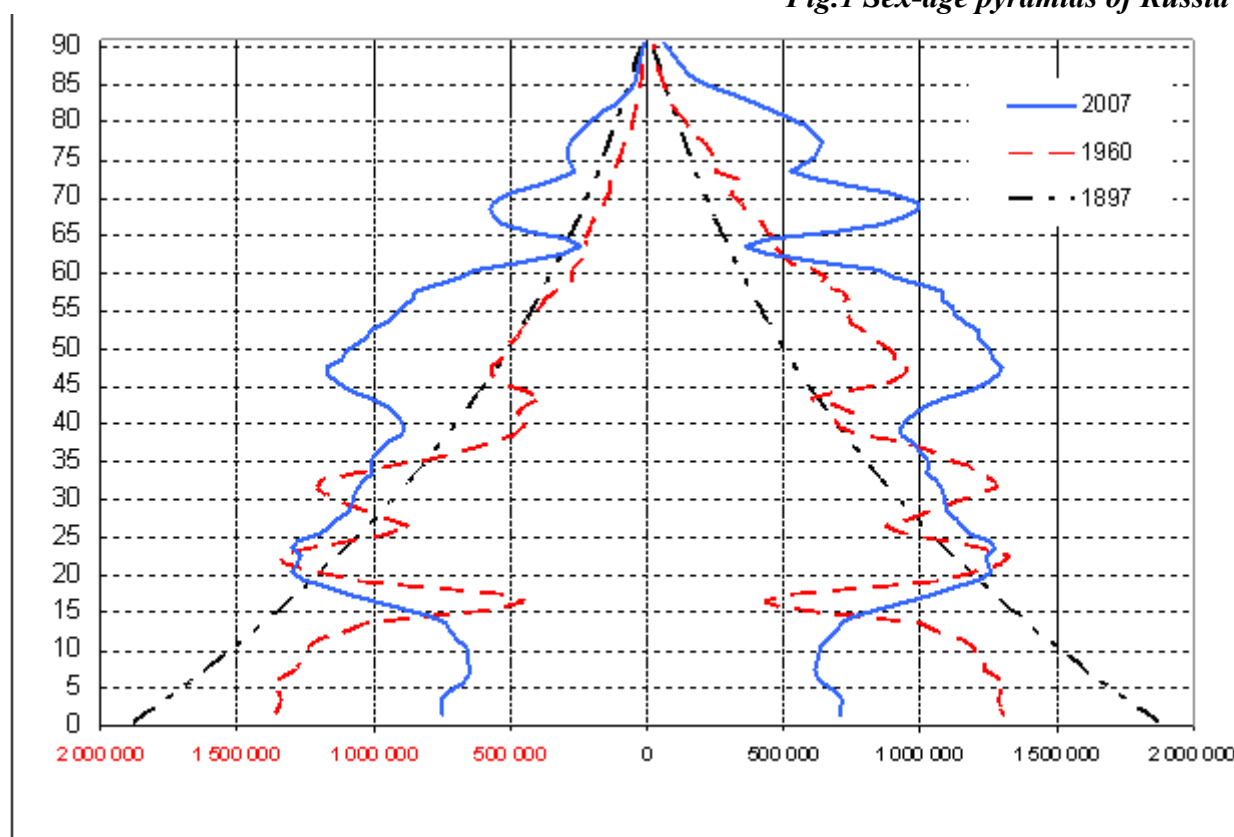


On the matter of existence of a demographic constant.

Not many know that the great Russian chemist D.I. Mendeleev professionally dealt with the issues of demography. In his study “To the knowledge of Russia” published in 1907¹, there was given an extensive analysis of the results of the population census of Russia (1897) and shown the statistical data on many countries in the world. Using the materials of research of D.I. Mendeleev, and comparing them with the data obtained with the centenary lag, we can see what fundamentally important changes have occurred over the past century in the sex-age distribution of the population of our country.

A graph «Sex-age pyramids of Russia» (see Figure 1) provides a wealth of information for thought. Let's pay attention to one distinctive feature: in our country, today, in our country the number of 70-year-old grandmothers is about 400 000 more than the number of seven-year girls.

Fig.1 Sex-age pyramids of Russia²



Although the comparative data analysis of Russia at the end of XIX and at the beginning of the XXI century is not quite correct because of changes in its borders, nevertheless, the qualitative characteristics of changing structure during that period are undisputed: there occurred a turn of the sex-age pyramid (see Fig. 1).

¹ D.I. Mendeleev “To the knowledge of Russia with attachment of Russia map”, 5-th edition, St. Petersburg, 1907.

² Sources: Mendeleev indic. thesis, www.mortality.org (Human Mortality Database), data on 1897 within the existed borders of the Russian Empire.

Fig.2 Sex-age pyramids of the Netherlands

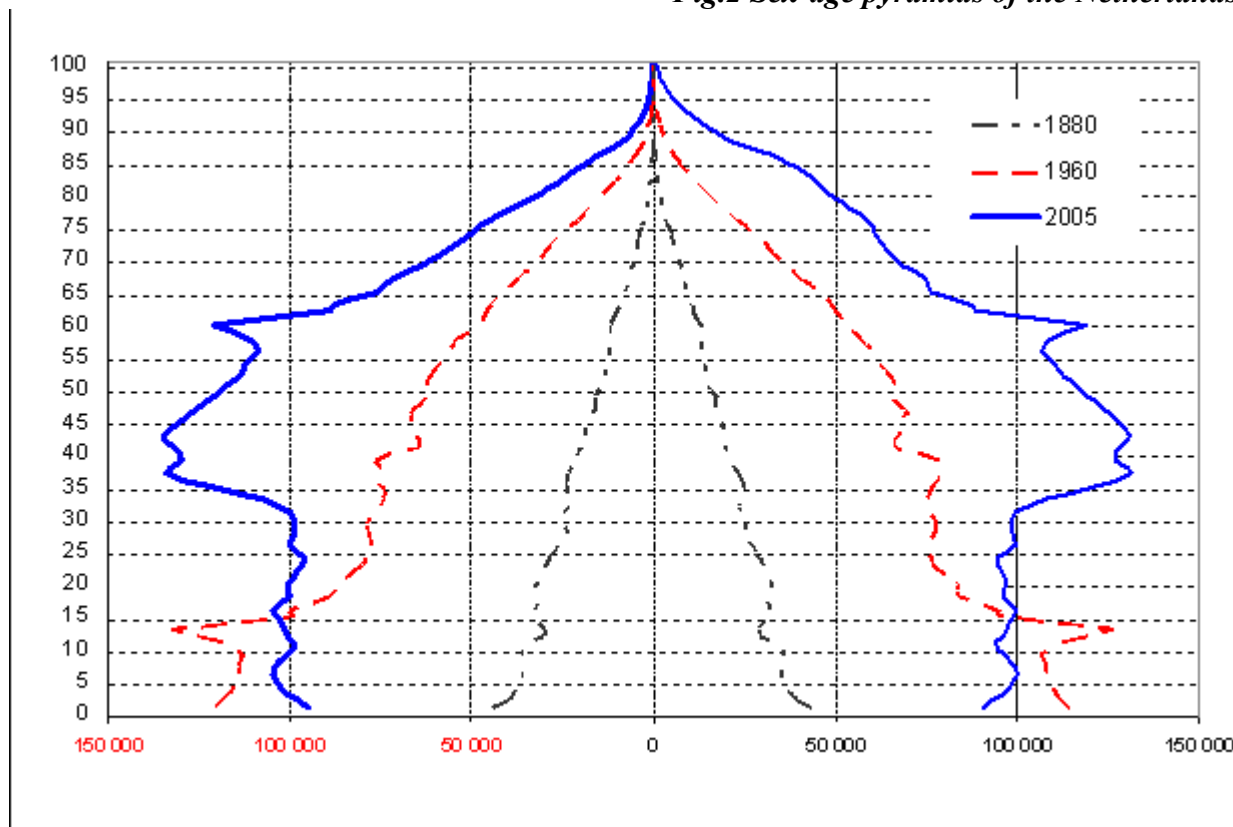
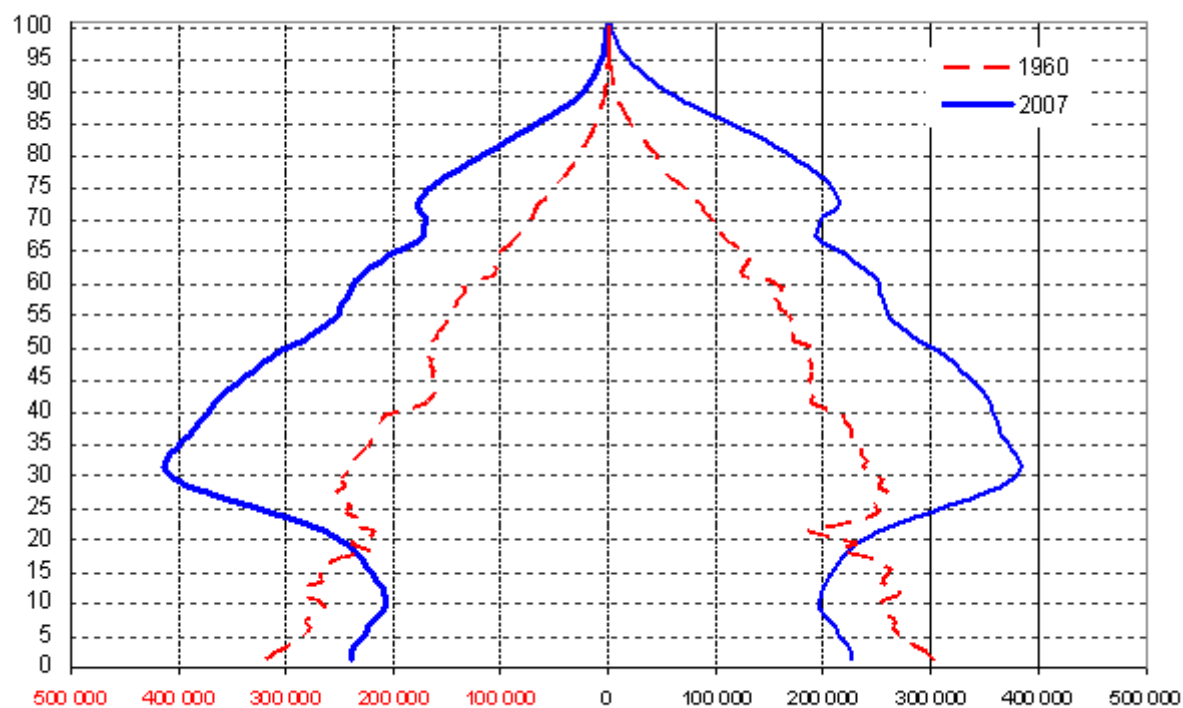


Fig.3 Sex-age pyramids of Spain



A marked trend – the turn of the pyramid, the appearance of a peculiar “hopper”, i.e. a sharp decline in number of the younger age categories of the

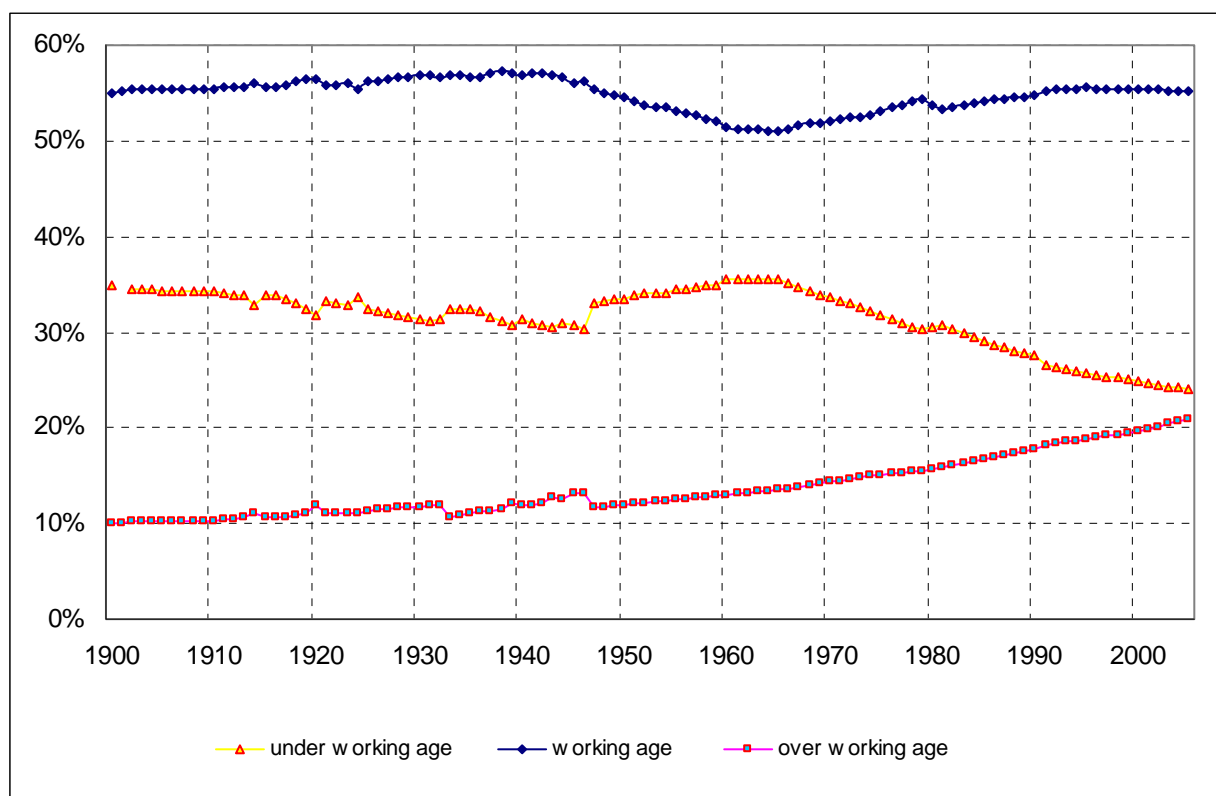
population – is common to all the European countries. As an illustration, there are shown the data for the Netherlands and Spain (see Fig. 2 and 3)³.

Studying the materials of demographic statistics, we have paid attention to the stability of the proportion density in the able-to-work age in various regions of the world and significantly separated from each other time intervals (see Fig. 4).

The analysis of statistical data being at our disposal, allowed us to form a hypothesis about the existence of demographic constant: **the average number of dependents per one earner (including himself) is a value being relatively permanent.** The value of this index (let's call it as a «level of demographic load of the employable» - **LDLE**) is calculated as the ratio of the entire population to the number of population in the able-bodied age. This ratio is characterized by a high degree of stability and its significance in the overwhelming number of cases does not exceed **2.0** for all the investigated countries in a statistically foreseeable range of time.

Calculations of **LDLE** (see Fig. 4), held within 1900-1980 and 1981-2007 were based on different values of the lower limit of the working capability range: from 1900 to 1980 – linearly changing from 15 to 20 years and then 20 years. The upper range within the whole period – 59 years.

Fig.4 Shares of different groups of population for the G7-countries



For the entire period to be studied, the upper limit of working age had been taken by us at the level of 60 years.

It is quite clear that the time of entering and exit the period of working capacity was changed during the human history. There is known the widespread use of child labor, as well as the absence of any upper limits of working age in the

³ From now on, the source of data on the countries in the world is www.mortality.org (Human Mortality Database).

past. Therefore, in calculations of **LDLE**, we have adopted boundaries of working age, which correspond to our perceptions of age of the ability to work and its changes over the past 100 years.

The authors in advance accept the criticism for a forced simplification of the situation, as well as they understand the need for greater specificity on the periods and differentiation on values of the range of working capacity, subject to the gender and geographical situation of the countries represented in the calculation. The same remark applies to the relative inaccuracy of assigning the whole array of people living in one or another country in this time range to the working age, as well as the inclusion of all the others in the group receiving the means of living from natural or legal persons⁴.

The results of the **LDLE** calculations held during 1881-1990 and 2005-2007 are shown in Table 1.

Table 1⁵

Country	Year	Ratio of the number of the whole population to the number of population in age of 15-59 years old.	Year	Ratio of the number of the whole population to the number of population in age of 20-59 years old.
India	1891	1,77		
Cuba	1899	1,66		
Japan	1898	1,69	2006	1,86
Brasilia	1890	1,82		
Argentina	1895	1,76		
USA	1900	1,68	2006	1,80
England, Scotland, Ireland	1891	1,73	2007	1,84
Holland	1889	1,78	2007	1,79
Denmark	1890	1,80	2006	1,85
Norway	1891	1,86	2007	1,86
Sweden	1890	1,79	2006	1,91
Germany	1890	1,74	2006	1,81
Austria	1890	1,72	2005	1,79
Hungary	1890	1,74	2006	1,76
Finland	1890	1,77	2006	1,83
Russia	1897	1,83	2007	1,65

⁴ It is assumed that the necessary clarifications may be done in more rigorous calculations for each separate country. In our case, it is an attempt to identify some COMMON regularity - a demographic constant, the existence of which is manifested clearly enough in the presented array of information.

⁵ Sources: www.mortality.org (Human Mortality Database)., D.I. Mendeleyev. Cit. source.

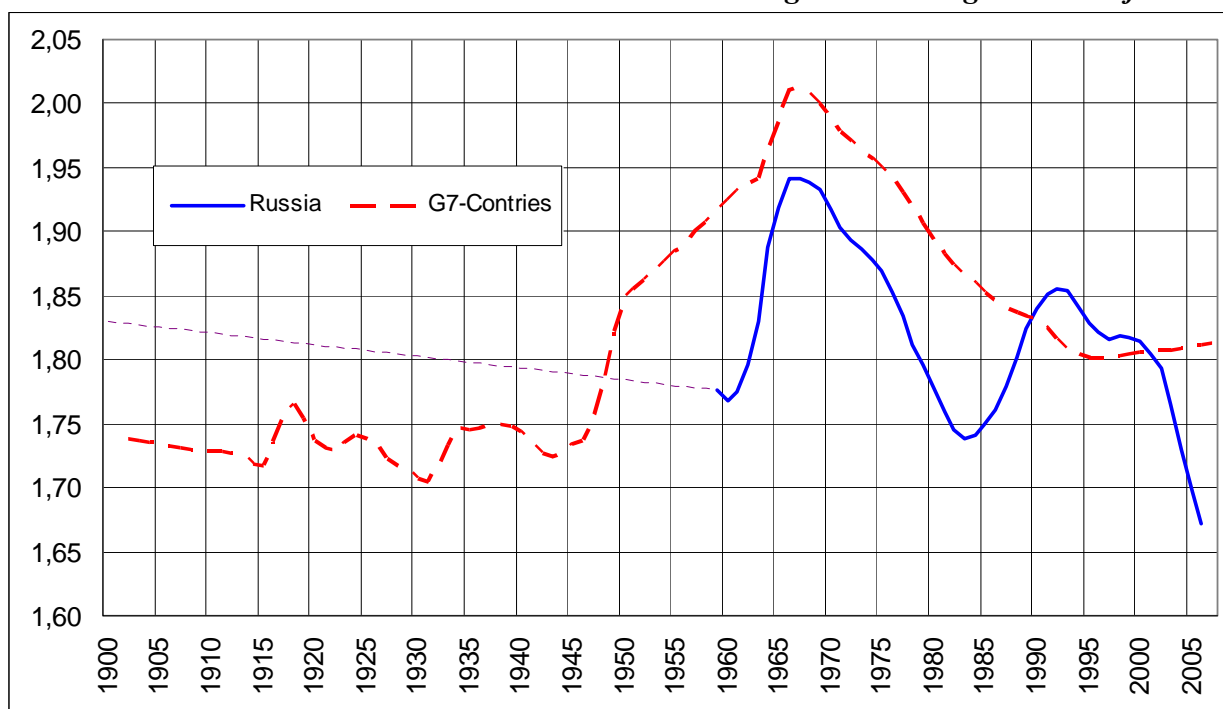
Italy	1881	1,78	2005	1,79
Spain	1887	1,74	2007	1,70
France	1891	1,66	2006	1,84
Belgium	1890	1,64	2007	1,83
Switzerland	1888	1,73	2008	1,85

In Figure 5 there are shown the averaged values of **LDLE**⁶ in the range of e 1900 – 2005 by the G7-countries and Russia.

Attention is to be paid to high stability of **LDLE** in place-to-place comparison and in comparison of the data on the selected period. The observed fluctuations in the index are in the range of $\pm 5\%$ of the mean value.

Although the calculations make it possible in our view, to record the existence of the demographic regularity – the relative stability of average ratio between the dependents and able-bodied members of the society, however, the specified ratio is subject to certain specified and sometimes quite significant fluctuations.

Figure.5. Averaged values of LDLE⁷.



Reasons of falling birth rates.

The birth-rate falling is the distinctive feature of the current state of all so-called developed countries of the European continent. However, the beginning of this process according to the statistical data refers to the period of the end of XIX, the beginning of XX centuries.

Explanations of this phenomenon are well-known.

⁶ For Russia, the depth of data available is very low – distributions of the number of population are given in existing sources starting just from 1959. Thus, on this graph, in the time range between the data of population census of 1897 and 1959, there is drawn a dashed line.

⁷ Sources: www.mortality.org (The Human Mortality Database), D.I. Mendelejev. Cit. source.

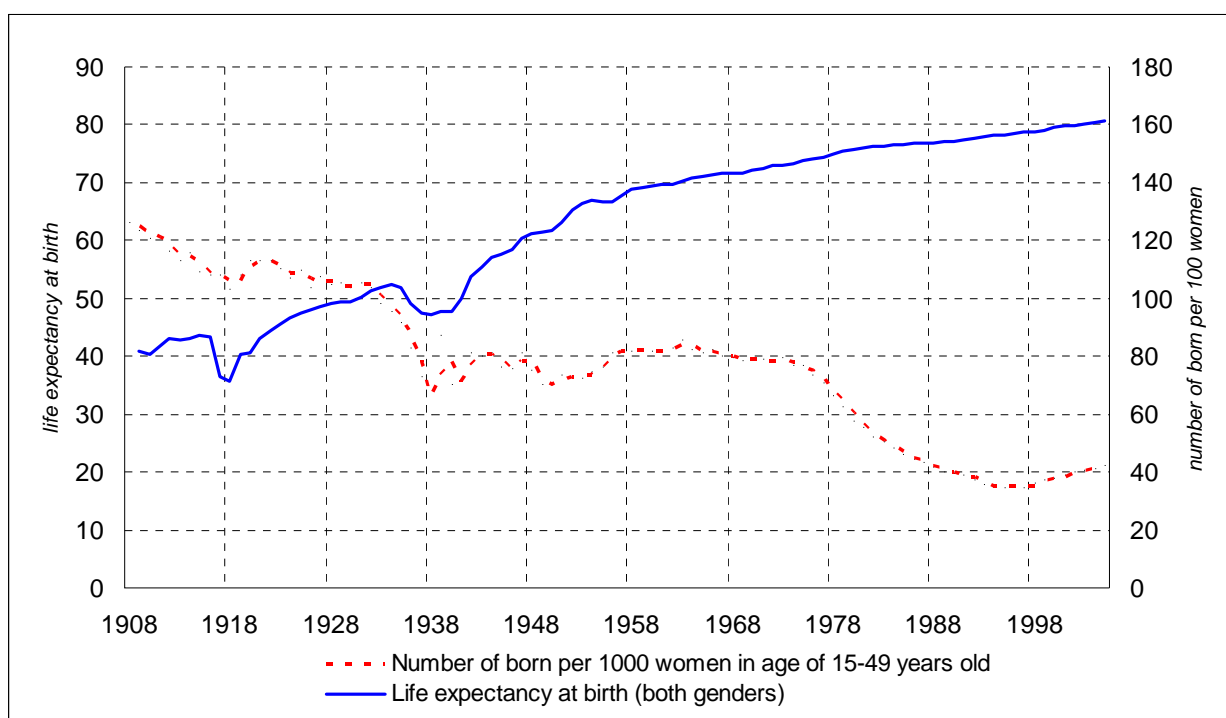
In building the graph, there were adopted the limits of working age being similar to the graph of fig. 4.

Here is one of them: «... the instinct of self-preservation is not an individual, but a collective one – and it dictates to humanity that we are in danger, but not because of the low, but because of the high birth rate. If we talk about the Earth as a whole, now its population is rapidly rising, 6.5 billion people - and will be even more – this is very much. So, there is no catastrophe in reducing the population on a global scale. In nature it happens, that there occurs an excessive propagation of population, and are engaged the biological mechanisms that restrain it, mostly through increased mortality. Human being so differs from animals that not waiting for disasters or epidemics, he begins to reduce birth-rate»⁸.

Perhaps that is so.

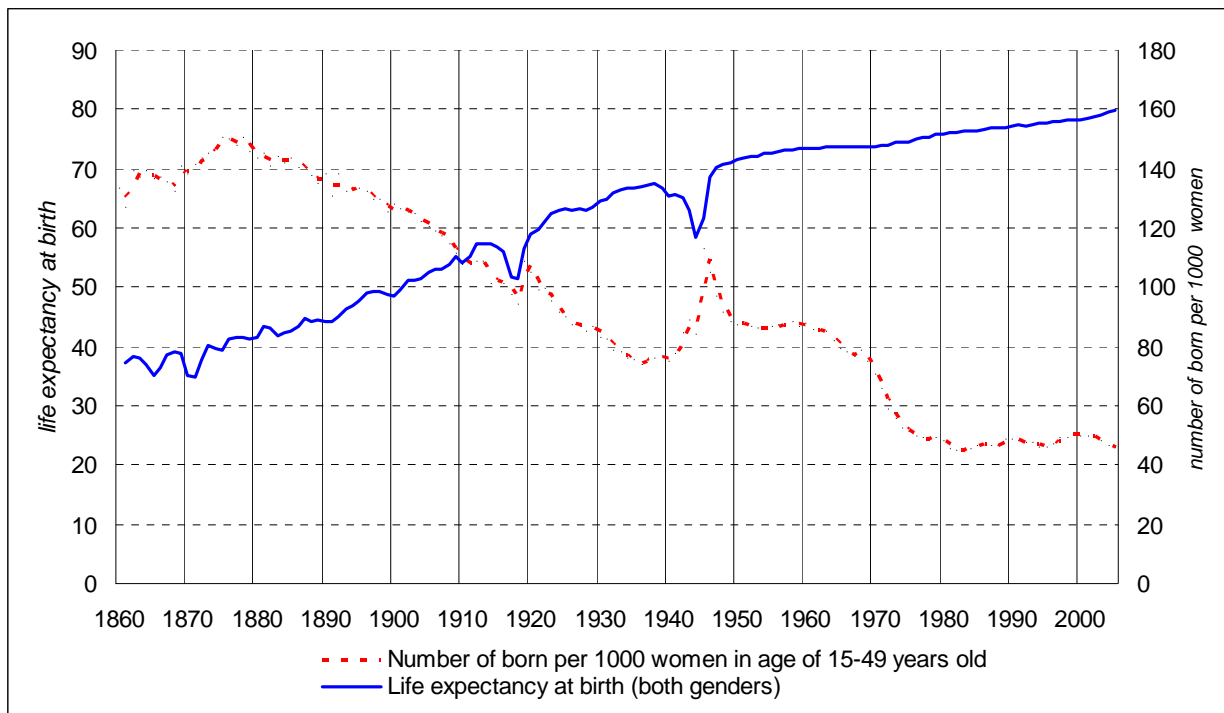
However, this brings up the question of unknown mechanism, or of the method hidden from our understanding, with the help of which the humanity (in the context of certain conditions of each country) gets wise to the need to implement its «collective instinct of self-preservation»?

Fig.7 Expectable lifetime and the number of born people per 1000 women in Spain.



⁸See Izvestiya, 13.04.06,- <http://www.izvestia.ru/russia/article3092017/>

Fig.8 Expectable lifetime and the number of born people per 1000 women in the Netherlands.



Presented in this thesis a hypothesis of the existence of the demographic constant – a relatively stable specific index of demographic load of the able-bodied person allows defining that the decline in birth-rate is the of compensation the **LDLE** value growth as a result of increasing the number of dependents: persons overstepped, and not reached the working age.

As one of the statistical evidence for justice of such finding, let's show the graphs of changes in lifetime and birth-rate levels in Spain and the Netherlands (see Fig.7 and 8).

It is interestingly, these two countries radically differ by mentality of the population that was manifested in significant differences of public attitude to the practice of birth-rate regulation. And nevertheless, a decline in birth-rate occurred in Spain as well. The threshold of 100 births per 1000 women was overcome in the Netherlands during about 1918-20 and in Spain during 1935-37. At present, the indicators of birth-rate in these countries are close enough.

Unlike the well-known phenomenon of the «Russian Cross» - growth of mortality being specific in particular for Russia accompanied by decreasing in birth-rate – the trends indicated here (Fig.7 and 8) have a universal character for the European countries.

Feedback between the lifetime and birth-rate has no doubt. Doubts arise about the mechanism of formation of such a link.

It seems to us that the mechanism includes two components: structural and social ones.

With regard to the structural component, that it is obvious. Essential value in forming the evident feedback of birth-rate and lifetime is in increasing the average age of women in fertile age. This growth of lifetime has natural influence on the

decline in birth-rate due to higher female reproductive ability in the junior categories of the period of female fertility.

The results of our calculations show that changes in the structure of women of fertile age are not the sole cause of birth-rate decline. Action of this factor has provided 12% of the total decline in birth-rate in RSFSR/Russia in the time range of 1959-2007.

In the process of birth-rate decline, the significant role (more than 85%) belongs to a social component.

It should be noted the factors being distinctive to all the countries in Europe, that influenced the change in demographics over the past half century. There are two of them:

- growth of average lifetime,
- growth of lower limit of occurrence of working age.

These factors reflect the result of use during the modern history of Europe of the regulative abilities of the society in the direction providing the better quality of life, on the basis of social policy consciously pursued. But on the other hand, the lateral, not predicted in advance result of social policy pursued in the European countries, aimed at increasing the lifetime, living standards and achieving the maximum employment, appeared to be a decline in birth-rate. We believe that the increase in lifetime and increase of the threshold of the able-bodied period, led to the growth in specific demographic load of the earner. This has led to fundamental changes in the sex-age distribution of the population of all the European countries. There occurred compensation – increasing in **LDLE** through considered factors of growth led to a decrease in the number of dependents in the lowest age-groups due to reducing the birth rate.

The process of growth of the average lifetime thoroughly examined in demographic studies based on the widespread use of medicine and biology achievements, has naturally caused a necessity to change the systems of material security for older (unworkable) generations fully developed in the previous centuries. Therefore, in the period considered by us, there has occurred a quite (by historical standards) harsh shift from the social principle of Bismarck – the next generations support the previous ones – to a system of guaranteed pension coverage.

Moreover, that shift was caused by interest of the fast-growing industry in destructing the patriarchal culture in the village that restrains the rate of forming the proletariat. The transition to a system of guaranteed (by the State, employer) pension coverage of employees, has created the preconditions to disappearance in the public consciousness of patriarchal, on its inner essence, severe connection between the number of children brought up by individuals with the reliability of ensuring an acceptable level for consumption in old age.

But the disappearance of connection in the consciousness, does not lead to the disappearance of actual relationships.

Pensions in the consumer finance market are a competitor of wages. In the paper «Corruption – is the reason of abnormal inflation», there was shown that the social benefits are one of the factors of forming the shaping extrovert inflation⁹. The striving to create personal retirement financial reserve in any of its possible forms, is directly related

⁹ See <http://www.viperson.ru/wind.php?ID=454178&soch=1>

to the reduction of level of current consumption, while at the same time there are indirectly created the incentives for individuals to seek affordable ways of compensation. This may be both a realization of the striving to increase income, and the formation of public behavior, aiming to avoid additional costs.

A significant factor being comfortable for the managerial elite of the social climate was and is the striving to ensure the maximum employment. A struggle with unemployment is a permanent feature of the socio-economic policies of the governments of all the countries in Europe in recent history.

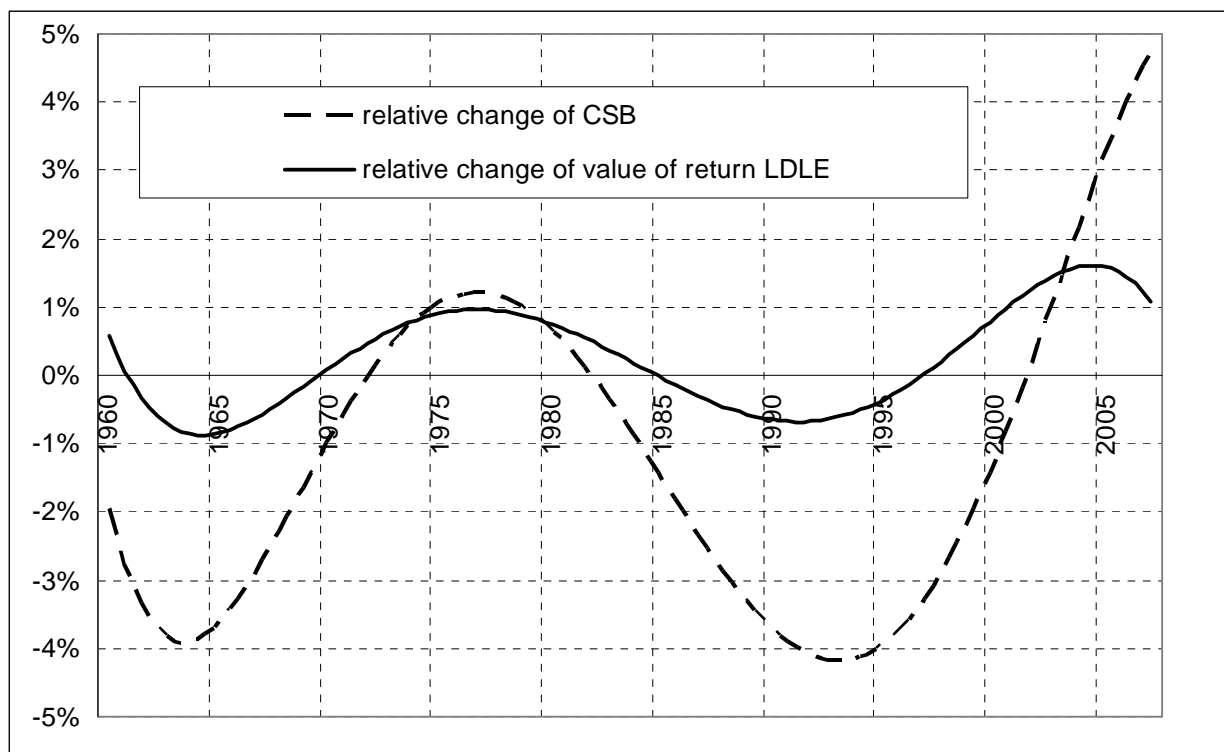
From the point of demographical view, the struggle for high employment was reflected in the increase in the threshold of working age. On the one hand, the increase in timing of studies is a reflection of the increased complexity of skill formation, but on the other hand, this is a form of reducing a level of competition for jobs.

One of the most significant issues to be solved by the demographic science is to define the internal causes of change in the dynamics and structure of human population.

Our research and the conclusion based on it regarding the determinancy of decline in birth-rate by the growth of demographic load of the earner, bears in its basis a quite meaningful paradigm. The essence of this key idea lies in the presence of a deep inner connection between the demographic and economic processes occurring in the society.

In this regard, considerable interest is the comparison of change of **LDLE** and the dynamics of birth-rate in RSFSR/Russia in the statistically accessible range: 1959 - 2006 years (see fig. 9).

Fig.9 Change of relative from year to year indices of the coefficient of the summarized birth-rate (CSB) and value of return LDLE (smoothed curves¹⁰).



¹⁰ There was used a least-squares method.

This quite amazing synchronicity of changing in birth-rate with the transformation of the demographic load of the employable Russian over the past fifty years can not fail to attract attention. On the one hand, those similarities, when the growth rate of the **LDLE** index is accompanied by a decline in birth-rate, and its decline is synchronized with the growth of CSB, is a definite confirmation of correctness of the hypothesis put forward by us regarding the existence of the demographic constant. While, on the other hand, the data presented in Fig. 9 are still perceived as the «information for thought», because it is quite clear that the dynamics of the **LDLE** index may be not the only factor influencing the change in birth-rate in one or another country. Confirmation or denial of the existence and valuation of the force of the connection of specific demographic load and birth-rate requires and advanced study in various countries around the world in various time intervals.

The results of our study of the dynamics and connection of **LDLE** with other demographic indicators allow affirming that the accountancy of impact of the demographic load changing of the earner could become one of the tools applied in forming the social and economic policies at the regional and state levels.