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WELFARE OF INDIVIDUALS AND THE AREA OF RESIDENCE: RISK DIAGNOSTICS — THE CASE OF THE URAL FEDERAL DISTRICT

The article examines the urgent problem of formalizing the assessment of risks to the welfare of individuals and the area of residence in the regions. This study identifies the place of economic security in the structure of the system for the welfare of individuals and the area of residence, and develops a classifier of risks. Economic security is viewed as one of the needs, towards which the provision of welfare is directed. The approach to the assessment of risks to the welfare of individuals and the area of residence of the regions includes three stages. The first stage involves calculating the welfare of individuals and the area. The second stage is used to calculate the variation coefficient to select the indicators describing the risks to the welfare of individuals and the area of residence. The third stage includes the assessment of selected risks causing the deterioration of welfare. The formalization of assessment of the risks to the welfare of individuals and the area of residence was based on the representation of the economic system of the region as a multidimensional stochastic system simulated in the form of a random vector, the components of which, in a general case, are mutually correlated. The diagnostics allowed to identify the main problems for the welfare of individuals and area of residence. The calculation of variation coefficient allowed to select the risk factors with high values of the coefficient indicating the high variability of selected indicators. The authors determined the values of risks to the welfare of individuals and the area of residence by assessing the probability of various crisis states for the regions of the Ural Federal District. For all regions, the probabilities of PC1 and PC2 states are fairly high. This may indicate an unstable socio-economic situation in the regions of the Ural Federal District. The findings may be used to develop an effective risk management system at the regional level.

Keywords: welfare of the individuals and the area of residence, economic security, needs, risk, classifier of risks, variation coefficient, region, stochastic system, probability of crisis situations, random vector

Introduction

Amid the processes of globalization, development of post-industrial economy and reorientation of the economy towards the individuals, the current stage in the development of Russia gives rise to the effect of unpredictability in the change of welfare as a result of increasing impact of economic crises, sudden threats and risks. One of the urgent problems in the area of risk analysis of socio-economic systems is the creation of adequate models. This can be explained by the multidimensional character of such systems, stochastic nature of their behavior, and complex interactions between their elements. For that reason, the article defines and addresses the methodological and procedural problem of formalizing the assessment of risks to the welfare of individuals and the area of residence in the Russian regions by using the case of the Ural Federal District (UFD).

Theory

The period of market transformations (late 20th — early 21st century) led to decline in the public welfare, as demonstrated by high-income differentiation of the population. According to statistics[1], in Russia, the income of the richest 10 % exceeded the income of the poorest 10 % of the population by 14 times in 2000 and, in UFD, this figure was 15 times. The situation has not improved in 2000–2015. On the contrary, the above income gap increased to 15.7 times in Russia and 17.5 times in UFD. The extent of social stratification can be described by R/P 10 % ratio. According to UN recommendations, the R/P 10 % ratio should not be more than 8–10 [1]. In Russia and its regions, the values of this indicator exceed the standard all along the period of 2000–2015, which indicates a strong social stratification.

The study of theoretical foundations of welfare allows to identify the following trends:

[1] Data of Federal State Statistics Service. (http://www.gks.ru).

1. Welfare includes the elements related to ensuring the vital activities of individuals, for example, the consumption of food (material elements), psychological and emotional elements, such as, the satisfaction from work activities, family relationships (non-material elements), as well as the channels used to create the benefits and bring them to the individuals, which allows to provide the benefits to people [2].

2. There are difficulties in correlating individuals and public welfare. In one interpretation of social welfare, it is reduced to the sum of individuals utilities, while another demonstrates the complexity of the comparing the individuals utilities required to build the public welfare [3, 4].

3. In foreign studies, a greater emphasis is placed on the welfare of individuals and the role of the state in aligning the individuals interests [3, 5, 6]. There is virtually no attention to considering a harmoniously developed personality as the highest form of public welfare realization. On the contrary, in Russian studies, the main subject is the comprehensive development of personality through active constructive activities and creative self-realization [7].

4. Need for ensuring social welfare amid the current globalization and significant income differentiation. Need for establishing the mechanisms for fair distribution of benefits generated in the society. There is a trend towards the development of social welfare by making the transition to the path of innovative development. The Russian science still did not focus on the factor of increasing social stratification dynamics, and on describing the patterns of welfare creation in the post-industrial economy.

5. The neoclassical theory cannot ensure the effective interaction of individuals and social welfare, which can be addressed within the theoretical and methodological works of institutional theory. In neoclassical theory, the public welfare is an abstract concept that does not take into account the social and individuals characteristics, which does not allow it to predict the behavior and motives of society [8].

6. In modern conditions, amid the formation of postindustrial society, there is an ongoing reorientation of the economy towards individuals. The contradiction between "social justice" and "economic efficiency," which is inherent to a market economy, gave way to the interdependence of these categories, as the social justice has become a necessary condition for economic efficiency. In this environment, we see the emergence of a new social inequality system related to the information and knowledge access. The welfare is viewed as the indicator of opportunities to use the human potential [9]. Knowledge and skills are viewed as a core value in the formation of human potential [10].

The welfare of the population and the region is related to the provision of material, non-material benefits and channels used for bringing these benefits to the welfare entities [2, 11]. The economic security describes the protection, the viability of entities, objects, and systems from internal and external threats. The uncertainty in the functioning of the region, the variability of internal and external conditions make it necessary to identify and assess the risks to the socio-economic development of the region. Fig. 1 presents the place of economic security in the system of the welfare of individuals and the area of residence.

The authors propose to represent the joint consideration of such categories as "welfare," "economic security" and "risks" in the form of following relationships. Welfare is the satisfaction of the needs of individuals and the area, where one of the needs is the need for economic security, while the infringement of needs and the conflict between the interests of individuals and the area in the course of their interaction generate the risks for the welfare of individuals and the area. In accordance with the classification of American scholar A. Maslow [13], the needs have a hierarchical structure, with the lowest level held by physiological needs and security needs and highest level held by the need for communication and love, self-affirmation and recognition, and self-actualization. Need is a state when the organism, individuals, personality requires something necessary for their normal existence[2]. In the classification of needs by A. Maslow, the need for security refers to basic needs, which must be satisfied in order to meet the needs of a higher order.

The approach to structuring the welfare is based on the expediency of separating the welfare of individuals and the welfare of area. Only a few works, for example, those of A.R. Safiullin, and M.A. Khazheeva, consider the area (in this study, the subject of the Russian Federation) as a welfare entity and take into account the extent of satisfaction of the needs of the subject of the Federation. A

[2] Kratky slovar psikhologicheskikh terminov [Concise Dictionary of Psychological Terminology]. Retrieved from: https://vocabulary.ru/termin/potrebnosti.html (In Russ.)

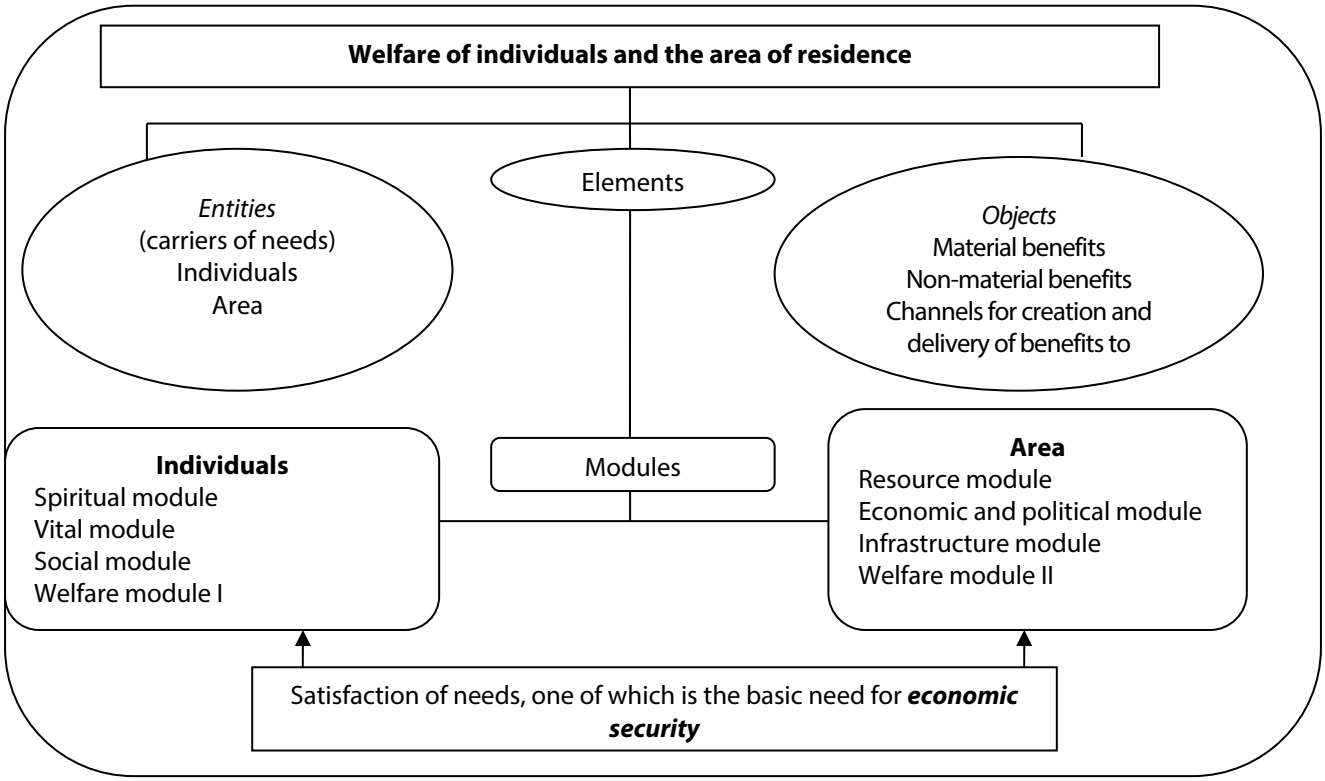

Fig. 1. *The structure of the system of the welfare of individuals and the area of residence (prepared by the authors based on [12])*

level-based approach to the study of welfare was proposed by M.A. Khazheeva [14], who identified the mega- (world economy), macro- (national economy), meso- (regional economy), micro- (economy of the firm), nomo- (household economy), nano- (economy of individuals). A.R. Safiullin [2] investigated the administrative-territorial (state, Federal district, subject of the Federation, municipal entity) and social (group by gender and age, income level, occupation) aspects of welfare.

In the studies of welfare, it is often equated with the standard of living or quality of population, the welfare cannot be reduced only to material aspects, it includes not only a full-fledged and decent human existence, comprehensive development of personality, but also the expanded reproduction of the area. The welfare should encompass all spheres of life not only for people, but also for the areas grouped by modules.

The authors understand the welfare of individuals and the area of residence as a complex socio-economic category that includes the spiritual, vital, social, resource, economic and political sub-sections, infrastructural modules, welfare modules I and II, and describes the provision of individuals and the area with vital benefits, and ensures the need for economic security in the context of minimizing the socio-economic risks for the individuals, including the risks of poverty, risk of health disorders, risk of depopulation from external causes, and risks for the area, including the risk of de-industrialization, the risk of financial depression and the risk of increasing workload for the working-age population.

Various threats and risks are hindering the improvement of welfare [15]. The risks and their classification were reviewed by Russian and foreign scientists for the various spheres of economic activities [16–22]. In their study of the welfare of individuals and the area, the authors propose a classifier of risks to the welfare of individuals and the area of residence (Fig. 2).

The risk of poverty prevents the growth of welfare, because it limits the starting opportunities for the people by lower incomes and generates a "vicious circle" of low average incomes — low level of savings — low level of investments — low rates of capital accumulation — low productivity of labor and capital — low average incomes [23].

The risk of disease makes a direct impact on the level of welfare, since a high incidence of disease among population leads to its inability to engage in full-fledged labor activity and, accordingly, negatively affects the income level [24].

The risk of depopulation from external causes describes the level of premature death among the population and reduction in the level of socio-hygienic well-being. The external causes include

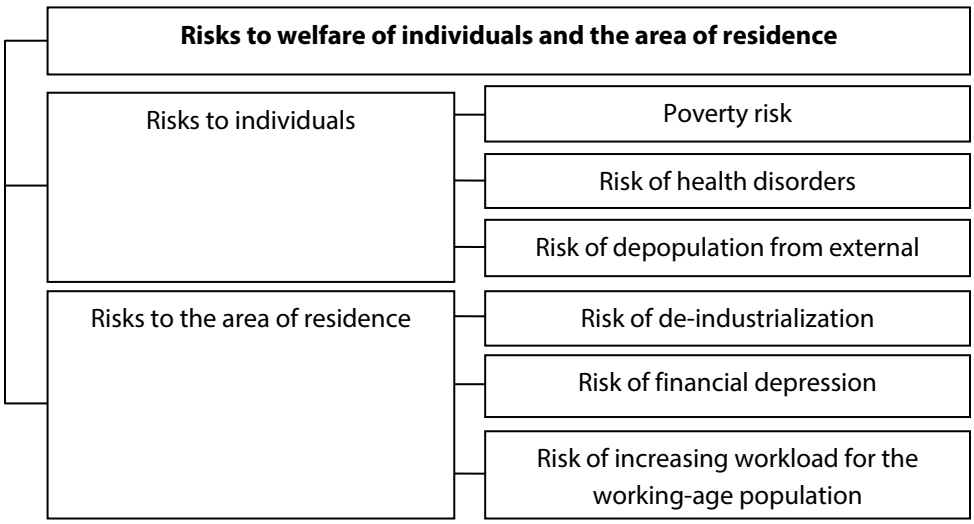

Fig. 2. *Classifier of risks to welfare of individuals and the area of residence*

intentional (homicide and suicide) and unintentional (accidents such as road accidents, fires, poisoning, etc.) ones, there is also damage inflicted with uncertain intentions[3].

The risk of de-industrialization is associated not only with a downturn in industrial production, but also includes the loss of certain technological level, destruction of industrial infrastructure, extensive depreciation of assets, growing number of imported components required to manufacture domestic products [25].

The risk of financial depression describes the availability of financial resources in the region necessary for the development of manufacturing [26, 27].

The risk of increasing workload for the working-age population describes the provision of the area with the labor force, the level of pressure exerted on it by pensioners and children, which affects the areas of socio-demographic and pension policies.

The realization of risks in the area can disrupt the material basis for the welfare of individuals.

Research methodology

All existing methods for assessing the socio-economic risks can be classified into three groups:

— Qualitative methods are based on detailed identification of all risk factors and expert opinion on the weight of particular factor in the materialization of risk (for example, SWOT analysis, analytic hierarchy process, Delphi method);

— Quantitative methods involve the selection of significant indicators affecting the functioning of the object and using them as the basis to determine the numerical value of specific risk (statistical and analytical methods);

— Comprehensive methods are based on the use of qualitative and quantitative data. The expert assessments are used to determine the qualitative indicators and the weights of factors, while the quantitative methods are used to determine the numerical values of the risk (for example, by building the ratings).

Quantitative methods are mostly used to assess the currency, banking, credit risks and virtually not used for the assessing the risks to the region's functioning. The authors made an attempt to use them to assess the risks at the regional level.

The authors propose a methodological approach, in which the risk means the probability of deviation from the established development trajectory and a change in the degree of crisis (transition from pre-crisis 2 to pre-crisis 3 or transition from crisis 1 to crisis 2). The approach to risk assessment includes three stages. The first stage involves the calculations of the welfare of individuals and the area by eight modules. The second stage is used to calculate the variation coefficient to select the indicators describing the risks to the welfare of individuals and the area of residence. The third stage includes the assessment of selected risks causing the deterioration of welfare (Table 1, (Fig. 3).

[3] Smertnost ot vneshnikh prichin v Rossii. Otkrytoye zasedanie NUG "Demograficheskiy analiz smertnosti" [Mortality from external causes in Russia. A public meeting of research and study group on Demographic Analysis of Mortality] Retrieved from: https://www.hse.ru/demo/death/news/79719462.html (In Russ.)

Table 1

Indicators describing the risks to welfare of individuals and the area of residence

Risk	Indicator
Risks to welfare of individuals	
Poverty risk	dynamics of real household incomes, % to the previous year; ratio of average pensions to the pensioner subsistence minimum
Risk of health disorders	disease incidence per 1000 people (registered diseases in patients with a diagnosis established for the first time in their life)
Risk of depopulation from external causes	mortality from external causes per 1000 people
Risks to welfare of area	
Risk of de-industrialization	index of industrial production; depreciation rate of fixed production assets
Risk of financial depression	budget revenues per capita; GRP per capita
Risk of increasing workload for the working-age population	coefficient of demographic load

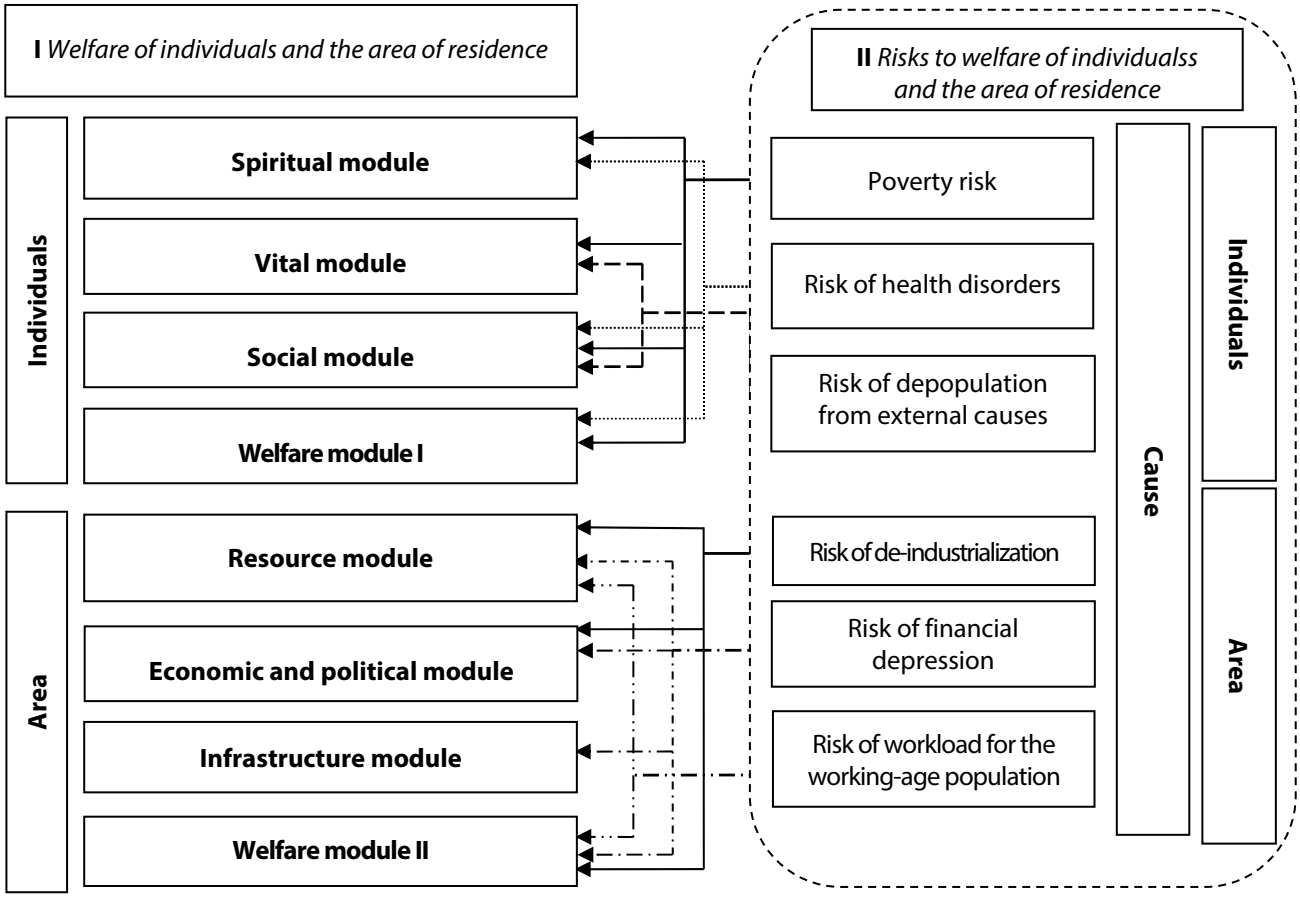

Fig. 3. *The impact of risks on modules of welfare*

In the second stage, to select the indicators describing the risks to the welfare of individuals and area of residence, we calculate the variation coefficient (*V*). It refers to statistical methods of risk assessment [28, 29] and allows to estimate the variability of economic indicator values around the average value:

$$V = \pm \frac{\sigma}{\bar{x}},$$

where σ is the mean-square deviation of the economic indicator; $\bar{x}$ is the average value of economic indicator.

Translation

The variation coefficient allows to compare the volatility of indicators that have different units of measurement. The variation coefficient can vary from 0 to 100 %. The higher is the variation coefficient, the greater is the volatility of the indicator and, accordingly, the higher is the risk. If its value is less than 10 %, the dynamics of the indicator can be described as a low risk; if it is in the range of 10 to 25 %, the risk is moderate; when it is more than 25 %, the risk is high.

In the portfolio theory, this coefficient is used as a relative measure of risk associated with investing in a specific asset or portfolio of assets [30]. The variation coefficient shows the risk per unit of expected return. The preference should be given to investment options with the minimum variation coefficient, because it describes the optimal balance of risk and return.

The third stage involves the risk modeling, in which the stochastic system is represented as a random vector with mutually correlated components, and its numerical characteristics are used as control variables [31–33]. The risk is managed by changing probabilistic properties in the components of the multidimensional stochastic system.

In the socio-economic system, let's select the risk factors $X_1, X_2, \ldots, X_m$. As a result, we will get a representation of the system in the form of a random vector $\mathbf{X} = (X_1, X_2, \ldots, X_m)$ with a certain probability density $p_{\mathbf{X}}(\mathbf{x})$.

Instead of commonly used selection of specific dangerous situations, we will specify the geometric regions of adverse outcomes. They may have a random look depending on the specific problem and are determined by using the available a priori information. For clarity, we will describe the proposed approach by using the common concept of adverse events as big and improbable deviations of a random value relative to its mathematical expectation. In this case, we will consider as dangerous situations any big and improbable deviations of the sample values x_{ij} of any of the components X_j relative to their mathematical expectations, $\mu_j = M[X_j]$, $j = 1, 2, \ldots, m$. Let's set the probability of adverse outcome for each component X_j as

$$P(D_j) = P(X_j \in D_j) = P(X_j \notin \overline{D}_j), \;\; \overline{D}_j = \{x : \mu_j - A_{1j}\sigma_j < x < \mu_j + A_{2j}\sigma_j\},$$

where σ_j is the mean-square deviation of random value X_j; A_{1j}, A_{2j} are the specified lower and upper thresholds (in units σ_j), that is, the region of favorable outcomes is limited to the range $(\mu_j - A_{1j}\sigma_j; \mu_j + A_{2j}\sigma_j)$.

Next, we need to set the multidimensional region of dangerous situations D by taking into account the impact of components on the emergence of adverse outcomes. It is equal to $D = \mathbf{R}^m \backslash \overline{D}$, where $\overline{D}$ is the region of values allowed for risk factors. Let's describe the region $\overline{D}$. This can be done in various ways. From a geometric point of view, the most justified method is to specify it as an internal region of m-axis ellipsoid

$$\overline{D} = \left\{ \mathbf{x} = (x_1, x_2, \ldots, x_m) : \sum_{j=1}^{m} \frac{(x_j - \mu'_j)^2}{A_j^2 \sigma_j^2} < 1 \right\}$$

with the center in the point $\boldsymbol{\mu}' = (\mu'_1, \mu'_2, \ldots, \mu'_m)$, $\mu'_j = \mu_j + A_j\sigma_j$, $A_j = (A_{1j} + A_{2j})/2$, $j = 1, 2, \ldots, m$. Then, for a random vector $\mathbf{X}$, the probability of adverse outcome will be equal to

$$P(D) = P(\mathbf{X} \in D), \;\; D = \left\{ \mathbf{x} = (x_1, x_2, \ldots, x_m) : \sum_{j=1}^{m} \frac{(x_j - \mu'_j)^2}{A_j^2 \sigma_j^2} \geq 1 \right\}. \quad (1)$$

Note that, in (1), the region D of adverse outcomes represents the outer region of m-axis the ellipsoid, in which the semi-axes for each of the coordinates are equal to $A_j\sigma_j$, respectively, i. e. for each j-th axis, this region corresponds to one-dimensional case D_j. Obviously, when the outcome does not lie on one of the axes, the event D may also materialize in the absence of risk deviations on all components (possible situations include $\mathbf{X} \in D$ and $\forall\, j \; X_j \notin D_j$).

By setting the function of the effects resulting from dangerous situations as $g(x)$, we will get the model for quantitative risk assessment

$$r(\mathbf{X}) = \int\int \ldots \int_{\mathbf{R}^m} g(\mathbf{x}) p_X(\mathbf{x}) d\mathbf{x}. \quad (2)$$

If we assume that

$$g(\mathbf{x}) = \begin{cases} 1, \mathbf{x} \in D, \\ 0, \mathbf{x} \notin D, \end{cases} \quad (3)$$

Translation

then $r(\mathbf{X}) = P(\mathbf{X} \in D)$, i. e., the risk is assessed as a probability of adverse outcome. If, at an early stage of system analysis, it is difficult to describe the function $g(\mathbf{x})$ with sufficient accuracy, then the formula (3) becomes the assessment of $P(D)$ and provides a convenient initial approximation of the risk model.

Next, let's consider the most common particular case, when $\mathbf{X}$ has a joint normal distribution with probability density

$$p_X(\mathbf{x}) = \frac{1}{\sqrt{(2\pi)^m |\Sigma|}} \exp\left\{-\frac{1}{2}(\mathbf{x}-\mathbf{a})^T \Sigma^{-1}(\mathbf{x}-\mathbf{a})\right\}, \quad (4)$$

where $\mathbf{a} = (a_1, a_2, \ldots, a_m)^T$ is the vector of mathematical expectations, $\Sigma = \{\sigma_{ij}\}_{m \times m}$ is the covariance matrix.

Let's use the models (1)–(4) to assess the macroeconomic risks for four regions (Kurgan region, Sverdlovsk region, Tyumen region, and Chelyabinsk region) of the Ural Federal District based on the data for 2001–2015. Table 2 indicates the risk factors and their symbols.

Table 2

Macroeconomic risk factors for the regions

Risk factor	Symbol
Dynamics of real household incomes, % to the previous year	X_1
Ratio of average pensions to the pensioner subsistence minimum	X_2
Disease incidence per 1000 people	X_3
Mortality from external causes per 1000 people	X_4
Industrial production index, % to the previous year	X_5
Depreciation rate of fixed assets (at the end of the year, %)	X_6
Budget revenues per capita, in 2015 prices, thousand rubles	X_7
Index of physical volume of GRP, % to the previous year	X_8
Coefficient of demographic load	X_9

Tables 3–6 provide the actual values of risk factors for the regions prepared in accordance with Rosstat data[4].

Table 3

Macroeconomic factors of risk to Kurgan region

Year	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
2001	106	0.969	817	311.32	115.9	44.6	18.231	101.2	702
2002	110.9	1.001	869.8	300.43	90.5	56.6	23.277	102	681
2003	104.1	1.055	831.8	289.55	113	48.3	25.626	107.9	652
2004	120.2	1.070	843.1	323.20	106.1	48.8	25.773	103.3	633
2005	108.4	1.177	801.3	252.93	105.4	50.5	28.443	107.5	620
2006	116.5	1.146	847.5	268.40	106.8	47.5	31.308	111.8	619
2007	113.3	1.253	841.6	225.47	105.9	50	40.017	104.4	625
2008	93.9	1.300	823.7	226.80	101.3	52.4	44.644	109.3	632
2009	102.9	1.613	901.4	206.10	77	55.5	46.890	92.9	651
2010	102.2	1.750	865	199.50	113.2	60.5	50.000	97.5	699
2011	95.6	1.901	868.8	188.90	110.4	62.8	51.201	106.8	734
2012	104.2	1.827	816.5	189.90	110.5	63.2	50.442	96	773
2013	101	1.702	889.7	187.30	100.8	58.6	47.939	102.8	809
2014	98.4	1.753	914.8	177.60	97.7	52.8	43.673	97.1	844
2015	86.1	1.519	925.2	172.70	101.6	54.9	39.272	97.6	882

[4] Federalnaya sluzhba gosudarstvennoy statistiki [Federal State Statistics Service]. Retrieved from: http://www.gks.ru/ (In Russ.)

Table 4

Macroeconomic factors of risk to Sverdlovsk region

Year	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
2001	111	0.896	642.3	274.85	111.2	50.3	25.044	108.6	640
2002	113.3	0.960	665.7	265.57	104	56.1	27.074	104.2	607
2003	117.9	1.065	686.4	256.28	109.2	45.1	27.881	109	587
2004	114.4	1.097	685.8	290.50	109.3	49	32.901	108.9	575
2005	117	1.173	711.1	223.21	104.8	51.7	37.841	109.5	568
2006	118.5	1.106	720.1	236.60	108.2	52.9	50.432	111.5	570
2007	104	1.219	735.9	200.32	107.3	53.1	59.217	109.4	577
2008	100.8	1.256	703.9	200.90	95.4	53.3	63.957	102.5	589
2009	103.9	1.542	734.5	188.80	81.1	53.3	52.860	88.4	609
2010	104.4	1.672	727.8	181.50	117.3	54.6	56.791	111.4	641
2011	102.6	1.825	739.7	172.50	106.2	54.8	61.030	108.9	661
2012	105.9	1.682	734.1	165.70	109.6	55.2	63.196	107.1	687
2013	103.7	1.743	766.8	162.40	102.7	57.8	60.057	102	715
2014	96.2	1.892	747.8	157.00	102.1	58.5	55.014	100.1	745
2015	93.6	1.574	728.1	155.80	96.3	58.5	51.308	94.8	776

Table 5

Macroeconomic factors of risk to Tyumen region

Year	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
2001	119	0.779	904.8	219.79	107.1	35.8	168.573	110.4	503
2002	102.4	1.059	909.7	210.97	107.3	49.8	157.132	104.9	474
2003	110.6	1.215	929.7	202.14	110.7	50.4	162.006	108.2	455
2004	107	1.416	897.3	204.70	107.9	51	205.703	106.5	445
2005	110.2	1.598	892.7	180.71	102.7	53	251.018	110.8	440
2006	112.3	1.335	917.8	178.50	103.2	54.3	234.878	106	440
2007	111.2	1.589	899.1	161.66	100.4	54.5	328.995	103.1	447
2008	90	1.421	889.9	158.90	99.2	55	229.218	103.8	458
2009	94.7	1.732	883.7	141.80	96.2	56.4	178.608	94.3	478
2010	97.2	2.024	848.9	142.90	100.7	58.4	187.520	106	498
2011	100.8	2.221	848	120.10	99.9	59	218.633	103.1	514
2012	106.3	2.352	846.3	125.50	99.3	58.7	203.046	99.8	537
2013	103.7	2.199	862.3	110.20	100.8	60.5	164.034	102.4	563
2014	100.3	2.324	821.3	110.90	99.8	61.7	180.052	98.1	591
2015	96	2.043	816.9	95.80	99.8	62.9	156.865	102.4	621

Table 6

Macroeconomic factors of risk to Chelyabinsk region

Year	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
2001	99	0.969	725.5	265.63	102	46	20.880	103.1	661
2002	108	1.084	728.8	256.59	102.2	50.7	23.351	100.9	628
2003	114.8	1.189	739.5	247.55	109	44.4	28.340	108.5	607
2004	107.8	1.195	750.6	269.60	104.5	48.1	33.841	104.9	593
2005	119.9	1.315	754.3	219.12	105.3	46.4	32.313	108.3	585
2006	114	1.304	784.2	224.90	110.5	45.6	43.074	110.6	584
2007	116.1	1.300	819.8	198.51	112.5	45.9	50.459	113.4	590
2008	97.4	1.360	826.1	193.40	96.3	44.7	53.845	101.5	599
2009	102.4	1.717	845.3	177.50	80.1	44.4	41.583	85.9	619
2010	103.1	1.839	870.7	186.30	111	44.3	47.600	106	648
2011	99.1	2.003	890	164.70	107.5	44.8	48.953	105.3	669
2012	101.8	1.900	881.9	169.00	101.7	45.5	50.097	102.4	694
2013	104.6	1.720	876.1	152.90	99.9	47.5	47.620	101.5	720
2014	99	1.807	873.3	163.10	104	48	46.047	102.8	747
2015	93.1	1.597	862.3	146.70	98	48.5	43.875	95	776

Translation

Table 7 provides the risk levels.

Table 7

Risk levels

Risk factor	PC1	PC2	PC3	C1	C2	C3
X_1	89.56	85.90	82.74	79.93	77.36	75.00
X_2	0.99	0.86	0.75	0.66	0.58	0.50
X_3	900.00	920.00	940.00	960.00	980.00	1000.00
X_4	265.98	287.62	305.94	322.08	336.64	350.00
X_5	96.95	91.75	88.02	84.98	82.35	80.00
X_6	63.91	66.79	69.21	71.33	73.25	75.00
X_7	33.22	29.18	25.37	21.75	18.30	15.00
X_8	95.29	92.62	90.37	88.40	86.62	85.00
X_9	830.89	858.80	884.18	907.60	929.45	950.00

For PC1 and C3, the risk levels were determined assuming that PC1 indicates growing negative trends, and C3 shows that the situation is critical and nears the destruction of the system. Table 7 uses the following designations of crisis situations based on the severity of danger: PC1 — pre-crisis initial state; PC2 — developing pre-crisis state; PC3 — critical pre-crisis state; C1 — unstable crisis state; C2 — threatening crisis state; C3 — emergency crisis state [34].

Results

The calculations for general index of the welfare of individuals and the area of residence (Fig. 4) indicate that the situation has slightly improved compared to 2000, although in 2000–2013 the positive trend in the level of welfare of the subjects of the Russian Federation included in the Urals Federal District was disrupted in 2014 by the crisis that lowered the welfare to level of C1 (Stage 1). Among the major challenges in the area of the welfare of individuals and the area of residence in 2015–2016, we should note the demographic problem, as seen in the decline of the birth rate, negative rate of the reproduction of population and aging of the population; increased poverty; disproportions in the area of education (growing number of people with higher education and decline in the number of people with vocational training); downturn of investments in fixed capital; higher debt burden on regional budgets.

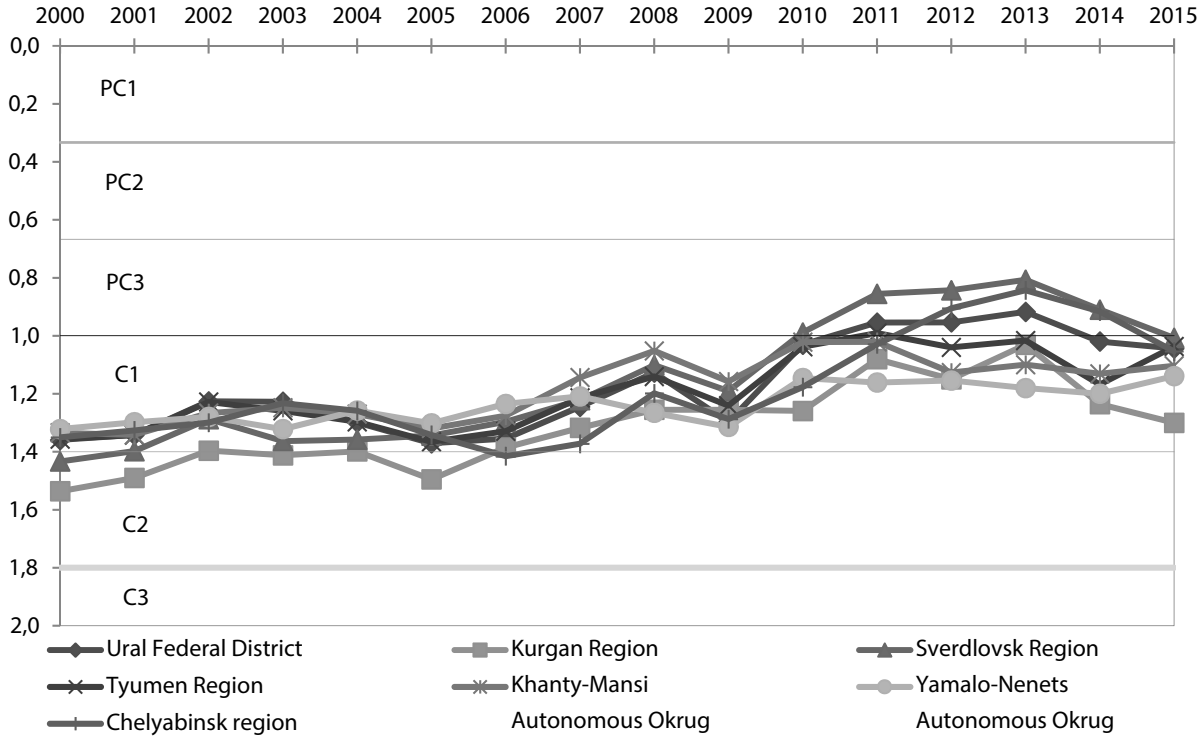

Fig. 4. *Change of status under the general index of the welfare of individuals and the area of residence*

Translation

To assess the risks to the welfare of individuals and the area of residence, we selected the indicators (Stage 2) with the variation coefficient corresponding to a medium or high risk (Table 8).

Table 8

Variation coefficient for selected 15 indicators, %

Variation coefficient	Kurgan Region	Sverdlovsk Region	Tyumen Region	Chelyabinsk Region
Dynamics of real household incomes, % to the previous year	8.50	7.55	8.64	7.88
Ratio of average pensions to the pensioner subsistence minimum	23.39	24.48	31.05	21.87
Disease incidence per 1000 people	4.30	4.62	4.07	7.43
Mortality from external causes, number of deceased per 100,000 people	22.28	26.07	28.22	23.99
Industrial production index, % to the previous year	9.26	8.35	3.86	8.14
Depreciation rate of fixed assets (at the end of the year, %)	10.84	7.19	14.27	3.91
Budget revenues per capita, in 2015 prices, thousand rubles	29.83	29.24	22.98	25.62
Index of physical volume of GRP, % to the previous year	5.29	6.25	4.29	6.38
Coefficient of demographic load	11.88	10.24	11.21	9.32

The provided variation coefficients for indicators in 2000–2015 reveal a high variability of selected indicators. In the analyzed period, there was a trend towards the deterioration of these indicators, which poses a risk to the welfare of individuals and the area.

Based on the methodological approach described above, Table 9 provides the assessments of probabilities for various crisis states in the four regions of UFD. This means that the period of 2001–2015 generated such probability of various crisis states.

Table 9

Assessments of the probability of various crisis states in the regions of UFD for the period of 2001–2015

Region	Crisis state					
	PC1	PC2	PC3	C1	C2	C3
Kurgan Region	0.652	0.390	0.218	0.117	0.061	0.031
Sverdlovsk Region	0.361	0.171	0.085	0.043	0.022	0.011
Tyumen Region	0.398	0.150	0.056	0.023	0.012	0.007
Chelyabinsk Region	0.465	0.234	0.113	0.051	0.022	0.009

Conclusions

The study allowed to demonstrate the place of economic security in the system of the welfare of individuals and the area of residence. Economic security is viewed as one of the needs, towards which the provision of welfare is directed. A risk classifier has been developed in order to better reflect the risks to the welfare of individuals and the area of residence.

The authors proposed a methodological approach to assessing risks to the welfare of individuals and the area by viewing the economic system as a multidimensional stochastic system that can be modeled as a random vector. The selection of risk factors was based on calculations of the variation coefficient. The authors determined the values of risks to the welfare of individuals and the area of residence by assessing the probability of various crisis states for the regions of the Ural Federal District, which allowed to make the following conclusions:

1. For all regions, the probabilities of PC1 and PC2 states are fairly high. This may indicate an unstable socio-economic situation for Russia in general.

2. Among all four regions, Kurgan region is in the most dangerous situations for each level of crisis states.

3. In terms of the crisis state PC1, the most secure is the Sverdlovsk region. However, with increasing danger, its security is gradually declining down to the third rank.

4. At the bottom danger level, Tyumen region is ranked second, and then goes to the top rank by becoming the most stable region in terms of the crisis states.

5. At first, Chelyabinsk region was ranked third at low danger levels, but gradually with the increasing level of danger, it becomes more stable and moves to the second rank, only slightly behind the Tyumen region.

The findings may be used to develop an effective risk management system at the regional level.

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