

Structural Changes in the Russian Industry 1992-2010

Inna Konstantinovna Shevchenko and Yuliya Viktorovna Razvadovskaya

Southern Federal University, Rostov-on-Don, Russia

Abstract: The article covers the issues of structural changes in Russian industries for the period from 1991 till 2010. This period of Russian economy development is characterized by instability of macroeconomic indicators that was determined by conducted political reforms and transition to market system. Irresponsible reforms of economic system led to a deep crisis of manufacturing sector and transformation of the Russian economy into raw-material-exporting one. The analysis of the dynamics of structural change related the following indicators: GDP, unemployment rates, quality and condition of existing productive assets revealed those manufacturing industries with the strongest output decline.

Key words: Structural changes • Industry • Russia • Technological structure • National policy

INTRODUCTION

Over the 1991 to 2000 period the industry of developed countries has been suffering from structural changes resulted in high-technology industries taking a dominant lead. Whereby, medium-technology and low-technology manufacture branches decreased. The technological modernization period covered the developed countries has not affected Russian industry. The basic economic output of Russian industrial sector is provided by the low-tech manufacture branches. And the main share of country's exports is yielded by extractive sectors.

Depending on the nature and purpose of political transition structural changes can have both positive and negative nature, causing either economic growth or crisis in the production structure [1]. Whereby, industrial sectors are sensitive to political transformations in different ways, as follows: reforming causes intensive or weak structural changes in different sectors. Sectors of extractive industries are less sensitive to political and economic reforms. The dynamics of structural changes in these sectors depends heavily on world energy prices [2]. Manufacturing sector is subject to structural fluctuations resulted from political and economic reformations within the country. National Russian reforms resulted in significant

structural changes in economy and had strong impacts on branches of the industrial sector [3]. It is confirmed by the analysis of structural change dynamics in Russian industrial sectors over the 1991 to 2010 period [4]. That particular period is specified by extreme instability, crisis developments and low rates of economic growth. Crisis developments of the first period of 1991 through 2003 in the industry are related to political reforms to emerge from command to market system of management. Ineffective national policy of the controlled management as well as irresponsible restructuring launched the structural crisis in the economy with long-lasting effects. The researches on the dynamics of economic growth identify various reasons for crises including the national reforms being an integral part of them [2]. The most intensive crisis developments appeared in the industrial branches of manufacturing sector.

In the period from 2004 to 2009 there are no strong negative structural changes in the industry. Except for the period of 2008-2009, characterized by a deep decline in production, which is the effect of the global financial crisis. However, the industrial policy of the period cannot be considered effective, as the qualitative changes in the production structure of the industry is not observed. The medium-low-tech industries group is the main in the Russian economy.

MATERIALS AND METHODS

Contemporaneous methods of quantitative reflection of structural modification more often use the criterion (structural change mass), being easy in the calculations and in complex with other indices the criterion enables undertaking a comprehensive analysis of dynamics, structural change quality and determining its limits and principle phases [5].

Illustrates the growing percentage of industrial branches expanding at a faster pace or reduction of the aggregate industrial ratio with a reduced percentage. At that the growth rate of all branches can be positive. With the proportional growth of all branches $M = 0$, with their increase the index-number value is approaching to unity. Some researches emendate that the quoted geometrical formula does not exactly refine multi-dimensional objects [6]. However, the same researchers confirm applying this formula in studies on structural changes in mid-term and long-run time periods and recognize its advantages to interpret the changes clearly and express them in percent.

The paper by Krasilnikov, presents the mass of the structural change as a ratio of a specific economic index-number in the definite structural aggregate [7].

$$M = P_0 - P \quad (1.1)$$

where P_0 is a base period, it is 2010 in this paper and P is an inquiry period. On the basis of this index-number one can determine the number of economic components forming the structural change in kind and in value terms. Computations on mass criterion of the structural change show the extent of ratio changes in the industrial structure and uniformity of these changes.

However, this criterion does not provide a comprehensive idea of structural changes and the study is supplemented by calculations of structural change index being the ratio between structural change mass and reference value of the economic index-number in a specific time interval, fractional, percentage and calculated from the following formula

$$I = \frac{P - P_0}{P_0} = \frac{M}{M_0} \quad (1.2)$$

M is a structural change mass in the research period, M_0 is a structural change mass in a base period. The present criterion is a relative variability measure of individual quantity indices, in other words, the ratio

between mean absolute deviation of individual indices and the correspondent summary index related to the coefficient of variation. The structural change index serves to identify dynamics intensity, time lags, correlation of structural modifications.

The next criterion of structural changes in the industrial economic sector is a structural change quality performance calculated from the following formula:

$$K = I \cdot N, \quad (1.3)$$

where I is a structural change index of a specific direction and N is a structural change direction. The direction is identified according to the relevance of the economic interests. In this case the change to increase producible knowledge-intensive industries can be estimated as positive, namely, $N = 1$ and the change to increase primary industries is relatively shown as $N = -1$. Thus, progressive tendencies of structural transformation appear in case of structural change direction to be positive within the growth of positive structural changes in high-technology industries.

Structural Changes and Phase of Industrial Policy: Period from 1992 till 2003 – passive industrial policy.

The calculations of structural change mass on the level of technological potential by renewal coefficient of fixed assets were performed according to the formula (1.1). The year of 2003 was taken as a base period. The obtained calculation data prove the change of proportions in the industrial structure with infixed production assets depicting the dynamics of deterioration in quality of technologic component in manufacturing sectors and quality improvement in extractive industries (Table 1). The greatest structural modifications appeared in fuel and energy sectors (5,5), at that the mass index-number of structural change had an upward trend proving the fact that in comparison with 1991 the quality of basic production assets in the business structure of fuel industry has increased by 2003. Practically all the manufacturing branches of the industrial sector over the 1991 to 1998 period have been suffering the structural crisis accompanied by quality downswing of the technological component provided by capital funds and that was proved by negative index-numbers of structural change mass.

Summing up index-numbers of structural modification mass for the branches enables identifying the increasing of special ratio of the components expanding at a faster

Table 1: Structural change index in the branches of the industrial sector per index-numbers of gross output, technology renovation, mass of man-power employed over the 1995 to 2003 period

Branches of the industrial sector	1992-1998			1999			2000			2001			2003			N
	TR	GO	MP ¹	TR	GO	MP	TR	GO	MP	TR	GO	MP	TR	GO	MP	
The whole industry	0,05	-	20,7	0,4	-	0,7	0,1	-	0,4	0,1	-	1,0	1,0	-	1,0	+
Electric-power supply industry	0,3	3,4	8,5	0,2	4,4	1,2	0,3	2,8	0,2	0,4	1,5	0,5	1,0	1,0	1,0	+
Fuel-producing industry	0,2	0	1,0	0,5	1,2	0,8	0,3	0	0,03	0	1,1	0,1	1,0	1,0	1,0	-
Iron and steel industry	0,9	3,0	2,0	0,1	2,5	0,15	0,2	0	0,1	0,2	1,5	0,6	1,0	1,0	1,0	-
Non-ferrous metallurgy	0,4	7,5	0,6	0,3	2,5	0,7	0,2	2,0	0,5	0,06	1,0	0,07	1,0	1,0	1,0	-
Chemical and petrochemical industry, incl. microbiological and medical industry	0,2	2,6	5,0	0,3	2,0	0,2	0,2	0,6	0,6	0,2	1,3	0	1,0	1,0	1,0	+
Metal-fabricating industries	0,1	6,3	14,9	0,2	10,6	1,5	0,2	6,3	1,1	0	2,0	1,2	1,0	1,0	1,0	+
Forest, pulp and paper and woodworking industries	0,3	3,0	10,2	0,3	0	0,7	0,1	1,5	1,0	0,05	1,5	1,6	1,0	1,0	1,0	-
Construction materials producing industry	0,1	0	15,0	0,3	0	2,3	0,08	0	2,3	0,08	0	1,3	1,0	1,0	1,0	-
Consumer goods industry	0,2	2,6	13,2	0,4	0,3	1,5	0	0,6	1,3	0	1,0	1,2	1,0	1,0	1,0	+
Textile industry	-	-	12,6	-	-	2,6	-	-	2,2	-	-	2,0	-	-	1,0	
Food processing industry	0,3	1,0	12,5	0,2	0,3	22,5	0,3	3,0	12,5	0,2	2,3	1,0	1,0	1,0	1,0	+

rate ordetermining the branches where structural modifications were insignificant and did not modify the dynamics of structural modifications.

Thu cumulated index-number of structural change mass on the level of technological renovation proves that strong structural modifications occurred in the branches of non-ferrous metallurgy (5,3), food (7,5). At that all the branch modifications are improving and far exceed the mass of structural modifications for the whole industry (2,2).

The significant growth of structural change mass was observed in the branches focused on exporting products, exports increased due to sharp rise in world energy prices. Such a high increase of coefficient of fixed funds renewal means the quality growth of technological component provided by capital industrial funds. It could be the evidence of a large share of investment expenditures channeled to the branches of fuel and energy sector resulting in enhancement of raw-material orientation of the economy.

Insignificant alterations (less than 1) were observed in chemical industry, construction materials producing industry and consumer goods industry. In other words, these branches do not exercise significant in fluent over the industrial structure within the time period under review. The summary index-number of structural change mass in machinery-producing industry is equal to the unity. And the dynamics of structural modifications dies away over the years.

The three-factor model analysis of structural changes suggests the existence of a structural change, which consists of several phases. The first phase of 1992 - 1998 is the emergence of a structural change that was caused by a significant effect of structural crisis. The first phase

includes two parts: the first wave of the crisis in 1992 and the second in 1998. The second phase of 1998 - 2003 was a growth phase of structural change, accompanied by attenuation of negative impact of structural changes according to industries' indexes.

Analysis of structural changes in the structure of the industrial sector in the period from 1995 to 2003 confirms the assumption that there were structural changes that vary in their strength. In the studied period, we can talk about the action of a structural change, nucleation phase of which was in 1992-1995 years and was caused by a strong structural crisis. In this case, prices liberalization, the change of the political system led to a significant transformation of the structure of industrial sector.

The strongest structural changes in the positive direction sustained the fuel and energy complex. Its share in the structure of the industry became dominant. Negative dynamics of structural change in the overall structure of the industrial sector of the economy, was caused by the manufacturing industries oriented to the domestic market, the main reason for the decline of the latter were breakages of technological chains, resulting from the collapse of the Soviet Union [4].

A definite relationship between the structural changes in the industrial sector of the economy and the output aggregative changes was found as the result of the undertaken study. So the structural crisis in the economy gives rise to certain structural shifts in the industrial sector. The recession reduces the rate of industrial production, as it is evidenced by the dynamics of mass of structural change in industries' gross output. A similar relationship was revealed during the study of the dynamics of renovation of fixed production assets and average annual employment in the structure of industry.

¹TR- technology renovation, GO- gross output, MP- mass of man-power employed

Table 2: Structural change index in the branches of the industrial sector per index-numbers of gross output, technology renovation, mass of man-power employed over the 2005 ti 2010 period

Branches of the industrial sector	2006			2007			2008			2009			2010			
	TR	GO	MP ²	TR	GO	MP	TR	GO	MP	TR	GO	MP	TR	GO	MP	N
Extractive industries	10,5	0,06	1,6	9,4	0,6	1,0	7,0	0,7	0,9	1,1	0,4	1	1	1	-	-
Food industry	1,2	0,5	1,5	0,7	0,6	1,3	3,2	0,7	1,6	2,7	0,4	1	1	1	-	-
Textile and garment manufacture	1,4	1,0	2,8	0,5	1,2	2,2	0,2	1,3	1,7	1,9	1,0	1	1	1	-	-
Manufacture of leasure goods and shoe-making	0,5	0	0,7	3,2	2,0	0,6	0,6	0	1,5	0,06	1,0	1	1	1	-	-
Woodworking, manufacture of wood handicrafts	3,3	2,0	1,6	2,7	0	1,2	2,5	0	1,2	1,5	0	1	1	1	-	-
Pulp and paper industry	6,0	1,3	0,8	25,0	1,0	1,0	1,0	2,0	0,2	4,4	1,0	1	1	1	-	-
Coke and petrochemical industry	0,6	24,0	3,0	0,4	1,0	2,7	0,07	1,3	2,7	0,7	1,0	1	1	1	-	-
Chemical industry	0,9	0,3	2,5	2,2	7,0	2,3	2,1	23,0	1,5	2,1	9,0	1	1	1	-	+
Manufacture of rubber and plastic products	5,3	2,5	0,05	4,7	3,0	0,3	17,2	3,0	0,7	2,5	0,3	1	1	1	-	+
Manufacture of other nonmetallic mineral products	1,9	1,0	0,5	2,7	2,0	0,4	5,0	0,5	0,7	5,7	1,5	1	1	1	-	-
Metallurgy and production of metal manufactures	0,2	1,7	1,6	0,8	1,7	1,3	0,5	4,2	1,1	0,5	4,0	1	1	1	-	+
Mechanical engineering	5,3	0,6	1,6	2,1	1,8	1,3	0,6	1,5	1,1	0,5	0,6	1	1	1	-	+
Manufacture of electrical and optical equipment	0	4,0	0,7	0,6	1,0	0,5	1,3	1,1	0,9	1,8	1,5	1	1	1	--	+
Transport vehicles and equipment production	2,1	0,2	1,3	2,9	2,5	0,8	2,2	0	0,9	1,8	2,5	1	1	1	-	+

The second phase, from 2004 till 2010 - the active phase of industrial policy.

The study of the dynamics of structural changes in the period from 2004 till 2010 will let to determine how positive the structural changes were, to identify the parameters of the structure and to determine the quality parameters of the industrial structure (Table 2).

Index of mass of structural change by renovation of fixed assets in virtually all branches of the industrial sector is negative and indicates the negative dynamics of structural shift in these branches.

The index of structural change indicates damped dynamics of structural modifications (Table 2). The slight increase in the coefficient was observed in 2008 in the extractive industries, food processing, manufacture of rubber and plastic products and manufacture of electrical equipment. Due to the economic crisis which began in 2008, the rate of structural modifications slowed in 2009, as it is evidenced by the decrease in the index of structural changes [8]. In the manufacture of rubber products index dropped from 17.2 to 2.5, in food production from 3.2 to 7.7, in the production of vehicles from 2.2 to 1.8.

The deep structural shift in the negative direction in the industrial sector of economy in 2008 - 2009 was associated with the impact of global financial crisis. The Russian economy did not plunge into depression so deep as the other former communist countries or the developed capitalist countries [9, 10].

However, the positive value of the summed mass index of structural change is observed in the sector of production of energy minerals, which indicates an

increase in the rate of production in the industry in 2010 in comparison with 2005. Positive mass index of structural shift is observed in the production of vehicles and equipment, manufacture of electrical equipment, chemical industry, rubber and plastic products, manufacture of coke and refined petroleum, food production, which also means a reduction in the rate of production compared to 2010. That is, there is a decline in production in industries which are basic in the formation of a new sixth technological mode [11].

Labor factor dynamically than any others reacts to the crisis developments, if according to the dynamics of gross output and coefficient of renewal the restructuring is in the range of 1 - 10 items, so then the dynamics of the average annual number is from 10 to 94 (the maximum index was in the industry of the production of machinery and equipment). Such dynamics is connected with the reduction of jobs in engineering as a result of the crisis. Despite high mass structural change, the calculation of the index of structural change in terms of employment reflects a decrease in the intensity of structural change (Table 2).

The calculations confirm that all three parameters adequately reflect the dynamics of structural change and are in constant interaction [12]. Periods of economic crisis cause changes in the structure of industry in the following sequence: first there is a personnel retrenchment (in case of crisis) or its growth (in the phase of economic growth), then there is a decline of production rates and so deterioration in quality of the technological content provided by fixed capital assets.

²TR- technology renovation, GO- gross output, MP- mass of man-power employed

CONCLUSIONS

A distinctive feature of the structural adjustments in the domestic industrial economy is uneven dynamics of structural modifications. In periods of structural crises there is an increase of economic clout of industries of fuel and energy complex in the industrial and a sharp decline in the manufacturing sector, especially the downs are felt by engineering, vehicle manufacturing and electrical equipment enterprises.

During the period of economic reforms technological structure of the industrial sector not only failed reach the level of industrialized countries, but on the contrary, it developed in the opposite direction by increasing the share of production in the medium-low-tech group. But significant rise by all the analyzed factors in industries represented by medium-low-tech complex was observed.

Inference: The deep structural change with negative focus in the industrial sector was associated with the global financial crisis. The Russian economy did not plunge into depression so deep as the other former communist countries or the developed capitalist countries.

For the period from 1991 till 1999, in the structure of the industry there was an increase of the share of industries of the high-tech mode of production, in medium-tech group there was an increase by 3 points, in medium-low-tech and low-tech groups there was a slight change.

Dynamics of structural changes in the industrial sector of Russian significantly differs from that of developed countries. In a period of intense technological development of the industry of developed countries from 1991 to 1999 and their reorientation to high technology in Russia there were processes of de-modernization of the industrial sector, as it is demonstrated by a negative focus of the structural changes according to gross output, investments in fixed assets and number of employees in the industry.

The main productive sectors of the economy remain medium-low-tech and low-tech groups. Government reforms of the early 90s had a negative impact on manufacturing production and caused severe structural changes of negative focus. The exception is the fuel and energy complex, which became the basis of specialization Russian economy.

ACKNOWLEDGEMENTS

The authors would like to thank reviewers for their comments and recommendations, which have improved the article. Dr. Garabed Minassian, Professor of Economics and Finance, Bulgarian Academy of Sciences, Bulgaria. Dr. Richard Connolly, Lecturer in Political Economy, Centre for Russian and East European Studies, University of Birmingham. Dr. Gregory Brock, Professor of Economics, Dept. of Finance and Economics, Georgia Southern University. The authors are grateful the Southern Federal University for financial support of research.

REFERENCES

1. Florio, M., 2002. Economists, Privatization in Russia and the waning of the Washington consensus. (Summer 2002) *Review of International Political Economy*, 9(2): 374-415.
2. Connolly, R., 2012. The Determinants of the Economic Crisis in Post-Socialist Europe. *Europe-Asia Studies*, 64(1): 35-67.
3. Myant, M. and J. Drahokoupil, 2011. *Transition Economies: Political Economy in Russia, Eastern Europe and Central Asia*. Hoboken, NJ, Wiley-Blackwell.
4. Wurzer, G., 2009. The political influence of economic elites in Russian Regions: An Analysis of the oil and gas industry, 1992-2005. *Europe-Asia Studies*, 61(8): 1508-1510.
5. Aivazyan, S. and V. Mhitoryan, 1998. *Applied statistics and principles of econometrics*. Moscow YuNITI, pp: 234.
6. Minassian, G., 2013. Bulgarian banking: looking for sustainability. (September 2013). *Contemporary Economics*, 26: 95-114.
7. Krasilnikov, O., 1999. *Structural Changes in Economy: theory and methodology*. Saratov: Scholarly book Press, pp: 232.
8. Bessonov, V., 2002. About the accuracy of consolidated indicators of economics dynamics in Russian transition economy. *Economics and Mathematical Methods*, 4: 113-127.
9. Velikhov, E. and V. Betelin, 2008. Industry, innovation, education and science in the Russian Federation. (Jun 2008). *Herald of the Russian Academy of Sciences*, 78(3): 257-263.

10. Attwood, L., 2012. Privatisation of Housing in Post-Soviet Russia: A New Understanding of Home? *Europe-Asia Studies*, 64(5): 903-928.
11. Mensch, G., 1979. *Stalemate in technology: innovation overcome die depression*. Cambridge (Mass.), pp: 114.
12. Batanov, I., 2000. *Foundations of social and economic changes theory*. St. Petersburg, pp: 160.