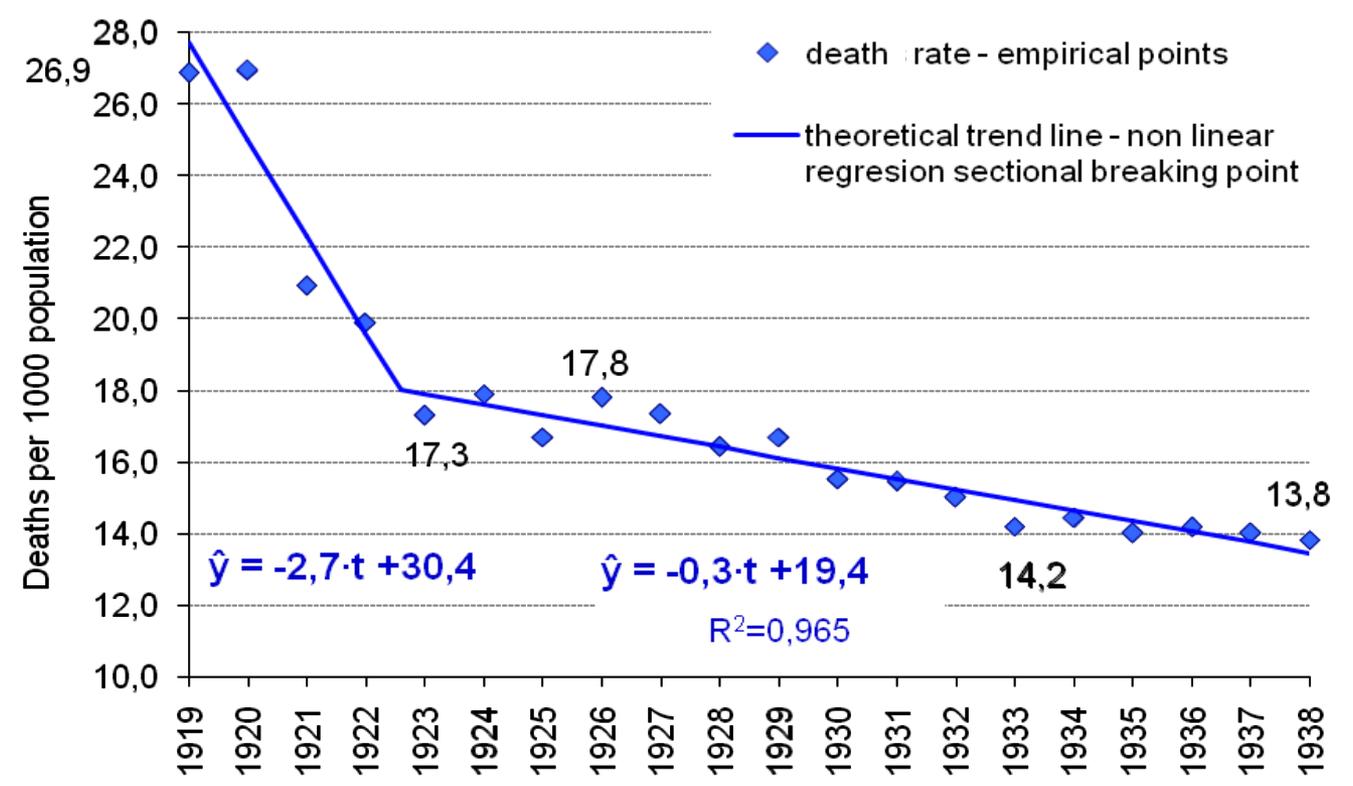
Next, the **beginning of Phase II - point T1_DEATHS** (reduction in mortality is higher than reduction in births) and point **T2_DEATHS** (mortality is stabilized) were fixed. The stabilization of death rates is continued for further but slower decrease in births. Hence the point **T2_BIRTHS** is the beginning of Phase IV. It was obtained from the anti-logistical function estimated for intensity of births.

Source. Own work based *Wiadomości Statystyczne* 1931,1939,GUS, Warszawa, Szulc S. (1936), „Ruch naturalny ludności w Polsce w latach 1895—1935”, E. Stańczyk, „Rodność i umieralność ...”, Warszawa, 2009.

The following values were obtained: $a = 22.16$, $b = 4.70$, $c = 30.65$, $d = 0.06$, and $T1_DEATHS = 1885$ $T2_DEATHS = 1959$. This function has an inflection point for $Tp = 1920$, i.e. after 1885 year a significant reduction in mortality was observed and mortality went down remarkably before 1920 and after 1920 it decreased slightly. In 1959 the mortality is stabilized. Values of the function decreased by 1.3 ‰ in the period 1880-1890 and by 3.4 ‰ in the years 1910-1920, by 3.3 ‰ in the years 1920-1930 and by 2.7 ‰ in next years

TREND OF DEATHS RATE POLAND TOTAL

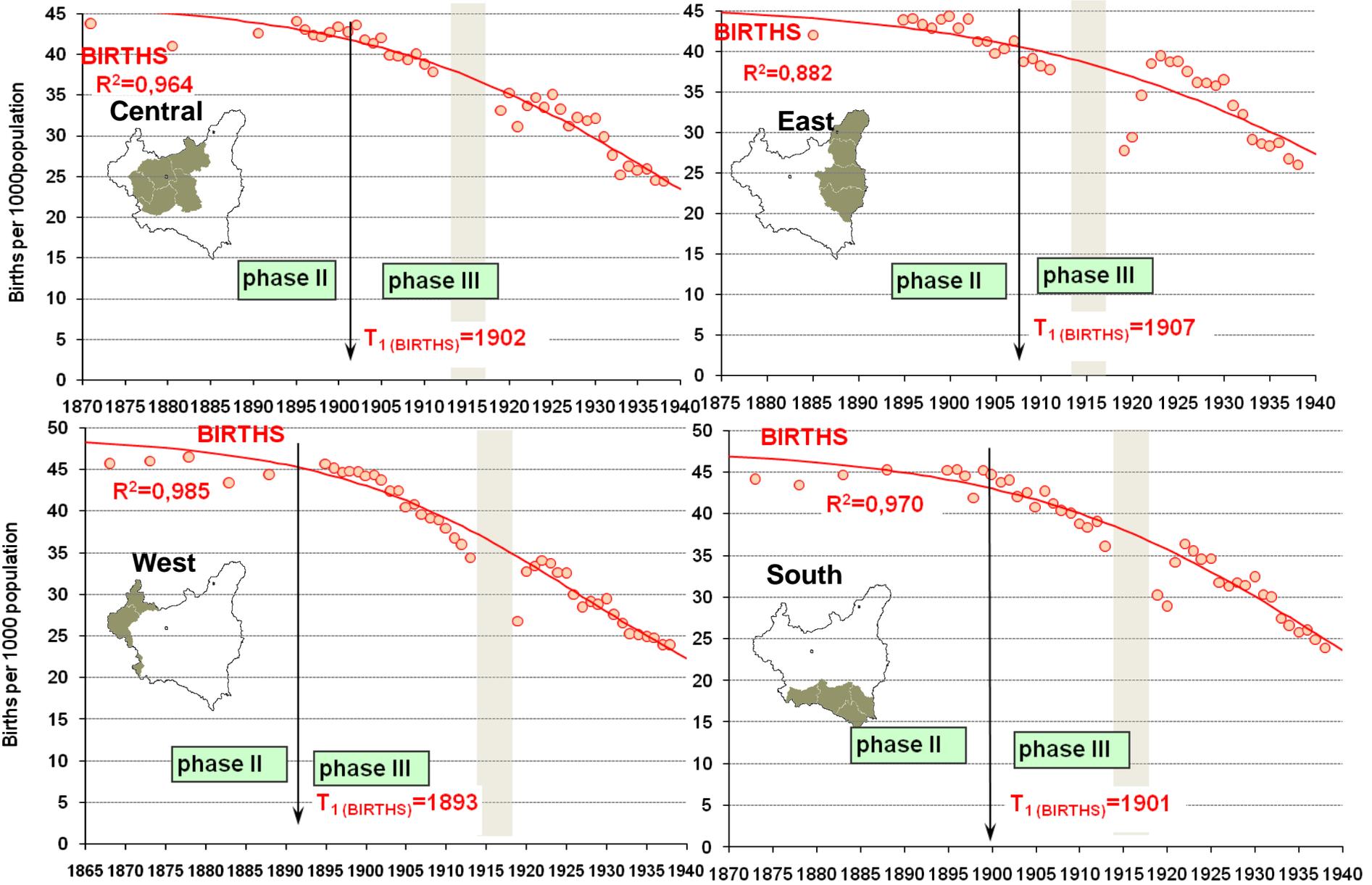
As in the case of birth rate dynamics of death rate ($Y_{DEATHS}(t)$) was calculated for the period 1919-1938. The model of non-linear regression with the crease for the independent variable (the breaking point in 1923) was used.



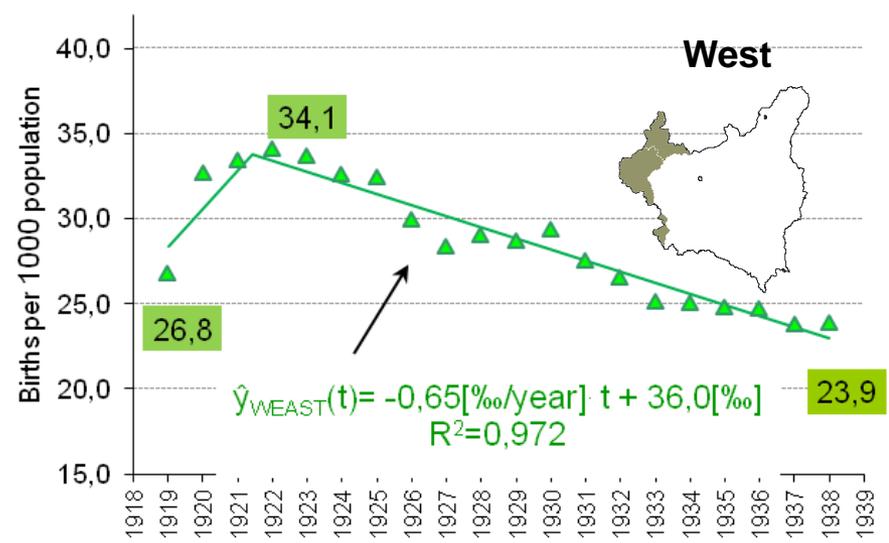
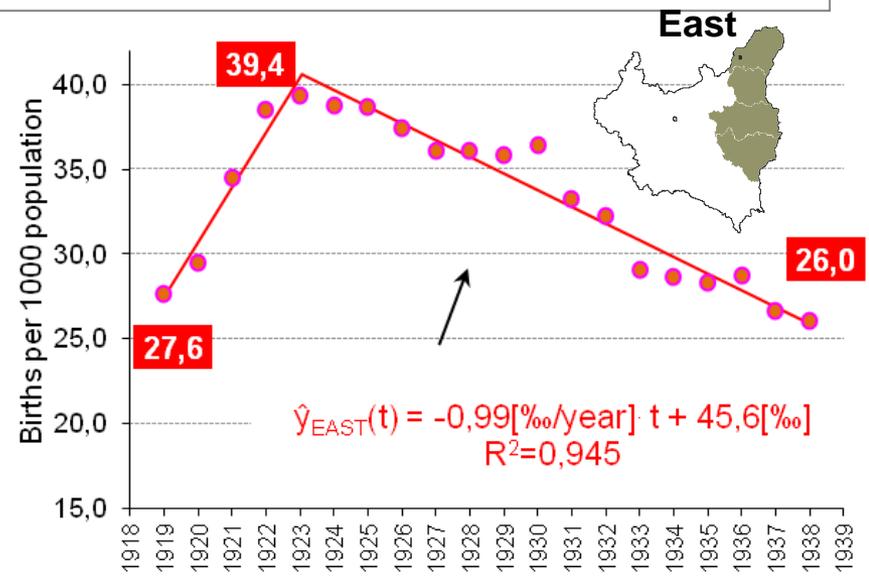
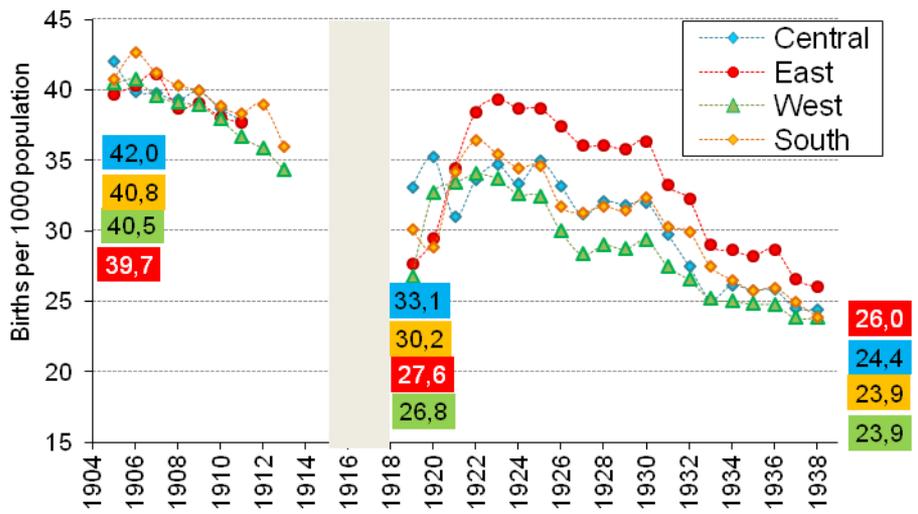
Both in the first years after the war, and in a subsequent period, the trend was negative. In the period 1924-1938 compared to the previous period, the average annual decline in mortality was 9 times lower (the slope of the line was only -0.30 ‰ / year).

Such high values of deaths rates in the first years after the war were caused by infectious diseases and poor material conditions.

BIRTH RATES BY GROUPS OF VOIVODSHIPS. PHASES OF DEMOGRAPHIC TRANSITION



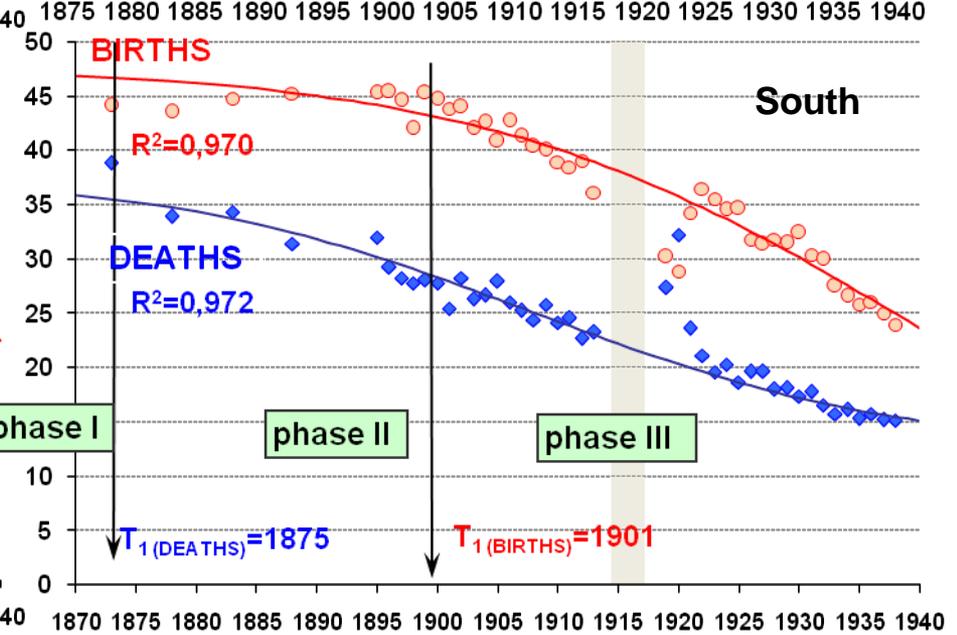
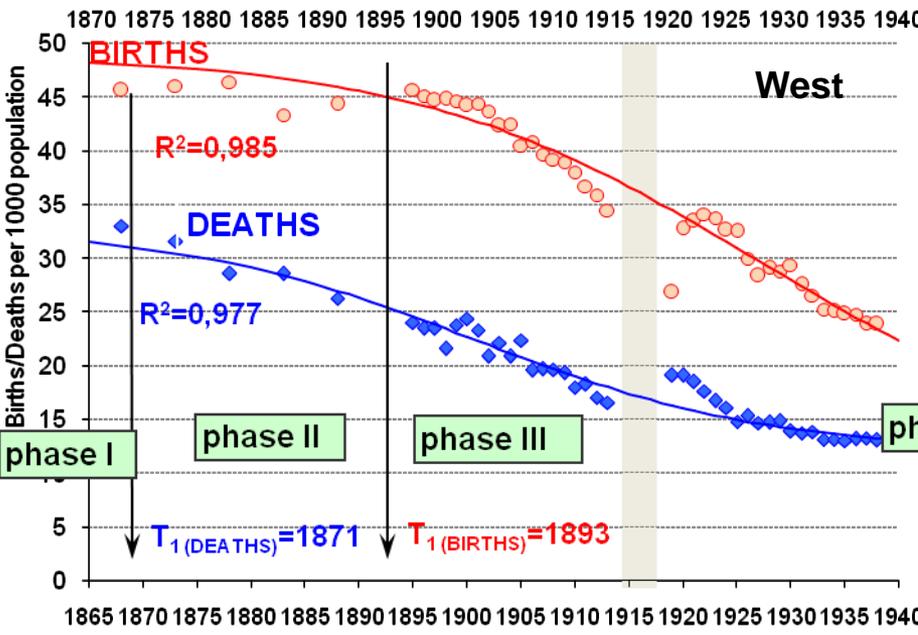
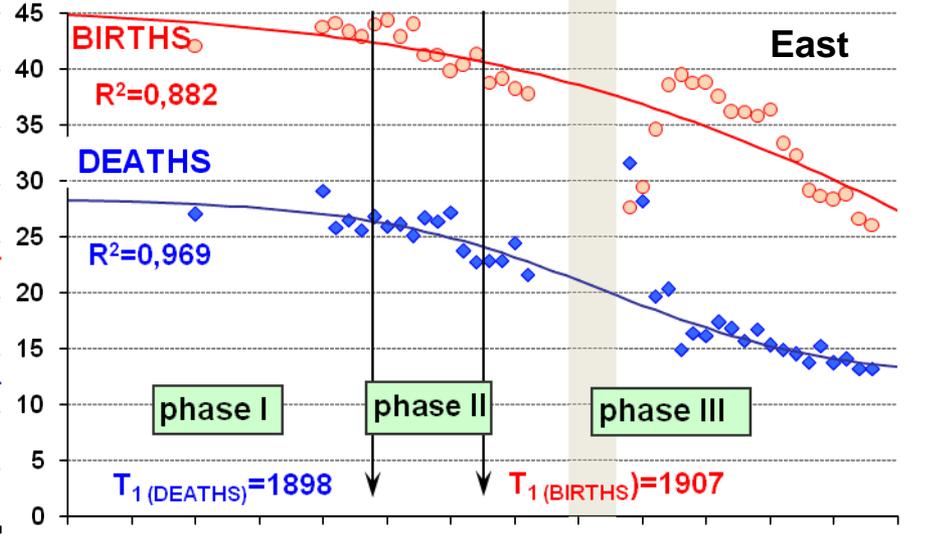
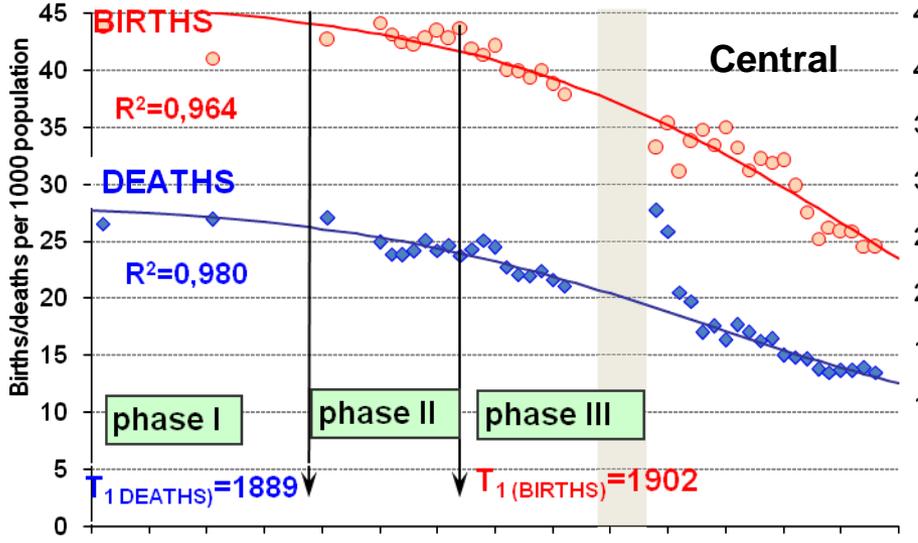
TREND BIRTH RATES BY GROUPS OF VOIVODSHIPS IN 1919-1938



Starting from 1923 the highest values of live births per 1,000 population were observed in the eastern provinces and the lowest in the western provinces. In 1938 the last year of the research there were 26 recorded births per 1,000 population in the eastern provinces, and 24 births per 1,000 population in the western provinces. It is worth noting that before the First World War birth rates in different groups of voivodships differed very slightly. The change in the ordering of the districts was observed. Before the war, the highest coefficients were in western and southern voivodships (not in the eastern and southern). This change was a direct result of unequal falls of coefficients in different districts.

Source. Own work based *Wiadomości Statystyczne* 1931,1939,GUS, Warszawa, Szulc S. (1936), „Ruch naturalny ludności w Polsce w latach 1895—1935”

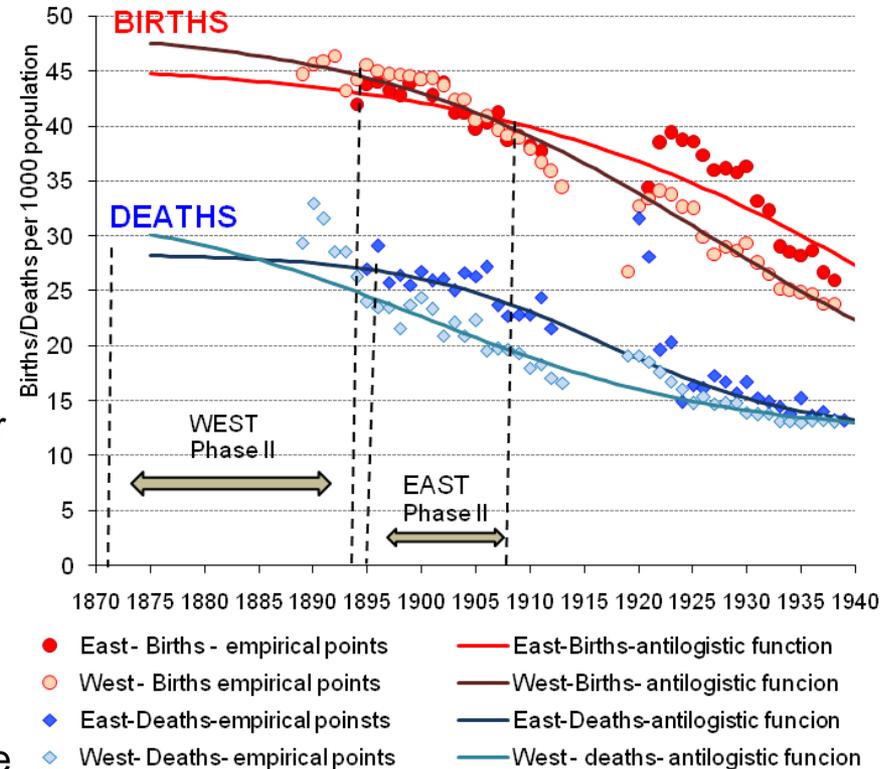
DEATH RATES BY GROUPS OF VOIVODSHIPS. PHASES OF DEMOGRAPHIC TRANSITION



PHASES OF DEMOGRAPHIC TRANSITION BY GROUPS OF VOIVODSHIPS OF POLAND. RESULTS OF ESTIMATION

.Results of estimation

Specification	Beginning of	
	phase II	phase III
Poland total	1885	1903
Groups of voivodships		
central	1889	1902
east	1898	1907
west	1871	1893
south	1875	1901



Source: Own work based *Wiadomości Statystyczne* 1931,1939,GUS, Warszawa, Szulc S. (1936), „Ruch naturalny ludności w Polsce w latach 1895—1935”

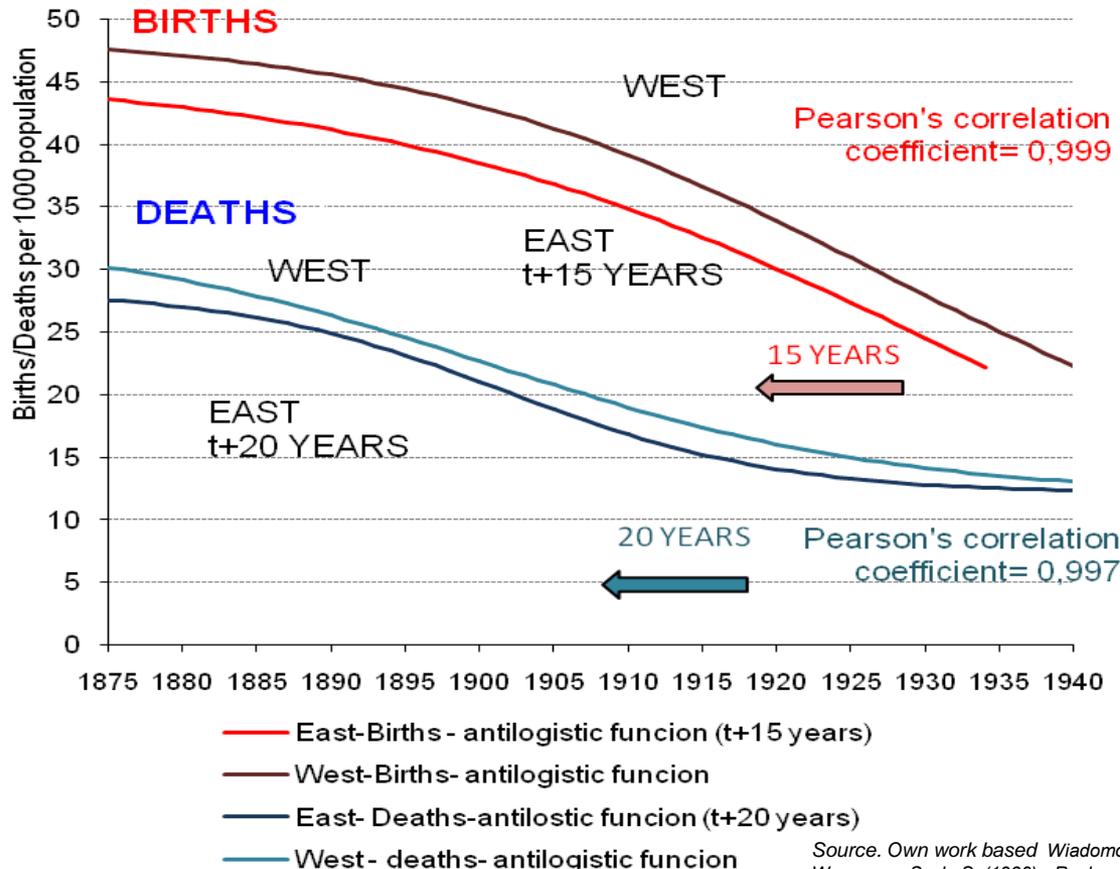
The estimated functions show that the earliest clear collapse of mortality trend occurred in the western and southern districts in 1871 and 1875 respectively. From that moment the "right" demographic transition took place on these territories. Due to the strong decline in the value of the mortality rates (the fertility rate was still remained at a level comparable to that of phase I) a strong increase in the rate of natural increase was observed (population explosion). The highest rates of population growth were in the western, central and southern districts at the turn of the nineteenth and twentieth centuries (in the western district - in 1898).

Only in the case of the eastern district higher growth of natural increase (population explosion) occurred during the Second Polish Republic (about 1926).

PHASES OF DEMOGRAPHIC TRANSITION BY GROUPS OF VOIVODSHIPS OF POLAND. RESULTS OF ESTIMATION

In order to determine the demographic modernization delay in the eastern voivodships compared to western, correlation coefficients between theoretical values (estimated from anti-logistic functions) of birth and death coefficients are calculated, with the phase shift (see figure below).

Anti-logistic functions for western and eastern voivodships of Poland (1875-1938)

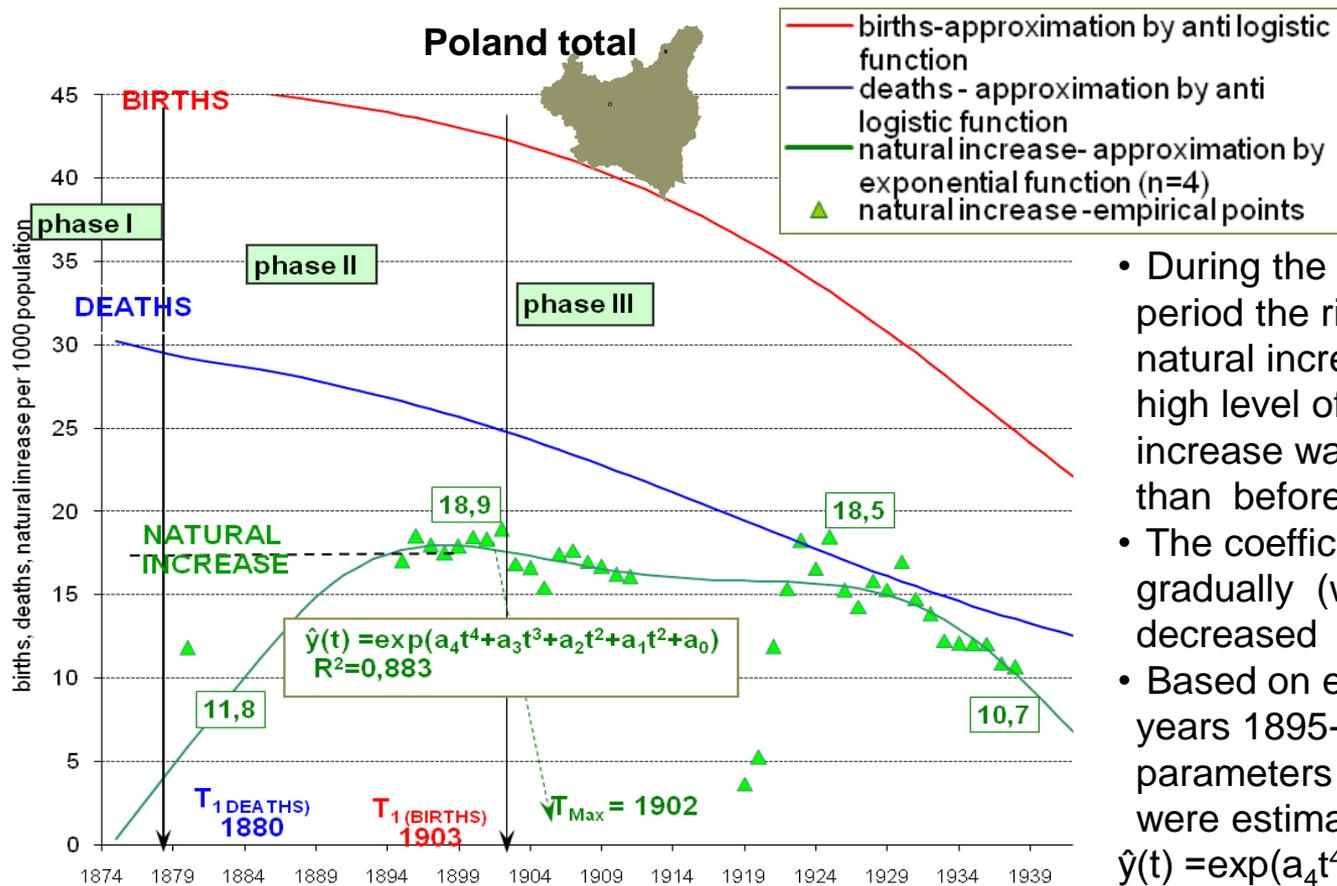


The highest value of the coefficient of correlation was achieved,

- if the function illustrating the births rates trend in the eastern territories was shifted by 15 years
- if the function illustrating the trend in deaths rates in the eastern territories was shifted by 20 years

Source. Own work based *Wiadomości Statystyczne* 1931, 1939, GUS, Warszawa, Szulc S. (1936), „Ruch naturalny ludności w Polsce w latach 1895—1935”

REPRODUCTION OF THE POPULATION OF POLAND. NATURAL INCREASE. TRANSITION PHASE PERIODS



- During the first years of the interwar period the rise in the value of coefficient of natural increase was observed. Due to the high level of mortality overall natural increase was lower after the World War I than before the war.
- The coefficient of natural increase gradually (with some variations) decreased in the years 1924-1938
- Based on empirical data (birth rates in the years 1895-1911 and 1925-1938) the parameters of the exponential function were estimated

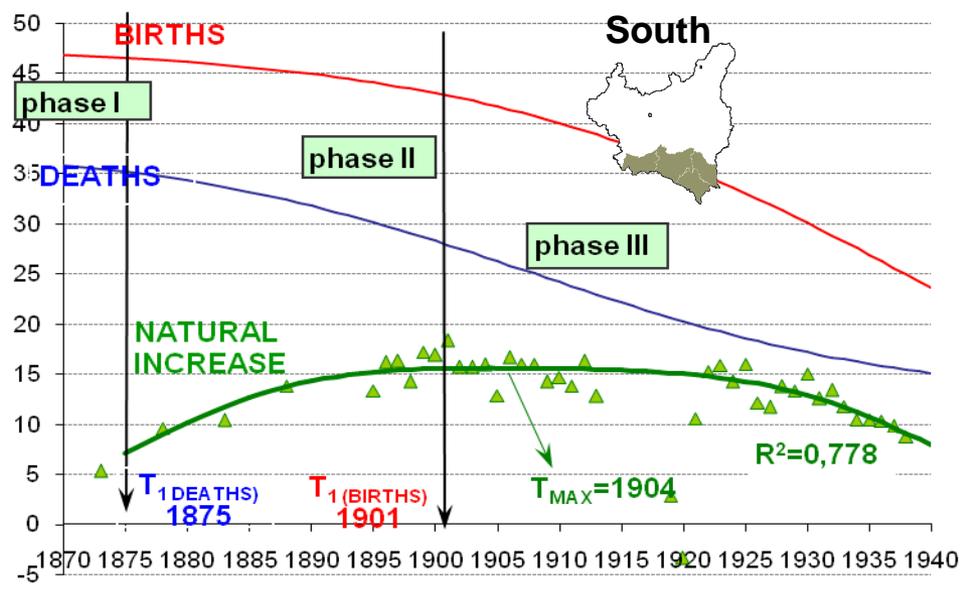
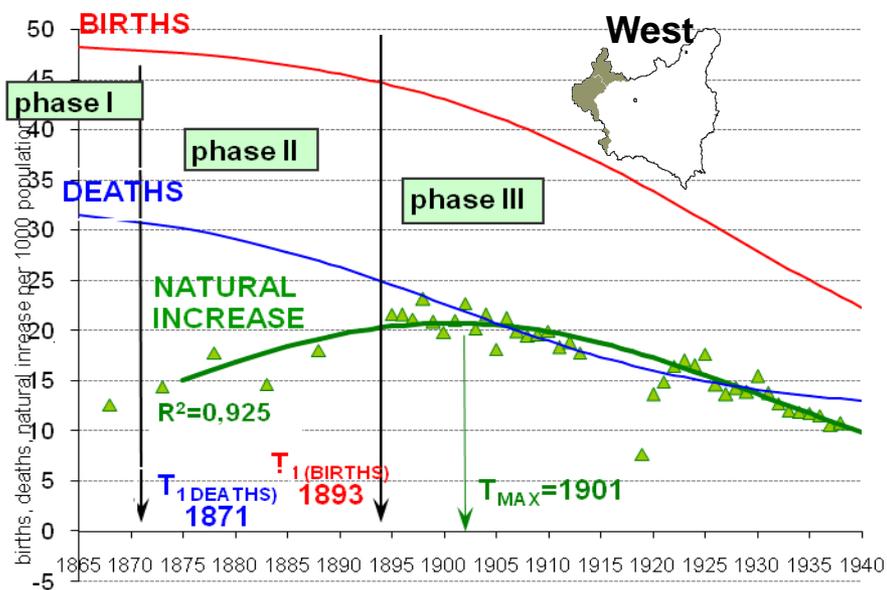
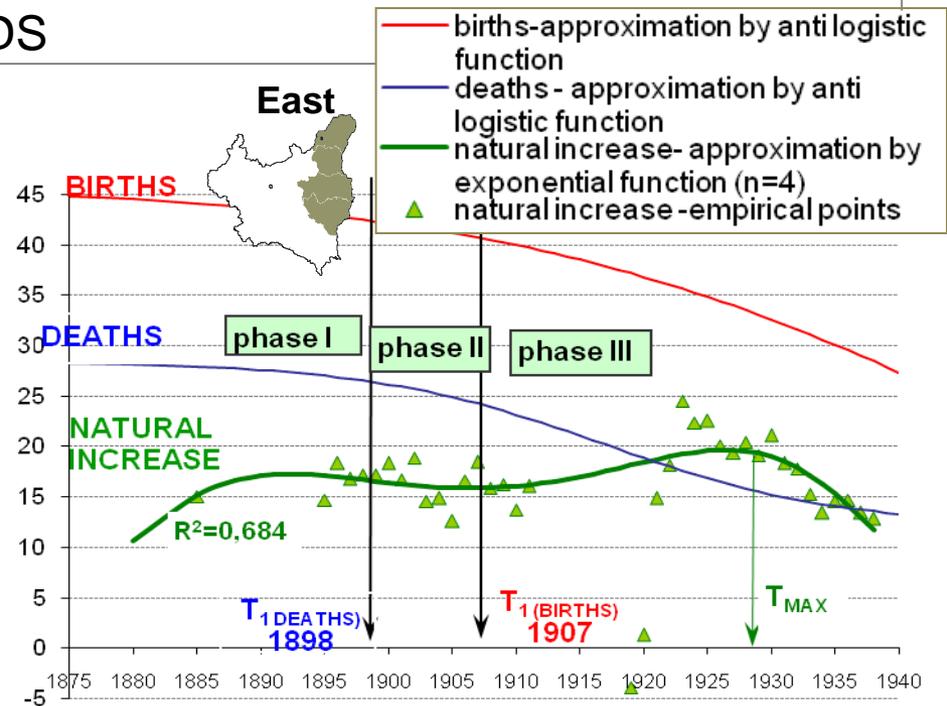
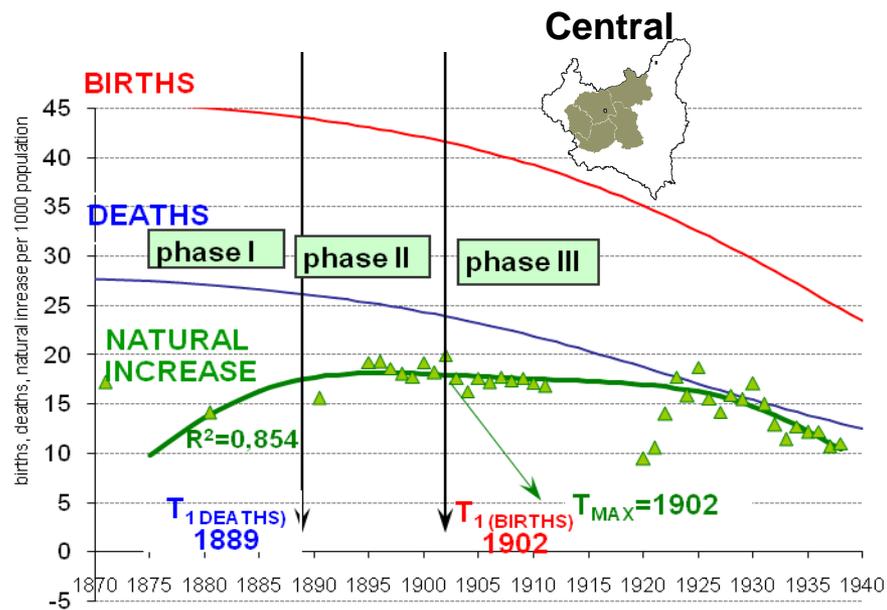
$\hat{y}(t) = \exp(a_4 t^4 + a_3 t^3 + a_2 t^2 + a_1 t^2 + a_0)$
and the point at which the function reaches its maximum was identified. ($T_{MAX} = 1903$)*

The demographic explosion in the Second Polish Republic occurred in the late nineteenth and early twentieth century

➤ The next slide shows coefficients of natural increase for all districts and theoretical models – exponential functions. The beginning of the first, second and third phase of demographic transition were determined and the point at which the population growth rate reaches its maximum value.

*It should be noted that due to insufficient number of data the estimation of the parameters of the exponential function is only indicative.

REPRODUCTION OF THE POPULATION OF POLAND. NATURAL INCREASE. TRANSITION PHASE PERIODS



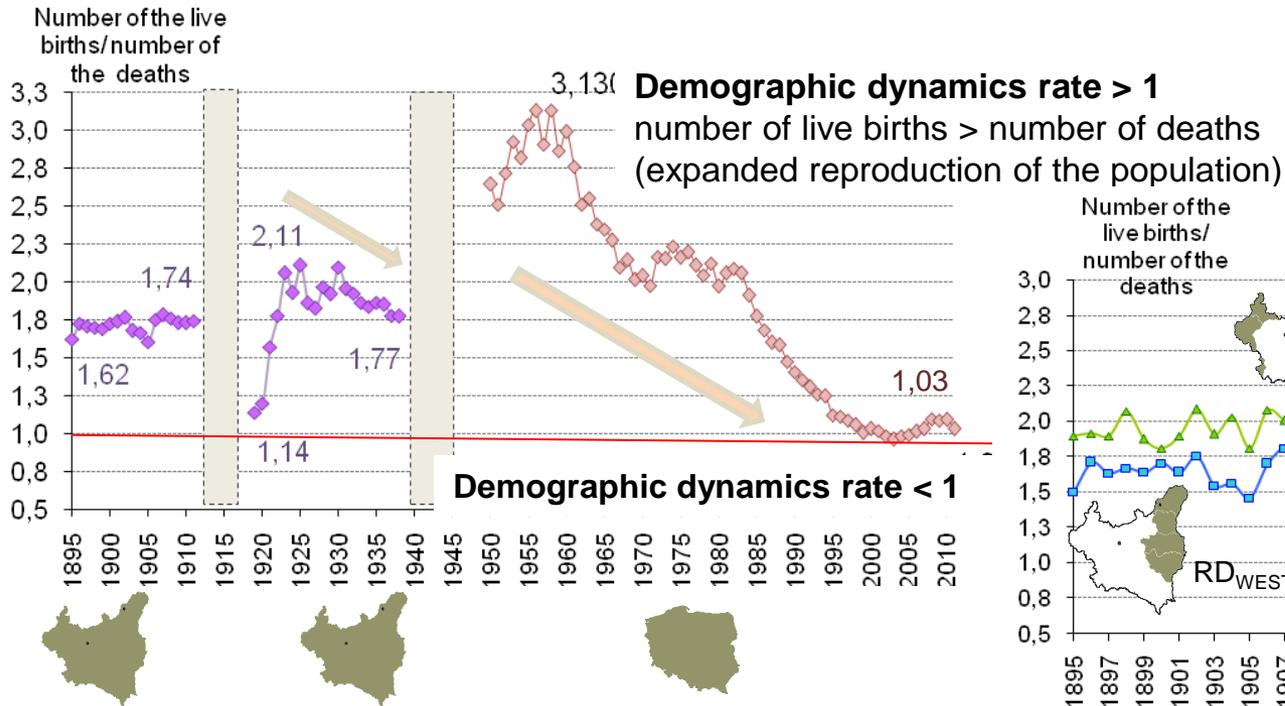
- births-approximation by anti logistic function
- deaths - approximation by anti logistic function
- natural increase- approximation by exponential function (n=4)
- ▲ natural increase -empirical points

REPRODUCTION OF THE POPULATION OF POLAND

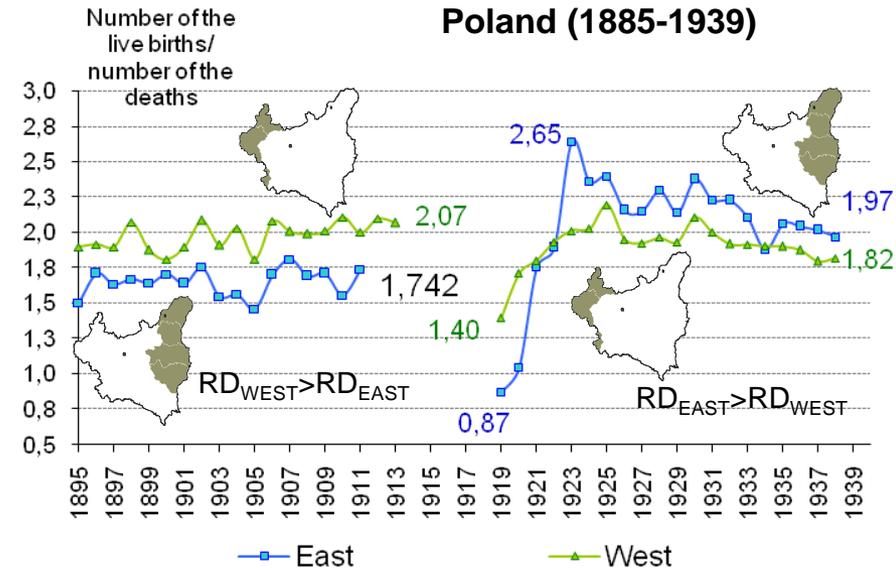
DEMOGRAPHIC DYNAMICS

Demographic dynamics rate
RD is the ratio of the number of live births to the number of deaths in a given period.

Demographic dynamics of Poland for years 1895-2011



Demographic dynamics rate on the west and on the east of Poland (1885-1939)



Source. Own work based *Wiadomości Statystyczne* 1931,1939,GUS, Warszawa, Szulc S. (1936), „Ruch naturalny ludności w Polsce w latach 1895—1935”

On Polish territories, both in the period before World War I and in the years 1919-1938 an expanded reproduction of the population was observed.

In the years 1896-1911 coefficients of demographic dynamics did not change a lot - for every 100 people who died there were from 160 to 176 newly born.

In the period 1919-1923 a strong increasing tendency of demographic dynamics coefficients was observed, while in the years 1924-1938 - with some variations - the downward trend was detected. Coefficients of demographic dynamics were different in different Polish districts. In the years 1923-1938 high demographic dynamics was in eastern voivodships - almost twice more births than deaths.

In the years 1895-1911 the western lands were characterized by the highest values of the analyzed coefficient.

REPRODUCTION OF THE POPULATION OF POLAND. REPRODUCTION RATES

Total fertility rate

Years	Poland total	Groups of voivodships			
		central	east	west	south
1900-1901	-	-	-	-	6,23
1928	4,03	3,94	4,72	3,58	3,99
1932	3,36	3,18	3,91	3,03	3,47

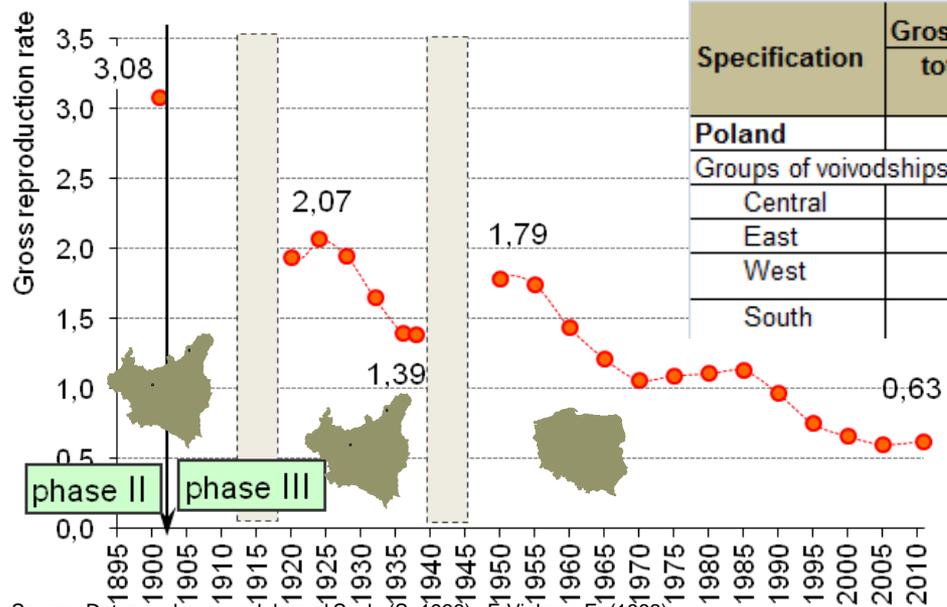
During the Second Polish Republic, comparing to the period before the war, a significant drop in total fertility rate was observed (*look south of Poland*)

Source: dates and own work based „Statystyka Polski „ A, t.27, C, z.41, C. z.45, z. 102, GUS, Warszawa,

Total fertility rate refers to the number of children which would be born to the average woman during the course of her entire reproductive period (15-49 years of age) assuming that in particular phases of this period she would give births with an intensity observed during a given year, i.e., in assuming age-specific fertility rates for this period to be constant,

Gross reproduction rate refers to the number of daughters which would be born to the average woman assuming that a woman during her reproductive age will give births with an intensity which is characteristic for all women giving births in the year for which the reproduction rate is calculated (constant fertility rates).

Gross reproduction rate in years 1900-2011



Specification	Gross reproduction rate		
	total	urban area	rural area
Poland	1,69	1,05	2,00
Groups of voivodships			
Central	1,64	1,05	2,01
East	1,93	1,03	2,11
West	1,52	1,12	1,80
South	1,72	0,95	1,99

According to the calculations done for the 1927-1928 and 1931-1932, the highest values of gross reproduction rate were in the eastern district, and the lowest in the western one.

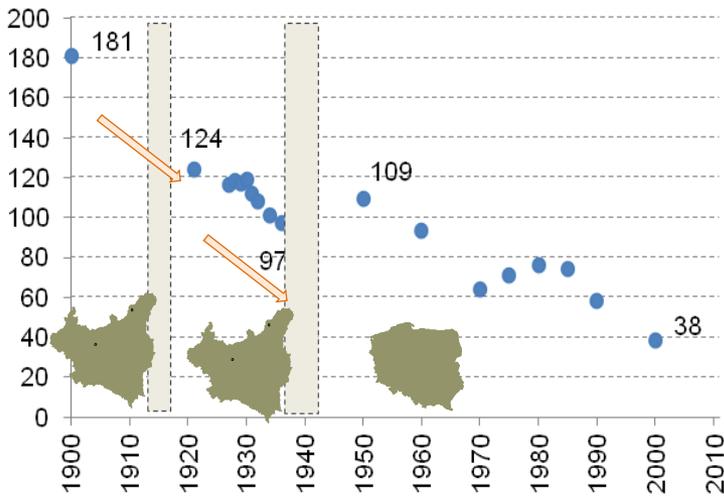
Source: Dates and own work based Szulc (S. 1936), E.Vielrose E. (1962), www.stat.gov.pl

At the turn of the nineteenth and twentieth centuries, on average one woman gave birth to over 3 daughters (assuming the constancy of fertility rates) during her breeding period. It means that a generation of mothers would be replaced by a three times more numerous population of daughters - 20 years later by a twice more numerous population of daughters. In the interwar period there was extended reproduction (gross rate guaranteed a simple replacement of generations).

REPRODUCTION OF THE POPULATION OF POLAND. FEMALE FERTILITY

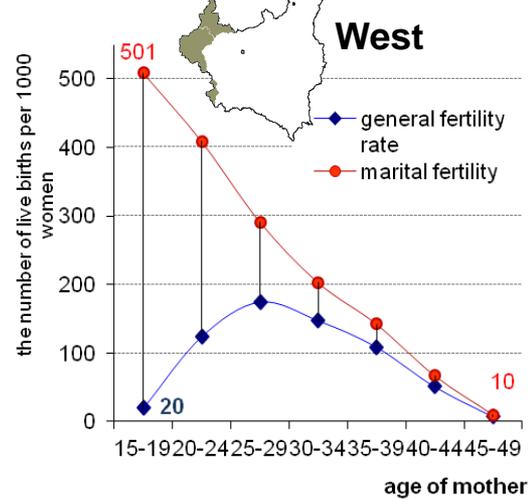
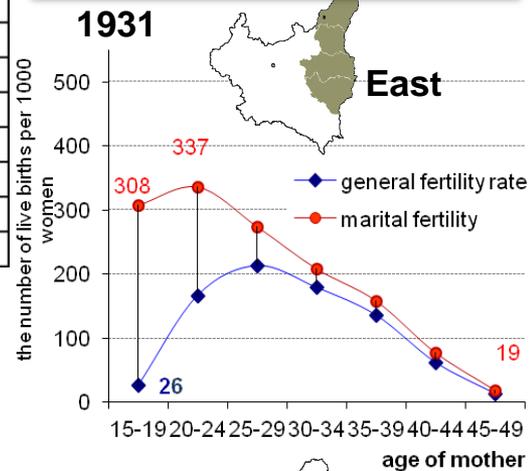
Female fertility rate is calculated as the ratio of the number of live births and the number of women in the reproductive age (15—49).

Female fertility rate



Rok	Female fertility				
	Poland total	groups of voivodships:			
		central	east	west	south
1896-1900	181	179	181	186	181
1921	124	118	137	123	126
1927	116	116	135	103	112
1928	118	119	135	105	115
1929	117	117	134	103	113
1930	119	118	137	105	117
1931	112	110	127	99	111
1932	108	103	126	96	111
1934	101	97	115	93	103
1936	97	-	-	-	-

- During the considered period female fertility rates in the Second Polish Republic were ones of the highest comparing to other European countries
- In the years 1921-1936 a further gradual decline in female fertility rates was observed
- Not only in a whole country, but also in each group of voivodships a decrease in female fertility rates was observed (the highest in western voivodships)
- There were significant differences in marital fertility by age, depending on the area of the Second Polish Republic - particularly high value of marital fertility rates were detected in the western voivodships
- Western voivodships also showed the greatest disparity between the general fertility and marital fertility



COALE STANDARDIZATION OF FEMALE FERTILITY RATES. PRINCETON EUROPEAN FERTILITY PROJECT INDICES

To analyze the spatial variation of fertility transition the Coale standardization was used - the total fertility index (I_f), the index of marital fertility (I_g) and marriages index (I_m).



Source. Own work based „Statystyka Polski „ C, z.41, z.94a, z.62, St. Szulc S (1936), „Wiadomości Statystyczne 1938, E.Stanczyk, „Płodność kobiet w II Rzeczypospolitej”, Acta Universitatis Wratislaviensis , Wrocław 2003, K. Iglicka, „Terytorialne przemiany płodności w Polsce w latach 1931-1988”, Warszawa, 1994

Fertility Indices:

I_f the ratio of the births the women in a given population actually have to / the number they would have if subject to a maximal well-recorded age-specific fertility schedule (that of the Hutterites).

I_g the ratio of the births the married women in a given population actually have to / the number they would have if subject to the maximal age-specific fertility schedule.

I_m the ratio of the number of births married women would experience if subject to the maximal age-specific fertility schedule / to the number of births all women would experience if subject to that same maximal fertility schedule.

Based on the estimated values of overall fertility indices in the years 1923-1938 (with constant age structure of women from 1931) one can claim that in the Second Polish Republic there was a decline in the total fertility index.

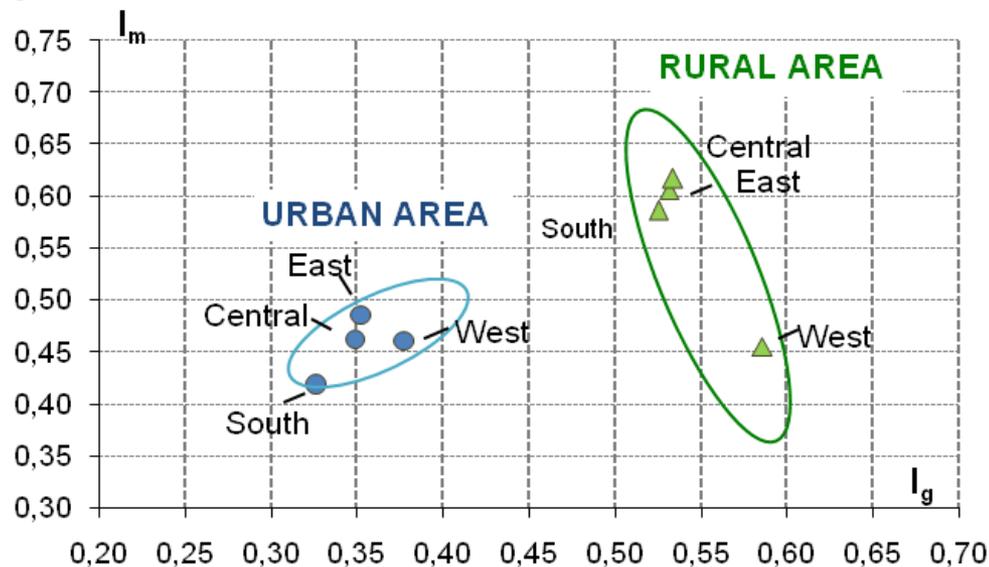
In 1923, the total fertility (I_f) was 34.0% of maximum fertility, and in 1938 - at the level of 23.3%..

In the years 1900-1931 in the Polish territories, the values of the marriages index were decreasing, too. The index in 1931 was 0.488 (I_g). At that time married women gave a birth to about 49% of children that might be born by all married women in urban areas - 35%, and 54% in rural areas.

COALE STANDARDIZATION OF FEMALE FERTILITY RATES. PRINCETON EUROPEAN FERTILITY PROJECT INDICES

Fertility Indices	Poland total	Group od voivodships			
		central	east	west	south
total					
I_f	0,282	0,276	0,319	0,252	0,285
I_g	0,488	0,474	0,511	0,504	0,485
I_m	0,543	0,552	0,596	0,457	0,542
urban area					
I_f	0,177	0,178	0,183	0,193	0,16
I_g	0,35	0,349	0,352	0,376	0,327
I_m	0,454	0,463	0,486	0,461	0,418
rural area					
I_f	0,329	0,334	0,344	0,289	0,329
I_g	0,536	0,532	0,534	0,586	0,525
I_m	0,583	0,606	0,617	0,455	0,586

1931



Source. Own work based „Statystyka Polski „ C, z.41, z.94a,

As mentioned earlier, in the considered period, the highest fertility was recorded in the eastern districts in 1931 and it accounted for 31.9% of the maximum level of fertility, while in the western districts - 25.9%.

The highest index was recorded in the eastern district - 0.596, while the lowest in the western - 0.457. There were small differences in the level of marital fertility indices by districts of the Second Polish Republic. In 1931-1932 married women from eastern provinces gave birth, on average, to approximately 51.1% of children that might be born by all married women and married women of the western provinces - 50.4%

CONCLUSIONS

- An approximation of the population trend on Polish territories during 1919-1938 was linear.
- The largest deviations from the trend line occurred in the first years after the war.
- The main determinant of the population size was natural increase – net migration rate was not very important.
- The linear regression equations with the crease in 1925 yields that overall population growth rates in Poland and in the eastern, central and south districts were higher in the first years after the war, than in next years. Eastern voivodships were characterized by the largest increase in population
- A slight changes in the age structure of the population of the Second Polish Republic were observed. These changes show the gradual aging of the Polish population
- Based on the concept of the first demographic transition model the beginnings of phase II and phase III were specified. The estimates show the demographic transition at the turn of the century. "Right" demographic transition (bigger reduction in mortality than in fertility) was observed on Polish territory around 1885
- The estimation of anti-logistic function for each district yields that evident break of mortality trend occurred first in the western and southern districts (about 1871 and 1875). From that moment on these lands "right" demographic transition took place.
- Between the districts (groups of voivodships), there were large disparities in levels and dynamics of fertility, mortality and reproduction of the population. The highest values of fertility rates occurred in the eastern districts, the lowest - in the western districts.
- Despite a decline in fertility rates and the gradual reduction in gross reproduction rates, the expanded reproduction of population was observed on Polish territory in the period before World War I. (Rates allowed for the simple replacement of generations).



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THANK YOU FOR YOUR ATTENTION!

