Modeling of Purchasing Managers. Index of the region and assessment of its influence on development parameters of Industrial Sectors of Economy (Example of Volga Federal District Regions

Marat Rashitovich Safiullin[1], Leonid Alekseevich Elshin[2]

1. **Kazan Federal University, the vice rector of the Kazan federal university concerning economic and strategic development, Leonid.Elshin@tatar.ru**

2., Kazan Federal University, Center of strategic estimates and forecasts of Institute of management, economy and finance; State Budgetary Institution Center of Perspective Economic Researches of Academy of Sciences of the Republic of Tatarstan

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 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.

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

Within the framework of the constructed system of regional indices, we tested the concept of determining the level of their influence on the development parameters of certain industrial sectors of the economy of regional economic systems of the Volga Federal District.

Key words: business activity of the region, modeling and forecasting, industrial sectors of the region's economy, competitiveness and sustainability of regional systems

1. INTRODUCTION

There are several examples of the compilation and publication of indices assessing business and economic activity at the national level in Russia: the entrepreneurial confidence index, the business activity index of the Association of Managers of Russia (AMR), the index of entrepreneurial expectations and others (Anoshin,2014; Zilbershtein,2010). At the regional level, this work is practically not carried out. Meanwhile, the regional economy is confronted with its own particular set of problems due to the direction and specificity of the economy of each particular territory, as well as it is not entirely correct to use the macroeconomic (national) level indicators to assess the regional economy (Zhikharevich,2011; Safiullin et al, 2016)**.** Therefore, it is necessary to develop a special system of meso-level indicators that would take into account the specifics of factors and mechanisms for the development of individual regional economic systems, as well as would form the basis for the development and scientific justification of predictive assessments of their development in the conditions of vertical and horizontal integration into the macro-and meso-level added value formation system.

Taking into account that the regions, for a variety of reasons, adapt differently and react to any changes occurring, including within the national and/or global socio-economic environment, the nature and trajectories of their development will have personalized features, including business activity of their systems (Modigliani,1954; Lucas,1976). Thus, the in-depth study of business activity at the regional level requires a fundamental analysis of a wide range of factors that determine its sensitivity to them, as well as predetermine the formation of channels for the spread of business activity of other economic systems that are mutually integrated into a particular regional economy.

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

Cognition and scientific substantiation of this process will allow optimizing the solution of a number of issues (in the field of regulation and "manual management" of the cyclical development phases of business activity of the region) in the case of occasional need to impart additional impulses smoothing crisis phases of short-term economic cycles, generated as a result of successive transformations of business environment parameters.

It is also important that at the present time the theory of regional economy has not still formed a single methodological approach that reveals the features of measuring, assessing and comparing the business activity in the context of individual regional economic systems, including their interrelations at the macro- and meso-level (Russell,1999; Kydland.1982).

2. METHODS

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. If the expectations can be expressed in a single system of statistical measurement, then their comparison in the territorial (horizontal) and macroeconomic (vertical) sections makes it possible to discover the nature of interrelations between them. Undoubtedly, the proposed hypothesis of solving the task of discovering the relationship nature between the business activities of different territorial (and hierarchical) levels requires, in addition to its direct justification, the development of a methodological tool forming the basis of the evidence base.

We will understand the composite (integral) business activity index as a complex indicator calculated on the basis of a combination of relative values of a number of statistical indicators. Each component in the generalizing index shall have its own weight. The values of weight ratios may be determined on the basis of a sufficiently wide range of methods used in the theory of statistical analysis (for example, they may include methods of correlation and factor analysis, ranking parameters, solving mathematical programming tasks, etc.) (Methods and Problems in Business Cycle

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

Theory. 1980). In this study we used the taxonomical analysis methods in assessing the weight ratios for sub-indices forming the basis for calculating the integral values of the business activity index of the region. In a concentrated form, the algorithm for determining the business activity indices in the region is shown in Figure 1.

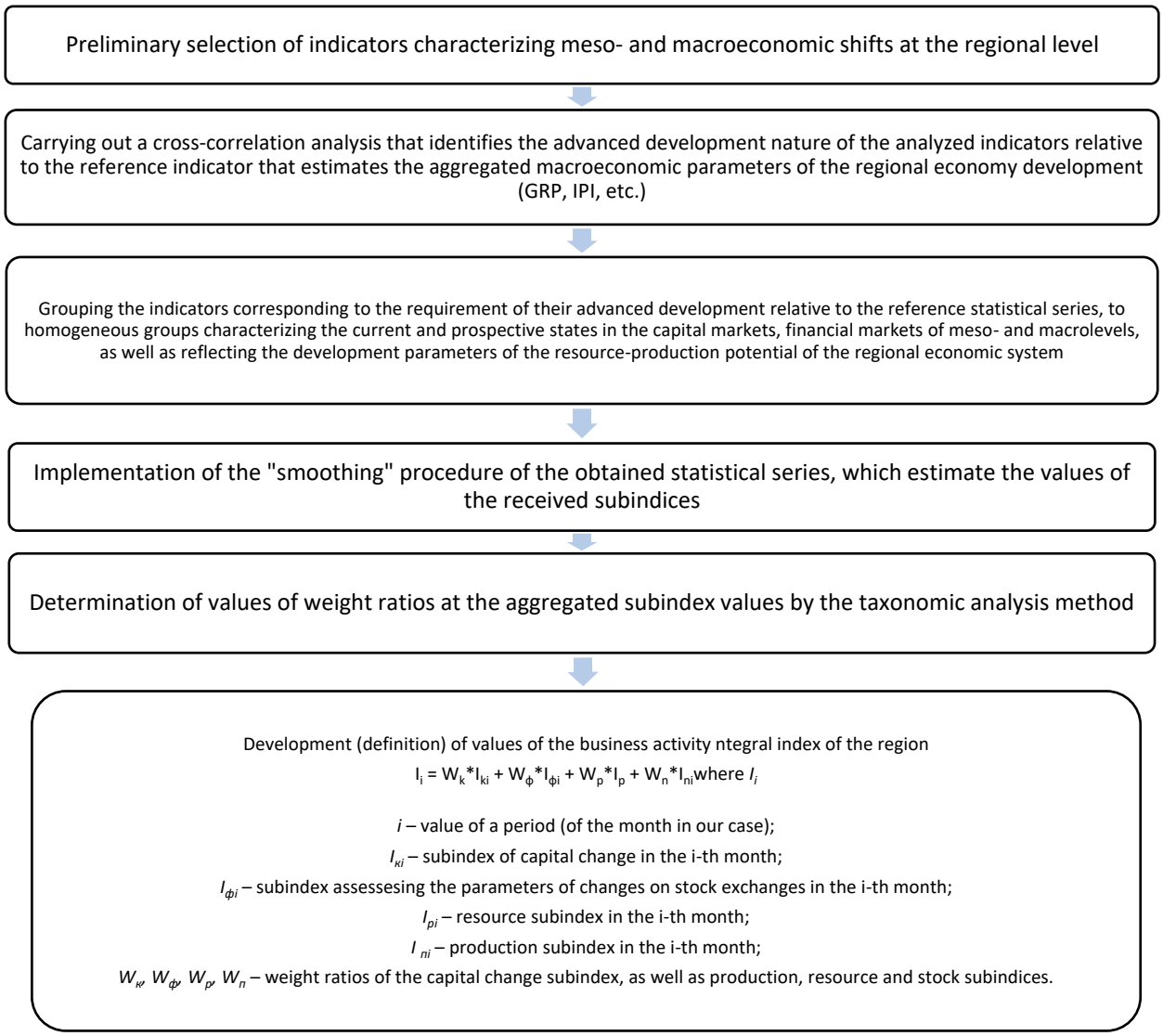

Figure 1 - Algorithm for determining the integral values of the business activity indices in the region

When choosing the macroeconomic indicators that are the basis for assessing the business activity index in the region, it is worth considering that in a real situation, some

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

indicators can be interchanged, supplemented, excluded depending on the economic policy and the economic development nature of the object under study, as well as the availability of statistical base on the necessary economic indicators.

3. RESULTS

The calculated sub-index values for the Republic of Tatarstan are shown in Table 1.

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

Name of indicator	Time period name											
2014												
	January	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*	*December*
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												
	January	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*	*December*
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												

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

	January	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*	*December*
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*

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.

The results of the implemented estimations (based on the taxonomic analysis methods) 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 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.

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

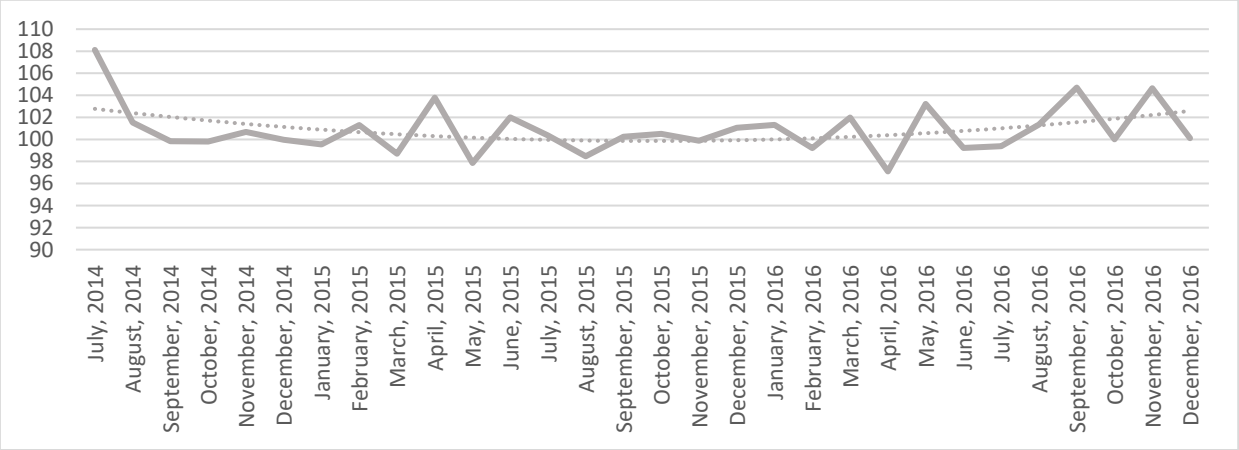

Figure 2 - Dynamics of the business activity regional index of the Republic of Tatarstan, 2014-2016.

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 end of the first - the beginning of the second quarter 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.

Having applied the developed methodological approaches, the authors assessed the indicators that determine the values of a composite business activity index in the context of the regions of the Volga Federal District (Figure 3).

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

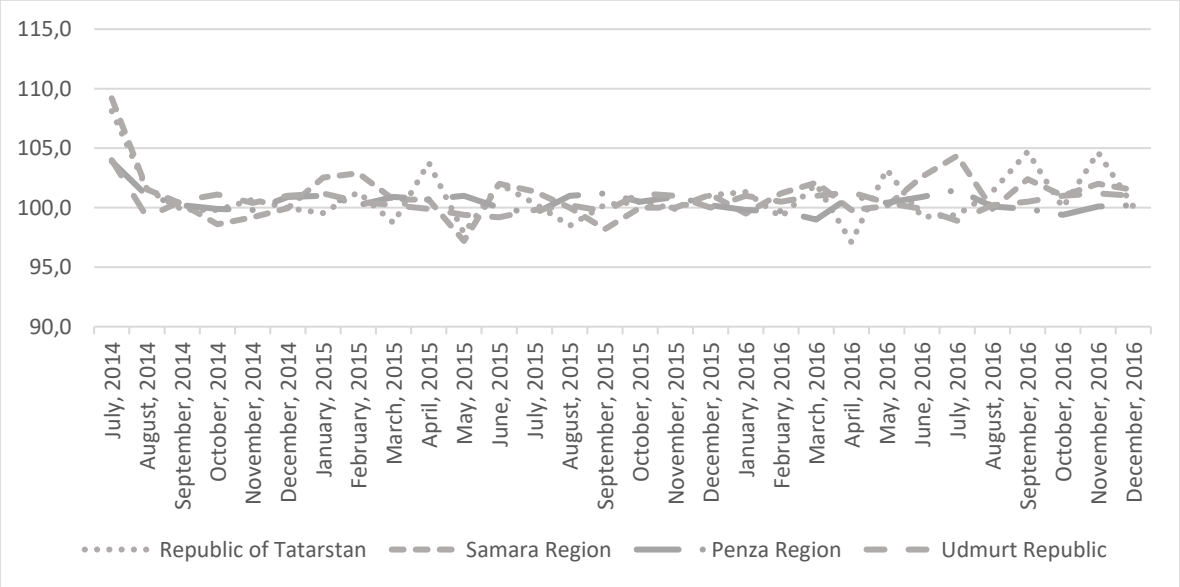

Figure 3 - Dynamics of the business activity index in the regions of the Volga Federal District

The data presented in the figure, which reveal the dynamics of business activity in the context of the studied set of regions, demonstrate their differentiated nature, but at the same time, staying within the general aggregated trend. The allocated generality in the dynamics of the indicator under study is expressed in the fact that all regions considered here have been generating a change of two phase shifts during 2014-2016. The first phase of the business activity decline (W-shaped) is fixed in the period from March, 2014 to January, 2016, with the subsequent transition to the recovery phase (Fig. 4).

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

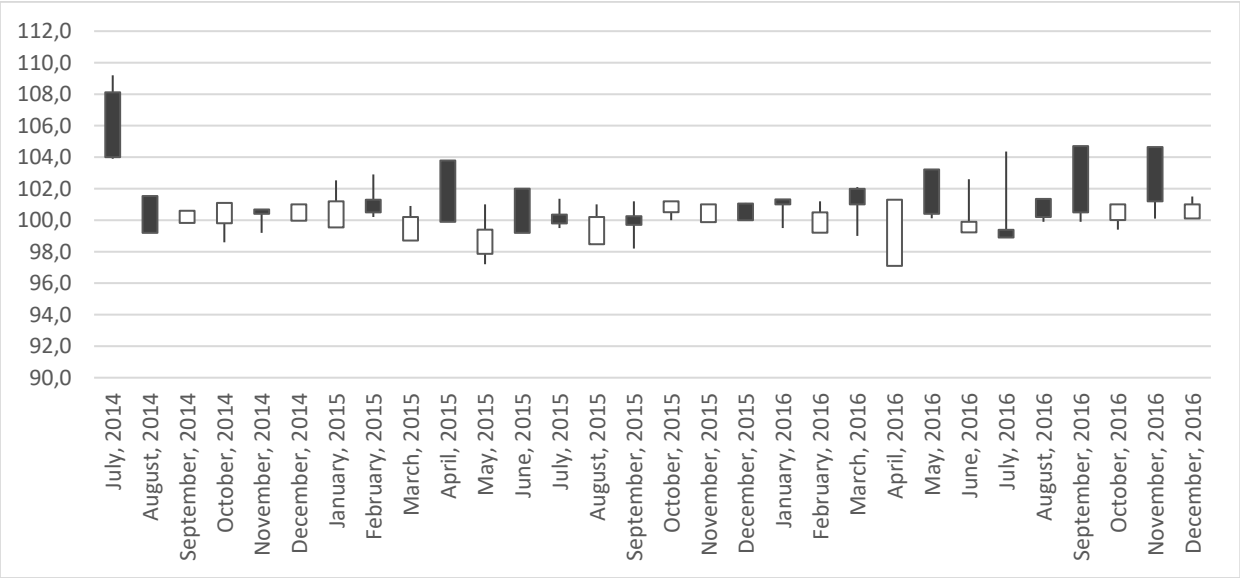

Figure 4 - Aggregate trend of business activity dynamics of the set of studied regions of the Volga Federal District

Despite the identified similar trends in the formation and generation of business activity in the studied regions of the Volga Federal District, their graphic interpretation uniquely identifies their dissonant trajectories. At the same time, it is important that the regions characterized by a higher level of structural and economic development demonstrate a higher level of volatility in the RBA index. Moreover, the business activity of these regions is most susceptible to adjustments observed in the external and internal environment. Meanwhile, the regions with less pronounced diversification of structural and economic development are less sensitive to the changing parameters of the institutional and conjuncture order. Based on the calculated data, we can state their higher level of resistance to different kinds of impulses triggering the mechanisms for changing expectations and business activity of economic agents.

The allocated response differentiation of economic agents of individual regional economic systems to various kinds of changes generated in the external and internal markets predetermines and actualizes the solution of a task aimed at identifying and analyzing the sensitivity of certain sectors of the region's economy to the transforming parameters of business activity.

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

There are the correlation analysis results below (Table 4) that establishes the relationship between two analyzed statistical series - the growth rates of the RBA index and the growth rates of industrial sectors of the economy. The parameters of the analyzed series are expressed in monthly growth rates and include data for the period from 2014 to 2016.

Table 4 - Values of correlation ratios assessing the relationship tightness between the growth rate dynamics of the composite business activity index and the growth rates of industrial sectors of the regional economy

No.	Name of indicator studied	Correlation ratio value			
		Republic of Tatarstan	Samara Region	Penza Region	Udmurt Republic
1	Industrial production	0.667	0.753	0.661	0.607
2	Mining process	0.401	0.379	0.456	0.547
3	Manufacturing processes	0.723	0.815	0.697	0.581
4	Production and distribution of electricity, gas and water	0.377	0.472	0.371	0.356

The largest value of the correlation ratio between the RBA index and the corresponding industrial sector of the region's economy is had by the manufacturing sector. Therefore, the modeling and approbation of the assessment of the influence level of economic agents' expectations on the parameters of economic development were carried out in the context of this type of industrial production.

Table 5 presents model calculations characterizing the main parameters of the regression equations obtained, which estimate the relationship between the dynamics of industrial growth in the manufacturing sector and the RBA index. The presented calculation results demonstrate the consistency of the models constructed (criteria p – values less than the specified significance level of 0.05).

Table 5 Ratio values and their statistical significance

	Y – crossing	P - value (p = 0.05)	P (lag value)	P - value (p = 0.05)	IDA	P - value (p = 0.05)

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

					(lag value)	
Republic of Tatarstan	70.89	0.00	0.231	0.00	0.089	0.03
Samara Region	54.23	0.00	0.35	0.03	0.99	0.00
Penza Region	69.2	0.01	0.39	0.02	0.066	0.00
Udmurt Republic	70.02	0.00	0.29	0.051	0.053	0.04

where

P - growth rates of the manufacturing industry in the region (smoothed series);

IDA - growth rates of the composite business activity index in the region.

4. CONCLUSIONS

The calculation results show that the economy of the regions of the Volga Federal District has a link reflecting the dependence of the growth rates of manufacturing industry on the dynamics of changing the business activity indices. At the same time, the level of relationship tightness in the regions with a less socio-economic potential (Penza Region, Udmurt Republic) is much less than the similar values typical for the Republic of Tatarstan and the Samara Region. This may mean that the structure of manufacturing industries in the regions studied has no uniformity in responding to changes in business activity. Thus, it can be argued that the dynamics of sustainable development of certain types of production in particular and regional systems in general largely depends on the external "impulses" generating the structure and nature of the expectations of economic agents.

At the same time, as the estimates and calculations have shown, the regions with less pronounced social and economic potential are more resistant to the volatility of factors generated in the external and internal markets, which is confirmed by a lower level of elasticity ratios under corresponding exogenous factors (RBA index) of a regression model. However, it should be noted that their weaker integration into the system of reproductive chains and cooperative links of the national and global levels, forms a

Articulo recibido: 05-11-2017

Aprobación definitiva: 07-12-2017

system of risks expressed in retarded socio-economic development in the conditions of stable parameters of the external and internal environment (10).

5. SUMMARY

In conclusion, it should be noted that the developed methodological approach makes it possible to evaluate the degree of reaction of certain types of economic activity from the impact on the regional and national economic systems of the parameters of institutional and conjuncture order. At the same time, the ratio values indicating the elasticity of the endogenous parameters studied as a result of current and prospective adjustments to the expectations of economic agents may largely indicate the susceptibility level of various economic activities to various impacts (Bodrunov,2015). Thus, it is possible to judge the current and prospective competitiveness levels not only of the regional sectoral activities, but of the entire region as a whole. This, in turn, forms a significant scientific and practical potential for the development of adapted forecast models.

6. ACKNOWLEDGEMENTS

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University (26.8732.2017/8.9).

7. REFERENCES

Anoshin, I. 2004.Business Activity Indices in Russia [Text] / I. Anoshin // Macroeconomics. No. 10 (12). – p. 20 – 21.

Bodrunov, S.D. 2015.Economic System of Modern Russia: Anatomy of the Present, Alternatives of the Future [Text] / S.D. Bodrunov, R.S. Grinberg, D.Ye. Sorokin // M.: Lomonosov Moscow State University. - 2015. – 402 p.

Lucas, Robert E., 1976.“Econometric Policy Evaluation: A Critique,” Carnegie-Rochester Series on Public Policy 1 .

Kydland, Finn and Edward Prescott, 1982.“Time to Build and Aggregate Fluctuations,” Econometrica 50, 1345-1370; Prescott, Edward, “Theory Ahead of Business-Cycle Measurement,” Carnegie-Rochester Series on Public Policy 25, Autumn 1986, 11-44.

Methods and Problems in Business Cycle Theory. 1980. *Journal of Money*, Credit and Banking 12 (4, Part 2: Rational Expectations): 696-715.1980.

Articulo recibido: 05-11-2017
Aprobación definitiva: 07-12-2017

Modigliani, Franco and Richard Brumberg,1954. "Utility Analysis and the Consumption Function: An Interpretation of Cross-Sectional Data," in K.K.Kurihara, Post-Keynesian Economics, 388-436 (New Brunswick: Rutgers University Press)

Russell C. and Russell W.M.S. 1999.Population Crises and Population cycles. London: Galton Institute.

Safiullin M., Elshin L., Prygunova M. 2016.Methodological approaches to forecasting the mid-term cycles of economic systems with the predominant type of administrative-command control. Journal of Economics and Economic Education. Volume 17. Special issue 2. p. 277-287

Zilbershtein, L.V. 2010.Development of Business and Economic Activity Regional Index (based on materials from the Samara region) [Text] / L.V. Zilbershtein, E.V. Chebotareva // Journal "Ekonomicheskie Nauki" (Economic Sciences). No. 6(67). – p. 122-127.

Zhikharevich, B.S. I.2011.nstitutional Dimension of Regional Socio-Economic Space: Approach to Research [Text] / B.S. Zhikharevich // Economics of the North-West: Problems and Prospects. - 2011. - No. 2 – 3. - P. 47.

The publication was prepared within the framework of the scientific project No.16-06-00062 supported by the Russian Foundation for Basic Research.

Articulo recibido: 05-11-2017

Aprobación definitiva: 07-12-2017