FERTILITY CONVERGENCE AT THE REGIONAL LEVEL: EMPIRICAL EVIDENCE FROM RUSSIA

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Abstract

Russia has long grappled with the problem of the convergence of demographic development. The paper presents the results of a study into within-country convergence/divergence of fertility in Russia. The analysis looks at the period between 1990 and 2016. Convergence/divergence is studied through two different concepts: σ- and β-convergence.

The following results were obtained. Firstly, the study of σ-convergence does not provide convincing evidence in favor of the unification of fertility levels in the regions. Secondly, research into β-convergence has also not provided definitive proof that regions are becoming more homogenous as regards fertility levels. Thirdly, a comparison of the convergence of total fertility rate and crude birth rate shows that the level of the latter indicator is more homogenous, and the pace of their convergence is higher.

The conclusions are as follows. Regional imbalances in fertility rates persist and are not declining over time. Evidently, countries composed of many constituent parts with a high degree of variability as regards demographic development require demographic policies that are aimed at smoothing regional variations. However, it appears that the active implementation of federal and regional demographic policies in Russia has yet to make a positive impact as regards mitigating these differences.

Key words: σ-convergence, β-convergence, fertility, Russian regions

JEL Code: J11, J13

Introduction

The sustainability of a system's development is directly related to the balance between the dynamics of its individual components. Stable demographic dynamics in a country cannot be observed in conditions of pronounced regional imbalance. The problem of imbalance in regional demographic development is historically relevant in Russia. For example, Table 1 shows the highest and lowest values of the total fertility rate in the regions of Russia in different years. As the presented data suggests, regional differentiation in terms of the fertility

levels is quite high when observed from an historical perspective, which hinders effective demographic development.

Tab. 1: Total fertility rate in Russian regions

Years	Min	Max	Ratio of max to min
1990	1.40	3.22	2.30
2000	0.93	2.46	2.65
2010	1.32	3.35	2.54

Source: compiled by the author according to the Russian single inter-departmental information and statistical system (Total Fertility, 2017).

The study of demographic convergence/divergence is important in demographic forecasting. Indeed, formed and sustainable demographic trends are needed for long-term assessments. The trends, in turn, are determined by the consistency of changes occurring in individual regions. Consequently, the degree of and changes in this consistency are of interest to researchers. Such analysis may provide better-informed fertility assumptions for future population projection models.

There are several approaches to the definition of convergence. Sala-i-Martin (Sala-i-Martin, 1996) presented the concepts of σ-convergence and absolute and conditional β-convergence. The convergence/divergence of processes can be studied with the help of a set of inequality measures (Islam, 2003). There are few studies in the field of demography where statistical convergence meters are used. The number of works where the concepts of σ-convergence and β-convergence are adapted for the study of fertility is even lower. There are 3 groups of such studies.

The first group consists of studies of fertility convergence between different population groups in the same territory. Dubuc presents new fertility estimates for immigrants and the children of immigrants by ethnic group in the United Kingdom (Dubuc, 2012), while Haines analyzes historical fertility trends in the United States: the author looks at the fertility, mortality, and marital experiences of racial, ethnic, and nativity groups from the nineteenth to the late twentieth centuries (Haines, 2003).

The second group consists of studies of fertility convergence between different regions within one country. For example, Franklin and Plane analyze β- and σ-convergence, as well as Club Convergence of regional fertility in Italy (Franklin & Plane, 2003).

The third group consists of studies of fertility convergence between different countries. For example, Lanzieri examines hypotheses about the convergence of fertility levels in 27 EU countries (Lanzieri, 2014). Strulik and Vollmer study the evolution of the distribution of fertility rates across the world from 1950 to 2005 based on σ- and β-convergence (Strulik and Vollmer, 2015). The study conducted by Dorius is founded on these same concepts and tests the hypothesis that the second half of the twentieth century was a period of global demographic convergence (Dorius, 2008).

The Russian scientific citation index (a national database with deep coverage of indexed materials from the beginning of 2005) has indexed only one study of fertility convergence in the country on the basis of the aforementioned concepts. Sinitsa examines the convergence between regions and federal districts (Sinitsa, 2017), but the methodology used raises doubts. In particular, the validity of using Barro regression for the period from 1990 to 2014 is questionable. During these years, the total fertility rate in the regions of Russia did not have a unidirectional development trend. Thus, the use of Barro regression, where the annual average rate is applied, is problematic. We also cannot agree with some of the conclusions of the author.

1 Data and Methods

The purpose of the paper is to study the within-country convergence/divergence of fertility in Russia. The study uses two indicators – total fertility rate (TFR) and crude birth rate (CBR). The analysis covers the period from 1990 to 2016, the whole array of regional fertility data available in official Russian statistics. A separate analysis is carried out for the 2000-2016 data (the period of the last birth rate growth in Russia) and for the 2007-2016 data (when measures aimed at stimulating the birth rate were strengthened). The analysis includes all regions of the Russian Federation except for the Chechen Republic. In the official Russian statistics, fertility data for the Chechen Republic have only been collected since 2004.

Convergence/divergence is studied by applying two different concepts. The first is σ-convergence (Sala-i-Martin, 1996), which is characterized by the fact that the interregional dispersion of the studied indicator is reduced over time. Two indicators used here are the standard deviation and the coefficient of variation.

The second concept is β-convergence on the basis of Barro regression (Barro, 1991; 1992). This helps us study the convergence of regions due to differences in the growth rates of

fertility levels: higher in regions with initially low indicators and lower in regions with a relatively high fertility level.

Barro regression is estimated as follows:

$$\frac{1}{T}\ln\left(\frac{y_{i,t+T}}{y_{i,t}}\right) = \alpha + \beta \cdot \ln y_{i,t} + \varepsilon_{i,t}\,, \tag{1}$$

where $y_{i,t}$ and $y_{i,t+T}$ – fertility level in region *i* at the initial and final point in time; $\frac{1}{T}\ln\left(\frac{y_{i,t+T}}{y_{i,t}}\right)$ – average annual growth rate of the fertility level in region *i* during the period of time (*t*, *t*+*T*); α – constant; β – regression coefficient; $\varepsilon_{i,t}$ – random errors.

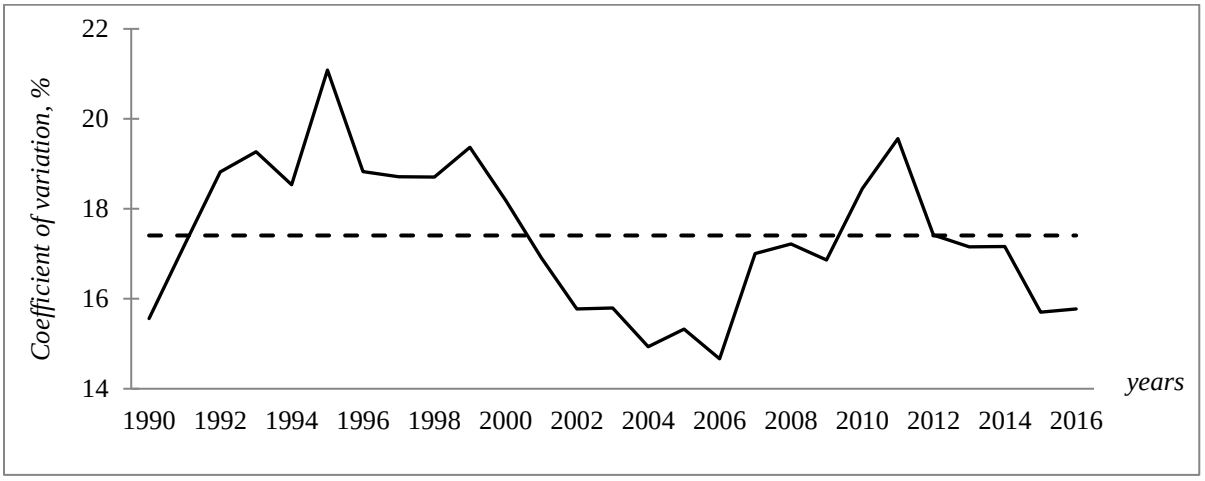
If the regression coefficient is statistically significant and is less than zero, then the hypothesis of β-convergence is confirmed. This means that there is a so-called "catch-up" effect in the data - regions with initially lower fertility levels show higher growth rates, and are thus "catching up" with regions with initially higher fertility levels. As a result, there is an effect of demographic convergence, i.e. convergence of regions. However, if parameter β in the equation is positive, these regions have a divergence in fertility levels.

2 Results

The following results were obtained.

1. Ambiguous results were obtained in the process of studying σ-convergence. On the one hand, an analysis of the dynamics of interregional TFR variability has shown that the coefficients of variation have insignificantly decreased in recent years (Fig. 1).

Fig. 1: Coefficients of variation of regional TFR



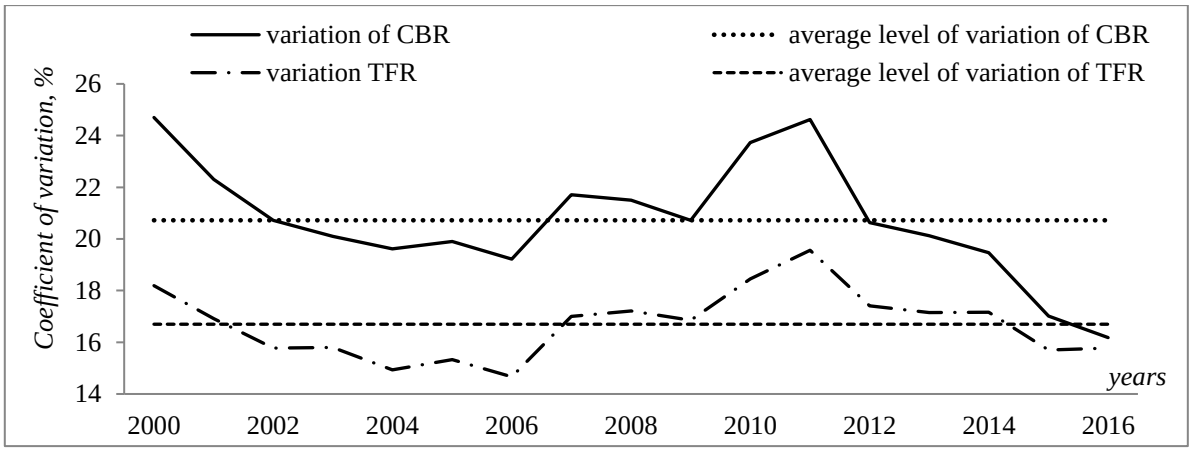
Source: compiled by the author on the basis of the research data.

A decrease in variation in this context indicates a decrease in the degree of imbalance in the regions in terms of fertility levels. In the longer term, however, the dynamics of the coefficients are indicative of fluctuations around a certain average level rather than a tendency for regions to converge/diverge. Similar results were obtained during the analysis of the interregional variability of CBR. It is important to note that both tendencies (convergence/divergence of the regions) are observed in the periods of progressive birth rate growth in the country (2000-2016) and of the strengthening of measures aimed at stimulating the birth rate (2007-2016).

Thus, the study of σ-convergence on the basis of variation coefficients does not provide convincing evidence in favor of the unification of fertility levels in the regions.

2. Comparison of the σ-convergence of the CBR and TFR shows that the regions of Russia are slightly more homogeneous according to the value of the latter indicator. Fig. 2 shows the dynamics of the coefficients of variation during the period of birth rate growth. As can be seen, the coefficients of variation of regional TFR were lower during the entirety of the studied period. On the other hand, the variability of regional CBR in recent years has decreased with significantly more intensity, which means that the unification of regions in terms of CBR was faster.

Fig. 2. Coefficients of variation of TFR and CBR from 2000 to 2016



Source: compiled by the author on the basis of the research data.

3. Ambiguous results were also obtained when studying β-convergence. In comparison with the study of σ-convergence, a shorter period of time was chosen for the analysis and estimation of regression parameters. A methodical limitation to the estimation of Barro's linear regression is the need for a unidirectional trend in the dynamics of the studied indicator.

Only in this case will the evaluation of the average growth rates of the dependent variable be methodologically correct. In most Russian regions, as well as in the country as a whole, the trend of fertility level growth began in 2000. Thus, β-convergence of the birth rate in the country was estimated based on the data of 2000-2016. In addition, β-convergence estimates were made based on the 2007-2016 data, a period when there was an increase in measures to support the birth rate. Thus, four regression models were obtained: two models to evaluate β-convergence on the basis of TFR for the two aforementioned periods and two models to evaluate β-convergence on the basis of CBR for the same time periods. The main parameters of the regression equations are presented in Tables 2-4.

Tab. 2: Model summary

(model 1 – TFR_{2000}; model 2 – CBR_{2000}; model 3 – TFR_{2007}; model 2 – CBR_{2007})

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.578	0.334	0.325	0.00541267	2.041
2	0.338	0.114	0.103	0.00593310	1.801
3	0.358	0.128	0.117	0.00778412	1.887
4	0.637	0.406	0.398	0. 00796409	2.136

Source: author's calculations.

Tab. 3: ANOVA

(model 1 – TFR_{2000}; model 2 – CBR_{2000}; model 3 – TFR_{2007}; model 2 – CBR_{2007})

Model		Sum of Sq.	df	Mean Sq.	F	Sig.
1	Regression	0.001	1	0.001	38.118	0.000
	Residual	0.002	76	0.000		
	Total	0.003	77			
2	Regression	0.000	1	0.000	10.337	0.002
	Residual	0.003	80	0.000		
	Total	0.003	81			
3	Regression	0.001	1	0.001	11.446	0.001
	Residual	0.005	78	0.000		
	Total	0.005	79			
4	Regression	0.003	1	0.003	52.573	0.000
	Residual	0.005	77	0.000		
	Total	0.008	78			

Source: author's calculations.

Tab. 4: Coefficients

(model 1 – TFR_{2000}; model 2 – CBR_{2000}; model 3 – TFR_{2007}; model 2 – CBR_{2007})

Model		Unstandardized Coefficients		t	Sig.
		B	Std. Error		
1	Constant	0.068	0.007	9.082	0.000
	TFR_{2000}	-0.021	0.003	-6.174	0.000
2	Constant	0.027	0.001	22.629	0.000
	CBR_{2000}	-0.015	0.005	-3.215	0.002
3	Constant	0.032	0.003	11.603	0.000
	TFR_{2007}	-0.024	0.007	-3.383	0.001
4	Constant	0.094	0.012	8.134	0,000
	CBR_{2007}	-0.034	0.005	-7.251	0,000

Source: author's calculations.

The parameters of the equations are statistically significant: parameter β in all models is negative. Thus, there is an inverse statistical relationship between the initial fertility level in the region and its subsequent growth rates: regions with initially lower fertility levels seem to be "catching up" with regions with an initially higher level due to higher annual growth rates.

At the same time, the explanatory power of the equations is not high – from 11.4% to 40.6%. Such values of the determination coefficients cannot serve as a basis to draw a conclusion about the unification of the regions in terms of fertility level. In this case, while there is some convergence of regional fertility in relation to TFR over a longer time interval, a greater convergence was observed in terms of the CBR indicator during the period when Russia's demographic policy was strengthened. In general, the results of the β-convergence study also do not show unequivocally that the regions of the country are aligned by fertility level.

It should be noted that there is a different number of degrees of freedom in the obtained equations. This is due to some differences in the volume of the studied data. Outliers (regions with atypical high/low indicators) were excluded from the study during analysis.

3 Discussions

The conducted research does not support the fact that there is a convergence in the birth rate in Russia from a historical perspective. Regional indicators did not converge when measures aimed at stimulating the birth rate were actively implemented. In this regard, the following important observations need to be made.

Firstly, the lack of convergence of fertility level in the long term is another confirmation of the fact that Russia remains a country with a high level of regional differentiation in many socio-economic indicators. This leads to the impossibility of unified approaches to solving the demographic problems of Russian territories. It is obvious that countries composed of many constituent parts with a high degree of variability with regards to demographic development require demographic policies aimed at smoothing out regional imbalances.

Secondly, the effectiveness of modern demographic policy in Russia is constantly subject to critical assessments both from demographic scientists and politicians. Based on various types of analysis, demographers conclude that some positive changes in the dynamics of fertility have indeed been observed (both TFR and CBR are increasing) in recent years, but their significance is completely inadequate if we are to consider the future of Russian fertility levels with optimism. The results obtained in this study also lead to the conclusion that the active implementation of federal and regional demographic measures, which began in 2007, apparently has not yet produced a positive effect (at least with respect to leveling regional differences). A slightly more significant convergence of regional birth rates based on CBR can be explained by some unification of the sex and age structure of the population in the regions (it is known that CBR is subject to structural factors), and not by leveling of the actual birth rates.

Thirdly, the obtained results can be used as a basis for discussing the applicability of the theory of demographic transition to population reproduction in countries with a high level of regional differentiation. This theory claims that the demographic development of a particular region is determined, first of all, by global demographic patterns. Thus, the idea of convergence is embedded in the theory of demographic transition. The divergence of regional birth rates in Russia can serve as one of the empirical arguments showing a “vulnerability” in this theory.

Conclusion

Statistical measures of region convergence/divergence processes based on the concepts of σ-convergence and β-convergence are virtually never applied in Russian demographic studies. Both of these concepts were applied in this study of Russian regional fertility levels from 1990 to 2016. The obtained results made it possible to conclude that imbalance among the regions regarding the fertility levels has continued: it has not decreased over time. However, the statistical data available for analysis did not allow us to analyze a longer period, which

would have given us an opportunity to identify possible determinants of convergence/divergence processes.

The development of this study could involve producing an additional rationale for convergence/divergence based on other concepts, such as relative convergence or the modification of β-convergence (γ-convergence). The latter is most relevant in conditions when the time period available for analysis is not long enough or is characterized by a change in the development trend. Moreover, the study of so-called "Club Convergence" in order to detect various "clubs" or groups of regions with similar development trajectories may be a promising direction for further research

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