

Analysis of efficiency indicators of reproductive activity among the population of the Russian Federation

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Abstract:

This paper examines specific approaches to assessing the process of impelling reproductive labor. The potential of each approach is illustrated via the results of the authors' empirical research. The major purpose of this work is to develop specific areas for stimulating reproductive activity in various regions across Russia. The authors conduct a cluster analysis across Russia's regions via indicators of reproductive activity and key social-economic indicators. The work brings forward a methodology for the analysis of indicators relating to demographic, education, and healthcare statistics on variables characterizing reproductive activity in Russian regions. The authors identify specific groups of regions based on the tools, methods, and focus underpinning their practices of stimulating reproductive activity, which is expected to help ensure effective information-analytical support for management decisions in the area of regulating reproductive activity.

Key words: reproductive activity, quantitative and qualitative coefficients, reproductive labor, labor efficiency, cluster analysis, Russian population.

Introduction

Genesis of the scientific approaches

The demographic crisis Russia has been facing in the last decade is signaling the need to stop taking a narrowly demographic approach to resolving declines in the size and caliber of Russia's population. Among the possible steps that may be taken in this direction is the introduction of a special category into scientific discourse – the population's reproductive activity (Abilova & Bagirova, 2013), which may be construed as one of the most significant specific integral characteristics of reproductive labor reflecting the distinctive features of the process of its implementation (namely, the content and character of labor in the reproductive sphere) and the level of obtained results of labor and measured via indicators of the quantity and quality of labor and results of labor (Vitik, Koptyakova, & Balynskaya, 2016).

The methodological possibility of construing reproductive activity as a type of labor has been examined in a number of works by, both Russian and foreign, classic (G. Becker, K. Marx, A. Smith, S.G. Strumilin, F. Engels) and modern (U. Beck, R. Berthoud, J. Gershuny, R. Gronau, A. Toffler) scholars.

Identifying reproductive activity as a category within labor economics gives rise to a whole array of methodological issues in research into it (Gronau, 1977; Gershuny, 2000; Gershuny & Berthoud, 2000): the need to develop the key concepts of analysis, determine a set of methods and techniques of research, and work out specific methodologies.

The following key methodological concepts have been identified as most relevant to the study of reproductive activity:

- reflecting in a set of methods and methodologies for the analysis of reproductive activity its two major aspects – those associated with the study of the process of implementation of reproductive labor and the results of this labor;

- the use of both quantitative and qualitative indicators to measure the level of reproductive activity.

Note that quantitative and qualitative indicators may be used to measure labor activity in the area of productive labor as well. Thus, for instance, as quantitative indicators of labor activity one may use the volume of output, and as qualitative – labor productivity and the quality of products turned out. While when it comes to the sphere of reproductive labor, as quantitative indicators of activity one may use the number of children, reproductive labor on which is implemented at specific stages of reproductive activity, and as qualitative – efficiency indicators, achieved at various stages of reproductive activity (e.g., the share of healthy children at a certain age, the share of children who have successfully graduated from an institution of learning, etc.);

- reflecting the uniqueness of each stage of reproductive labor in the composition of indicators measuring activity, their number, and the correlation between quantitative and qualitative indicators. These characteristics are also governed by the degree of fullness of today's information on the quantitative and qualitative results of reproductive labor – and, more importantly, the process of its implementation;
- factoring in the stage-like character of reproductive labor and the advantages of taking a multi-stage approach to analyzing reproductive activity;
- factoring in regional differentiation in exploring reproduction processes;
- the need to use a set of methods of collecting and analyzing information in investigating the population's reproductive activity. This concept has to do with the following circumstances: firstly, reproductive labor is a multi-aspect category that ought to act as the subject of study in various sciences (Beck, 2000) armed with both general scientific and specific methods; secondly, the fact that the amount of primary information is limited for now makes researchers resort to using data that are available and adapting them to the purposes of their analysis of the population's reproductive activity.

The potential methods for exploring the population's reproductive activity may be classified into methods used for the analysis of the process of reproductive labor and those used for the analysis of the results of that labor.

The proposed methodological concepts and methods for the study of reproductive activity may be regarded as crucial components of the methodology for its analysis, the end purpose whereof is to work out specific areas for stimulating reproductive activity in various regions across Russia.

The population's reproductive activity as a vital condition for the economic and social development of Russian regions

Russia's current demographic downturn, reflected, among other things, in sharp declines in the size of its population, is posing a great threat to the nation with its highly negative effects. There is a decline in the number of people entering working age, with the overall structure of this segment getting worse. There are worries that over the next 20 years the issue of rapid declines in the number of employable citizens will affect all areas of life in Russian society. The deepening demographic crisis may actually entail the need to reconsider Russia's place in the global economic arena altogether (Abilova et al., 2015).

While future declines in the birth rate normally result in declines in the size of the employable population, the size of Russia's employable population is currently shrinking faster than that of its overall population (Pomazkin, 2014). It has been forecasted that there will be a shortage of labor resources in Russia by the year 2025 (Institute for the Economy in Transition, 2007, pp. 33-34). Russia's employable population will have dwindled by 7–8 million by 2020 and by more than 26 million by the year 2050 (Smol'yakova, 2013).

Russia's politicians and scientific community alike have been getting increasingly conscious of the issue's acuteness in recent years. The Russian government is currently implementing a range of measures to stimulate natality, with relevant research being conducted into the demographic process. The authors, however, are convinced that impelling just the natality process is unlikely to produce the results the government desires, which ought to be reflected not only in population growth but in boosts in the population's quality of life as well. This is due to that the nation's developing innovation-driven economy will inevitably require transforming the structure (Pahl, 1980) and caliber of national manpower, upping the requirements for the professional-qualification level of workers, as well as their responsibility and activity levels in the context of labor activity. That will also entail changes in labor itself – under conditions of a novel economy, it will be grounded in the sum of scientific knowledge, cultural achievements, and universal traditional human values. Activating the institution of family (Engels, 1884/1961) may play a significant role in boosting both the volume and caliber of the nation's human capital going forward.

The Concept on the Demographic Policy of the Russian Federation through to 2025 sets out as one of its major principles the ability to react in a timely manner to demographic trends in the current period and as one of its major mechanisms for implementing it the conduct of scientific research in the area. It has become obvious that the efforts of the science of demography alone will not suffice to resolve the nation's objectives for its demographic development – there is a need to take an interdisciplinary approach combining in itself concepts from economics (Strumilin, 1982; Renooy, 1990), demography, sociology (Oakley, 1974), psychology, and other disciplines. In this regard, it pays to view activity on bearing and raising children as an economic-labor process.

In the authors' view, to help boost the balance of all parts in the currently imbalanced demographic process, the government ought to focus on the population's reproductive activity, which may be construed as the activity of man aimed at bearing healthy children, raising them properly, and nurturing high-value human capital.

Thus, under conditions of steady depopulation in Russia, rising requirements for the caliber of labor resources, a lack of scientific solutions describing all of the above-mentioned issues, which are interrelated, as a single set, there is added relevance to investigating the issue of stimulating reproductive activity, which presupposes the expanded reproduction of quality human capital in present-day Russia.

In this regard, the main purpose of this study is to develop and implement a methodology for assessing the effectiveness of the process of impelling reproductive labor in Russia.

Theoretical and methodological preconditions for the study

The theoretical and methodological preconditions for the conduct of this study have been examined in the following works: *Parent Labor and Reproductive Activity: A Social-Economic Analysis: A Monograph* (2013) by M.G. Abilova and A.P. Bagirova, *Human Resources Management at an Enterprise Based on the Incentive Mechanisms for Reproductive Labor: Monograph* (2014) by N.R. Balynskaya, S.V. Vitik, S.V. Koptiakova, and I.V. Ritter, and *Present-Day Aspects of Economic Development: Theory and Practice: A Collective Monograph* (2015) by M.G. Abilova et al.

Material & methods

Methodology for the analysis of indicators of reproductive activity

Among the crucial methodological concepts in the analysis of reproductive activity are investigating its two-fold nature, utilizing quantitative and qualitative indicators, reflecting the uniqueness of each stage of reproductive labor in a specific set of indicators, factoring in regional differentiation in research, and utilizing a set of methods for gathering and analyzing information.

The aggregate of methods for the study of the population's reproductive activity is classified, based on the phenomenon's aspects under examination, into 2 groups:

- 1) methods used to gather and analyze information on the process of implementation of reproductive labor;
- 2) methods used to gather and analyze information on the results of the implementation of reproductive labor.

In exploring the process of implementation of reproductive labor, information may be gathered through observation, surveys, the documentary-formalization method, and qualitative methods. That being said, traditional methods for recordkeeping and analysis of work time expenditure employed in labor economics offer considerable potential in terms of being used in exploring reproductive labor time expenditure as well.

When it comes to exploring reproductive labor results, the range of potential methods for gathering information narrows down to include the documentary-formalization method, the survey method, and methods of qualitative sociology. As methods for analyzing information one may use economic-statistical quantitative methods of unidimensional and multidimensional analysis, as well as methods of qualitative analysis. That being said, there is high potential for use offered by economic-statistical methods of multidimensional analysis, which can be used for the integrated identification of the reasons behind the emergence and development of a particular situation in the reproductive sphere, as well as for the development, based on the clusterization of heterogeneous regional situations, of specific methods for regulating them for each cluster group of regions.

Implementing the proposed methodology within the frame of existing Russian statistics presupposes the use of generally available, traditional statistical indicators calculated across the constituents of the Russian Federation, which may be used as indicators of reproductive activity. For the initial stages of reproductive activity they are as follows:

1. Perinatal stage

1.1. Coefficient of the quantitative efficiency of labor at the perinatal stage ($K_{quan.}$)

$$K_{quan.} = Q_{born} + Q_{abort.} \quad (1)$$

where Q_{born} is the number of births per 1,000 females aged 15–49;

$Q_{abort.}$ is the number of abortions per 1,000 females aged 15–49.

The coefficient of the quantitative efficiency of labor shows the total number of completed or interrupted pregnancies per 1,000 females aged 15–49 and, thus, characterizes activity at the initial stage of reproduction in terms of the quantitative aspect.

1.2. Coefficient of births ($K_{birth.}$)

$$K_{birth.} = \frac{100}{Q_{ab. per 100 born}} \quad (2)$$

where $Q_{ab. per 100 born}$ is the number of abortions per 100 births.

The coefficient of births shows the number of births per one interrupted pregnancy and assesses the qualitative aspect of reproductive activity at the first stage of labor.

1.3. Coefficient of natality per 1,000 people ($K_{birth, 1000 ppl.}$)

$$K_{birth,1000\ ppl.} = \frac{Q_{born.alive}}{Q_{popul.}} \times 1,000 \quad (3)$$

where $Q_{born.alive}$ is the number of individuals born alive in a given period;

$Q_{popul.}$ is the average annual size of the population.

This coefficient is a common coefficient of natality that is in wide use in demographic statistics. That being said, in the economics of reproductive labor it serves as one of the indicators aimed at assessing the occurrence of births across the population as a whole and teams up with other indicators to assess the quantitative aspect of reproductive activity at the perinatal stage.

1.4. Coefficient of perinatal vitality ($K_{perin.vital.}$)

$$K_{perin.vital.} = 1 - K_{perin.mortal.} / 1,000 \quad (4)$$

where $K_{perin.mortal.}$ is the coefficient of perinatal mortality (per 1,000 individuals born alive or dead).

This coefficient helps assess the quality of reproductive labor implemented in the area of both home and social reproduction at its first stage.

2. Infant stage

2.1. Coefficient of infant vitality ($K_{infant.vital.}$)

$$K_{infant.vital.} = 1 - K_{infant.mortal.} / 1,000 \quad (5)$$

where $K_{infant.mortal.}$ denotes those who died under the age of 1 year per 1,000 individuals born alive.

This coefficient helps assess the quality of reproductive labor in the areas of home and social reproduction at the corresponding stage.

3. Preschool stage

3.1. Coefficient of vitality in the first 5 years of life ($K_{vital.0-5\ yrs}$)

$$K_{vital.0-5\ yrs} = 1 - P_{mortal.0-5\ yrs} \quad (6)$$

where $P_{mortal.0-5\ yrs}$ is the likelihood of death occurring from the moment of one's birth through to the age of 5.

This coefficient helps assess the quality of reproductive labor implemented in the area of both home and social reproduction at the preschool stage.

4. School stage

4.1. Share of minors with successful socialization ($K_{d\ minor.success.soci.}$)

$$K_{d\ minor.success.soci.} = 1 - \frac{Q_{commit.crime.14-17\ yrs}}{Q_{popul.14-17\ yrs}} \quad (7)$$

where $Q_{commit.crime.14-17\ yrs}$ is the number of identified individuals who committed crimes at the age of 14–17;

$Q_{popul.14-17\ yrs}$ is the average size of the population aged 14–17 in a given period.

This indicator assesses one of the aspects of the success of socialization, characterizing the share of individuals in the region who did not break the law. It assesses the qualitative result of reproductive labor.

4.2. Share of medalists among school graduates ($K_{d\ medal.}$)

$$K_{d\ medal.} = \frac{Q_{award.medal}}{Q_{graduates}} \quad (8)$$

where $Q_{award.medal}$ is the number of high school graduates awarded gold and silver medals;

$Q_{graduates}$ is the number of individuals who received a high school graduation certificate.

This indicator assesses the qualitative result of reproductive labor in the areas of home and social reproduction at its school stage.

The above indicators (1 through 8) describe the results of reproductive labor, not the characteristics of the process of its implementation, thus providing a trimmed estimation of the level of reproductive activity. At the same time, they help measure the results of labor exclusively at its initial stages (from the perinatal to the school stage). The lack of statistical information describing the characteristics of the process of implementation of reproductive labor in Russian families, as well as reflecting the results of reproductive labor at the subsequent stages of reproduction, limits the authors to just this set of key indicators, which, despite being key, may still require further expanding. This objective may be partially resolved by means of introducing into the reproductive activity analysis methodology a 6th stage which will involve profiling the regions clusters on variables, on which only there is only momentary information available that does not let one assess their dynamics.

Analysis of the population's reproductive activity in Russian regions

As baseline data for the implementation of the authors' methodology they utilized indicators relating to demographic, education, and healthcare statistics on variables characterizing reproductive activity in Russian regions (spanning the period 2002–2008).

The authors' analysis of efficiency indicators of reproductive labor activity across the Russian Federation spanning the period 2002–2008 helped reveal, based on the set of indicators outlined in Item 2.1, that overall across the nation the situation improved on most criteria (6 out of 8 indicators demonstrated a positive trend, among them all of the indicators of vitality – perinatal, infant, and in the first 5 years of life). At the same time, two indicators, namely the coefficient of the quantitative efficiency of labor at the perinatal stage and the share of minors with successful socialization, decreased, which is testimony to the results of reproductive labor getting worse at its corresponding stages.

Note that the change in the value of the coefficient of the quantitative efficiency of labor at the perinatal stage occurred under the influence of two factors:

- an increase in the number of births per 1,000 females aged 15–49;
- a decrease in the number of abortions per 1,000 females aged 15–49.

These changes could have been viewed as positive if the decrease in the number of interrupted pregnancies had been taken the place of by growth in the number of births. However, while the first indicator shrank by 13 units per 1,000 females of fertile age, the second one rose by just 9.4 units (Table 1).

Table 1. Dynamics of the Components of the Coefficient of the Quantitative Efficiency of Labor at the Perinatal Stage in the Period 2002–2008

Indicator	2002	2008	Absolute increase	Rate of growth, %
1. Number of births per 1,000 females aged 15–49	35.2	44.6	9.4	126.7
2. Number of abortions per 1,000 females aged 15–49	49	36	-13	73.5
3. Coefficient of the quantitative efficiency of labor at the perinatal stage	84.2	80.6	-3.6	95.7

Thus, there is little to cheer about when it comes to trends associated with growth in the efficiency of reproductive labor at the perinatal stage of reproduction based on the dynamics of the indicators related to the coefficient of quantitative efficiency.

At the same time, the other 3 indicators of activity at the initial stage of reproductive activity testify to the contrary. Specifically, in the period under analysis there was a considerable rise in the coefficient of births (the number of births against the number of abortions), with an increase also registered in the number of births per 1,000 people and the coefficient of perinatal vitality. It is worth noting that the first of the above 2 indicators is subject to the impact of both the afore-mentioned decrease in the number of interrupted pregnancies and changes in the structure of the population, while the positive dynamics of the coefficient of perinatal vitality is direct testimony to an improvement in the results of reproductive labor at its initial stage.

Thus, the changes registered at the first stage of reproductive activity attest to there being differently directed trends at it in the period from 2002 to 2008 across the nation as a whole. Despite high values on most criteria, the decline in the coefficient of the quantitative efficiency of reproductive labor at its perinatal stage, due

to the number of births failing to take the place of the number of abortions, does not yet let one speak of there having been formed a reproductive activity situation at said stage of reproduction.

It is known that the most representative testimony of natality levels are the values of the total coefficient of natality, which, according to the authors' analysis, have never risen above the population replacement level since 1989, with the average rate of its annual decline in the period from 1988 to 2009 totaling 1.54%. The coefficient reached its minimum value in 1999 (1.16), when it was lower than the population replacement level by 43.6%. In the period from 2000 to 2004, the situation showed some improvement, the total coefficient of natality reaching 1.34, which now was below the population replacement level by just 34.6%. In the period 2005–2006, there was some roll-back again, and the indicator then rose in the period from 2007 to 2009. Despite the fact that the total coefficient of natality registered in 2009 was the highest recorded in the last 17 years in Russian history, it is still too early to speak of the situation stabilizing for two reasons at a minimum: firstly, even the value of 1.537 achieved in 2009 is still considerably below the population replacement level (by 25.0%). In 2014, the total coefficient of natality in Russia was 1.75 children per 1 female, which is nearly 17% lower than the standard population replacement level (2.1 children per female), and in 2015 the number of children born in Russia declined by 0.2% compared with 2014 (Shcherbakova, 2016; Russian Federal State Statistics Service, 2017); secondly, the last 10-year period, which has seen overall growth in said coefficient, has also witnessed declines in it at certain points, which does not let one speak of the positive trend being sustainable.

The authors' assessment of the values of the total coefficient of natality across Russia indicates that among the regions that clearly bring up the rear in this respect are Leningrad Oblast and the city of Saint Petersburg, the Republic of Mordovia, and the Tula and Tambov oblasts. The highest values of the total coefficient of natality (over 2.00) are registered in the Tyva and Altai republics, the Chechen Republic, and Chukotka Autonomous Okrug. Most of the time, the total coefficient of natality ranges between 1.30 and 1.50 (around half of the overall number of RF constituents) with a median value of 1.45. At the same time, the variation of the values of the total coefficient of natality across the regions is quite high: 19.2% in 2006, 21.4% in 2007, and 21.1% in 2008. Note that this assessment of the total coefficient of natality is provided by the authors for purely representative reasons and does not describe in full measure the dynamics of the reproductive situation and the level of reproductive passiveness in Russia.

The authors' subsequent analysis of indicators of reproductive activity across the regions found that only 21 constituents of the Russian Federation demonstrate changes that are similar to those taking place nationally. The greatest concentration of such regions is observed in the Central, Volga, and Far Eastern federal districts, while Ural Federal District features no regions whatsoever where the reproductive situation would change the same way as across Russia as a whole.

The authors' analysis identified an array of RF constituents that exhibited in the period under review a clear trend toward reproductive activity at all the four of its stages: the Volgograd, Irkutsk, Kemerovo, Moscow, Nizhny Novgorod, Ryazan, and Sverdlovsk oblasts, the republics of Ingushetia and North Ossetia-Alania, and the city of Saint Petersburg. The findings of the authors' analysis attest to that in the above 11 constituents of the Russian Federation the reproductive situation developed in an integrated fashion, with positive trends encompassing not one but as many as four initial stages of reproductive labor (perinatal, infant, preschool, and school). These regions may be regarded as leaders in the formation of the reproductive activity situation in Russia in the period under analysis, as they demonstrate tangible improvements in reproductive labor results at all stages of this activity.

A more detailed and credible classification of regions may be drawn up based on the use of the multidimensional statistical method of cluster analysis. As baseline data for it the authors used the indexes of variables, characterizing the reproductive activity of regions (for the period 2002–2008) calculated based on statistical data (Russian Federal State Statistics Service, 2005; Russian Federal State Statistics Service, 2009a; Russian Federal State Statistics Service, 2009b; Russian Federal State Statistics Service, 2007; Marx, 1867/1960; Russian Federal State Statistics Service, 2003; Russian Federal State Statistics Service, 2009c). All variables included in the cluster analysis had a coefficient-based form of expression, which obviated the need for preliminary standardization.

To conduct the cluster analysis, the authors resolved to include in their statistical aggregate only those regions on which there was information available on all the variables (the coefficient of births was not included in the analysis, since this variable has a strong correlation with the coefficient of the quantitative efficiency of reproductive labor at the perinatal stage and the number of births per 1,000 people). Among the regions not included in the analysis on account of not all of the necessary data being available are the Chechen Republic, Stavropol Krai, and the Republic of Crimea.

The cluster analysis procedure was performed using the hierarchical agglomerative clusterization method. As their measure of distance the authors utilized Squared Euclidean Distance, while Ward's method was used to determine the distance between the clusters.

To determine the possible number of clusters, the authors used a special quantity – the coefficient of growth, which shows the distance between the clusters at each step of the analysis.

To assess the credibility of the clusters obtained, the analysis was conducted in several iterations using various measures of distance between the objects (in particular, using the regular Euclidean distance and the Manhattan distance) and between the clusters (complete-linkage clustering, or farthest neighbor clustering), as well as using the non-hierarchical clusterization procedure (k-means clustering). In all the cases, the results of classifying RF regions into homogeneous groups based on the dynamics of indicators of reproductive activity overlapped for the majority of the objects. Despite minor variances between the average values of variables within the segments identified, most of the common characteristics and consistent patterns detected in the analysis stayed the same, which is testimony to the sufficient credibility of, first, the number of the clusters, and, second, the composition of each cluster.

As part of the authors' subsequent analysis, they conducted tests for the difference between mean indicators on a number of variables in the regions clusters identified, for which purpose they employed one-way analysis of variance. For pair-wise comparisons of means in the clusters, the authors utilized Levene's test to assess the equality of variance. The t-test was used to assess the equality of means. The statistical significance of differences was substantiated for a whole array of variables, including:

- the share of the cost of fixed assets in the region's economy in the national cost of fixed assets;
- the share of the region's gross product in gross domestic product;
- the share of the region's volume of shipped goods of own production and works and services carried out by own efforts across the types of economic activity (extraction of mineral resources, processing (manufacturing) operations, production and distribution of electric power, gas, and water) in the nation's total volume;
- the share of the region's agricultural output in the nation's total output (inclusive of crop farming and animal husbandry);
- the share of the region's volume of construction work in the national volume of construction work;
- the share of the total area of residential buildings brought into use across the region in the nation's total volume of such buildings;
- the share of the region's retail turnover in national retail turnover;
- the share of investment in fixed assets in the region in the nation's overall volume of investment;
- the share of the region's exports and imports in the nation's volume of exports and imports.

The variables means on which differ significantly across the clusters have a social-economic nature and describe the region's economy and the social status of its population.

The distribution of RF constituents across the clusters obtained with a breakdown by the nation's federal districts is illustrated in Table 2.

Below are characterizations of each of the identified regions clusters by way of specific indicators of reproductive activity and key social-economic indicators as of 2008 (Russian Federal State Statistics Service, 2003).

Table 2. Distribution of RF Constituents Across the Clusters

Federal district	Number of RF constituents included in the analysis	Including		
		in Cluster 1	in Cluster 2	in Cluster 3
Central	18	9	4	5
Northwestern	10	5	2	3
Southern	11	3	1	7
Volga	14	8	-	6
Ural	4	-	2	2
Siberian	12	9	1	2
Far Eastern	9	3	3	3
Total	78	37	13	28

Cluster 1

This cluster incorporates 37 RF constituents, most located in the Central, Volga, and Siberian federal districts. This is the largest regions cluster, occupying 43.6% of Russia's territory. As of January 2009, its combined population accounted for 47.3% of Russia's overall population. Compared with the other clusters, this regions cluster possesses the largest share of people employed in the economy (46.6%), conducts the largest

share of work within the processing (manufacturing) sector, and has the decidedly greatest relative share of agricultural output. This cluster is also characterized by the largest share of residential buildings brought into use (47.8% in 2008, i.e. nearly half of Russia's national volume). However, despite the cluster's considerable size, the values of a whole array of indicators characterizing economic activity in it are far from being high. For instance, its combined population share being 47.3%, the relative share of its combined gross regional product is just a little over a third of Russia's national indicator (35.3%), with the cost of fixed assets checking in at 36.1% and the volume of extraction of mineral resources at 26.7% of the national figures. Overall, relative to its counterparts, the cluster exhibits low indicators of the volume of imports (29.0% of the national volume) and exports (23.2%). Thus, on key social-economic indicators this cluster of regions may be characterized as a large segment containing nearly half of the nation's population as a whole and employed population in particular but, at the same time, not leading the way in levels of economic activity on a whole array of crucial economic indicators.

A certain degree of inertness is also detected in the dynamics of reproductive activity results within this cluster of regions. Most of the indicators exhibit some lagging behind Russia's average ones. Thus, for instance, compared with the 71% increase in the coefficient of births overall nationally, the regions within the cluster are exhibiting a rise of 66%, and, compared with the 25% national increase in the coefficient of natality, in Cluster 1 it is 25%. The cluster's specific difference from its counterparts is that it has extremely low average indicators for the results of the perinatal stage of reproductive labor, namely the coefficient of births (0.67 births per 1 abortion in 2002 and 1.12 births per 1 abortion in 2008), the overall coefficient of vitality (9.72 and 11.86% in 2002 and 2008 respectively), and the coefficient of the quantitative efficiency of labor (88.68 and 84.22%). Despite positive dynamics exhibited by the first 2 parameters, the level of all the 3 indicators remains considerable lower than in the other clusters.

Thus, Cluster 1, which comprises numerous regions and is home to a large portion of the nation's population, is characterized by slow positive dynamics on most indicators of reproductive activity and low indicators reflecting activity at the perinatal stage of reproductive labor. The regions within this cluster are also not economically active on a whole array of crucial economic indicators.

Cluster 2

This cluster comprises just 13 RF constituents located in 6 federal districts, with most forming part of the Central and Far Eastern federal districts. The cluster incorporates the city of Moscow and two Ural regions, the Sverdlovsk and Tyumen oblasts.

The regions within this cluster occupy just a fourth of the nation's territory and are home to a combined fifth of the national population (20.36% as of January 1, 2009, with a slightly higher share of employed residents of 22.71%). At the same time, this cluster leads the way in gross regional product (41.87% of the national volume), extractive-industry output (57.13%), size of fixed assets used in the economy (41.32% of their national cost), exports and imports (57.84 and 49.69% of the national volume). The cluster is characterized by a large share of investment in fixed capital, which accounts for nearly a third of its national volume (30.9%), and a low share of agricultural output (less than 10% of Russia's national output).

Thus, on key social-economic indicators this regions cluster may be characterized as not too large population- and territory-wise but extremely active in levels of economic activity in the crucial sectors of the economy and oriented toward innovative development.

The findings of the analysis of the perinatal stage of reproductive activity across the regions within this cluster indicate high levels of most indicators in the period 2002 and 2008 and not so high a level of their positive dynamics in said period. Thus, for instance, the average values of the coefficient of births and the coefficient of the quantitative efficiency of labor at the perinatal stage in this cluster were the highest in both 2002 and 2008 compared with the other clusters. At the same time, this regions cluster exhibited comparatively lower levels of the indicators of vitality – perinatal, infant, and preschool (ages under 5 years) – and demonstrated their positive dynamics, as was the case overall nationally. This cluster is also distinguished by sharp dynamics of improvement in results at the school stage of reproductive labor, which, particularly, is attested to by major growth (by 66%) in the relative share of medalists among high school graduates.

Thus, the Cluster 2 regions are characterized by high, and growing, reproductive labor results at the perinatal stage, and steadily increasing, if somewhat lower compared with the other clusters, indicators of vitality at the perinatal, infant, and preschool stages of reproductive labor, as well as tangible boosts in reproductive activity at the school stage. Apart from being active in terms of reproductive labor, the regions within this cluster appear to also be active with respect to productive labor within the most significant sectors of the economy and oriented toward innovative development.

Cluster 3

This cluster comprises 28 RF constituents located across absolutely all the federal districts, with their significant portion (64%) concentrated in the Central, Volga, and Southern districts.

The cluster's total population accounts for around a third (32.32%) of Russia's total population, its share of the population employed in the economy being just a bit smaller – 30.65%. These indicators rank the cluster 2nd in population size among the three clusters identified in the analysis. However, on the majority of key economic indicators Cluster 3 demonstrates the lowest values – this, in particular, is the case with gross regional product (its share just 22.80% of Russia's GDP), the size of fixed assets (22.62%), extraction of mineral resources (16.13%), retail turnover (26.84%), and the volume of exports and imports (18.87 and 21.31% respectively). At the same time, certain economic indicators make this regions cluster stand out due to their high values, as is the case with its total volume of agricultural output (42.77% of Russia's national volume, inclusive of crop farming (44.73%) and animal husbandry (40.50%)).

Thus, based on the authors' assessment of key social-economic indicators across the regions in this cluster, it is possible to conclude that the cluster, which is home to nearly a third of the nation's population, exhibits a certain degree of passiveness in most sectors of the economy while demonstrating robust activity in agriculture.

The results of the authors' analysis across the stages of reproductive labor within this cluster's regions revealed some of their common characteristics exhibiting discrepant trends across particular stages.

Firstly, at the perinatal stage of reproductive labor this cluster demonstrates the lowest, compared with the other clusters, values of the coefficient of the quantitative efficiency of labor, which are somewhat on the decline in the period under analysis (87.05% in 2002 and 85.33% in 2008); at the same time, the level of the common coefficient of natality here is the highest, with its positive dynamics being the highest (by 23%). Notable dynamics are also observed in the values of the coefficient of births (from 0.90 in 2002 to 1.50 in 2008).

Secondly, the discrepancy of the results of reproductive labor at its school stage (Russian Education Statistics, n.d.) is reflected in that, while the share of minors with generally successful socialization (assessed based on the share of minors who committed crimes in the overall number of minors) is the same, there is a tangible decline (by 13%) in the number of medalists among school graduates.

Thus, while exhibiting considerable positive dynamics in the period under analysis, the regions with the nationally highest indicators of reproductive activity in the form of births per 1,000 people demonstrate discrepant trends at certain (namely, the perinatal and school) stages of reproductive labor. From an economic standpoint, this cluster is also characterized by a certain degree of passiveness in most sectors of the economy, despite the regions within it being active agriculturally.

Implementation of the proposed methodology for assessing the efficiency of reproductive activity

Below is a comparative analysis of the authors' segments on secondary variables, information on which is only available for the year 2008. As was noted in Item 2.1, this will help supplement the results of the cluster analysis and get closer to the authors' integrated characterization of the results of reproductive labor across its stages. The results of the initial cluster profiling on these variables are provided in Table 3.

Table 3. Results of Profiling the Regions Clusters on Secondary Variables (Level 1)

Cluster	Number of RF constituents	Morbidity rate for children aged 0–17 per 1,000 people		Share of participants in the State Unified Exam (SUE) who did not proceed to perform assignments with detailed answers (on Russian and Math) in the number of those who took the SUE on these disciplines	
		average	median	average	median
I	37	3224.4	3185.7	21.3	21.5
II	14	3260.4	3297.2	22.1	22.0
III	27	2878.5	2979.5	20.6	21.0
overall across the RF	78	3076.5	3169.5	21.7	21.6

The data provided in Table 3 helps produce the following inferences:

1) The regions within Cluster 1 are exhibiting low levels of activity at the first stage of reproductive labor and slow positive dynamics across its initial stages, with medium levels of the efficiency of activity detected at the subsequent stages of home and social reproduction. The median level of child morbidity in these regions is 3185.7 cases per 1,000 people, the median share of refusals to perform detailed-answer assignments (one of the major summarized outcomes in the SUE) being 21.5%. These characteristics let one view Cluster 1 as a group of regions with medium indicators, tending toward lower values, of reproductive activity, which may require implementing a special set of measures aimed at stimulating it at all stages of reproductive labor;

2) The regions within Cluster 2, characterized earlier as leading the way in levels of reproductive activity in the period from 2002 to 2008 and which exhibited high labor results at the initial stages of reproduction, demonstrated a totally contrary picture in the subsequent analysis, posting the lowest levels of morbidity and SUE efficiency compared with the other clusters. In particular, compared with the median Russian level of morbidity (3169.5 cases per 1,000 children), in the Cluster 2 regions it is 3297.2; compared with the median national share of refusals to solve more complex SUE problems (21.6%), here it is 22.0% (the significance of differences in indicators in the other clusters statistically proven). Thus, the Cluster 2 regions demonstrate quite an uneven, across the stages, development of the reproductive situation, when there arises the risk of high results of reproductive labor achieved at its initial stages being offset by low results at the subsequent stages. Consequently, the focus of measures for stimulating reproductive activity ought to be on the characteristics of implementing the labor process at its later stages and on identifying and regulating the factors determining the results at these stages specifically;

3) The Cluster 3 regions, which earlier exhibited discrepant trends at the various initial stages of reproductive activity, demonstrated high labor results at the subsequent stages. The data provided in Table 3 indicate a higher weight of healthy children and a better level of SUE efficiency in this cluster of regions specifically. To be specific, the median level of morbidity here is 2979.5 cases per 1,000 children, which is lower than in Cluster 2 by almost 10%; the median share of full SUE answers is the highest across the clusters, 79%. Thus, to achieve high reproductive labor results across this cluster of regions, it is needed to pursue a policy focused on boosting the results of activity at the initial stages of home and social reproduction.

Considering that implementing the above two stages in the analysis produced quite illuminating, if somewhat disparate when viewed across the stages of reproductive labor, results in each of the 3 clusters identified, as well as taking into account the methodological principle of regional differentiation in the study of reproduction processes which was introduced in Item 2.1, it appears to be advisable and necessary to implement one more stage in the analysis – a second level of profiling the clusters identified, which deals with identifying regions with indicators that are higher and lower than Russia's average ones. This makes it possible to obtain in each segment of regions a set of the more complicated Russian constituents requiring foremost differentiated measures aimed at stimulating reproductive labor in them. The results of this Level 2 profiling in the three clusters identified earlier are provided in Table 4.

Table 4. Results of Profiling the Regions Clusters on Secondary Variables (Level 2)

Clusters	Sub-clusters	Number of RF constituents	Morbidity rate for children aged 0–17 per 1,000 people		Share of participants in the SUE who did not proceed to perform assignments with detailed answers (on Russian and Math) in the number of those who took the SUE on these disciplines	
			average	median	average	median
I	1	26	3079.0	3021.0	20.0	19.8
	2	11	3568.0	3599.7	24.5	23.7
II	3	10	3133.1	3022.4	21.5	21.2
	4	4	3578.7	3585.1	23.7	23.3
III	5	23	2730.3	2802.5	19.9	19.8
	6	4	3730.8	3731.3	24.5	24.3
overall across the RF		78	3076.5	3169.5	21.7	21.6

The results of the authors' analysis provided in Table 4 led them to draw a couple of new inferences:

- firstly, the authors identified specific groups of priority regions requiring urgent measures to be taken to stimulate reproductive labor in them. These are the more troubled, in terms of reproductive labor results, regions in Sub-clusters 2, 4, and 6;

- secondly, considering the fact that the troubled 19 regions belong to the 3 first-level clusters, it appears to be possible to establish the primary focus of priority measures. This focus is on the initial stages of reproductive labor in Sub-cluster 6, on later stages in Sub-cluster 4, and encompasses all stages of activity in Sub-cluster 2. The limited number of troubled regions makes it possible to implement in them differentiated, in

terms of the nature of the development of reproductive situations, focal strategies for impelling reproductive labor under existing social-economic conditions;

- thirdly, the most extreme results of reproductive labor at its later stages were detected in the third cluster of regions: while in the fifth sub-cluster the average and median values for morbidity and SUE efficiency are the lowest (a median value of 2802.5% and 19.8% respectively), these values, by contrast, are the highest in the sixth sub-cluster (3731.3% and 24.3%). This is testimony to the need to develop a highly-differentiated policy for stimulating results in reproductive labor within this cluster that would be especially susceptible to the levels of these results we have today already;

- fourthly, reproductive labor results were found to differ tangibly across the regions within the first cluster of RF constituents. The regions within the first sub-cluster registered a median value of 3021.0% on child morbidity and 19.8% on SUE efficiency, the respective values for the second sub-cluster checking in at 3599.7% and 23.7%. This points to the need to develop and implement a medium-differentiated policy for stimulating results in reproductive labor within this cluster that would have a multi-stage nature;

- fifthly, profiling on secondary variables did not let the authors detect in the second cluster high differentiation across the sub-clusters (there were minor differences in the levels of variables in Sub-clusters 3 and 4). This is testimony to the need to develop for them a differentiated policy and makes it possible to view, going forward, all 14 regions within Cluster 2 as quite homogeneous in terms of the development of reproductive activity in them and, consequently, in terms of stimulation measures used by them.

Results and discussion

The authors have developed and implemented a methodology for exploring reproductive activity, with specific groups of regions having been identified based on the characteristics of tools, methods, and focus underpinning their practices of stimulating reproductive activity, which is expected to help ensure effective information-analytical support for management decisions in the area of regulating reproductive activity.

Analysis of economic gain

The authors' cluster analysis procedure followed by a multi-level profiling of the clusters helped obtain the following results:

1) The first cluster of Russian regions, which is comprised of numerous constituents and is well-populated, is characterized by slow positive dynamics on most indicators of reproductive activity and low indicators reflecting activity at the perinatal stage of this type of labor. Here the authors detected medium efficiency levels of activity at the subsequent stages of home and social reproduction. The characteristics obtained make it possible to view the first cluster as a group of regions with medium indicators, tending toward lower values, of reproductive activity, which may require implementing a special set of measures aimed at stimulating it at all stages of reproductive labor, factoring in intra-cluster differentiation on secondary variables.

2) The regions within Cluster 2 are characterized by high, and growing, results of reproductive labor at the perinatal stage and increasing, if somewhat lower compared with the other clusters, indicators of vitality at the perinatal, infant, and preschool stages of reproductive labor, as well as tangible boosts in reproductive activity at the school stage. Subsequent profiling helped detect here an uneven, across the stages, development of the reproductive situation and some risk of the high results of reproductive labor achieved at its initial stages being offset by the low results of this labor at the subsequent ones. Measures for stimulating reproductive activity ought to be focused here on the implementation of the labor process at its later stages and on identifying and regulating the factors that determine results produced at these stages specifically.

3) The regions within Cluster 3, exhibiting the highest national efficiency indicator of reproductive activity in the form of the number of births per 1,000 people, with its dynamics in the period under analysis being notably positive, are characterized by discrepant trends at the initial stages of reproductive labor. Yet, at the same time, one is observing here high results of labor at the subsequent stages. To achieve high results of reproductive labor on the whole in this cluster of regions, one ought to pursue a policy focused on improving the results of activity at the initial stages of home and social reproduction. In addition, the major differentiation in reproductive labor results at its later states detected by the analysis in this cluster signals the need to work out a highly-differentiated policy for stimulating the results of reproductive labor within it.

4) The outcomes of applying the authors' methodology include identifying a group of priority Russian regions that are the more troubled in terms of the results of reproductive labor, which require taking immediate measures for stimulating this type of labor in them. The limited number of such regions makes it possible to implement in them differentiated, in terms of the nature of the development of reproductive situations, focal strategies for impelling reproductive labor under existing social-economic conditions.

The study's practical significance consists in the following:

- developing a methodology for the analysis of the dynamics of reproductive activity is expected to make it possible to conduct monitoring of its major indicators, opening up the potential for control over reproductive activity in various regions;

- the developed methods and tools for stimulating reproductive activity may open up the potential for their practical utilization at the federal and regional levels with a view to boosting the volume and caliber of the future human capital of the country and regions across it;
- the authors' methods and tools for stimulating reproductive activity, differentiated by types of regions, are expected to make it possible to determine specific areas for implementing reproductive policy factoring in the type of region.

Conclusions

It has been established that reproductive activity, as a crucial specific integral characteristic of reproductive labor, has a twofold nature that is reflected in its association with both the characteristics of the flow of the labor reproduction process and its results. Stimulating it in present-day Russia may require the use of an array of methods and tools aimed at changes in both the content and character of reproductive labor, which will be developed relative to specific conditions of place and time.

The key conditions necessary for vibrant reproductive activity in Russia include having in place a sound system of stimulating and, from the perspective of the subjects of reproductive labor, motivating it, as well as creating the right conditions for the competent implementation of the labor process.

The analysis conducted based on the authors' methodology for the analysis of reproductive activity in Russian regions has identified 3 clusters of regions, which differ significantly in the dynamics of the reproductive situation in them. Identifying and profiling these groups of regions substantiates the need for taking a differentiated approach to stimulating reproductive activity in them. In this context, it pays to be oriented toward the specific tools and methods for stimulating reproductive activity identified in the analysis that are a priority to each type of regions.

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