

**METHODICAL APPROACHES TO A MULTILEVEL ASSESSMENT OF BUSINESS ACTIVITY  
AND ITS INFLUENCE ON INDUSTRIAL DEVELOPMENT OF REGIONAL ECONOMIC  
SYSTEMS (ON THE EXAMPLE OF THE REPUBLIC OF TATARSTAN)**

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**Abstract.** The study of business activity at the regional level is an important scientific and methodological issue, the solution of which has not found a generally accepted approach to the present time. The search for methods aimed at identifying the impact of regional business activity on the development parameters of individual sectors of economy is an equally important issue, both in the scientific-cognitive and in practical terms. This article is devoted to solving these issues. The object of research is the business activity of the region (on the example of the Republic of Tatarstan) and its impact on the development of regional economic systems. The subject of study is the methods for determining and modeling the business activity of the region and assessing its impact on the development parameters of certain types of economic activity. The authors consider in detail such aspects of a topic as the identification of factors that form the development parameters of business activity of regional economic systems, the analysis of intraregional features that determine the change in the trajectories of business activity indices, expressing the change in the expectations of economic agents in a concentrated form. Particular attention is paid to the issues of economic and mathematical modeling of the impact level of cyclically generated trends in the business activity of the region on the development trajectory of certain types of industrial economy of the region.

**Key words:** business activity of the region, regional cyclical fluctuations, expectations of the economic agents, modeling and forecasting of industrial development, multifactor analysis of expectations.

## 1. INTRODUCTION

The issues of analysis, diagnosis and forecasting of business cycles in the context of studying and modeling the regional economic systems have not been universally accepted in the scientific community due to the small development degree of this area of scientific researches (Ilyina, 2012) (Smirnov, Frenkel, & Kondrashov, 2016) (Lucas, 1976) (Perez, 1987). Meanwhile, the solution of issues posed will enable to formulate and optimize the system of methodological approaches to forecasting the social and economic development of the regions, to improve the development of the state management programs of the regional economy, development strategies for short- and medium-term periods, taking into account the identification and evaluation of influence on the trends of economic development cyclically corrected in time parameters of business activity of regional economic systems.

The search for the most optimal directions that form the basis for diagnosing the business activity indexes at the regional level is far from complete. In our opinion, it is possible to solve the task posed by the complex identification of expectations of the economic agents in a concentrated form expressing business activity in the short-, medium- and long-term prospects, generating in turn the economic cycles of the regions of the corresponding amplitude. Undoubtedly, the proposed hypothesis of solving the issue posed requires, in addition to its direct justification, the development of a methodological tool that forms the evidence base. This article is devoted to this, which is, in fact, an invitation to a discussion on the most promising and adaptable (to the current realities) directions in the choice of tools and the research paradigm on the issue.

## 2. METHODS

The idea that the change in the business activity phase is not instantaneous, but relatively gradual given the time-adjusted expectations of economic agents, has been formed quite a long time ago - in the second half of the twentieth century. The representatives of traditional and non-traditional theories of economic growth believed that changes in expectations of the economic agents formed stable bases for macroeconomic shifts, the acceleration/deceleration of which multiplied on the processes of phase shifts in the cyclical development of economic systems. At the same time, one of the main methodological issues, which are tried to be solved in many scientific works of these theories, is the search for key, system-forming factors, the correction of which

forms the corresponding shifts in expectations and, accordingly, determines the trends of business activity of the economic entities. Understanding and identification of these factors, the generation of which outstrips the general economic dynamics, makes it possible to identify (with a certain lag) the promising shifts in the economic development of the system, which forms the basic bases not only for the development of the prognostic assessment system, but also helps to understand the logic of forthcoming transformations. At the theoretical level, such indicators, quantitatively reflecting the set of factors under consideration, are classified as leading indicators, and the aggregated indices obtained on their basis are the integral indices of outstripping development (Golovina, 2009) (Charles, 1982) (Modigliani & Brumberg, 1954).

The method used in this study is based on a factor approach that facilitates understanding of the influence of the aggregate of factors participating in assessments (individually and in aggregate) on the change in the resultant index - the regional business activity index. In this approach, the analyzed factors are firstly combined into sub-indices, based on summing up of the weighted components that determine its value, then they are summed up using the identified values of weighting ratios for each sub-index, forming the integral index - the "Regional Business Activity Index (RBA)", which determines the level of business activity of the assessment object (region) as a whole. The weights, in this case, were calculated based on the ratio of current values of the indicators, expressed in the growth rates to the previous time period, to the sum of such growth rates for all the component indices of the sub-index.

Based on the analysis of the outstripping impact on the economic development of territorial systems, we accepted the composition of indicators of the composite outstripping index, which ultimately determined the value of the regional business activity indicator (on the example of the Republic of Tatarstan) (Figure 1).

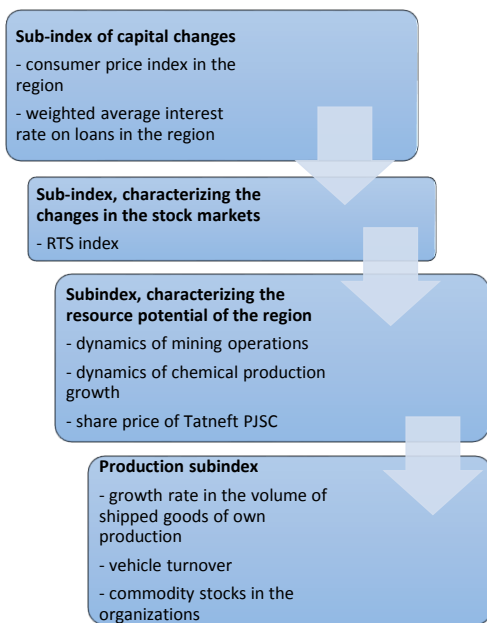


Figure 1. Composition of indicators of the composite outstripping index determining the value of integral index of business activity in the region (on the example of the Republic of Tatarstan)

### 3. RESULTS

The calculated sub-index values for the Republic of Tatarstan are shown in Table 1. A detailed algorithm and its description are presented in the earlier works of the authors (Safiullin, Elshin, & Prygunova, 2016).

After the procedure of seasonal smoothing of the formed time series characterizing the dynamics of the respective sub-indices, it became possible to proceed to the calculation of the final composite index of business activity in the region. The composite Regional Business Activity Index (RBA) is composed of the calculated series of indicators or sub-indices of business activity, taking into account previously defined values of their weighting factors.

Formally, the determination of value of the RBA index corresponds to the following calculation algorithm (Charles, 1982):

$$I_i = W_k * I_{ki} + W_{\phi} * I_{\phi i} + W_p * I_{pi} + W_n * I_{ni}, \quad (1)$$

where  $I_i$  - value of the business activity integral index in the i-th month;

$i$  – value of the period (the calculation is carried out in months);

$I_{ki}$  – sub-index of capital change in the i-th month;

$I_{\phi i}$  – sub-index assessing the parameters of changes on stock exchanges in the i-th month;

$I_{pi}$  – resource sub-index in the i-th month;

$I_{ni}$  – production sub-index in the i-th month;

$W_k, W_{\phi}, W_p, W_n$  – values of the weighting ratios of the corresponding sub-indices.

At this stage, the weight of a certain component (sub-index) was determined in accordance with an algorithm based on the taxonomic method. The results of the implemented estimations characterizing the specific weights of the respective sub-indices involved in the determination of integral values of the business activity index in the region are specified in Table 2.

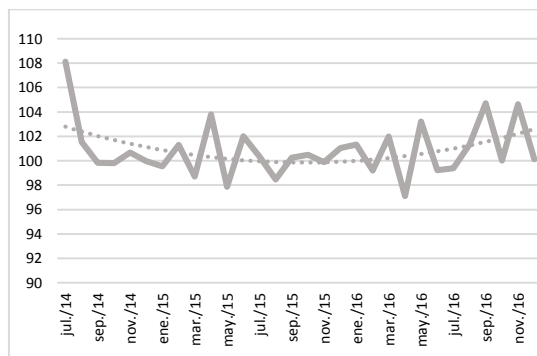
Table 1: Calculation of sub-indices - four components of the "Regional Business Activity Index"

Indicator name	Time period name											
	2014											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Octo.	Nov.	Dec.
$I_1$	101.2	102.3	97.9	102.3	101.6	102.4	101.4	99.8	101.3	101.1	101.8	102.5
$I_2$	90.18	97.4	90.2	97.4	96.8	94.3	112.1	105.4	89.3	97.6	94.4	97.1
$I_3$	98.7	98.3	106.2	96.7	101.3	103.2	101.7	103.1	93.9	110.0	100.8	98.8
$I_4$	80.7	108.8	103.9	104.3	103.4	99.8	99.3	104.5	98.8	97.1	99.1	113.8
2015												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Octo.	Nov.	Dec.
$I_1$	110.1	105.1	101.0	98.6	101.8	97.1	99.2	99.4	98.9	101.0	99.5	96.2
$I_2$	89.3	81.2	93.3	121.6	98.2	116.9	94.1	97.0	91.4	97.1	94.7	107.1
$I_3$	106.6	105.1	104.1	97.1	103.4	101.4	101.8	104.5	91.5	111.1	100.2	102.5
$I_4$	71.3	120.9	107.1	97.7	100.6	109.7	96.8	102.8	103.9	101.9	98.4	103.9
2016												
	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Octo.	Nov.	Dec.
$I_1$	103.2	99.0	102.1	100.6	100.4	99.1	97.7	100.1	99.4	96.9	99.8	99.6
$I_2$	100.2	89.4	98.5	103.2	114.0	108.6	95.1	102.9	99.7	102.5	104.3	99.8
$I_3$	99.9	95.2	108.1	95.0	101.3	103.4	97.5	104.8	97.8	105.0	105.6	106.1
$I_4$	78.0	112.3	109.0	95.9	104.4	104.3	96.8	106.4	102.6	101.2	98.3	103.9

*Table 2: Values of the weighting ratios of the composite index sub-indices of business activity in the region*

Sub-index name	Value of the weight assigned
Capital sub-index	0.278
Stock sub-index	0.364
Production sub-index	0.205
Resource sub-index	0.153

The use of obtained values of weighting ratios in the model for determining the RBA index, as well as the values of the corresponding sub-indices obtained earlier, has made it possible to carry out final calculations, the results of which are shown in Figure 2.



*Figure 2. Business activity index of the Republic of Tatarstan for the period of 2014-2016.*

In accordance with the graphical illustration of the business activity dynamics, we can observe its decrease down to the end of 2015 - the beginning of 2016, with its subsequent recovery and transition to the growth phase from the middle of 2016. The negative dynamics of a trend of the dynamic series under consideration was caused by structural issues that had accumulated in previous periods. Their aggravation was more clearly manifested as a transformation result of conjuncture and fundamental management conditions in the period of 2014 - middle of 2016. However, the implementation of a number of state program measures aimed at supporting the financial sector, transition to a floating rouble exchange rate, etc., largely contributed to the adaptation of economic agents to the new established realities, which was reflected in transition from the phase of negative dynamics of business activity to positive. This is confirmed by the polynomial curve growth observed from

February to March 2016, which characterizes the growing trend of the indicator in question.

Taking into account that the RBA index is built on the basis of monitoring the conjuncture changes in the external and internal markets of macro- and meso-levels, it can be confidently asserted that the developed impact model of external and internal (in relation to the studied regional system) "impulses" on their development contributes not only to solving the issues in the field of identifying the business activity, but also to determining the perspective trends of economic growth in general, or certain types of economic activity of regional systems in particular.

Approbation of the conceptual approach proposed is specified below, within the framework of the series of economic and mathematical calculations aimed at determining the relationship tightness between the IPI and the RBA. An important factor in the process of implementing calculations and assessments aimed at determining the level of dependencies of this kind (measuring the impact of the indicator dynamics assessing business activity and the growth rates of industrial sectors of the regional economy) is that it is expedient to identify the most promising (in terms of logic of the economic and mathematical modeling) aggregated types of industrial productions, characterized by high elasticity ratios to adjusting expectations of the economic agents at the initial stage. This step is due to the need to achieve more qualitative and statistically significant estimates obtained in the process of solving the task assigned.

The results of correlation analysis, which identifies the level of interrelationship between the surveyed statistical series that estimate the growth rates of industrial production in the context of its individual enlarged components and the regional business activity index during 2014-2016 are specified in Table 4.

*Table 4 - Correlation ratios between the statistical series estimating the growth rates of the composite regional business activity index (RBA) and the growth rates of industrial sectors of the economy of the Republic of Tatarstan*

No.	Name of indicator studied	Correlation ratio
1	Industrial production, including:	0.618
2	Mining process	0.410
3	Manufacturing processes	0.732
4	Production and distribution of electricity, gas and water	0.328

#### 4. CONCLUSIONS

The presented estimations show that the greatest level of interrelation between the analyzed series is characteristic for the enterprises of the manufacturing sector of industrial productions. This, in turn, predetermined the further choice of the statistical analysis parameters, which is based on an attempt to assess the impact of changes in expectations of the economic agents generating their business activity on the development of this industrial economy sector of the Republic of Tatarstan.

Table 5 presents the main calculation results demonstrating the ratio values for one of the exogenous parameters of the regression model - the RBA index. The table includes the types of manufacturing industry in the region, the "participation" of which in the econometric modeling process has corresponded to the parameters of an adequate description of the constructed regression equations from the point of view of statistical analysis.

*Table 5 - Ratio values with a factor assessing the business activity in the region*

No.	Type of economic activity	Ratio value
1	Production of food products, including beverages and tobacco	-0.029
2	Production of petroleum products	-0.035
3	Wood processing and production of wood products	0.054
4	Pulp and paper industry; publishing and printing activities	0.058
5	Production of electrical, electronic and optical equipment	0.062
6	Production of rubber and plastic products	0.070
7	Chemical production	0.089
8	Metallurgical production and production of finished metal products	0.102
9	Production of machinery and equipment	0.121
10	Production of vehicles and equipment	0.141
11	Manufacture of leather, leather goods and footwear	0.149
12	Textile and clothing manufacture	0.202

#### 5. SUMMARY

In conclusion, it should be noted that the algorithms and approaches presented in this study make it possible to identify the system-forming factors of cyclical development of business activity at the regional level to a large extent. The

search for the most optimal directions that form the basis for diagnosing the business activity at the regional level is far from complete. With this regard this article is an invitation to a discussion on the most promising and adaptable (to the current realities) directions in the choice of tools and the research paradigm on the issue.

The lack of traditional approaches to modeling the business cycles of regional order can be overcome only on the basis of a new paradigm of scientific approaches and tools of scientific knowledge and modeling. This will largely contribute to diagnosing the emerging threats, developing the regional forecast models and justifying the recommendations for public authorities in the field of intensive development of both national and regional economies.

The obtained results, based on the modeling the business activity index of the Republic of Tatarstan, demonstrate that different sectors of the manufacturing industry have a differentiated nature of sensitivity to the changing parameters of business activity in the region. A number of them have a significant degree of reaction to expectations of the economic agents, while others are less susceptible to this kind of change. The revealed differentiation in many respects helps to determine the logic of development trajectories of the individual industrial sectors of the economy, which forms stable bases for determining the state influence measures on them under conditions of various phase shifts in the economic cycles. In addition, the assessments received contribute to the development of adaptive mechanisms for forecasting and scenario modeling of the region's economy in the various phases of their cyclical development.

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