

## INPUT OF ECONOMIC GROWTH FACTORS INTO THE VALUE ADDED INDEX IN THE INDUSTRIAL SECTOR IN 2014

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*The results of decomposition of output growth rates demonstrate that, in 2014, gross value added (GVA) in industrial production continued to be pushed up by the increasing inputs of extensive factors. The preliminary estimates of the growth rates of combined factor productivity (CFP) derived for the main types of economic activity are negative. The structure of inputs provided by the main production factors in industry in 2014 is dominated by capital inputs; labor inputs in industrial production are influenced both by increasing labor reserves (the actual number of the employed) and the increasing intensity of their use (the working hours).*

One of the approaches applied in the studies on the causes of varying rates displayed by different types of economic activity relies on by-factor decomposition of economic growth. The decomposition method estimates the specific values of differential production function, which means that the rate of output growth is presented as the sum of three variables. The first two variables describe the effects of changes in the main production factors – labor and capital inputs (the extensive growth components). This method assumes that the inputs of these factors can be determined by multiplying the values of both factors (the actual number of the employed and the volume of fixed assets) by the intensity of their use (the working hours of one employed person and the load on production capacities). The third variable is combined factor productivity (CFP), defined as the residual that cannot be explained by the effect of the main production factors, which describes the intensive growth components. This estimation of combined factor productivity reflects not only changes in the ‘technological’ components, but also exogenous shocks, effects of better production organization, management quality, and changes in demand and prices<sup>1</sup>.

According to data published by the Federal State Statistics Service (*Rosstat*) for the year 2014, gross value added increased on the previous year in the processing industries by 2.5%, and in the mineral extraction sector by 0.1%; in the sector of production and supply of electric energy, natural gas and water it declined by 0.1%. In contrast to the situation in the previous period, the processing industries displayed a declining

growth rate of GVA, which amounted to 1.4 p.p. In the other two sectors the value added growth rate was on the rise: in the mineral extraction sector it increased by 3.9 p.p., and in the sector of production and supply of electric energy, natural gas and water – by 2.1 p.p.

In 2014, the companies operating in the mineral extraction sector demonstrated low value added growth rates. The structure of GVA growth rate for this type of economic activity in 2014 differed little from the corresponding indices demonstrated by that sector in recent years. According to the results of decomposition (*Table 1*), the growth rate of the inputs of main production factors in 2014 was significantly higher than that of value added in the mineral extraction sector. Capital input was the strongest factor influencing the value added growth rate in the mineral extraction sector: its component in the growth rate of GVA, determined as growth of fixed assets, was nearly thirtyfold greater than that of labor input. The labor input growth for this type of economic activity more strongly depends on the growth rate of the number of the employed, which is four times higher than that of the number of the working hours.

The year-end results of 2014 for the mineral extraction sector demonstrate a decline of the combined factor productivity index. As noted earlier, the CFP index represents the residual that cannot be explained by the effect of the main production factors. More specifically, the application of the value-based output and capital indices may result in a biased CFP estimate due to the uneven movement of output prices and fixed asset value. The movement of CFP in the mineral extraction sector (by comparison with other industrial sectors) more strongly depends on the movement of world raw material market prices. An econometric assessment<sup>2</sup> of the relationship between the CFP

<sup>1</sup> The decomposition method applied in this study is based on the methodology suggested by E.F. Denison. He was the first to consider the fluctuations in demand intensity as one of the main irregular factors determining changes in productivity. Demand data were incorporated in our CFP estimations for 2014 due to unavailability of data on the load on production capacities – an index that over short-term periods changes depending on demand fluctuations. (Denison E.F. (1974), “Accounting for United States Economic Growth 1929–1969”, Washington, Brookings Institution).

<sup>2</sup> The singling out, in CFP’s structure, of a ‘situational’ component is estimated by applying a regression model of the CFP growth rate and the growth rate of world oil prices, based on annual data for the period 1993–2014.

## VALUE ADDED GROWTH DECOMPOSITION FOR THE INDUSTRIAL SECTOR IN 2013–2014\*

	Mineral extraction		Processing industries		Production and supply of electric energy, natural gas and water		Industrial production**			
	2013	2014	2013	2014	2013	2014	2013		2014	
GVA	-3.8	0.1	3.9	2.5	-2.2	-0.1	0.3		1.3	
I. Factor inputs	3.17	3.66	0.08	3.65	2.10	2.92	0.44	(1.43)	3.52	(3.57)
I.1. Labor ***	0.01	0.11	-1.04	0.56	-0.61	0.74	-0.70	(-0.61)	0.44	(0.42)
Number of employees	0.04	0.08	-0.67	0.49	-0.18	0.35	-0.43	(-0.36)	0.35	(0.33)
Working hours (per worker)	-0.04	0.02	-0.37	0.08	-0.44	0.40	-0.27	(-0.26)	0.09	(0.09)
I.2. Capital	3.17	3.56	1.12	3.09	2.72	2.18	1.14	(2.04)	3.08	(3.15)
Fixed assets ****	4.68	3.56	3.54	3.09	2.72	2.18	3.81	(3.85)	3.08	(3.15)
Capacity load	-1.52	-	-2.42	-	0.00	0.00	-2.67	(-1.81)	-	(-)
II. CFP *****	-6.99	-3.56	3.79	-1.14	-4.27	-3.01	-0.17	(-1.15)	-2.18	(-2.23)

\* For 2014, preliminary estimates are applied. The deviations from the previously published results for 2013 occurred due to the adjustments made to production indices by *Rosstat*.

\*\* The industrial production estimates are derived on the basis of aggregation of the initial data estimated for each type of economic activity (in brackets we show the results of decomposition derived by pooling the estimated for different types of economic activity).

\*\*\* Preliminary estimates of the growth rate of the number of the employed in the industrial sector are based on data on occupied job positions for 2014, assuming that the ratio of the employed, by type of economic activity, to the number of occupied job positions is constant.

\*\*\*\* Preliminary estimates of the physical volume of fixed assets for 2014 are based on the assumption that the coefficient of retirement of fixed assets and the share of investments earmarked for their renewal are constant values.

\*\*\*\*\* The 2014 CFP estimates for the mineral extraction sector, the processing industries and industry as a whole are biased due to absence of data necessary for accurately assessing changes in the load on production capacities relative to each type of economic activity.

growth rate and the growth rate of world oil prices has made it possible to identify two components of CFP: the 'situational' component (determined by the movement of prices on world raw material markets) and the 'final residual'. It should be noted that the separation, within the CFP index for the mineral extraction sector, of its component determined by the movement of oil prices results in no qualitative changes in the conclusions as to the movement of combined productivity: the 'final residual' also displays a negative growth rate.

Similarly to the situation observed over the previous years, in 2014 the processing industries were characterized by the highest value added growth rate across Russia's industry. The value added growth rate structure in the processing sector is similar to that in the mineral extraction sector. As before, capital input is the dominant component for this type of economic activity, although the processing sector demonstrates a drop, on the previous years, in growth rate of fixed assets. The labor input in the growth rate of GVA for this type of economic activity is nearly six times lower than capital input. In 2014, the growth rate of the number of persons employed in the processing sector became positive for the first time in several years, so labor inputs were determined by the simultaneously increasing indices of the number of working hours

and labor reserves, and the input of the number of employed persons into the growth rate of GVA was six times higher than that of the intensity of their use. It should be noted that the processing industries are the only sector in Russian industry where the number of employed persons failed to reach its 2008 level.

As shown by preliminary data, in 2014 the growth rate of CFP in the processing industries remained negative, although this estimate is probably biased because it is not adjusted by changes in the load on production capacities.

The sector of production and supply of electric energy, natural gas and water was the only sector in Russian industry where the value added growth rate negative. Its decomposition revealed that the shrinkage GVA was fully determined by shrinking CFP in face of increasing capital and labor inputs. Similarly to the other industrial sectors, the structure of inputs of main production factors in the sector of production and supply of electric energy, natural gas and water was dominated by capital input; the amount of capital input in the reduction rate of GVA was three times higher than that of labor input. The labor input in the sector of production and supply of electric energy, natural gas and water was pushed up both by the growing number of the working hours of one employed person and the

growing number of employed persons; the inputs of both these factors into the growth rate of GVA in this sector were nearly equal.

The estimates based on the aggregate data for each type of economic activity demonstrate that, on the whole, the industrial production value added growth rate for 2014 amounts to 1.3%, which is 1.0 p.p. above the corresponding index for 2013.

According to the preliminary decomposition results (in absence of data on the load on production capacities), in 2014 the growth rate of GVA in industry was fully determined by the increasing inputs of main production factors. Within their structure, capital input remains the prevailing component of the industrial production value added, in spite of the slowdown in the growth rate of fixed assets. In 2014, in contrast to earlier periods, the industrial sector demonstrated positive growth rates both with regard to the number of employed persons and the number of their working hours. The growth rate of CFP for industrial production in 2014 is negative. The separation, within CFP, of the component describing the redistribution of value added, labor and capital inputs between types of economic activity results in a slight shift in the productivity input into the growth rate of industrial production GVA. At the same time, the less prominent differences between the CFP estimates obtained on the basis of aggregate data and for each sector separately point to a slowdown, in 2014, in the process of redistribution of resources between industrial sectors by comparison with the previous period.

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In 2014, the growth rate of GVA in industry varied by sector: in the mineral extraction sector and in the processing industries value added was on the rise, while in the sector of production and supply of electric energy, natural gas and water this index displayed a downward trend.

The preliminary decomposition results have led to two conclusions, which are true for every type of economic activity. Firstly, in Russia's main industrial sec-

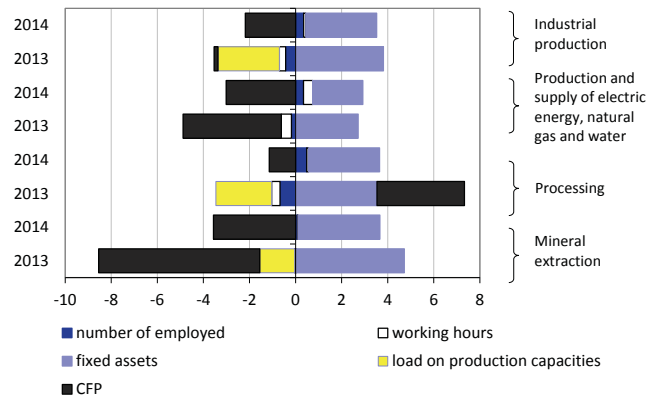


Fig. 1. The Structure of Gross Value Added Growth in Industrial Production in 2013–2014

tors the growth rates displayed by the inputs of main production factors are much higher than the growth rate of GVA. In other words, the current upward movement of the value added index in industry is achieved due to the effect of the extensive factors. Secondly, in the structure of inputs of main production factors the dominating role belongs to capital inputs.

The movement, in 2014, of labor and capital inputs in the main industrial sectors point to the similarities between the current changes: in each sector, labor inputs are increasing due to the growing labor reserves (the number of the employed) and the increasing intensity of their use (the number of working hours); all the industrial sectors display a downward movement of the growth rates of their fixed assets.

According to our preliminary estimates (in absence of data on the load on production capacities), in 2014 the input of combined factor productivity into the growth rate of industrial production GVA was negative. The growth rate of CFP was also negative when broken up by type of economic activity. However, in contrast to the previous period, the CFP indices for the mineral extraction sector and the sector of production and supply of electric energy, natural gas and water demonstrated a reduction in their decline rates. ●