Assessment of the sustainable development prospects and competitiveness of industrial production of a region under external shock "impulses": the case of the Republic of Tatarstan

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Abstract

Modern conditions of management are characterized by a high level of integration of national economic systems. These adaptation processes of the regional economic systems to “external” impulses are urgent particularly because of Russia’s joining WTO in 2012 and increasing tension between Russian Federation and the particular part of the world community during last months. The purpose of the paper is to approbate the methodical approaches of assessment of the external shock “impulses” impact on sustainable development and competitiveness of industrial productions of the region and on that basis to define the level of subjection to external “impulses” of the regional economic system as a whole.

Keywords: regional development, external shock "impulses", outlook, industry, sustainable development of the region

1. Introduction

The research of the origin of the external “impulses”, the extent of consequences in the result of their impact on the national and regional economic systems requires the detailed investigation. What important is that at the root of the macroeconomic consequences, expressed in the GDP volume and dynamics changes, are the structural changes.

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in one kind of economic activity or another. That defines the character and the structure of development of the regional economic systems, each of which is unique through the prism of reproduction structure.

Thus, the investigation of the impact processes of external “impulses” on the regional economic systems should rely on complex analysis of its sectoral development (Fig. 1).

Fig. 1. Logical model of impact of external “impulses” on the regional development of economic systems

Very important aspect in analyzing and assessment of external “impulses” impact on regional economic development is systematization and classification of foreign economic activity in two groups:

- Types of economic activity where export (e.g. chemical production) prevails in the structure of sales volume;
- Types of economic activity aimed at home market (production of food products, including drinks, tobacco, and textile and clothing manufacture)

For instance, if by the external “impulses” we understand the liberalization of foreign trade (in the result of joining WTO), then the nature of the changes, taking place will depend on what group a foreign economic activity refers to. The reasons are that export-oriented and import-substitution TEA (types of economic activity) has different orientation in getting corresponding impact.

If by external “impulses” we assume sanctions of the particular part of international community expressed, for instance, in restriction on export, on access to financial markets, on the latest technology transfer, then there will be one-sidedness negative effects, independently on TEA’s belonging to the mentioned groups. It is noteworthy that external sanctions create new organizational environment for functioning of corporations, limiting greatly their investment activity, as a result predetermining the decline in business and operating activities. However, sectoral sanctions can limit import volume and the newest foreign technologies. That fact would create an additional catalyst for the development of domestic enterprises producing import-competing goods and services.

Accordingly, structural-logical scheme of simulation of external “impulses” impact on development of the regional TEA was developed by the authors (Fig. 2).
2. Methods

It is important to consider several indicators defining the totality of exogenous parameters of TEA development. It should be noted that quantitative indicators of particular types of economic activity development are influenced by a large combination of factors. For instance, dynamics of international and national economic growth rates, investment activity in the economics sector, changes in the price situation of the products etc. However, inclusion in the model of a large number of predictors can lead to several known problems. Therefore, it is advisable to make the model on the basis of the limited number of exogenous factors characterizing first of all the dynamics of expectations of economic agents as the most important indicator of economic development. Furthermore, the totality of indices strongly correlates with the expectations of economic agents. Therefore, the factors were excluded from given equation in order to avoid doubtful results.

Thus, when choosing functional form of econometric model of external “impulses” impact on the regional development of the regional industrial economic system we excluded several factors from independent factors in the equation, accounting for two main aspects:

1. Possible additional factors are derivative from the factors used
2. Use of additional factors can cause the problem of endogeneity provoking displacement of the assessment coefficient in empirical models.

The way of choosing an index, characterizing the expectations of economic agents, in the model of external “impulses” impact on the industrial TEA development is the following. Expectations are the main chain in the process of defining the perspective plan of development elaborated in a corporate sector. Any economical agents’ action that leads to the adjusting of the produced and dispatched goods volume results and follows from their expectations. If expectations of the economical agents are adaptive, then the current levels of production and
delivery of products will be determined by previous values of growth rate. The modeling of expectation was done on the basis of the index estimating business activity of the region.

As the index that enables to track the status of business activity regularly every month, it is advisable to use the composite index of business activity of the region. When measuring the index we used the same basic approaches, which are applied to measuring and analyzing the indices of business and economic activity during the conference “Board” in the USA since 2001. Four basic indices were taken as components. The set of indices included in composite index was determined from the factors affecting forming the economic situation and dynamics of the region development.

The process of modeling is to define the index of business and economic activity of the region and of its particular economic sectors. The use of this method enables to reveal inter-market interactions, to define the structure of economic crisis origin and to define the reaction of the economic agents on external “impulses”.

We will construct the logical model of elaboration of business activity index of the region (BAI) and its approbation on the example of the Republic of Tatarstan. The body of macroeconomic data, presented by the official statistical services, was used when estimating BAI.

Macroeconomic data is divided in the following groups: production, financial sector, the resource base of economics, consumer market. The data from companies are accumulated in the category “Entrepreneurial perceptions and expectations”. Within every category they define weight of its indices; every category in its turn has its weight in integral index of business activity.

In general, the integral index of business activity consists of four basic components: three weighed indices from different industry groups of economics (index of capital changes, resource and industrial indices), and the stock index that reflects the tendency of the securities market development.

The results

Weighing coefficient’s determination of each component of a consolidated index was based on the carried-out cross-correlation analysis. The analyzed log made from 3 to 8 months. Weights were calculated in proportion to obtain the maximum correlation coefficient.

Table 1. Cross-correlated analysis of the weighting values comprising consolidated leading index.

<table>
<thead>
<tr>
<th>The name of sub-index</th>
<th>The valuation of assumed weight number</th>
<th>The correlation number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index of ranging of an asset</td>
<td>0,33</td>
<td>0,76</td>
</tr>
<tr>
<td>Share index</td>
<td>0,19</td>
<td>0,50</td>
</tr>
<tr>
<td>Resource index</td>
<td>0,29</td>
<td>0,69</td>
</tr>
<tr>
<td>Productive index</td>
<td>0,19</td>
<td>0,26</td>
</tr>
</tbody>
</table>

The usage of presented methodological approaches and their approbation leads to conclusions that in the Republic of Tatarstan during the period from 2007 to 2013 there was divergence of tendencies in dynamics of economic activity of business entities. Throughout 2010 and the beginning of 2012, the consolidated leading index of economic activity generally showed a positive tendency which confirmed strengthening of economic growth expectations. However, by the end of the second quarter of 2012, there was a recession in its level. But since September, 2013, dynamics of economic activity’s level of index started showing essential falling.
Considering that the ISM index is constructed on the basis of accounting term changes in foreign and domestic markets, we can assert that the developed model of the external "impulses" impact on the development of Foreign Economic Activity in certain regions analyses the relationship between domestic and foreign markets of products. Thus the work sets the task of approbation of the methodological accounting principles of the external "impulses" impact on the development of Foreign Economic Activity and determination of the exposure level to external "impulses" of regional economies as a whole.

The choice of criteria for the construction of economic and mathematical model was carried out on the available statistical base. The system of indicators does not contain expert indicators or indicators based on the results of surveys of business entities.

Further, we present a stated concept of the external "impulses" impact on the development of regional Foreign Economic Activities on the example of industrial economic activities of the Republic of Tatarstan. Thus, initially, the simulation will be based on the correlation analysis. This approach differs from those previously published by us in terms of the transition from the simulation of multiple regression equations containing a set of exogenous variables, including ISM index, to the measure of an impact of indicator’s dynamics estimating narrowness of communication between expectations of economic agents of the region (ISM index) and growth rates of industrial sectors of economy.

Results of the correlation analysis based on the measurement of narrowness of communication between the studied indicators and constructed on the basis of monthly data in the range of 2009-2014 are presented in Table 2. All the sampling includes 65 observations for each type of economic activity of the Republic of Tatarstan, referring to the industrial sector of the economy.

Table 2. Values of correlation coefficients estimating narrowness of communication between dynamics of growth rates of a consolidated ISM index and growth rates of industrial sectors of economy.

<table>
<thead>
<tr>
<th>The name of the studied indicator</th>
<th>The value of the correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial production</td>
<td>0,609</td>
</tr>
<tr>
<td>Mining operations</td>
<td>0,399</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0,671</td>
</tr>
<tr>
<td>Production and distribution of electricity, gas and water</td>
<td>0,365</td>
</tr>
</tbody>
</table>
The highest level of communication between the studied indicators is observed in manufacturing industry. Based on that, in future, we will carry out an attempt to assess the impact of changes in expectations of economic agents to the development of the given sector of the economy of the Republic of Tatarstan.

The basis of the structural and logical model estimating interrelation level between the studied indicators in the considered type of the industry is foregoing econometric approach presented by us above, including the previously published works. It is based on the approach that opens interrelation between growth the dynamics of industrial sectors and their pace in the previous periods, as well as growth rates of values of region’s ISM index.

In our view, very important and informative way is the assessment of the coefficients of the factors, estimating expectations of economic agents. So, if we calculate these values in the context of a plurality of individual economic activities of the industrial sector of the region it is possible to define with high degree of probability the extent of their reaction to external "impulses". Thereby, in fact, it is possible to determine the level of competitiveness and stability of development of the data of Foreign Economic Activity and the region as a whole and to predict their further development taking into account the now formed shock impulses and those in the future ones in the environment.

As an example, this article presents the estimated key parameters of an econometric model that defines interrelation between the growth dynamics of chemical industry of the Republic of Tatarstan from external "impulses".

\[ P = 89.05 + 0.105 P (-1) + 0.083 \text{IDA} (-2) \ (R^2 = 0.7821), \]

where \( P \) – is the growth rates of the chemical industry (graduated series); \( \text{IDA} \) – is the growth rates of consolidated ISM index of the region.

Table 3. The characteristic of the statistical significance parameters of the econometric equation estimating dynamics’ dependence of the chemical industry production of the Republic of Tatarstan from external "impulses".

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>t- statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y – cross.</td>
<td>89.05</td>
</tr>
<tr>
<td>P (-1)</td>
<td>0.105</td>
</tr>
<tr>
<td>IDA (-2)</td>
<td>0.083</td>
</tr>
</tbody>
</table>

Similarly, the calculations were carried out for other economic activities of manufacturing of the Republic of Tatarstan (Table 4).

Table 4. The valuation of indices with the factor of expectations of economic agents.

<table>
<thead>
<tr>
<th>Type of economic activity</th>
<th>The valuation of the index</th>
<th>t-statistics (p=0.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture of food products, beverages and tobacco</td>
<td>-0.035</td>
<td>1.256</td>
</tr>
<tr>
<td>Manufacture of petroleum products</td>
<td>-0.041</td>
<td>2.567</td>
</tr>
<tr>
<td>Wood processing and wood products manufacturing</td>
<td>0.048</td>
<td>0.964</td>
</tr>
<tr>
<td>Pulp and Paper Industry, Publishing and Printing Activities</td>
<td>0.05</td>
<td>3.598</td>
</tr>
<tr>
<td>Manufacture of electrical and optical equipment</td>
<td>0.068</td>
<td>1.501</td>
</tr>
<tr>
<td>Manufacture of rubber and plastic products</td>
<td>0.075</td>
<td>5.215</td>
</tr>
<tr>
<td>Chemical industry</td>
<td>0.083</td>
<td>1.251</td>
</tr>
<tr>
<td>Metallurgical production and finished metal products</td>
<td>0.095</td>
<td>1.659</td>
</tr>
</tbody>
</table>
The results of an assessment of the coefficients at an exogenous factor estimating elasticity of changing growth rates of separate industrial productions as a result of fluctuations of a consolidated ISM index are presented in Table 4 (in descending order).

### 3. Discussion

Thus, the calculation results demonstrate that there is no uniformity of response to changes in business activity in the region in the structure of industrial production. A number of industrial productions has pronounced the nature of dependence on the reaction of economic agents to certain "shock" manifestations while a number of other productions have immaterial values of elasticity coefficient which indicates a weak susceptibility to various kinds of external manifestation which determines the dynamics of expectations in the medium-term perspective.

Thus it can be argued that the dynamics of sustainable development of certain types of production, hence degree of competitiveness, substantially depends on external “impulses” which generate the structure and nature of the expectations of economic agents.

Further, as an example, we will form the forecast scenarios of development of exogenous variables of the equation as well as methodological approach of forecast scenarios of shock impulses on the example of the chemical industry of the Republic of Tatarstan.

The equation includes two variables, and one of them is lag which does not foresee adjustments to the actual values of the previous periods. The forecasting of exogenous variables includes the elaboration of scenarios of the business activity development in the region with short-term changes and forming shock impulses.

The paper considers two scenarios:

1. **Worse-case scenario**
   1.1. The planned implementation of WTO norms and rules which provides for reduction of the weighted average rates of import duties from 10% to 6.5% -5% by 2015 in the chemical industry (considering that the transition period for the liberalization of a market access, as a rule, is 2-3 years on average).
   1.2. The further expansion of the sanctions spiral from a number of countries against institutional and economic parameters of Russia's development.

2. **Optimistic scenario.**

The given scenario differs from the first one; it assumes the phased reduction tensions between Russia and a group of the so-called Western countries.

The forecast of the foreign trade liberalization shock dynamics due to Russia's joining the WTO includes the adjustment of trajectory of economic activity in the region following the changes in the major subindices which define this trajectory. In the case of long-term, strategic shock impulses it gives effect of cumulative index accumulation, which characterizes the business activity.

It is important to analyze dynamics of duties reduction in time and to determine on this basis adjustments in expectations of economic agents who operate in the framework of the studied economic activity.

At the same time, in the case of short-termed impulses (sanctions pressure) there is also need to value the modeling of the structural elements of the consolidated index of business activity in the region and on this basis to define the dynamics of the integral index.

In working out the forecast of business activity changes in the region on the basis of modeling scenario the following parameters were used in the context of individual enlarged groups of “external shocks”:

1. **Group 1:** External shocks caused as a result of reduction of tariff duties.

The reduction in business activity index by 0.4% in the quarter, which generally corresponds to the response observed in retrospect.
The growth will be accumulating as a result of the progressive increase of the supply of industrial products abroad due to softening or removal of tariff barriers.

2. Group 2: External shocks caused by sanctions pressure on the Russian economy.

   The fall in business activity by 0.8% in the quarter, which also corresponds to the dynamics of the business activity index in the first half of 2014 seems to be quite an adequate response.

   The general view of the business activity index forecast in the Republic of Tatarstan in 2014 is shown in Figure 4.

![Business Activity Index Forecast](image)

**Fig. 4:** The forecast of the business activity index in the Republic of Tatarstan in 2014

Having described the possible scenarios in the part of forecasting dynamics of exogenous variables considering “shock” external impulses we turn to the worked out econometric model for developing the forecast of the endogenous variable development dynamics, whose dynamics is determined, first of all, by the evaluation of the worked out model and the dynamics of exogenous shocks. The forecast for the chemical industry production dynamics in the Republic of Tatarstan for the two scenarios which we considered earlier is shown in Figure 5.
4. Conclusion

The results of research demonstrate that impact of “external” shocks will have no significant impact on the chemical industry in the Republic of Tatarstan in the short term. Given that the value of the index which evaluates the reaction of production valuation in the chemical industry as a result of adjustments in the business activity is small (0.083), the impact of shock impulses slightly affects the production indicators of considered type of economic activity. The results of the analysis and the conclusions are fully consistent with the conclusions published in the report of the Coordinating Council of RSPP department in the Volga Federal District.

In conclusion, it should be noted that the developed methodological approach allows us to estimate the degree of the reaction in certain types of economic activity from the impact on regional and national economic system of shock “impulses”. The valuation of indices indicating the elasticity of the studied endogenous parameters as a result of current and future expectation adjustments of economic agents in many ways may testify the level of certain economic activities susceptibility to various kinds of impacts. Thus it is possible to judge the current and future levels of competitiveness not only for regional industrial kinds of activities, but also for the entire region.

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References


Fig. 5: The forecast of the chemical industry development in the Republic of Tatarstan