**RUDN Journal of Sociology.** ISSN 2313-2272 (print), ISSN 2408-8897 (online) **2023 Vol. 23 No. 4 825–838**
**Вестник РУДН. Серия: СОЦИОЛОГИЯ** http://journals.rudn.ru/sociology

DOI: 10.22363/2313-2272-2023-23-4-825-838
EDN: HYQPFP

# Interdisciplinary study of the medium-term fertility trend in Latvia (1970–2022)*

**V. Menshikov[1], J. Kudins[1], A. Kokarevica[2], V. Komarova[1], E. Cizo[1]**

[1]Daugavpils University,
*Vienibas St., 13, Daugavpils, Latvia, LV-5401*

[2]Riga Stradins University,
*Dziriema St., 16, Riga, Latvia, LV-1007*

(e-mail: vladimirs.mensikovs@du.lv; janis.kudins@du.lv; anita.kokarevica@rsu.lv; vera.komarova@du.lv; edmunds.cizo@du.lv)

Abstract. The article aims at identifying the medium-term fertility trend in Latvia. The main research question is whether it is possible in the near future to increase fertility in Latvia, as planned in the "Strategy for the Reproduction of the Nation FAMILY — LATVIA — 2030 (2050)". The authors conducted the mathematical analysis of fertility in Latvia for the medium-term period of 1970–2022 (53 years), which includes two decades of the so-called "Soviet era" and the period of independence after the collapse of the USSR. The study is based on the available data of the official Latvian statistics on the total fertility rate. The novelty of this interdisciplinary — demographic, economic and sociological — study is determined by the use of mathematical analysis to identify demographic trends, which is not typical for the publications of Latvian and foreign researchers. The study is also based on the theory of economic cycles to identify demographic fertility cycles and their phases in Latvia and to predict fertility rates in Latvia for the near future. Furthermore, the analysis of the sociological surveys data allowed to understand the main reason for the steady — in the medium-term perspective — linear decline in fertility in Latvia. This reason is value changes in the society, in which children are no longer at the center of the life value system of men and especially women in Latvia, i.e., are no longer considered necessary for the realization of their life goals and ambitions. Based on the results of the mathematical analysis of the medium-term fertility trend in Latvia, the authors believe that the decline in fertility in Latvia will continue for several more years before the bottom of the next demographic fertility cycle will be reached (and this bottom will be lower than the previous one, i.e., below 1.22 –1.25), and there will be an upturn in a linearly declining fertility trend. However, even this expected rise will not reach the previous peak; the next peak is likely to be below 1.74. Thus, the desired and even expected by the creators of the "Strategy for the Reproduction of the Nation" increase in fertility in Latvia to the level of 1.77 by 2027 is considered by the authors unattainable.

Key words: fertility; total fertility rate; mathematical analysis; demographic cycles; economic cycles; value system changes; Latvia

---


*The article was submitted on 17.07.2023. The article was accepted on 16.10.2023.*

The starting point for this study was the "Population Reproduction Strategy FAMILY — LATVIA — 2030 (2050)" [11] presented on November 9, 2022. Its main goal, which is clear from its title, is to ensure the population reproduction in Latvia in the near decades. Since the presentation of the Strategy, its priorities and forecasts have been widely discussed in the Latvian mass media [13; 16; 31] and by Latvian academic researchers, who have focused on the issues of reproduction of the population of Latvia both before and after the adoption of the Strategy [15; 34; 35] to examine the current global trends in fertility decline [9; 25; 27; 30; 33]. Thus, the decline in fertility is not a purely Latvian problem, and the scientific community, the public and the state all over the world, are concerned about it [1; 12; 17; 19; 20].

The article aims at considering the medium-term trend in fertility in Latvia in terms of the total fertility rate (the average number of children that could be born by one woman during her life if the birth rate in each age group remained at the level of the reference year [22]) with the mathematical and sociological methods. The main research question is whether the Strategy's goals can be achieved in the near future. According to the summary, the "Population Reproduction Strategy FAMILY — LATVIA — 2030 (2050)" is "a targeted set of necessary measures designed to stop the decline in demographic indicators and contribute to the revival of the nation. The Strategy presents specific strategic directions of actions, support tools, programs and ways to increase the birth rate in the country" [11. P. 5]. As for specific figures of the total fertility rate in Latvia, the Strategy aims at achieving the fertility level of 1.77 by 2027, with an intermediate indicator of 1.72 in 2024, a base indicator of 1.61 in 2018 and a real indicator of 1.57 in 2021 [11. P. 5]. However, in 2022 the total fertility rate in Latvia was 1.47 [6]. Concerning the real demographic indicators, the Strategy's goal — 1.77 by 2027 — seems unrealistic. The Latvian demographer Z. Vārpiņa has already called this Strategy "a letter to Santa Claus" [16]. In order to evaluate the possibility of increasing fertility in Latvia in the near future, we conducted the mathematical analysis [5; 7; 10; 32] of the fertility trend in Latvia for the medium-term period of 1970–2022, which consists of the so-called "Soviet era" and the period of the Latvian independence after the collapse of the Soviet Union [6].

The results of our review of publications on fertility trends in the contemporary world show that usually the analysis of these trends is rather descriptive [4; 8; 17; 18]. For instance, "the total fertility rate shows the most favorable situation in the 1980s and the lowest level of population reproduction in the second half of the 1990s" [4] (situation in Latvia); "after the Second World War, the birth rate in Latvia increased slightly and fluctuated around 19 newborns per 1000 inhabitants, but then decreased and fluctuated between 16–17 newborns in the 1950s" [18]; "the total fertility rate in Latvia increased to 1.74 in 2016, reaching its highest level since 1992, however, since 2017 it has gradually decreased and in 2021 it was 1.57, which is slightly higher compared to 2020–1.55; however, it is far from the number of children per woman required for a normal generational change" [8]; "fertility had

fell continuously from 1992 to 2003, primarily due to educated women increasingly delaying their first child. The rise in fertility from 2005 confirmed that the preceding decline in fertility was actually a result of some women delaying their first child… As a result, women in their 30s overtook women in their 20s as having the highest rates of fertility and the total fertility rate increased and peaked at just over 2 babies per woman in 2007. From that peak in 2007, the fertility rate has fallen over the last decade and by 2018 it was back to approximately the historical low recorded in 2001" [17] (situation in Australia). Such a descriptive approach to the analysis of fertility trends, first, is rather superficial, without a detailed formalized analysis and an understanding of fertility in dynamics; second, does not allow to scientifically answer our research question. Therefore, we wanted to fill this methodological gap in fertility research with the mathematical and economic-sociological analysis of the fertility trend in Latvia in the medium-term period of 1970–2022 (53 years).

For a mathematical model of the nonlinear process of changes in fertility in Latvia in terms of the total fertility rate over several decades, i.e., for a formula for the total fertility rate function based on several dozen points, the authors used the polynomial interpolation method for approximation of the function [10]:

$$f(x) = a_0 + a_1x + a_2x^2 + \ldots + a_nx^n, \quad (1)$$

f ($x$) — approximating function;

$a_0, a_1, a_2, \ldots, a_n$ — coefficients to be found ($a_0$ — value of the free term, indicates the value of $y$ at $x = 0$, i.e., this is the initial level of fertility at the beginning of the period under study);

$x$ — independent variable ($x$ value from data points).

The authors chose the polynomial type of interpolation as the most suitable approximation method, in which a function is approximated by a polynomial that passes through all given points; thereby, representing the behavior of the function over the range of interest [7]. To assess the influence and interpretation of a polynomial function, the authors used additional analysis of the function (In particular, differentiated the function, i.e., analyzed its derivatives at each point corresponding to each year of the period under study) [10] and visualization of the graph of the medium-term fertility trend in Latvia. Methodologically, even simple comparisons of fertility rates for specific years can show how fertility has changed over time. On the other hand, the derivative provides a more general and continuous way for the analysis of changes in variables (fertility rates) over the entire period under study, not limited to just specific years. Such an approach reveals more subtle trends and periods of change, which may be less obvious from simple comparisons of variables for specific years [5; 10]. The derivative can also help identify precise points in a trend change, such as the year fertility began to decline or rise.

For a function of type $f(x) = a_0 + a_1x + a_2x^2 + \ldots + a_nx^n$ (1), where n is the degree of the polynomial, and $a_0, a_1, a_2, \ldots, a_n$ are coefficients, the derivatives will

be calculated by differentiating each term separately with the rule of differentiation of the degree function $x^n$ [10]:

$$dy/dx\ (x^n) = nx^{n-1}. \quad (2)$$

Since the polynomial function can have different slopes in different parts of its graph, calculating its derivative at each point *x* allows to understand how the value of the function *y* changes as the variable *x* changes [5; 10]. The smaller the absolute value of the derivative, the slower the fertility rate changes in a particular year within the time period under study. If the derivative is negative at a certain point, this means that as the value of *x* at that point increases, the value of the function *y* decreases; if it is positive, it increases.

The authors began the mathematical analysis of the fertility trend in Latvia for the medium-term period of 1970–2022 by approximating the function based on the polynomial interpolation method [5]. Thus, the following mathematical model of changes in fertility over the last half century was used on the data from [6]:

$$y = 0{,}0097*x^6 - 0{,}1751*x^5 + 1{,}1776*x^4 - 3{,}599*x^3 + \\ + 4{,}8292*x^2 - 2{,}393*x + 2{,}2168 \quad (3)$$

*y* — fertility rate;

*x* — the ordinal number of the year in a 53-year period (0 = 1970, 0.1, 0.2, …, 5.2 = 2022), reduced by 10 times to avoid a linear growth of the derivative due to large values ____of the ordinal year numbers [32].

The approximating mathematical model of changes in fertility rates in Latvia over the past half century is a polynomial function of the sixth degree, i.e., the relationship between variables (the total fertility rate and the ordinal number of the year within the period of 1970–2022) is complex and contains nonlinear effects. The determination coefficient $R^2$ is equal to 0.8463, which indicates a good quality of approximation: the share of variation over time in the total fertility rate explained by the approximating function is almost 85 %. The statistical significance of the $R^2$ was estimated by testing the null hypothesis of Fisher's *F*–statistics: $F_{act}$=15,8 at a 5 % significance level, which is larger than the critical value $F_{cr}$=4.96. The null hypothesis about the inconsistency of the equation after the approximation was rejected [26]. The determination coefficient $R^2$ is statistically significant, and the resulting mathematical model can be used in further analysis.

From the approximating mathematical model of changes in fertility in Latvia over the last half century (3), we can make the following conclusion: since a degree function always has several extrema (maxima and minima) and bends in graph, the medium-term fertility trend in Latvia has a 'wave' nature: like all social processes, the medium-term fertility trend in Latvia is non-linear, i.e., there have been and will

be ups and downs in fertility, which do not say anything about the general trend — downward or upward. These repeated fluctuations in fertility resemble economic cycles/cycles of economic activity [14] and characterize only short-term cyclical changes that periodically replace each other: an increase in fertility is followed by a decrease, then an increase again, then a decrease again, etc., regardless — by and large — of changes in political situation, economic conditions, climate and other factors — their influence on fertility indicators overlaps and 'produces' a result that does not go beyond the global longer-term, declining fertility trend.

However, we need a graph of functions, both initial and approximating, which allows to more accurately assess the nature of the medium-term fertility changes in Latvia, to visually assess the shape of dependence, highlight the features of the function (extrema and bends) and visually represent the general direction of the fertility trend in Latvia. In order to identify more subtle trends and periods of change in the fertility trend, we differentiated the function obtained after approximation (3; Fig. 1), i.e., defined the derivative of the function at each point *x*, indicating the ordinal number of the year during the entire 53-year period under study.

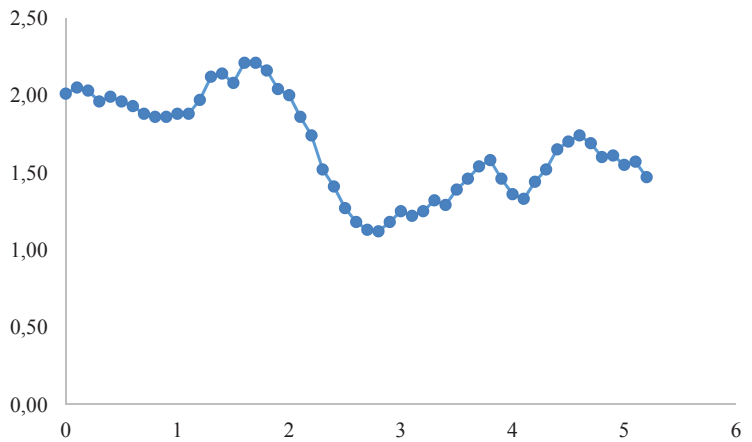


Figure 1. Changes in the total fertility rate, 1970–2022, Latvia
(y — total fertility rates, x — years, i.e., 0 = 1970, 0.1, 0.2, ..., 5.2 = 2022)

Table 1 shows changes in the total fertility rate and the derivative of the fertility function in Latvia over the period of 1970–2022, providing an empirical interpretation (In relation to fertility) of changes in value of the derivative. The data in Table 1 (and Fig. 1) show the cyclical nature of the medium-term fertility trend in Latvia, with a generally decreasing slope — from 2.01 in 1970 to 1.47 in 2022. Furthermore, in the medium-term perspective of changes, there were periods of apparent contradiction — when fertility increased, and the derivative of the function (rate of change) was negative (for example, 1970–1971, 1983–1984), and the opposite also happened — fertility decreased, and the derivative of the function was positive (for example, 2003–2004, 2009–2010)

*Table 1*

Changes in the total fertility rate and in the derivative of fertility function, 1970–2022, Latvia

| Year | Total fertility rate | Change compared to the previous year | Value of the derivative* | Percentage change in the derivative compared to the previous year** | Empirical interpretation |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 1970 | 2.01 | | –2.393 | | |
| 1971 | 2.05 | 0.04 | –1.5305 | 36 | Previous growth in fertility is slowing (In 1965–1.74) |
| 1972 | 2.03 | –0.02 | –0.8569 | 44 | |
| 1973 | 1.96 | –0.07 | –0.347 | 59.5 | |
| 1974 | 1.99 | 0.03 | 0.0225 | 106.5 | Fertility growth slowed down and changed to decline |
| 1975 | 1.96 | –0.03 | 0.2729 | 1112.9 | |
| 1976 | 1.93 | –0.03 | 0.4236 | 55.2 | Fertility decline continues but slows |
| 1977 | 1.88 | –0.05 | 0.4926 | 16.3 | |
| 1978 | 1.86 | –0.02 | 0.4958 | 0.6 | Fertility decline stopped and changed to growth |
| 1979 | 1.86 | 0 | 0.4478 | –9.7 | |
| 1980 | 1.88 | 0.02 | 0.3615 | –19.3 | Fertility growth continues but slows |
| 1981 | 1.88 | 0 | 0.2483 | –31.3 | |
| 1982 | 1.97 | 0.09 | 0.1184 | –52.3 | |
| 1983 | 2.12 | 0.15 | –0.0197 | –116.6 | Fertility growth stopped and changed to decline |
| 1984 | 2.14 | 0.02 | –0.1583 | –703.6 | |
| 1985 | 2.08 | –0.06 | –0.2913 | –84 | Fertility decline continues but slows (a short-term fertility rise in 1986–1987 did not change the general trend) |
| 1986 | 2.21 | 0.13 | –0.4135 | –41.9 | |
| 1987 | 2.21 | 0 | –0.5208 | –25.9 | |
| 1988 | 2.16 | –0.05 | –0.61 | –17.1 | |
| 1989 | 2.04 | –0.12 | –0.6791 | –11.3 | |
| 1990 | 2.00 | –0.04 | –0.7266 | –7 | |
| 1991 | 1.86 | –0.14 | –0.752 | –3.5 | |
| 1992 | 1.74 | –0.12 | –0.7554 | –0.5 | |
| 1993 | 1.52 | –0.22 | –0.7375 | 2.4 | |
| 1994 | 1.41 | –0.11 | –0.6997 | 5.1 | |
| 1995 | 1.27 | –0.14 | –0.6439 | 8 | |
| 1996 | 1.18 | –0.09 | –0.5722 | 11.1 | |
| 1997 | 1.13 | –0.05 | –0.4872 | 14.9 | |
| 1998 | 1.12 | –0.01 | –0.392 | 19.5 | |
| 1999 | 1.18 | 0.06 | –0.2894 | 26.2 | |
| 2000 | 1.25 | 0.07 | –0.1829 | 36.8 | |

*End of Table 1*

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| 2001 | 1.22 | –0.03 | –0.0757 | 58.6 | Fertility decline stopped and changed to growth |
| 2002 | 1.25 | 0.03 | 0.0288 | 138 | |
| 2003 | 1.32 | 0.07 | 0.1274 | 342.4 | Fertility growth continues but slows (the short-term fertility decline in 2009–2010 did not change the general trend) |
| 2004 | 1.29 | –0.03 | 0.217 | 70.3 | |
| 2005 | 1.39 | 0.1 | 0.2946 | 35.8 | |
| 2006 | 1.46 | 0.07 | 0.3575 | 21.4 | |
| 2007 | 1.54 | 0.08 | 0.4034 | 12.8 | |
| 2008 | 1.58 | 0.04 | 0.4305 | 6.7 | |
| 2009 | 1.46 | –0.12 | 0.4373 | 1.6 | |
| 2010 | 1.36 | –0.1 | 0.423 | –3.3 | |
| 2011 | 1.33 | –0.03 | 0.3873 | –8.4 | |
| 2012 | 1.44 | 0.11 | 0.3306 | –14.6 | |
| 2013 | 1.52 | 0.08 | 0.2542 | –23.1 | |
| 2014 | 1.65 | 0.13 | 0.1602 | –37 | |
| 2015 | 1.7 | 0.05 | 0.0514 | –67.9 | |
| 2016 | 1.74 | 0.04 | –0.0682 | –232.7 | Fertility growth stopped at the 1965 rate (1.74) and fertility began to decline |
| 2017 | 1.69 | –0.05 | –0.1937 | –184 | Fertility decline continues but slows |
| 2018 | 1.6 | –0.09 | –0.3189 | –64.6 | |
| 2019 | 1.61 | 0.01 | –0.4367 | –36.9 | |
| 2020 | 1.55 | –0.06 | –0.5385 | –23.3 | |
| 2021 | 1.57 | 0.02 | –0.6145 | –14.1 | |
| 2022 | 1.47 | –0.1 | –0.6535 | –6.3 | |

* Derivatives were calculated using Formula 3, taking into account, respectively, three or four decimal places
** Calculation of percentage changes is necessary to consider both absolute and relative differences between values of the derivative and to reduce the effect of a purely mathematical relationship between values of the function and its derivative associated with changes in the variable x

Such situations are a good example of how important not only values of the function but also its derivatives are for a more complete understanding of the dynamics of changes in fertility in the general trend. For example, the negative derivative in 1970–1971 under the rising fertility rates indicated that the previous growth in fertility (In 1965–1.74 [6]) was slowing down, and the negative derivative with an increase in fertility in 1983–1984 — that the growth of fertility stopped and changed to decline. In turn, the positive derivative in 2003–2004 (when fertility fell) indicates that fertility growth continued but

slowed down, and the short-term decline in fertility in 2009–2010 (most likely due to the 2008 global financial crisis) did not change the general growing trend in 2003–2015. The behavior of the derivative of the fertility function in Latvia (Fig. 2) confirms a fairly uniform cyclicality in the development of fertility at least since 1973, i.e., before the social-economic and political changes in Latvia in the early 1990s.

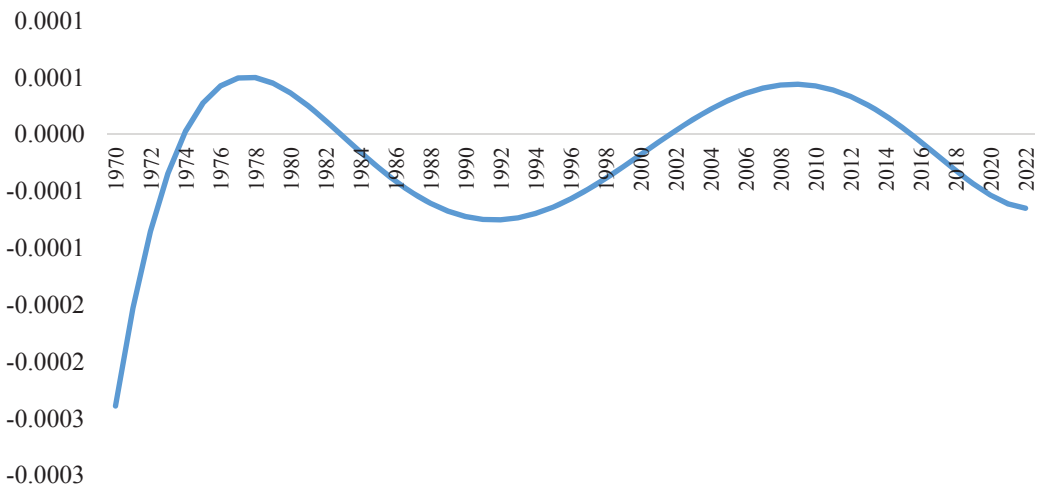


Figure 2. The derivative (rate of change) of the fertility function, 1970–2022, Latvia

In Table 2, we identified the various phases of the demographic fertility cycles in Latvia, using an analogy with the phases of economic cycles — growth (expansion), peak or boom, decline (recession), bottom (depression) [29]. We also tried to predict the fertility trend in Latvia in the near future, focusing on the possibility of its increase.

According to the data in Table 2, there are indeed empirically based, demographic fertility cycles similar to economic cycles [14; 29] and even related to them [21; 23]. In the demographic perspective, historical process is a sequence of demographic cycles, and the mirror image of demographic cycles are cyclical changes in per capita consumption, that is, cycles of real wages or income [21]. Based on the results of our mathematical analysis, we can expect that the fertility decline in Latvia will continue for several more years until the bottom of the next demographic fertility cycle will be reached, followed by a reversal in the long-term declining fertility trend. However, the next growth will not reach the previous peak. Thus, the desired and even expected by the creators of the "Population Reproduction Strategy FAMILY — LATVIA — 2030 (2050)" increase in fertility in Latvia to the level of 1.77 by 2027 with an intermediate indicator of 1.72 in 2024 is unattainable in any social-economic and political conditions.

*Table 2*

Phases of the demographic fertility cycles, 1970–2022, Latvia

| Time interval | Empirical interpretation of changes in the derivative value | Duration of phase | Name of phase |
|---|---|---|---|
| 1970–1973 | The growth in fertility slows (1.74 in 1965, 1.96 in 1973) | 4 years | Growth (expansion) |
| 1974–1975 | Fertility growth slowed down and changed to decline (1.99–1.96) | 2 years | Peak (boom) |
| 1976–1977 | Fertility began to decline, with the rate of decline slowing (1.93–1.88) | 2 years | Decline (recession) |
| 1978–1979 | Fertility decline stopped and changed to growth (1.86 in 1978 and 1979) | 2 years | Bottom (depression) |
| | Next demographic fertility cycle | | |
| 1980–1982 | Fertility growth continues but slows (1.88–1.97) | 3 years | Growth (expansion) |
| 1983–1984 | Fertility growth stopped and fertility began to decline (2.12–2.14) | 2 years | Peak or boom |
| 1985–2000 | Fertility decline continues but slows (the short-term rise in fertility in 1986–1987 — a result of M. Gorbachev's anti-alcohol campaign which did not change the general trend) (2.08–1.25) | 16 years | Decline (recession) |
| 2001–2002 | Fertility decline stopped and changed to increase (1.22–1.25) | 2 years | Bottom (depression) |
| | Next demographic fertility cycle | | |
| 2003–2015 | Fertility growth continues but slows (1.32–1.70); a sharp short-term decline in 2009–2010 as a result of the 2008 global financial crisis (1.46–1.36) | 13 years | Growth (expansion) |
| 2016 | Growth stopped at the 1965 level (1.74), fertility began to decline | 1 year | Peak or boom |
| 2017–2022 | Fertility decline continues but slows (1.69–1.47) | 6 years | Decline (recession) |

The decline will continue for several more years until the bottom of the next cycle will be reached (this bottom will be lower than the previous one, i.e., below 1.22–1.25), and there will be a turn towards fertility growth as a part of the long-term declining trend. Thus, the next growth will not reach the previous peak, i.e., the next peak may be below 1.74

The main reason for the impossibility of increasing fertility in Latvia in the near future is value changes studied and interpreted by sociologists and demographers in Latvia and other countries. In the Soviet era, the ideal family model was a family with two children (both large families and childless ones were rare) [35], which ensured the fertility rates close to 2. Today, as the data of the comparative sociological "Study of factors affecting marriage, fertility and positive parent-child relationships" (2004 — N=1970; 2022 — N=2297), conducted by the University of Latvia, show, "family still has value (safety, health of loved ones), but the child

is no longer the only and necessary means of realizing one's life ambitions; the child is no longer at the center of the value system" [16] (Table 3). Thus, "with a decrease in the self-worth of children and families, one can expect that people will make less effort to achieve this value, i.e., they will be less willing to create families and have children" [24. P. 57]. The current tendency among the youth not to put in extra effort (to work) is also evidenced by the results of the international survey conducted by the Randstad Deutschland (N=35,000, 18–24-year-olds): 58 % would quit their job if it interfered with their enjoying life, and 38 % have already done this at least once. Many HR managers in Western (and not only Western) companies complain that young people do not want to take responsibility, do not want to work 5 days a week, and in every possible way avoid "overtime" [2].

*Table 3*

Hierarchies of values, Latvia [24. P. 57].

| Values | Place in the hierarchy, 2004 | Place in the hierarchy, 2022 | Values |
|---|---|---|---|
| Family safety (safety of loved ones) | 1 | 1 | Family safety (safety of loved ones) |
| Health (no physical or mental illness) | 2 | 2 | Health (no physical or mental illness) |
| Children and family (as an intrinsic value) | 3 | 3 | Peace in the world (no wars and conflicts) |
| Inner harmony | 4 | 4 | Freedom (of action and thought) |
| Mature love | 5 | 5 | Inner harmony |
| Self-esteem | 6 | 6 | Self-esteem |
| Sincere friendship | 7 | 7 | Honesty |
| Freedom (of action and thought) | 8 | 8 | Intelligence |
| Intelligence | 9 | 9 | Country safety (protecting my people from enemies) |
| Honesty | 10 | 10 | Sincere friendship |
| Peace in the world (no wars and conflicts) | 11 | 11 | Mature love |
| Country safety (protecting my people from enemies) | 24 | 22 | Children and family (as an intrinsic value) |

Researchers of the female childlessness in Lithuania, based on the results of the comparative survey of women of two generations, concluded that "the subjectively perceived causes of childlessness reveal different ways of experiencing childlessness… In terms of voluntary childlessness, the differences between two generations are great. Older women never say that they chose to remain childless, even though they admit never really wanting children; younger women are not afraid to declare they chose to be childfree and enjoy it" [30. P. 19–20]. Thus, "the value choice largely determines the pace and direction of the evolution of the contemporary society" [3. P. 247], including its demographic development. "Previously, it was believed that economic success was the decisive factor in improving people's lives, achieving social dynamics and success in international cooperation" [28. P. 427]. Much later, the "programming role of culture" [3. P. 246] was recognized as "a way to transfer the accumulated social-historical experience (supra-biological programs of human life) to the organization of social life, its changes and generations… To change and transform into a new type, the society needed a change in its cultural code, worldview universals, then in technical and economic development and competition with other societies, which would determine the future fate of the new type of social organization" [28. C. 428–429].

We believe that the short-term ups and downs in fertility in Latvia are determined mainly by social-economic and political factors. For example, fertility increased in 1986–1987 due to M. Gorbachev's anti-alcohol campaign and decreased in 2009–2010 due to the shock of the 2008 global financial crisis. Such short-term ups and downs do not imply fundamental changes in the current phase — growth or decline — of the demographic fertility cycle. More sustainable and long-term changes in the fertility trend are most likely determined not by social-economic or political factors, but by value system changes. Furthermore, the current cult of enjoying life does not support the childcare idea, which is the key factor for the steadily declining fertility rate — both in Latvia and in other countries of Europe and the world.

## References

1. Adhia N. Some demographic trends in the world's most populous country-to-be. *Demographics, Social Policy, and Asia (Part II)*. 2018; 23 (2).
2. Baumejster A. Do not work! Be lazy and enjoy life! *YouTube*. 2023. (In Russ.).
3. Belov A.A., Danilov A.N., Rotman D.G. Value factor of the countries uneven development. *RUDN Journal of Sociology*. 2023; 23 (2).
4. *Bērziņš A*. Changes in birth rates. Krišjāne Z., Krūmiņš J. (Eds.). *Population Reproduction and Challenges for Renewal of Society in Latvia*. Riga; 2019. (In Latv.).
5. Brannan D. *A First Course in Mathematical Analysis*. Cambridge; 2006.
6. Central Statistical Bureau of the Republic of Latvia. IDK010. Fertility rates 1965–2022. 2023. URL: https://data.stat.gov.lv/pxweb/lv/OSP_PUB/START__POP__ID__IDK/IDK010/table/tableViewLayout1.

7. Deshpande J.V. *Mathematical Analysis and Applications: An Introduction.* Alpha Science International; 2004.
8. Eglīte P. Birth rates and family policy in Latvia, 1990–2009. *LZA Vēstis=Bulletin of the Latvian Academy of Sciences.* 2011; 65 (3/4). (In Latv.).
9. Eurostat. Total fertility rate (tps00199). 2023. URL: https://ec.europa.eu/eurostat/web/population-demography/demography-population-stock-balance/database
10. Gedroica V. *Differential Calculus of Functions of One Argument.* 2005. URL: https://de.du.lv/matematika/gedroica/Difrek1.pdf. (In Latv.).
11. Interdepartmental Coordination Center. *National Regeneration Strategy FAMILY — LATVIA — 2030 (2050).* 2022. URL: https://www.pkc.gov.lv/sites/default/files/inline-files/TAS_Plans%2009.11 %20projekts.pdf. (In Latv.).
12. Kearney M.S., Levine Ph.B. The causes and consequences of declining US fertility. 2022. URL: https://www.economicstrategygroup.org/publication/kearney_levine.
13. Klimovičs R. (2022) Strategy for national regeneration. Looking for a way out of the "demographic hole". URL: https://lvportals.lv/norises/346533-tautas-ataudzes-strategija-mekle-izeju-no-demografiskas-bedres-2022. (In Latv.).
14. Korotaev A.V., Tsirel' S.V. Kondratieff waves in the global economic dynamics. Korotaev A.V., Khalturina D.A. (Eds.). *System Monitoring. Global and Regional Development.* Moscow; 2009. (In Russ.).
15. Krišjāne Z., Krūmiņš J. (Eds.). *Population Reproduction and Challenges for Renewal of Society in Latvia.* Riga; 2019. (In Latv.).
16. Latvia Television Program "Forbidden Technique". [Europe is dying — what can be done to have more children in Latvia? Explores the "Forbidden Technique"]. 2023. URL: https://www.lsm.lv/raksts/zinas/zinu-analize/eiropa-izmirst-ko-darit-lai-latvija-dzimtu-vairak-bernu-peta-aizliegtais-panemiens.a491783. (In Latv.).
17. McDonald P. A projection of Australia's future fertility rates. 2020. URL: https://population.gov.au/sites/population.gov.au/files/2021-09/2020_mcdonald_fertility_projections.pdf
18. Mežs I. Ethnic and regional aspects of birth in Latvia 1985–2010. *LZA Vēstis=Bulletin of the Latvian Academy of Sciences.* 2011; 65 (3/4). (In Latv.).
19. Mosakova E.A. Era of covid-19: How the pandemic affected gender inequality and fertility (on the example of BRICS). *RUDN Journal of Sociology.* 2023; 23 (2). (In Russ.).
20. Mubila M. Briefing Note 4: Africa's demographic trends. 2012. URL: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/FINAL%20Briefing%20Note%20 4 %20Africas%20Demographic%20Trends.pdf
21. Nefyodov S.A. On the theory of demographic cycles. 2001. URL: http://www.hist.msu.ru/Labs/Ecohist/OB8/nefedov.htm. (In Russ.)
22. Official statistics portal: Number of births and birth rates. 2023. URL: https://stat.gov.lv/lv/statistikas-temas/iedzivotaji/dzimstiba/238-dzimuso-skaits-un-dzimstibas-koeficienti. (In Latv.).
23. Ovechkina N.I., Shulgina N.A. Cyclicity theory in economics and demography. *Vestnik NGUEU=Bulletin of the NSUEM.* 2012; 2. (In Russ.)
24. Pirsko L., Sebre S., Upmane A. Exploring the factors contributing to marriage, fertility, and positive child-parent relationships: A comparison of 2022 and 2004 survey results. Riga; 2022. (In Latv.).
25. Pourreza, A., Sadeghi, A., Amini-Rarani, M., Khodayari-Zarnaq R., Jafari H. Contributing factors to the total fertility rate declining trend in the Middle East and North Africa: a systemic review. *Journal of Health, Population and Nutrition.* 2021; 40 (11).
26. Revina I. *Econometrics.* Riga; 2002. (In Latv.).


*Статья поступила 17.07.2023 г. Статья принята к публикации 16.10.2023 г.*

27. Skirbekk V. *Decline and Prosper: Changing Global Birth Rates and the Advantages of Fewer Children.* Springer; 2022.
28. Stepin V.S. *Man. Activity. Culture.* Saint Petersburg; 2019. (In Russ.).
29. StudySmarter: Economic cycle. Macroeconomics. 2023. URL: https://www.studysmarter.co.uk/explanations/macroeconomics/economic-performance/economic-cycle.
30. Tretjakova V., Gedvilaitė-Kordušienė M., Rapolienė G. Women's pathways to childlessness in Lithuania. *Sociālo Zinātņu Vēstnesis=Social Sciences Bulletin.* 2020; 31 (2).
31. Unāma E., Jansone M. Big interview at the crossroads: Demographer Zane Varpinya. 2022. URL: https://lr1.lsm.lv/lv/raksts/krustpunkta/krustpunkta-liela-intervija-demografe-zane-varpina.a167968. (In Latv.).
32. Volodko I. *Higher mathematics. Part I.* Riga; 2007. (In Latv.).
33. World Economic Forum: *What Does the Global Decline of the Fertility Rate Look Like?* 2022. URL: https://www.weforum.org/agenda/2022/06/global-decline-of-fertility-rates-visualised.
34. Zitmane M., Lāma E. "Wake up and think of the children!": The ambivalent relationship between motherhood, femininity and anti-vaccination. *The New Communication Revolution.* Uniwersytet Jagiellonski; 2023.
35. Zvidrins P. The dynamics of fertility in Latvia. *Population Studies,* 1979; 33 (2).

DOI: 10.22363/2313-2272-2023-23-4-825-838
EDN: HYQPFP

# Междисциплинарное исследование среднесрочного тренда рождаемости в Латвии (1970–2022 годы)*

**В. Меньшиков[1], Я. Кудиньш[1], А. Кокаревича[2], В. Комарова[1], Э. Чижо[1]**

[1]Даугавпилсский университет,
*ул. Виенибас, 13, Даугавпилс, LV-5401, Латвия*

[2]Рижский университет им. Страдыня,
*ул. Дзирциема, 16, Рига, LV-1007, Латвия*

(e-mail: vladimirs.mensikovs@du.lv; janis.kudins@du.lv; anita.kokarevica@rsu.lv; vera.komarova@du.lv; edmunds.cizo@du.lv)

**Аннотация.** Цель статьи — оценка среднесрочного тренда рождаемости в Латвии. Основной исследовательский вопрос — возможно ли в ближайшем будущем повышение уровня рождаемости в Латвии согласно планам «Стратегии воспроизводства населения СЕМЬЯ — ЛАТВИЯ — 2030 (2050)»? Авторы провели математический анализ показателей рождаемости в Латвии за среднесрочный период 1970–2022 годов (53 года), который включает в себя так называемую «советскую эпоху» и последовавшие за ней десятилетия независимости Латвии после распада СССР. Эмпирическую базу исследования сформировали общедоступные данные официальной латвийской статистики о суммарном коэффициенте рождаемости. Новизна данного междисциплинарного — демографического, экономического и социологического — проекта обусловлена применением математического анализа для изучения демографических трендов, что почти не встречается в публикациях латвийских и зарубежных исследователей, а также использование теории экономических циклов для определения демографических циклов рождаемости и их фаз в Латвии — в целях прогнозирования уровня рождаемости

в стране на ближайшее будущее. Кроме того, анализ данных социологических опросов помог авторам понять основную причину устойчивого в среднесрочном периоде линейного падения рождаемости в Латвии — это изменение ценностных доминант общества, вследствие чего ребенок больше не находится в центре системы ценностей мужчин и особенно женщин, больше не считается краеугольным камнем жизненной самореализации. По результатам математического анализа среднесрочного тренда рождаемости авторы высказывают предположение, что спад рождаемости в Латвии будет продолжаться еще несколько лет, прежде чем будет достигнуто дно очередного демографического цикла (его показатель будет ниже предыдущего, т.е. ниже 1,22–1,25) и наметится тенденция роста рождаемости в рамках линейно снижающегося общего тренда. Но и этот ожидаемый подъем не достигнет предыдущего пика (скорее всего будет ниже 1,74). Таким образом, желаемое и даже прогнозируемое создателями «Стратегии воспроизводства населения» повышение рождаемости в Латвии до уровня 1,77 к 2027 году авторы считают совершенно недостижимым.

**Ключевые слова:** рождаемость; суммарный коэффициент рождаемости; математический анализ; демографические циклы; экономические циклы; изменения ценностной системы; Латвия