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Measuring poverty**Development of methodology in the field of measuring inequality and poverty in transition to new sources of information: Experiences and problems****Note by the Federal State Statistics Service of the Russian Federation (Rosstat)***Summary*

The document highlights the key features of the Russian statistical system and new possibilities to measure and analyse poverty, provided by the Population Income Survey (PIS) program. The document also presents new findings based on an expanded range of statistical indicators measuring poverty and an approach ensuring data comparability over the period of transition to new sources of information. The report describes methods to construct a harmonized set of indicators required to estimate the hardship and deprivation index, given the large inter-regional differences in the living conditions, way of life and living standards within the Russian Federation.

This document is presented for discussion to the Conference of European Statisticians' seminar on measuring poverty.

I. Introduction

1. In accordance with the current methodology, the Federal State Statistics Service has been producing poverty indicators since 1992. At that time, the published evaluation system was based on the use of a limited set of indicators, beyond which there was a wider set of indicators aimed to reflect the processes of socio-economic differentiation and poverty, including those standardized for comparative analysis at the global international level.

2. Currently, Rosstat is shifting to a broader system of indicators, which by its nature complies with more progressive methods of statistical measurement of these processes. The shift is determined by two factors:

- statistical base support for monitoring the Global SDG Indicator Framework;
- a need to expand the system of assessing the distribution of income and poverty in the light of government programs to improve the standard of living of the population.

II. Poverty measurement in the Russian Federation

3. Rosstat has been publishing poverty indicators since 1992. Poverty indicators are built on the basis of information on the population's monetary income level and the official poverty line, which is set in accordance with the current legislation determining the subsistence minimum value. The value of the subsistence minimum (SM) is defined per capita and by major socio-demographic groups (able-bodied population, pensioners, children) for Russia at large and for each constituent entity of the Russian Federation. The SM is a valuation of consumer baskets for each socio-demographic group being revised with a five-year periodicity. The subsistence minimum is calculated on the basis of state statistical data on the level of consumer prices for goods included in the consumer basket. The level of consumer prices is monitored monthly throughout the constituent entities of the Russian Federation. The SM value is regulated quarterly by the Government of the Russian Federation (for Russia as a whole) and by the executive authorities of Russian constituent entities.

4. The statistical indicators of the population's monetary income and data on the official poverty line are developed at the national and regional levels, which allows to differentiate the poverty estimates taking into account the economic development of the regions, to reveal the range of differences across the country and to determine the contribution of each of the Russian Federation's entities to the overall picture of poverty.

5. The plan for the development and publication of statistical information, approved by the Government of the Russian Federation, distinguishes several stages of the data production process. The peculiarity of this approach lies in obtaining poverty estimates for the entire population using a model-based technique, as well as estimates for the profile (structure) of the poor, based on household surveys direct data.

6. This approach is primarily determined by the need to undertake urgent measures of state support for the regions and, given the above, Rosstat is set to solve the problem of providing an operational data set on the entire population poverty rate at the national level (quarterly) and at the regional level (annually).

7. The next steps, aimed at providing social support to the most vulnerable population groups, determine the need for information on the localization of poverty within certain

demographic and socio-economic groups of households. This task is tackled based on direct data from household income and expenditure surveys.

8. The methodological approach to address the tasks, assigned to Rosstat, is based on the application of:

- empirical data of household budgets sample surveys (HBS), conducted quarterly in all the regions of the Russian Federation with a coverage of 48.5 thousand households;
- an analytical model¹, based on the application of HBS results and the macroeconomic indicator of the population's per capita cash income, calculated monthly at the national and regional levels on the basis of organizations' and tax authorities' reports on wages, pensions and benefits paid to the population and on business and property revenues received by the population with a reappraisal by the income generated in the economy's informal sector, for the relevant reporting period.

9. The variance in the estimates obtained using HBS direct data and data of the analytical model raises several problems. The main concern is the lack of coherence in the information on the poverty rate for the entire population and on the level of poverty broken down by the demographic and socio-economic groups of population and households.

10. The main factor complicating the harmonization process is obviously the problem of obtaining adequate information during the HBS. The field practice of this and other surveys of the kind shows that respondents tend to underestimate their income or do not provide complete information on the income received. This is indicative of the difficulties in the coverage of households at the highest end of income distribution that affect the sample structure.

11. Furthermore, the HBS program, by reference to its primary goal of obtaining information on household expenditure and consumption, does not contain a complete set of variables determining all the components of household incomes and, for this purpose, household income indicators are used, which are specified by respondents using an interval scale². These estimates are of an approximate character and therefore show a considerable deviation from the macroeconomic indicators of the population's money income (68% in 2015). Consequently, in 2015 the HBS poverty rate amounted to 24.7%, exceeding more than twice the estimate obtained on the basis of administrative data for the rate of poor people living in families that receive social benefits.

12. In consideration of the divergence between HBS poverty data and alternative estimates based on other data sources, as well as of the HBS program analytical capacity initial limitations, the published evaluation system relies on the use of a limited set of indicators, while a wider set of poverty indicators are left beyond its scope.

13. Starting with 2011, a system of additional household sample surveys on socio-demographic problems is being introduced into Russian statistical practice. Along with

¹ The analytical modeling approach is based on the assumption that the character of the population's monetary income distribution corresponds to the lognormal (two-parameter) distribution function. The ascertainment of the assumption using the χ^2 fitting criterion and the model validity check was carried out based on the data of a single (once in five years) income survey of 170 thousand families (310 thousand - for former USSR). This survey structure allowed for more accurate data compared to the budget survey characterized by a smaller sample size.

² Assessment of HBS indicators of households expenditure and increments in their financial assets demonstrates low level deviations between these measures and the income estimates indicated by households using the interval scale

traditional surveys (HBS, labor force sample survey, etc.), supplementary sample surveys are aimed at reflecting practically the whole spectrum of present day issues: household incomes, living conditions, availability of social support and social services, diet, time budget, etc.

14. The sample survey of the population income and participation in social programs (PIS) is an integral part of the new federal statistical surveys system. Starting with 2012³, the survey is carried out annually according to the following pattern:

- with a gradual expansion of the households number covered by the survey: in 2012 – 10,000 households, in 2014 and 2015 – 45,000 households, in 2016 – 60,000 households;
- with a recurrent (once in 5 years) increase in the sample frame up to 160,000 households, effective 2017.

PIS key features:

	2012	2014	2015	2016	2017
Time frame	April 2012	March 2014	March 2015	February 2016	February 2017
Number of households surveyed, ths.	10,0	45,0	45,0	60,0	160,0
Refused to participate (% of households visited)	14,4	15,1	15,3	15,1	13,6

15. Following the PIS results, 858 primary variables are constructed which serve the basis for the estimation of 929 variables that allow for the aggregation of data on 200 components of cash payments and income received in cash and in kind.

16. The aggregation procedure for the monetary income components most closely approximates the European Survey of Income and Living Conditions (SILC) methodology and is consistent with the main provisions of the ILO Resolution on Household Income and Expenditure (2013).

Table 1

System of households income indicators based on PIS results:

<i>Cash income</i>	<i>Comprehensive income</i>
Employment income	Employment income, including monetary evaluation of own products used for own consumption
Property income	Property income Income from own production of services for own consumption (estimated equivalent of net imputed rent)
Transfers received in cash	Transfers received in cash and in kind (in money equivalent)
Social benefits	Social payments and benefits in cash and in

³ With the exception of 2013 when the results of the first (pilot) round were analyzed in order to launch a full scale project.

	kind (in monetary terms)
Cash receipts from individuals and organizations, aside from social benefits	Cash and in-kind (in monetary terms) receipts from individuals and organizations, aside from social benefits
Forwarded transfers	Forwarded transfers
Disposable cash income	Disposable comprehensive income

17. In the course of PIS (as well as HBS), the refusal probability is higher for relatively high income population groups compared to low-income ones. When extending the results to the general population, neglecting this problem can lead to unjustified overestimation of the absolute poverty rate and underestimation of disparity and, consequently, of the relative poverty.

18. In order to minimize the systematic bias associated with household refusals to participate in PIS, a statistical weighing is performed to formulate its results, which, alongside conventional methods, includes procedures that compensate for the households' entire refusal to participate in the survey.

19. Statistical weights are estimated in two stages in the context of each constituent entity of the Russian Federation:

- the first stage comprises the calculation of "base weights", that allow to bring the sample survey data to the general population, based on selection principles (calculation of weights inversely proportional to the selection probability, calibration by household size, by age, gender and place of residence);
- the second stage consists of adjusting the "base weights" for the bias, caused by the inability, for various reasons, to obtain information on the full range of households, included in the sample frame.

20. Calculation of weights in the second stage is performed based on the following provisions:

- the average value of income in the general population is taken as equal to the value of the macroeconomic indicator of per capita monetary income;
- the general population has the same principle of distribution by incomes, as the sample frame (lognormal distribution);
- the estimation of the mode value for the sample frame is taken as the most reliable estimate of one of the general population parameters.

21. The second weighing stage is performed through bringing the frequency distribution resulting from the first weighing stage to the frequency distribution of the general population by per capita monetary income level.

22. The frequency distribution estimates in the general population are based on dimensioning the lognormal distribution function underlying income distribution and are derived from:

$$L(x; x_0; \sigma_{\ln x}) = \begin{cases} 0 & \text{with } x \leq 0; \\ F(u) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^u e^{-\frac{t^2}{2}} dt & \text{with } x > 0. \end{cases}$$

where

$$u = \frac{\ln x - \ln x_0}{\sigma_{\ln x}}; \quad \ln x_0 = \ln \mu - 0,5 \cdot \sigma_{\ln x}^2; \quad \sigma_{\ln x_{ij}} = \sqrt{(2 \cdot [\ln(\mu) - \ln(Mo)] / 3)};$$

μ – macroeconomic indicator of the value of per capita monetary income;

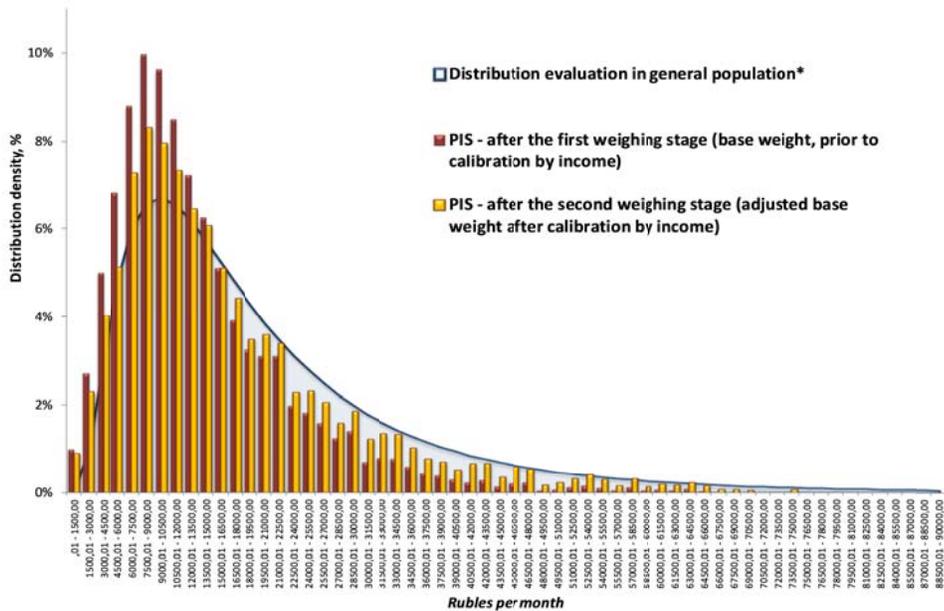
$\sigma_{\ln x}$ - mean square deviation of income logarithms, defined based on income empirical distribution data resulting from household survey;

Mo - estimation of the mode value for the sample frame, formed after the first weighing stage.

23. This method of calibrating weights by income level allows us in a mathematically sound way to counterbalance the frequency distribution displacement towards the low-income part and fill in the missing part of high-income population groups within the income range, observed in the survey.

24. Figure 1 presents reallocation of the population distribution density by the level of per capita cash income based on PIS-2011 results and achieved by adjusting “base” weights (before and after the income level calibration - first and second weighing stage, respectively).

Figure 1
Population frequency distribution by cash income level



* The estimation based on the mode value in terms of the PIS results and the macroeconomic indicator of per capita monetary income.

25. Table 1 shows the income, poverty rate and cash income differentiation indicators, which characterize the effect of transition to adjusted weights after the income level calibration, which minimizes bias related to refusals, as shown by PIS and HBS data for 2011.

Table 1

	Monetary income, median	Poverty rate , %		Coefficients of differentiation		Deviation from macroeconomic indicator, %
		absolute poverty ⁴	relative poverty ⁵	Gini	decil (d9/d1)	
PIS						
1-st stage (base weight, prior to calibration by income)	11 552	15,8%	14,6%	0,366	5,5	69
2-nd stage (adjusted base weight, after calibration by income)	13 567	12,4%	15,8%	0,391	6,4	84
HBS						
1-st stage	7 857	34,5%	13,3%	0,342	4,8	46
2-nd stage	10 484	22,7%	16,5%	0,419	6,8	69

26. The application of a two-level system of weights allows to achieve better consistency in the results of surveys using the macroeconomic indicator of population's monetary incomes (PMI) (see table 2).

27. Table 2 shows that HBS results deviate from the macroeconomic indicator of the population's monetary income to a larger extent compared to PIS results. This divergence is caused by lower reliability of HBS income data based on the respondents' choice within the interval scale, as distinguished from the separate accounting of all income components provided for in the PIS program.

28. The introduction of the advanced population's income survey into statistical practice allowed us to answer a number of important questions related to the reliability of poverty indicators estimated based on the current methodology including the analytical model application.

29. As Table 3 indicates, the PIS absolute poverty estimates are quite coherent with the official assessment of poverty indicators for the entire population made using the analytical model, and on the whole validate the estimates for long time series.

⁴ Here and elsewhere - to estimate both the PIS and HBS absolute poverty levels the subsistence minimum value (SMV) was applied at the level of each household as the absolute poverty line. SMV was determined proceeding from the household composition and based on the SMV characteristics specified for different socio-demographic groups within a corresponding constituent entity of the Russian Federation

⁵ Computation based on per capita monetary income, without application of equivalent scale

Table 2

	Average, \bar{X}	95% confidence interval (boundaries)		Correlation with macroeconomic level indicator (PMI), %		
		lower	upper	by average	by confidence interval boundaries	
					lower	upper
2013						
HBS	18 072,4	17 434,9	18 710,0	70	67	72
PIS	22 912,0	22 166,2	23 657,8	88	85	91
Macroeconomic indicator of the population's monetary income (PMI)	25 928,0			-		
2014						
HBS	19 656,6	18 924,5	20 388,7	71	68	73
PIS	24 228,7	23 568,0	24 889,4	87	85	90
PMI	27 767,0			-		
2015						
HBS	20 664,8	19 895,3	21 434,3	68	65	70
PIS	25 824,1	25 141,0	26 507,3	85	83	87
PMI	30 467,0			-		

Table 3

Absolute poverty rate by monetary income⁶

	2008	2009	2010	2011	2012	2013	2014	2015
PIS estimates	...	...	...	12,4	...	9,6	10,1	13,5
Estimates based on the analytical model	13,4	13,0	12,5	12,7	10,7	10,8	11,2	13,3
HBS estimates	26,9	26,5	23,6	22,7	18,9	20,8	21,3	24,7

30. Taking into account the results achieved and retaining the established annual periodicity of income observation, in the near term Rosstat intends to switch over to the poverty measurement system based entirely on PIS results. The analytical model will be used as an instrument to derive preliminary short term estimates.

⁶ To estimate both the PIS and HBS absolute poverty levels the subsistence minimum value (SMV) was applied at the level of each household as the absolute poverty line. SMV was determined proceeding from the household composition and based on the SMV characteristics specified for different socio-demographic groups within a corresponding constituent entity of the Russian Federation

31. Alongside absolute poverty indicators based on PIS and HBS results, pilot relative poverty indicators have been developed for long-term dynamics.

32. One of the tasks of the pilot computation was to provide for a consistent time series of relative poverty indicators. For these purposes we used HBS data for the entire households surveyed in the course of all quarterly observations for each calendar year. Bringing the HBS data to the annual base period made it possible to even the irregularities in the income flow within a year which lead to a considerable bias in the poverty rate estimates compared to PIS where the annual base period has been applied, thus creating a convergence platform for the estimates of the two observations.

33. To proceed in this direction Rosstat needs to establish a more clear definition of the composition and computation methods for relative poverty indicators with regard to new data sources, as well as to provide for a coordinated and user-understandable incorporation of the new system of indicators into the existing set of data published.

Table 4

Relative poverty rate by equivalized disposable monetary income⁷
% of entire population

	2008	2009	2010	2011	2012	2013	2014	2015
HBS estimates								
60% of M_e	23,5	22,3	22,6	21,9	...	...	...	...
50% of M_e	16,6	15,6	15,2	14,6	...	...	...	...
40% of M_e	10,3	9,4	8,6	8,2	...	...	...	...
PIS estimates								
60% of M_e	...	...	...	21,9	...	20,3	20,2	20,9
50% of M_e	...	...	...	14,6	...	13,7	13,6	14,0
40% of M_e	...	...	...	8,8	...	8,1	8,1	8,1

34. The PIS program analytical capacity triggered the development of comprehensive statistical poverty indicators. Based on the survey results it was possible to:

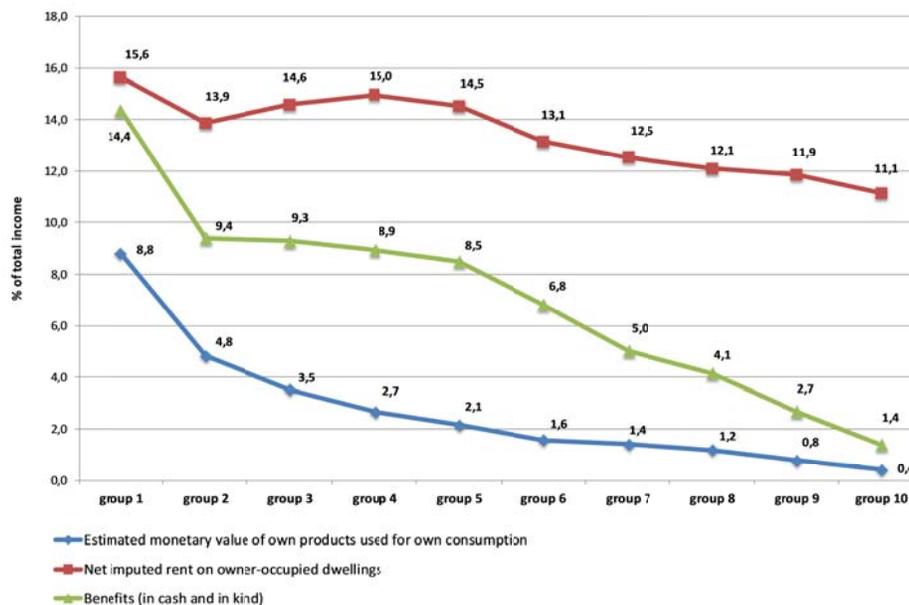
- expand the set of income aggregates used to analyze monetary poverty estimates⁷
- enable poverty estimates disaggregation by socio-demographic groups within the framework of SDGs monitoring;
- create empirical base and test design methods for a number of nonmonetary poverty indices.

35. The expansion of the income aggregates set used to estimate the absolute poverty rate was instrumental in evaluating the input of nonmonetary income into the overall level of households' well-being that arrived in the form of own production used for own consumption, social transfers and transfers from other sources and was received by households in-kind, as well as to experimentally evaluate the input of the net imputed rent monetary equivalent.

⁷ In the computation the coefficient of equivalence $E=0,5$ was used.

36. With these components added it became possible to exceed the scope of the strictly monetary income bracket and to evaluate the differences in the income in-kind for various household groups (Fig.2).

Figure 2

Income in kind for various household groups

37. The following data refer to the changes in the absolute poverty rate when considering separate aggregates of households' monetary and overall income (as % of entire population):

	2013	2014	2015
Monetary income			
before taxes and levies	9,6	10,1	13,5
after taxes and levies	11,2	12,1	16,1
before social benefits (cash allowances)	10,5	11,1	14,5
Overall income			
before taxes and levies	5,9	6,3	8,5
before social benefits (cash and in-kind allowances)	7,7	8,3	11,0
before imputing net rent value	7,7	8,5	12,0

38. With the need to expand the poverty estimates system Rosstat is now challenged to transfer to a wider system of indicators. The focus area here is the implementation of nonmonetary poverty indices into statistical practice.

39. The development of survey techniques for nonmonetary poverty should rely on a sound definition of the set of indicators and weights determining the input of each indicator into the index value.

40. The work on defining and testing the statistical methods applied to measure nonmonetary poverty indicators and indices follows three consequent steps:

- **Phase 1 (2015).** Identifying the set of indicators to be used in the measurement of material deprivation and preparing to test them on the data obtained through wide-scale household surveys.

41. In cooperation with leading Russian experts the following conditions were specified to compile the list of indicators:

- equivalent significance throughout the territory of the country with due account for considerable economic, national, climatic and nature differences among the regions;
- coherence enabling comparability analysis at the international level
- data accessibility for annual collection.

42. The following results were attained in the course of research:

- A set of social indicators was identified that is characteristic of the entire population prevailing living standard (63 items defined);
- A list of material deprivation items was compiled based on the analysis of the reference group⁸ findings pertaining to distinctive features of families unable to provide for the consumption standard established in the society. The indicators selected were verified to belong to the category of socially essential ones;
- The list of deprivation items was operationalized in the form of specific questions to be included into the programs of household surveys.

43. Eventually, as an outcome of phase 1, the material deprivation list was compiled to cover 39 items including indicators that had shown high reliability when tested (11 variables) as well as indicators requiring further testing on wide-scale survey data (28 variables).

Phase 2 (2016). Collecting empirical data for the specified deprivation list in the course of:

- Living conditions comprehensive survey (round 2016 to cover 60 thousand households)
- Sample survey of population's income and participation in social programs (rounds 2016 and 2017 to cover 60 thousand and 160 thousand households respectively).

Phase 3 (2017). Testing nonmonetary poverty indices calculation algorithms:

- Multidimensional Poverty Index (MPI) and At Risk Of Poverty Or Social Exclusion index (AROPE)
- Deprivation Index
- Social Exclusion Index.

44. At this stage of research the following activities will be undertaken based on the empirical data acquired:

- The deprivation line feasibility evaluation with the help of variance and logistic regression analyses;

⁸ Dedicated group of experts experienced in data collection for the analysis of households poverty in diverse Russian regions (altogether 200 experts in 33 constituent entities of the Russian Federation)

- Analysis aimed to diagnose the correlation stability:
 - a. between the values of each of the nonmonetary poverty indices computed based on the results of every survey;
 - b. between the values of each of the nonmonetary poverty indices and absolute and relative poverty indices based on the results of every survey for the entire population and broken down by major socio-economic categories of households (population).
- Data analysis in terms of the composition of indicators used in the compilation of the global scale multidimensional poverty index (MPI) and the social exclusion index, and structuring thereupon the required corrections to adjust them in order to provide for a more comprehensive projection of the national context.
- Development of metadata facilitating the correct analytical interpretation of nonmonetary poverty indices and data on absolute and relative poverty in official statistics publications.

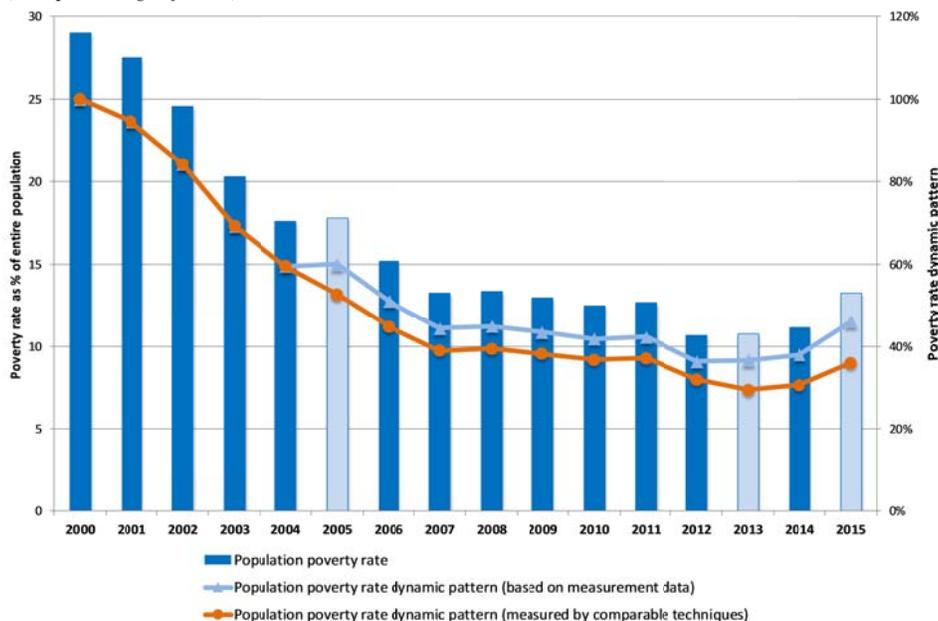
45. Further activities in the field of poverty measurement should be primarily directed towards providing a statistical base to the Global SDG indicator Framework (hereinafter - SDGs monitoring).

46. An important milestone allowing for the evaluation of the actual situation with the accomplishment of the mission on eliminating poverty in all of its forms, is to provide for comparability of poverty rate estimates in the long run. SDGs envisage a two times decrease in the poverty rate observed in accordance with the national methodology. These trends should be measured by comparable techniques, otherwise a drop in the poverty rate might be achieved through pure modification of the estimation approach and would have nothing in common with the real dynamics (decrease or even increase) of the poverty rate.

III. Practical example

47. Rosstat has been producing official estimates of the poverty rate for the whole of Russia since 1992. However the poverty line is determined by the subsistence minimum and its computation procedure underwent changes several times (in 2000, 2005 and 2013). This resulted in an increase of the subsistence minimum value by 15 -20% compared to the former algorithm of the SM computation.

Figure 3
Population poverty rate dynamic pattern⁹
(as a percentage of 2000)



48. Against this background, and compared with the poverty rate in 2000, in 2015 the poverty rate decreased 2,2 times judging by the measurement data, and 2,8 times if the computation techniques comparability is taken into consideration.

IV. Conclusion

49. To ensure comparability of the poverty rate indicators for long term dynamics Rosstat estimates the poverty rate value as a percentage of the preceding year, following the unified methodology of computing the poverty rate (the value of subsistence minimum included) for the current and preceding years which offers a quantitative estimate of the change in the poverty rate, clear of discontinuities caused by modifications in the computation techniques within the scope of the time series analyzed.

⁹ In 2005 and in 2013 the computation procedure for the subsistence minimum value was transformed. In 2015 the accounting structure of the population was changed