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Forecasting the economic dynamics of regional indicators affecting the Inclusive Development Index

Proyección de la dinámica económica de los indicadores regionales que afectan el Índice de Desarrollo Inclusivo

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Marat Safiullin*
Kazan (Volga Region) Federal University, Kazan, Russia
Center for Advanced Economic Research, Academy of Sciences of the Republic of Tatarstan, Kazan, Russia
The University of Management "TISBI", Kazan, Russia
*Corresponding author Email: Marat.Safiullin@tatar.ru
ORCID: https://orcid.org/0000-0003-3708-8184

Kirill Smolyanitskiy
The University of Management "TISBI", Kazan, Russia
Email: kirsmol@list.ru
ORCID: https://orcid.org/0009-0004-4435-4094

Abstract

This article presents a correlation and regression analysis of GRP indicators, along with a forecast of the main factors contributing to the inclusive growth index of regions, using the Volga Federal District as an example. The aim of the article is to forecast key development indicators for the Volga Federal District within the framework of the inclusive development concept. The research methods include correlation-regression analysis, statistical analysis, mathematical modeling, graphical analysis, comparative analysis, and a bibliometric review. The author identifies significant factors affecting GRP and the relationships between them. The analysis highlights that per capita income and demographic load are the major factors significantly impacting GRP and inclusive growth. The study also features charts depicting the dynamics of key socio-economic development factors in the Volga Federal District over a five-year period, up to 2028.

Keywords: Inclusive Growth, Sustainable Growth, Development, Socio-Economic Factors, Inclusive Development, Volga Federal District, Concept, Assessment, Analysis.

Resumen

Este artículo presenta un análisis de correlación y regresión de los indicadores del GRP, junto con un pronóstico de los principales factores que contribuyen al índice de crecimiento inclusivo de las regiones, utilizando el Distrito Federal del Volga como ejemplo. El objetivo del artículo es pronosticar los indicadores clave de desarrollo para el Distrito Federal del Volga en el marco del concepto de desarrollo inclusivo. Los métodos de investigación incluyen análisis de correlación-regresión, análisis estadístico, modelado matemático, análisis gráfico, análisis comparativo y una revisión bibliométrica. El autor identifica los factores significativos que afectan al GRP y las relaciones entre ellos. El análisis destaca que el ingreso per cápita y la carga demográfica son los principales factores que impactan significativamente en el GRP y el crecimiento inclusivo. El estudio también presenta gráficos que representan la dinámica de los factores clave de desarrollo socioeconómico en el Distrito Federal del Volga durante un período de cinco años, hasta 2028.

Palabras claves: Crecimiento inclusivo, Crecimiento sostenible, Desarrollo, Factores socioeconómicos, Desarrollo inclusivo, Distrito Federal del Volga, Concepto, Evaluación, Análisis.

Introduction

Despite the economic growth observed in the regions of the Volga Federal District in recent years, serious employment problems such as high unemployment, underemployment, instability and informal employment remain in the region (Akhmetshin et al., 2023, Plotnikov et al., 2022). Given the importance that the labour market has for income generation by industries, especially in a region where coverage by universal social protection systems is very limited, these disadvantages often lead to poverty and increased social vulnerability (Bagratuni et al., 2023).

The escalating of this crisis now requires an inclusive paradigm capable of combining the perspectives of political economy and green economy, offering an holistic and integrative view (Eskerkhanova et al., 2023). Inclusive economics aims to build an integrative paradigm of different critical currents that links analyses and solutions to current problems with necessary and urgent transitions to an alternative mode of production, exchange and distribution of goods and services necessary for a socially just and sustainable existence (Kirillova et al., 2023).

Now, many countries are trying to fight poverty and change the concept of a capitalist economy to an inclusive one. Inclusion is the mindset, tendency or policy of integrating all people into society so that they can participate, contribute and benefit from the process. Inclusion aims to ensure that all individuals or social groups have the same opportunities to fulfill themselves as individuals especially those who are segregated or marginalized.

According to some authors, such as R. T. Burganov (2022; 2023), L. A. Elshin (2022), V. V. Klimanov, S. M. Kazakova (2021), M. R. Gafarov (2021) and many others, the state through its institutions must implement plans and policies to promote inclusion and social well-being in order to change situations of unequal distribution of resources as well as widespread injustice.

Inclusion is the process of improving the abilities, opportunities and dignity of disadvantaged individuals because of their identity so that they can participate in society, however, it is not the same as equality.

The issue of inclusive development of the regions of the Volga Federal District is actively addressed by such national researchers as L. A. Elshin (2021; 2022), M. R. Gafarov (2021), M. R. Safiullin (2021), R. T. Burganov (2021; 2022a; 2022b; 2022c; 2023) and others, and the topics of inclusive development of regions: S. M. Kazakova (2021), O. V. Zetkina (2021), A. A. Chistyakova (2021), I. L. Beilin (2023), T. A. Miroshnichenko (2022), S. V. Podgorskaya (2022)and others.

The assessment of the Volga Federal District development shows unevenness and inequality of regional development, but at the same time a great potential for growth, both economic and inclusive (Federal Law No. 466-FZ, 2022).

The aim of the article is to forecast the main development indicators of the Volga Federal District in the implementation of the concept of inclusive development.

Methodologies and Data

Research methods: correlation and regression, statistical, mathematical modelling, graphical and comparative analyses, bibliometric review.

The correlation and regression method was used to identify significant factors affecting the gross regional product (GRP). Correlation analysis made it possible to determine the degree of dependence between various socio-economic indicators and GRP, while regression analysis was used to build a model of the dependence of GRP on selected factors.

The application of correlation analysis involved the construction of a correlation matrix in order to identify multicollinearity of factors. The principal component method was used to deal with multicollinearity.

Statistical method was used to process and interpret the collected data. It included descriptive statistics, analysis of variation and application of significance criteria for hypothesis testing.

Mathematical modelling was used to compose regression equations that described the relationships between GRP and the factors affecting it. The

coefficients of the regression equations were estimated using the least squares method.

The data were visualized using graphs and charts, which allowed to demonstrate changes in the main socio-economic indicators and their impact on GRP. The graphs included forecast scenarios for the development of key indicators for a five-year period, which made it possible to compare the baseline and inertial development scenarios. The results reflected in the graphs were compared with each other using the comparative method, which made it possible to identify specific features and differences in the development of the regions, as well as to determine the factors that require most of attention.

The bibliometric review included research articles, reports and data from official sources such as the Russian Federal State Statistics Service. The analysis of scientific publications and studies by Russian and foreign authors on the topic of inclusive development and economic growth made it possible to place the research in a socio-economic context and compare it with existing studies.

Results and discussion

Based on the analysis of the studies of the above-mentioned authors, the main factors that particularly require impact and stimulation for each region of the Volga Federal District can be identified (Table 1).

Table 1. Factors stimulating inclusive growth in the regions of the Volga Federal District

Regions of the Volga Federal District	E[1]	COLI[2]	PW[3]	GI[4]	LOP[5]	UR[6]	MI[7]	DR[8]	SI[9]	PWF[10]	DebtR[11]
The Republic of Bashkortostan											+
The Republic of Marij El		+	+	+	+		+			+	
The Republic of Mordovia					+		+			+	
The Republic of Tatarstan											
The Udmurt Republic				+							
The Chuvash Republic	+				+		+			+	+
Perm Krai			+								+
Kirov Region				+		+		+	+		
Nizhny Novgorod Region			+			+					
Orenburg Region	+		+						+		+
Penza Region										+	
Samara Region											
Saratov Region		+									
Ulyanovsk Region			+								

[1]Employment; [2]Cost-of-living index ; [3]Population with money income below the minimum subsistence level; [4]Gini index; [5]Level of poverty; [6]Unemployment rate; [7]Money income per capita; [8]Dependency ratio; [9]Share of investments in fixed assets to GRP; [10]Potential work-force; [11]Debt ratio.

This table highlights the most pressing problems in each region that affect the Inclusive Development Index. There is certainly a need for each region to systematically impact each criterion, but the most problematic identified areas should be addressed more thoroughly.

In order to forecast the socio-economic situation of Russia's regions, it is necessary to take into account all the factors that affect the foreign economic

situation of the country as a whole. In the present state of global economic crisis, the concept of inclusive development is, in our opinion, difficult to implement. However, the creation of a theoretical foundation for this concept is certainly becoming a top priority in the scientific community.

The given analysis of inclusive development of the Volga Federal District in the study (Smolyanitsky & Elshin, 2023b) shows the average level of inclusiveness of the Volga Federal District, which is probably spread throughout the country. At the same time, it should also be noted that currently the state is actively fighting social problems of the society by developing social policy. Unfortunately, this policy contributes to a short-term reduction of financial difficulties of the population and forms subsidy dependence among able-bodied citizens, as well as marginalisation of certain districts and even regions. All of this is directly related to the high growth of unemployment and the ineffectiveness of its control.

In order to identify the significance of factors that affect GRP, it is necessary to do correlation and regression analysis. The factors to be analysed will be the criteria affecting inclusive growth from Table 1. In Table 2, the designations for the factors under study are defined.

Table 2. Introduced designations for GRP factors

No.	Name of factor	Designation entered
1	Employment	y_1
2	Cost-of-living index	y_2
3	Population with money income below the minimum subsistence level	y_3
4	Gini index	y_4
5	Poverty level	y_5
6	Unemployment rate	y_6
7	Money income per capita	y_7
8	Dependency ratio	y_8
9	Share of investments in fixed assets to GRP	y_9
10	Potential work-force	y_{10}
11	Debt ratio	y_{11}

The indicator X - GRP - is chosen as the resulting indicator of the model. All data of each factor for analysis are taken from the Russian Federal State Statistics Service for the period 2013-2022 (Rosstat).

At the first stage, in order to identify the factors with the highest impact on GRP X, correlation analysis of the initial data was performed. Using inbuilt analysis in Microsoft Excel, the correlation matrix of the factors and the target function was constructed (Table 3).

Table 3. Correlation matrix of inclusiveness factors

	X	y_1	y_2	y_3	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}	y_{11}
X	1											
y_1	–0,453	1										
y_2	–0,853	0,625	1									
y_3	–0,547	0,314	0,585	1								
y_4	–0,939	0,496	0,762	0,406	1							
y_5	–0,492	0,274	0,541	0,997	0,338	1						
y_6	–0,826	0,123	0,680	0,695	0,691	0,674	1					
y_7	0,951	–0,450	–0,806	–0,727	–0,869	–0,679	–0,840	1				
y_8	0,966	–0,549	–0,813	–0,510	–0,972	–0,448	–0,695	0,916	1			
y_9	–0,913	0,378	0,748	0,208	0,916	0,150	0,688	–0,747	–0,893	1		
y_{10}	–0,255	–0,590	–0,128	0,224	0,177	0,230	0,433	–0,271	–0,212	0,219	1	
y_{11}	0,000	–0,226	–0,004	–0,127	0,183	–0,156	0,074	–0,021	0,010	0,039	–0,106	1

The first column of the matrix shows the dependence of the resulting parameter X on yi. The most significant values obtained are indicated in the table by highlighting the colour. Applying the method of principal components to deal with

multicollinearity of factors, we determine that the GRP indicator X is most related to the variable factors: y7, y8.

In the next stage, regression analysis of the data was done, y7, y8 were selected as dependent variables, so correlation analysis showed the relationship with X. The regression specification is displayed in Tables 4-5.

Table 4. Specification of the regression equation sought in MS Excel (X = a*y7+b)

Results output						
Regression statistics						
Multiple R			0,950979826			
R-squared			0,904362629			
Normalised R-squared			0,892407958			
Standard error			998992,2426			
Observations			10			
Dispersion analysis						
	df	SS	MS	F	F-value	
Regression	1	7,54969	7,5497	75,649	2,381	
Excess	8	7,98388	9,9799			
Total	9	8,34808				
	Coefficients	Standard error	t-statistic	P-value	The bottom 95%	The top 95%
Y-intersection	–18443890,4	3583420,057	–5,147	0,0008775	–26707271,9	–10180509
Variable X 1	1128,1996	129,713	8,698	2,381	829,081	1427,32

The coefficient of determination of this model is 0.904, which corresponds to about 90%. This means that money income per capita has a significant impact on the GRP indicator and confirms the correctness of the choice of the factor for building this model. The higher the coefficient of determination, the better the quality of the model.

Table 5. Specification of the regression equation sought in MS Excel (X = a*y8+b)

Results output						
Regression statistics						
Multiple R			0,965596856			
R-squared			0,932377289			
Normalised R-squared			0,92392445			
Standard error			840029.6015			
Observations			10			
Dispersion analysis						
	df	SS	MS	F	F-value	
Regression	1	7,78356	7,78356	110,30345	5,8793	
Excess	8	5,6452	7,0565			
Total	9	8,34808				
	Coefficients	Standard error	t-statistic	P-value	The bottom 95%	The top 95%
Y-intersection	–25600610,39	3647161,55	–7,0193	0,00011049	–34010980	–17190241
Variable X 1	53821,83966	5124,6475	10,5025	5,879	42004,4	65639,3

In this case, the coefficient of determination is 0.932, which corresponds to about 93%. Dependency ratio

If R-squared > 0.95, we say that the approximation accuracy is high (the model describes the phenomenon well). In our case, 90% and 93% indicate high accuracy of the results.

The calculated level of significance (significance of Fisher's criterion) is not significant.

The t-criterion values of 8.7 and 10.5 found from the observation data, respectively, are compared with the tabulated (critical) value determined by Student's distribution tables - 1.984. Since the absolute value of the statistic is higher than the critical value, the difference in the coefficient is statistically significant (non-random).

The fields “The bottom 95%”, “The top 95%” in Tables 4 and 5 denote the confidence interval for the parameter, i.e. with a reliability of 0.95 this coefficient lies between 829 and 1427 in the first case and between 42004 and 65639 in the second case.

Similarly, we make calculations for the selected factors xi. Results of calculations are combined in Table 6.

Table 6. Results of regression analysis of factors

y_i	*R*2	Fisher's criterion	Student criterion	Confidence interval
y_1	0,2	2,07	– 1,44	–3807218 – 881251
y_2	0,73	21,3	– 4,6	(–876137483,8) – (–292268502,8)
y_3	0,299	3,41	– 1,846	–185644 – 20544,77
y_4	0,88	59,77	– 7,73	(–274279211) – (–148251166,3)
y_5	0,242	2,56	– 1,599	–3901065 – 705401,6
y_6	0,68	17,149	– 4,14	–43776,2 – (–12460,6)
y_7	0,904	75,649	8,698	829 – 1427
y_8	0,932	110,3	10,5	42004 – 65639
y_9	0,83	40	– 6,3	(–1152339) – (–536710)
y_{10}	0,065	0,56	– 0,74	–61611,2 – 31495,45
y_{11}	0,23	1,6	– 0,001	–0,305474–0,30581

Table 6 also proves that only two factors have a significant weight for GRP: dependency ratio and money income per capita. The values of the calculated Fisher's criteria are many times greater than the critical one obtained from the table, F = 3.98. Similarly, Student's criterion exceeds the critical value, F = 1.984. This allows us to say that the variables are statistically significant and their inclusion in the regression equation is necessary. It is possible to predict the GRP with the data of these factors.

Having determined the dependence, it can be argued that the other factors do not significantly affect the GRP indicator, but they form a holistic picture of socio-economic development of the regions of the Volga Federal District. Therefore, let us

make a forecast of socio-economic development of regions according to the concept of inclusive economy for some inclusiveness factors.

Taking into account various external and internal factors affecting the development of the economy of the regions of the Volga Federal District, the forecasting of socio-economic development for the five-year period is carried out according to two scenarios: basic and inertial.

For this purpose, let us plot the graphs of the development of criteria affecting inclusive economic growth over the next 5 years. The projections described are summarized in Figures 1-5.

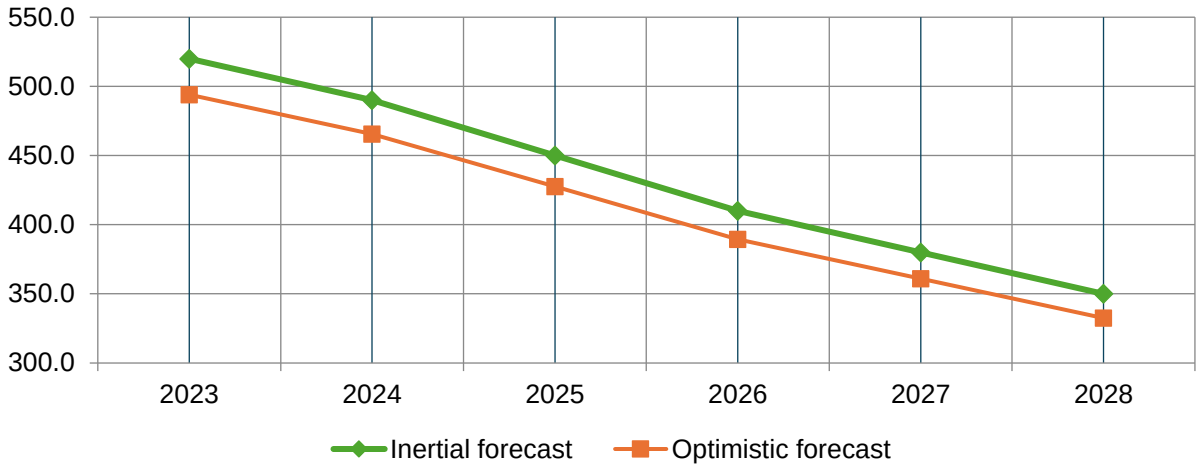

Figure 1. Inertial and optimistic scenarios of the criterion “Number of unemployed in the Volga Federal District aged 15-72 years”

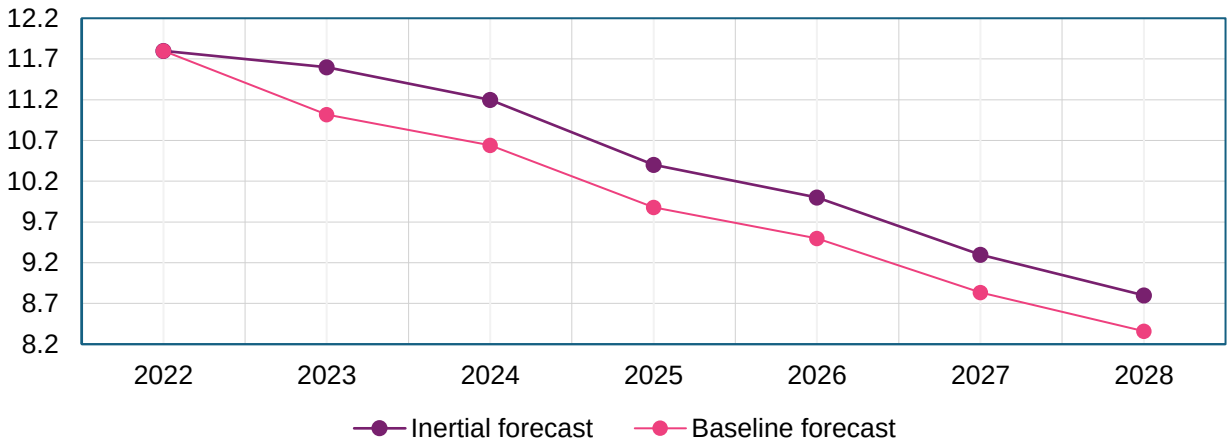

Figure 2. Baseline and inertial forecasts of the criterion “Poverty rate in the Volga Federal District” 2022-2028.

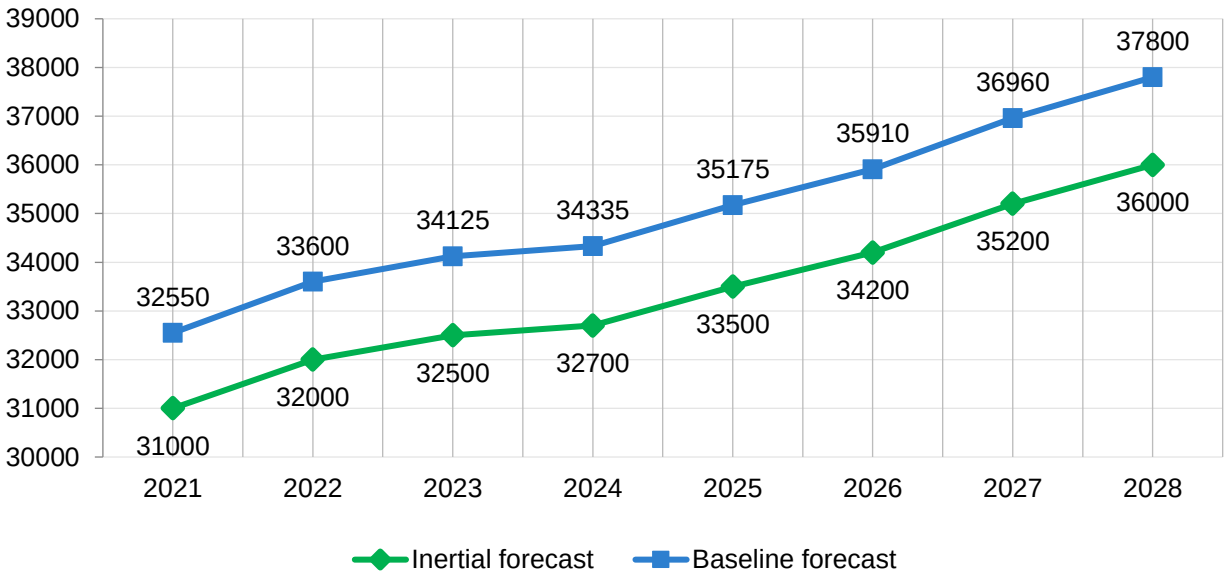

Figure 3. Inertial and baseline forecasts of the criterion “Cash income in the Volga Federal District per capita rubles per month”

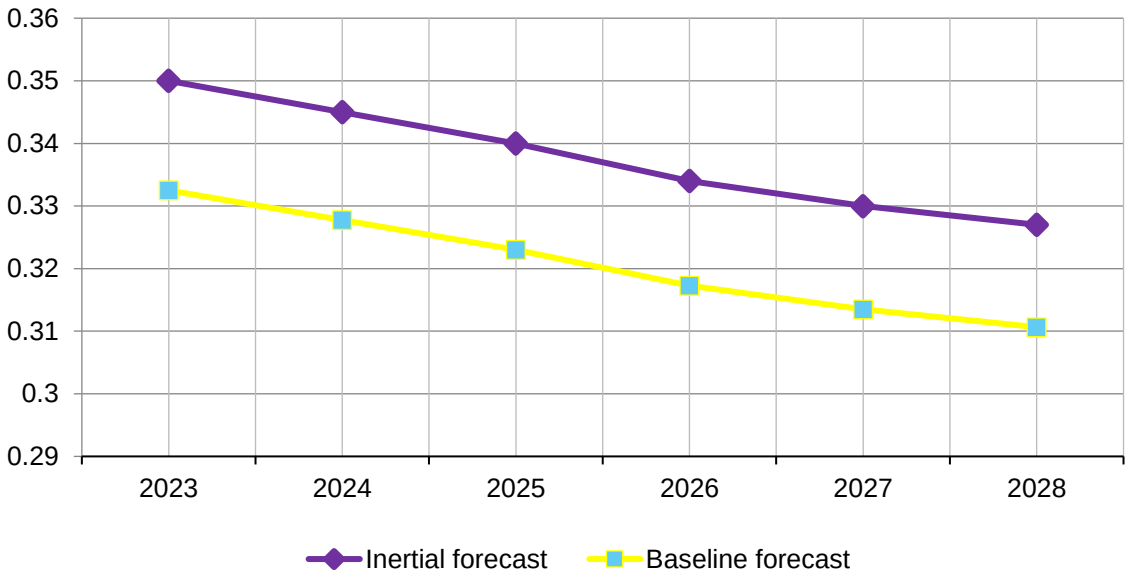

Figure 4. Predictive evaluation by the criterion “Gini index”

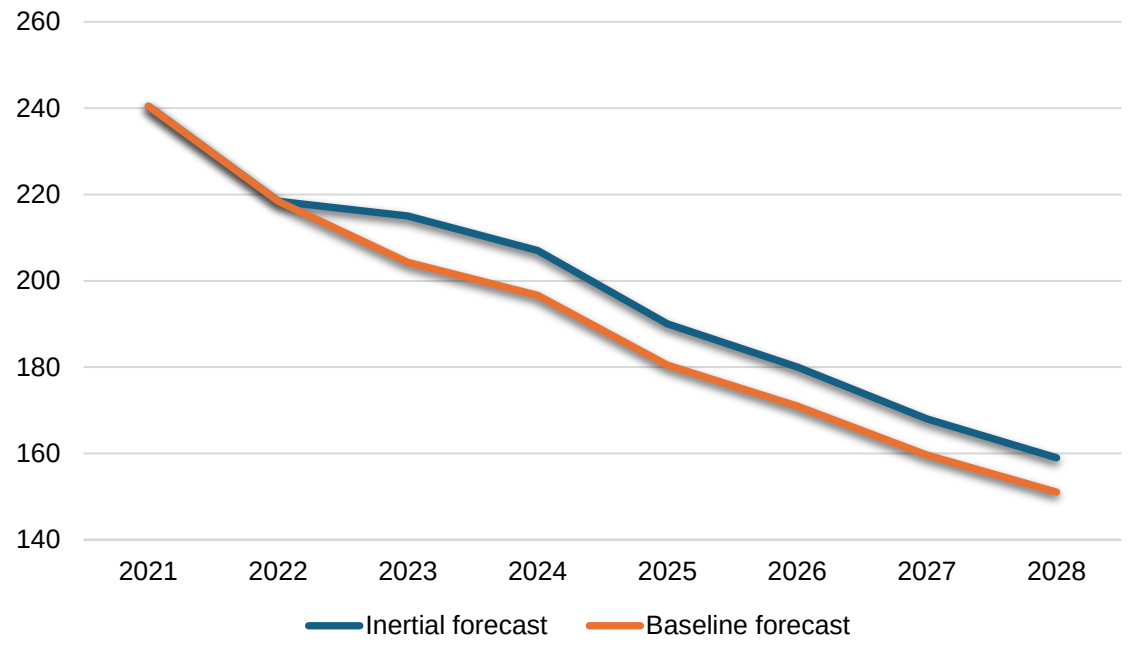

Figure 5. Population with money income below the minimum subsistence level

Discussion

Having analyzed the results, it can be concluded that a commitment to the concept of inclusive growth and development can contribute to a significant jump in selected important regional indicators. Referring to the proposed conceptual model

in (Smolyanitsky & Elshin, 2023a), it can be noted that the impact on citizens' livelihoods will immediately have a positive impact on the entire chain of indicators that make up inclusive development.

Based on the projected criteria, we present the change in GRP in Figure 6.

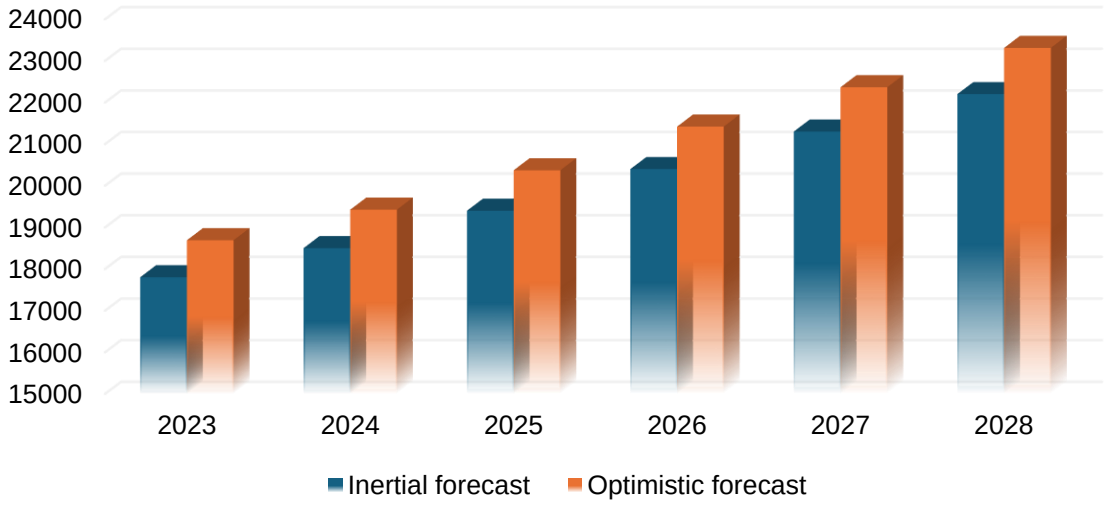

Figure 6. GRP forecast for the Volga Federal District

According to the result of the projected criteria, we can see that the inertial forecast of GRP of the Volga Federal District is also quite positive, despite the geopolitical difficulties of our country.

The optimistic scenario indicates an expected GRP growth of 114.6 per cent in 2026, 119.7 per cent in 2027 and 124.7 per cent in 2028. These numbers are significant, so programmes and directions for influencing the levers of inclusive growth need to be more carefully selected.

Ensuring macroeconomic stability, balanced public finances and budgetary efficiency will be achieved by adapting budget policy to the principles of frugality and responsibility and shifting from “budget management” to “results management”.

Conclusion

The concept of inclusive regional development implies the implementation of strategies to enhance synergies between the areas of productive convergence and social protection, as well as to promote social inclusion. The proposal is to invest and create new social sectors to reduce both productive inhomogeneity and the social deficits of the most vulnerable sectors.

Equality will be invested in with the creation of new social sectors. The proposed policy would, on the one hand, favor the process of productive convergence, as productivity gains in lagging sectors reduce the “internal gap”. On the other hand, it implies a contribution to social protection objectives, as an increase in the provision of social services would alleviate the needs of groups in relative poverty. In turn, higher activity levels will stimulate job creation and higher wages, leading to a more equitable distribution of income.

The main findings relate to various aspects. Firstly, the analysis shows the uneven way in which the needs of the population are being met and the factors that determine the structure on which policies are based. In this regard, we can say that structural inhomogeneity implies an uneven distribution of income, determined by the uneven degree of satisfaction of social needs of different groups that make up the social structure of the county's regions. While the lack of social services affects the entire population, social deficits are higher among individuals and families living in lower-income households, i.e. in relative poverty.

In this context, it can be noted that in low-income groups there is a significant proportion of unmet social needs, or “social deficits”, which are material in nature (e.g. reduced income due to lack of access to work and lack of basic services), and that there are deficits in non-material services (safe coexistence, recreation, communication). Consequently, both aspects of social needs should be included in policies to reduce social deficits through the production of new social services.

Among alternative forms of production, the social economy plays a leading role. This economy includes a wide range of organizations that are not part of either

the public or for-profit private sector. In other words, it represents an intermediate pathway, based on innovative forms of partnership and creative resource management techniques, which enables social economy organizations to operate in different spheres of public authority, such as legislative and fiscal.

The implementation of budget policy approaches defined in the State Programme of the Russian Federation “Public Finance Management and Regulation of Financial Markets” is aimed at increasing the sustainability of public finances and reducing the volatility of fiscal policy by generating new sources of revenue replenishment and strengthening the revenue side of the budget, accumulating the Federal Fund, revising the debt policy, concentrating budget expenditures on priority areas, strengthening fiscal transparency, automation and digitalization of the budget process.

New services that address the problems faced by the low-income population can be divided into three main groups: services to improve people's care and developmental conditions, services to promote people's social inclusion, and cultural and recreational services for people.

Finally, it is worth considering the impact that the social economy can have. It is estimated that in the medium to long term, i.e. between 10 and 20 years, investment programmes in new social sectors can have a significant impact on reducing social deficits, thus contributing to social protection policies, promoting productive convergence and competitiveness, improving employment and social inclusion.

It is estimated that in ten years the social deficit of the most vulnerable segment of the population living in relative poverty could be reduced by 66%.

The social economy could contribute to the process of productive convergence. It is expected that through investment in new social sectors, by the end of the ten-year period, the “internal productivity gap” could be narrowed by

expanding and strengthening the medium productivity group and by creating new and better employment opportunities for workers in the low productivity group.

Finally, investments in new social sectors are expected to promote social inclusion, allowing for the integration of socially excluded labour market groups as well as improving income distribution. On the one hand, labour market indicators should tend to improve during this period, given that the increase in output produced by new social sectors can contribute to the growth of overall employment, thereby reducing unemployment.

Labour conditions could also be expected to improve as a result of higher productivity, which would lay the foundation for workers to enjoy higher real wages and greater social protection. On the other hand, all these changes are aimed at making the distribution of income more equal, since the increase in employment and wages created by the social economy should lead to an increase in labour's share of income.

Modernization and improvement of the economy of the Russian Federation will ensure a gradual transition to an inclusive economy and significantly reduce inequality among the population. All the above measures and necessary transformations should have a legislative basis and clearly defined instructions for implementation, as well as control of proper actual implementation. The reduction of unemployment will reduce crime and regression of certain categories of citizens, hence the implementation of all the proposed measures in 3-5 years will show positive dynamics and a high level of inclusive development.

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