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STRUCTURAL SHIFTS: IMPACT ON PRODUCTIVITY AND GROWTH OF UKRAINE'S ECONOMY

The leading feature of the modern world has been the deep structural shifts caused by radical transformations of its industrial landscape. The corresponding transformations were caused by changes in the internal structure of national industrial sectors and were based on the technologies of the "fourth industrial revolution", whose emergence gave additional impetus to the structural transformation of the world economy, intensifying competition in global markets. The Covid crisis was a catalyst for accelerating changes in the intersectoral proportions of the world economy, complicating the existing structural problems.

The study shows that the key feature of the model of structural changes that occurred in Ukraine's economy after the global financial crisis was the accelerated reduction of the industrial sector, especially the loss of potential of the processing industry, its technological simplification and narrowing the variety of industries. This was accompanied by increased dominance of the tertiary sector and the growth of the primary sector. Excessive share in the structure of production is occupied by industries, whose mode of reproduction is able to generate only relatively low rates of economic growth (mining and related industries of primary processing in industry and agriculture). Such a trend of structural shifts is not able to generate the necessary boost of economic growth, and much less so as it is burdened by the risks of deepening structural inconsistency of Ukraine's economy with the cardinal changes taking place in the world economy.

Comparison of parameters and trends of structural changes in Ukraine's economy and in a comparable group of countries and the world as a whole shows that the changes in the structure of Ukraine's economy were much more intensive, but did not create sufficient potential for sustainable economic growth. The author analyzes the gaps in labor productivity between economic activities and sectors of Ukraine's economy, as well as changes in their dynamics, which leads to the conclusions about the relationship between the rates of technological development of different sectors of Ukraine's economy and the gradual slowdown of the already imperfect technological development of this country's industry with further loss of competitiveness. Estimated the degree of influence of such factors as investments and technological innovations, as well as shifts in the structure of employment on the increase

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of labor productivity in Ukraine's economy. Using the apparatus of econometric modeling, the author evaluates the dependence of the dynamics of GDP growth on the change of the indices of the physical volume of GVA in the sectors of this country's economy.

Keywords: *structural changes, index of structural changes, labor productivity, economic growth, industrial sector, manufacturing, technological development*

Structural shifts due to advances in production and service technologies are the main factor of economic growth and an indispensable feature of the development of modern economy [1]. According to the three-sectoral model of the economy, the main direction of structural transformation is the shift from primary production (agriculture and mining), to manufacturing and then to services (or tertiary sector). The absorption of capital and technology, especially beginning with the industrialization phase, is of great importance for the development of the processing industry, thus achieving higher levels of productivity, and creating the basis for a flourishing post-industrial service economy. The impulses of structural change are transmitted through productivity gains and reallocation of factors of production to sectors with higher efficiency, thus achieving sustained economic growth.

The decade since the global financial crisis has been marked by structural trends opposite to those prevailing in the previous period. In particular, the role of the manufacturing in the global economy has increased and it has regained its high position. The contribution of the manufacturing to global GDP creation increased by 1.3% between 2009 and 2018 to 15.4% (2018), including 1.1% in developing countries and 0.7% in industrialized countries [2]. Radical transformations in the global industrial landscape caused by the development of technologies of the "fourth industrial revolution" have provided new types of production, which gave an additional impetus to structural changes in the global economy and intensified competition in the markets. Against this background, for Ukraine with its inefficient economic structure and non-modernized production technologies, the risks of its further slide to the margins of global development and weakening of its geopolitical position are growing. Therefore, the issue of structural transformations based primarily on industry and the achievement of stable economic growth of the national economy acquires special importance.

Structural change and economic growth: a review of recent studies and publications

Structural change processes and assessment of their impact on economic growth of individual countries and the world have long been a subject of scientific research [3, 4]. These topics have never lost their relevance due to the dependence of geopolitical positions of each country on the productive structure of its economy [5, 6]. The attention of researchers is focused on the study of structural change trends [7–9], and on identifying their levers and determinants (labor, capital, innovative technologies, savings, national and foreign investment, and foreign trade) [10, 11].

Since the state plays an active role in economic diversification and modernization, the issues of its functions and mechanisms of implementing structural (industrial) policies and initiating economic growth are invariably present in academic studies. Of great interest are retrospective analytical studies of structural progress in countries where a "big push" occurred in the second half of the 20th century leading them from agrarian to industrial economy. These countries became the world's most competitive manufacturers of complex industrial products (South Korea, Singapore, and Hong Kong) and achieved high levels of social welfare through an effective public policy [12]. Researchers emphasize that industrialization (for example, in Korea) was based on the achievements of agrarian reform - improving the distribution of land and income. This laid foundation for the rise of the middle class and entrepreneurship, and the formation of an active civil society, which was crucial for further economic development[2].

At the same time, researchers note the evolution of approaches and forms of state influence - from direct government guidance at the initial stages of industrialization and cardinal technological changes, to selective intervention in the economy (by supporting the activities of strategic industries and companies), and to the application of indirect levers [13]. The latter refers to state assistance in modernizing the structure of the economy by using monetary policy instruments, liberalizing markets, improving the financial system, stimulating entrepreneurial initiative and innovation, providing quality education, and reducing social inequality [8, 13]. Currently, there is a balance between the roles of government, market and civil society, and their synergistic interaction in the mechanisms of structural change management, which provides the development of a creative economy in which human creativity is the main source of value creation.

The specifics of government structural policy in relation to the Ukrainian economy have been studied by scientists in a variety of ways. In particular, the study of the peculiarities of structural transformations in the national economy by a number of components revealed macroeconomic imbalances that hinder economic development [14]. Studies by V. Sidenko [15] added a sharp tone to the discussions about the challenges posed to the national economy as a result of structural shifts in the global economy. That's absolutely right, he raised a number of important issues, namely the lack of "beacons" in government policies and reform programs to adjust and modernize the structure of the national economy, and the need for continuous monitoring and analysis of structural and technological changes, given the threatening slide of the country's economy to the periphery of the world economy. The analysis of key features of the Ukrainian economy, qualifying it as a small, open, and also raw material based in terms of production and export structure [16], revealed the resulting weakening of macroeconomic dynamics, and the threats of Ukraine's

[2] Against this background, how contrasting is the "big leap" to industrialization made in the USSR in the 1930s, the resources for which the state mobilized by plundering the countryside and brutally suppressing civil resistance, by using the slave labor of collective farmers (not for money but for the work-day unit known as *trudoden*'). In the course of industrialization, the peasants were impoverished, subjected to mass starvation, and since then have remained a poor stratum of society for many years.

further technological lagging behind the more innovative and the world's most dynamic economies. The study of internal origins of the distortion in the structure of the national economy showed their institutional conditionality by property relations, which were formed against the background of unfair campaigns to privatize state property, the emergence of ultra-profitable private monopolies and the establishment of oligarchs' power [17]. The authors reveal specific features of current business financing models, based on the use of shadow reserves and offshorization of financial relations that create significant financial constraints on the structural development of the economy [18].

Consideration of a wide range of issues of inclusive development has provided a detailed rationale for transition to a model of economic growth in which people, their standard of living and quality of life are the focus of efforts to bring about structural change [19]. In the context of the search for effective economic policy instruments, the feasibility of introducing a smart specialization strategy based on a combination of science, technology, innovation, regional and industrial policies to facilitate the structural modernization of the economy has been proven [20]. The treatment of regional proportions and regional hierarchy in the national economy showed the priority of manufacturing development for the prosperity of regional population and proved that a key to increasing the economic prosperity of regions and overcoming the structural-territorial disproportionality is the deepening of the decentralization of state powers, developing a technology-based Industry 4.0 [21].

The authors reveal external factors of the apparent process of structural simplification of the Ukrainian economy and its approximation to the structural characteristics of less developed economies of the world, due to the peripheral status of the national economy in global value chains [15]. The feasibility of implementing a development strategy based on the expansion of Ukraine's market, its ability to meet the needs of consumers and to correct imbalances in foreign trade was substantiated [22, 23].

Analysis of the processes of industrial revolutions, whose necessary condition is technological progress (from the first such revolution to the current one based on Industry 4.0 technologies), and which cause radical structural shifts, enriches the science with theoretical conclusions and helps to formulate practical recommendations for modern industry [24, 25]. After the global financial crisis of 2008 and COVID-19 pandemic, the issues of state industrial policy focused on sustainable structural change and innovative and technological development, sectoral priorities, and localization of production chains appeared on the political agenda with a new force [26]. A model response to today's challenges is demonstrated by the USA, where the United States Innovation and Competition Act of 2021 [27] was passed, which provides for the implementation of structural policy measures, such as: public investment in innovation for national producers, increased public funding for applied research, expansion of the network of National Research Centers, improvement of the quality of the workforce and its technical training, and investment in the development of priority sectors (namely semiconductor manufacturing).

This study assesses the parameters of the structural shifts that took place in Ukraine during the 2000s, identifies the effectiveness of these structural shifts in terms of labor productivity and economic growth dynamics, and determines approaches to structural policy design.

Methods for measuring structural shifts

Structural change is assessed using several indicators. The focus is usually on measuring the change in the contribution of each component part of an economic system (economic sector, economic activity or industry) to GDP creation, labor force participation, and labor productivity growth [8, 28, 29]. For example, the degree of industrialization, recognized as a cornerstone of economic development, sustainable productivity growth and social welfare, is mainly measured by three indicators: the share of manufacturing value added in GDP at constant and current prices, and the share of employment in manufacturing in the total number of people employed in the economy [30]. The latter indicator reflects the distribution of labor resources in the economy and indicates the direction of their movement over time.

The evaluation indicators reveal quantitative or even qualitative characteristics of those changes caused by structural shifts. In particular, to define quantitative parameters, the structural change index is most often used, which assesses the degree of changes in the sectoral composition of the economy that occurred over a period of time. There are two main variants of this index; in one of them structural changes are estimated in terms of value added, and in the other one, in terms of the number of employees:

$$ISC_{VA} = {}^{1}/_{2} \sum_{i=1}^{n} |VA_{it} - VA_{i(t-1)}|, \quad (1)$$

where ISC_{VA} - the index of structural changes in terms of value added;

n - the number of economic sectors (economic activities, industries);

VA_{it} and $VA_{i(t-1)}$ - the share of value added of sector i in current period t and previous period $(t-1)$, respectively.

Another indicator, the structural change coefficient, is similar to the one already mentioned, but estimates changes together with employment by economic sector:

$$ISC_{L} = {}^{1}/_{2} \sum_{i=1}^{n} |L_{it} - L_{i(t-1)}|, \quad (2)$$

where ISC_L – the index of structural change in the number of people employed;

L_{it} and $L_{i(t-1)}$ - the share of those employed in economic sector (economic activity, branch) i in current period t and in previous period $(t-1)$, respectively.

Both variants of the index are used to estimate the intensity of structural change in the countries around the world, economic regions, in other words, in the territorial aspect which ensures comparability of estimates, for example in three-sector economic models. The index reflects the net result of the impact of various factors on output and employment. For example, investment in new technology contributes to the increase in the output in a particular industry, increases its productivity, and often results in the release of some workers and in changes in their professional and qualification composition.

The presented indices measure the intensity of structural shifts, but do not indicate the quality of the changes in terms of whether they cause positive or negative effects on economic development. In order to identify the qualitative effect of structural

shifts, a composite indicator, *the productivity growth index ($I_{\Delta P}$)*, calculated by the shift-share method, is used:

$$I_{\Delta P} = \sum_{i=1}^{n} \frac{L_{i(t-1)}\Delta P_i}{P_{(t-1)}} + \sum_{i=1}^{n} \frac{P_{i(t-1)}\Delta L_i}{P_{(t-1)}} + \sum_{i=1}^{n} \frac{\Delta L_i \Delta P_i}{P_{(t-1)}}, \quad (3)$$

where, in addition to the indicators already mentioned, there are:

$P_{(t-1)}$ - labor productivity (in other words, added value in constant prices per worker employed) in the base period;

ΔP_i - growth in sector productivity and in current period (t) compared to base period (t-1);

and ΔL_i - increase in the proportion of people employed in sector *i* in current period compared to previous (baseline) period.

The composition of the three summands allows us to analyze the effect of each component on the change in labor productivity, taking into account shifts in the employment structure. The first summand of formula (3) gives an indication of the internal sources (within effect) of productivity growth in economic sectors, adjusted for the number of people employed in them. The second additive, called the static structural effect, reflects the contribution of the reallocation of employment across sectors at the underlying level of productivity. The latter additive is considered to reflect the dynamic structural effect, as it measures both shifts in employment and changes in sectoral productivity.

The transformation of Ukraine's economic structure and its impact on economic dynamics

According to the UN Industrial Development Organization, Ukraine's economy belongs to the category of emerging industrial economies and is closely integrated into global trade and production networks [5]. Such integration potentially facilitates the transfer of new production technologies through global value chains, which usually boosts industrial development and economic growth. However, in the global system of production relations, Ukraine, which was among the top ten countries in terms of industrial development in the early 1990s, found itself in the marginal positions of a supplier of mineral ores, simple metals, agricultural products, and labor. The country's predominantly raw material specialization in the international division of labor has caused excessive dependence on price fluctuations on world markets and consequently economic instability [16]. The almost complete cessation of Ukraine's production of high-tech products, the demand for which is now met by imports, has worsened this country's trade balance and caused economic instability (23). The GDP growth of Ukraine during 2000–2020, with short ups and downs was interrupted by waves of crises and deep declines (ranging from +11.8% in 2004 to -15.1% in 2009), caused by external influences (the global financial and economic crisis of 2008–2009; loss of some economic potential of the country due to Russian aggression and occupation of industrially intensive territories since 2014).

At the same time, the structural shifts occurring in the national economy exceeded the global level and the level of the comparable group of Central European and Baltic countries (similar to Ukraine in terms of development) in terms of intensity (Figure 2). In particular, the average structural change index (in terms of value added) in

Ukraine reached 2.1 in 2000–2019, compared to 0.6 in the comparable group of countries and 0.5 in the world.

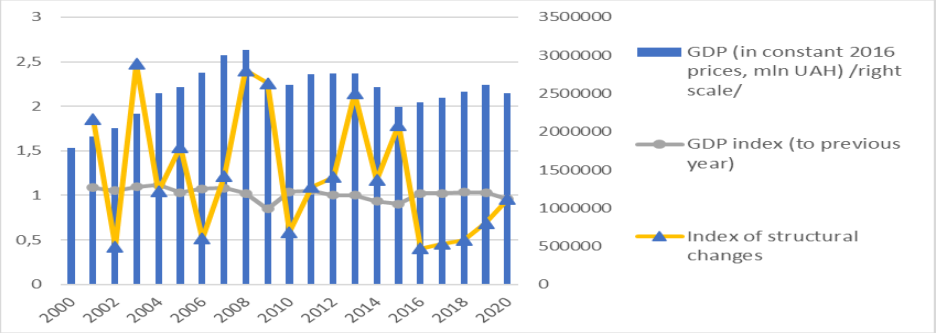

Figure 1. GDP dynamics and structural changes in the Ukrainian economy in 2000-2020

Source: calculations based on State Statistics Service of Ukraine data. URL: http://www.ukrstat.gov.ua/

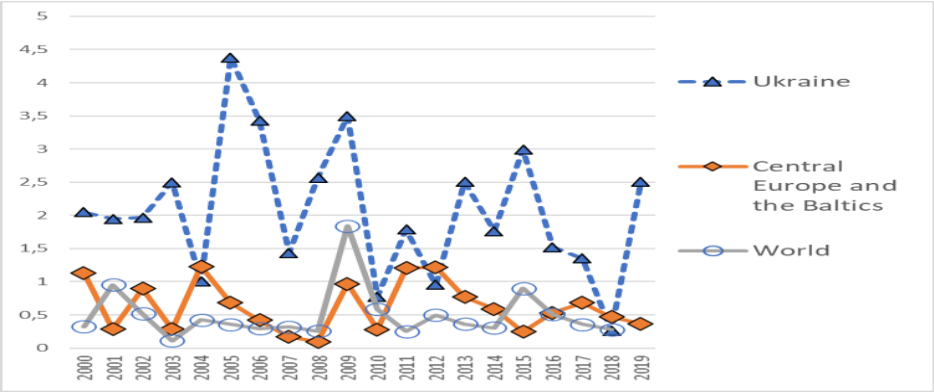

Figure 2. Structural change index by value added in the world and in Ukraine 2000-2019

Source: World Development Indicators. URL: https://databank.worldbank.org

Typically, strong structural change is associated with large opportunities for economic growth that arise from increases in aggregate productivity and income [31]. This is confirmed by the examples of Asian countries (China, India, etc.) where powerful structural changes have well served economic growth [3, 10]. However, the structural shifts in Ukraine, whose directions have persisted since the 1990s, proved to be destructive for the economy as they were accompanied by the loss of much of its industrial potential, a significant drop in GDP and one of the worst economic dynamics in the world [32].

The brief period on the road to industrial recovery and growth (2000-2007) was interrupted by the impact of the crisis waves, which caused irreparable damage to this country's industrial potential. The defining signs of structural change in the Ukrainian economy after 2007 were, on the one hand, a reduction in the weight of the industrial sector (primarily processing industry), in contrast to global trends (Figure 3) and, on the other hand, a rapid increase in the weight of the tertiary and primary sectors (Figure 4). In particular, the share of the industrial sector in Ukraine's

GDP dropped to 22.5% (at the end of the analyzed period), which is less than the global level of 25.6% and that of the comparable group of the Central European and Baltic states at 27.6%. At the same time, the share of manufacturing in Ukraine dropped to 10.8% of GDP compared to 15.4% globally and 17.6% in the comparable group. The long-term trends towards loss of weight by industry, together with the low level of average per capita income (which has never exceeded US$ 3.400), are signs of premature deindustrialization [33, 30] of the Ukrainian economy.

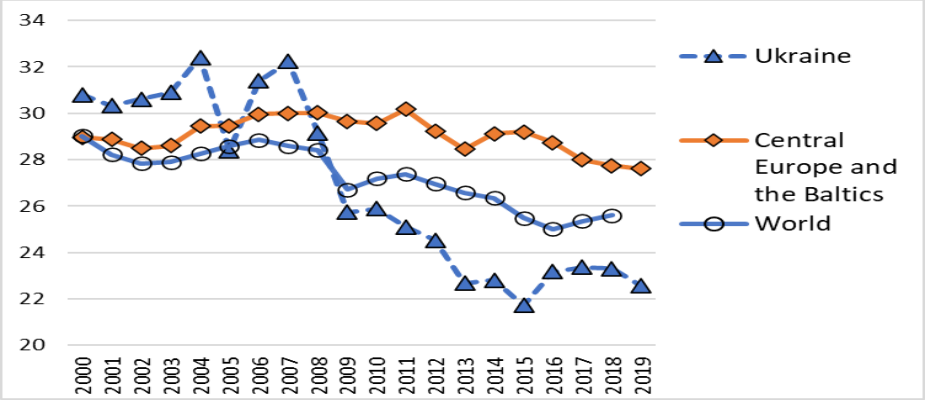

Figure 3. Industry value added in the world and in Ukraine in 2000-2019, *% of GDP*

Source: World Development Indicators. URL: https://databank.worldbank.org

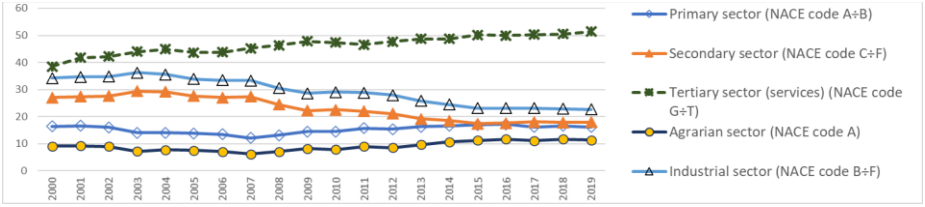

Figure 4. Sectoral composition of GDP in Ukraine 2000-2019 (at constant 2016 prices), *%*

Source: State Statistics Service of Ukraine. URL: http://www.ukrstat.gov.ua

Ukraine's share of the agricultural sector (9% of GDP in 2019) is almost three times higher than the global average, and even higher than that of the comparable group of countries. The advantages associated with strong agriculture and the ability to build long chains of Ukraine's production are underutilized or lost for economic development when raw rather than processed products are exported to world markets. The movement from agrarian to industrial and service economies provides countries with socio-economic progress - rapid growth of real GDP and a way out of poverty. Significant are the examples of China and Vietnam, whose economies have transformed from poor agrarian economies to the newest industrial ones with high growth rates [21, 34]. The movement in the opposite direction, as we can see, does not give similar results. In general, the reproduction mode of primary sector industries (mining and related primary processing industries in industry, and agriculture) is able to generate only relatively low rates of economic growth.

Premature deindustrialization of the national economy affects the development of the services sector - its dynamics are slowing down and its high-tech types are shrinking. This is an objective effect of the dependence of service sector growth on industrial growth. The biggest component of this sector - trade - can expand through the inflow of imports into Ukraine's market, but the functioning of high-tech services (such as radio and television, telecommunications, computer programming, information services, research and development, etc.) requires a solid industrial base both for their logistical support and to support sustainable effective demand for services. Otherwise the sector is doomed to import dependence and loss of efficiency.

The significance of the impact of industrial growth on the dynamics of the tertiary sector has been tested by regression modelling. The empirical study is based on annual data covering the period 2001–2019.

$$Serv\_GDP\_gr = 0{,}317 + 0{,}719*Ind\_GDP\_gr \quad (4)$$

Prob. t-Statistic (0,0007) (0,0000)

R^2= 0,84; DW= 1,744; Prob(F-statistic)=0,0000,

where Serv_GDP_gr – gross value-added index of the services sector (in previous year's prices);

Ind_GDP_gr - gross value-added index of the industrial sector (in previous year's prices).

The simulation results indicate that all regression coefficients are statistically significant. The high coefficient of determination (0.84) captures the proportion of the variation in the dependent variable that is explainable from the independent variable. Checking the residuals of model random deviations using the Durbin-Watson test statistic and the Breusch-Godfrey test showed the absence of first- and second-order autocorrelation. Testing for heteroscedasticity (using the White, the Glaser, and the Breusch-Pagan tests) confirmed that the model residuals are homoscedastic and have constant variance. In view of the regression coefficient, it can be argued that each percentage point increase in the value added of the industrial sector causes the value added of the service sector to increase by an average of 0.719 percentage points (holding other factors constant). Consequently, the claim that industrial growth serves as a basic precondition for the development of the service sector is true and valid.

Analysis of the cross-sectoral distribution of employment in the national economy shows a consistent trend towards an increasing absolute dominance of the services sector. This dominance was evident well before 2000 and reached 63% in 2019 (Figure 5). The intersectoral flow of labor was also in favor of the service sector. The outflow of workers from the industrial sector was more intensive than from the agricultural sector. While the share of industrial employment decreased from 28% to 19% or by one third during 2000–2019, the share of agricultural employment decreased from 21 to 18% or by 14%. The general tendency of the 2000s to a decrease by an average of 1% per year in the number of employed in the economy was stronger in industry, at 3%, and in agriculture, at 2%, while in the services sector the level of employment remained

relatively stable. The process of intensive reduction in industrial employment complements the overall picture of deindustrialization of the economy.

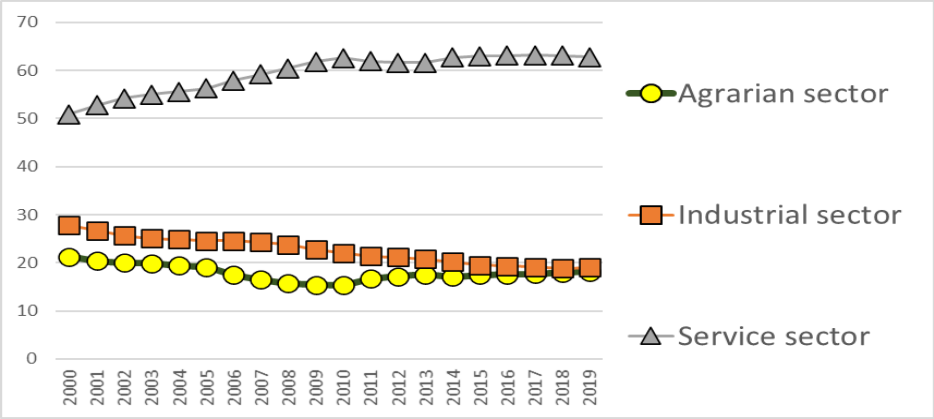

Figure 5. Sectoral composition of employment in Ukraine, 2000-2019, *%*

Source: calculations based on State Statistics Service of Ukraine data. URL: http://www.ukrstat.gov.ua/

The changes taking place in the industrial landscape of Ukraine have signs of technological simplification and narrowing of industrial diversity. The proportions in the manufacturing have changed significantly over the last decade. In particular, analysis of the data on sales of industry products (Table 1) shows the development of several trends:

- the increasing predominance of low-technology manufacturing (its share rose from 33% to 44% during 2010–2020, mainly due to an increase in the food industry and, to a certain extent, in the wood manufacturing industry);

- a reduction in the share of production facilities using medium technology. The share of medium-high-technology and medium-low-technology decreased from 17% to 14% and from 47% to 36% respectively. The backbone sector of the Ukrainian economy, metallurgy, as well as machine-building and chemical industry, are losing their importance;

- the preservation of a relatively stable and rather small importance of high-technology in the structural composition of the manufacturing industry. Some increase in the share of this category of industries in sales (from 3% to more than 4%, respectively) is due to pharmaceuticals. The rest of the industries in this group (NACE 26; 30.3) remain in the area of unstable development, with uncertain prospects for the future[3]. At the same time, this group generates almost double the share in added value of the total industry, although its reduction (from 11% to 7% in 2013–2019) indicates a decrease in the relative efficiency of these sectors.

The structural changes in the manufacturing were caused by a significant gap in growth rates between types of manufacturing. The analysis of output indices by activity (Table 2) shows that the following led to an overall decline in manufacturing volumes in 2020 compared with 2013:

[3] After 2015, Ukraine has not produced a single aircraft, although it used to produce hundreds of them every year. The future of our rocket industry is not very promising either [35].

Table 1

Industrial products sold by activity and technological categories of manufacturing in 2010–2020, *% of total*

Industrial activity; technological category of manufacturing	**NACE code - 2010**	**2010**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Manufacturing	***C***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***
food, beverages, and tobacco manufacturing	10 – 12	26.7	31.0	33.5	34.9	35.2	33.7	31.3	33.7	35.6
textiles, clothing, leather, leather goods and other materials	13 – 15	1.2	1.2	1.3	1.5	1.5	1.6	1.7	1.7	1.5
manufacture of wood, paper products, and printing activities	16 – 18	3.8	4.4	4.8	5.3	5.5	5.2	5.5	5.4	5.6
coke and refined petroleum products manufacturing	19	10.7	6.0	5.2	5.3	5.3	6.3	6.2	4.7	3.7
manufacture of chemicals and chemical products	20	4.6	5.9	5.5	6.0	4.6	4.0	4.2	4.4	4.4
manufacture of essential pharmaceutical products and pharmaceutical preparations	21	1.1	1.5	1.6	1.8	2.0	1.9	1.8	2.0	2.6
manufacture of rubber and plastic products, other non-metallic mineral products	22+23	6.5	7.1	7.1	7.5	8.2	8.2	8.5	9.0	9.7
metallurgical manufacturing, the manufacture of fabricated metal products, except machinery and equipment	24+25	28.4	25.4	26.3	24.4	24.2	25.3	26.1	23.2	23.2
mechanical engineering	26 – 30	13.8	13.9	11.3	10.1	10.0	10.3	11.1	11.6	10.8
furniture and other manufacturing; the repair and installation of machinery and equipment	31 – 33	3.2	3.6	3.4	3.1	3.3	3.5	3.6	4.3	3.2
Industry group										
high technology manufacturing		3.0	3.7	4.0	4.0	3.8	3.8	3.6	3.8	4.2
medium-high technology manufacturing		17.0	18.2	14.6	14.1	13.0	12.5	13.6	14.4	13.7

Table 1 (end)

medium-low technology manufacturing		47.2	40.3	40.7	39.1	39.7	42.0	43.0	39.5	35.5
low technology manufacturing		32.9	37.8	40.8	42.9	43.5	41.7	39.8	42.3	43.9

Source: calculations based on State Statistics Service of Ukraine data. URL: http://www.ukrstat.gov.ua/

- manufacture in the three advanced technology groups declined (high-technology by 10%, medium-high-technology by 22% and medium-low-technology by 24%), reducing their aggregate share in the manufacturing sector to 56% or by -8%. Metallurgical manufacturing, the manufacturing of computers, electronic and optical products, the manufacturing of vehicles, and the manufacturing of medical and dental instruments and supplies suffered a deep decline (over 30%). These manufacturing subsectors with reducing output still retain sufficient share in the sales volume of the manufacturing and therefore have a decisive inhibiting effect on its growth;

- a moderate upward trend in a number of items (namely weapons and ammunitions, furniture, other non-metallic mineral products, rubber and plastic products, basic pharmaceutical products and pharmaceutical preparations, food, beverages, and tobacco products, etc.) helped reduce the overall depth of manufacturing decline, but could not prevent it. The potential impact of this group of 'growth leaders' on overall industrial development is determined by their aggregate share in the sales volume of manufacturing (which reached 49% in 2020, including food processing at 35%), but they lack momentum.

Thus, the vector of transformation of the structural composition of Ukraine's manufacturing is directed towards technological simplification and narrowing of the diversity of manufacturing types. This trajectory causes risks of further deepening of the structural inadequacy of this country's economy against the background of cardinal shifts in the global economy, its diversification, generated by the technological progress of the industrial revolution 4.0.

Table 2

Indices of industrial output, by activity and technological group in Ukraine for 2014–2020, *(2013 = 100%)*

Industrial activity and technological group	2014	2015	2016	2017	2018	2019	2020
Manufacturing	90.7	78.8	83.2	87.6	90.1	90.9	85.5
High-technology manufacturing	93.3	79.2	87.2	94.2	96.5	96.9	90.1
manufacture of basic pharmaceutical products and pharmaceutical preparations	101.9	93.6	103.4	107.1	101.8	105.5	108.7
manufacture of computers, electronic and optical products	77.9	55.3	60.5	72.3	88.8	81.3	61.2
Manufacture of air and spacecraft and related machinery*		87.1	79.2	78.6	92.3	92.9	77.4
Medium-high-technology manufacturing	81.5	69.0	70.4	75.8	85.4	87.5	78.0

Table 2 (end)

Manufacture of chemicals and chemical products	85.8	70.3	72.5	74.2	85.5	96.6	101.5
Manufacture of arms and ammunition*		103.5	112.2	146.6	168.9	169.4	126.9
Manufacture of electrical equipment	100.9	83.7	90.2	101.9	107.2	101.5	100.6
Other machinery and equipment manufacturing	88.7	80.8	80.8	84.4	93.4	95.7	80.4
Manufacture of motor vehicles, trailers and semi-trailers and other vehicles	64.3	54.3	53.7	62.6	72.2	69.9	52.2
Manufacture of medical and dental instruments and supplies	88.1	49.8	43.7	45.2	45.1	45.5	43.2
Medium-low-technology manufacturing	85.7	74.7	79.6	78.6	80.3	80.8	75.7
Manufacture of coke, refined petroleum products	78.7	65.1	69.5	64.9	69.3	71.5	70.1
Manufacture of rubber and plastic products, other non-metallic mineral products	91.2	86.6	96.3	101.4	102.2	109.0	109.1
Manufacture of fabricated metal products, except machinery and equipment	85.5	73.9	77.6	75.5	76.2	75.1	68.6
Shipbuilding and boatbuilding*		89.3	88.3	100.2	108.8	126.6	100.1
Repair and installation of machinery and equipment	91.9	75.4	82.5	88.5	104.8	102.8	87.2
Low-technology manufacturing	101.5	89.0	94.6	101.2	100.4	102.3	100.9
Food, beverages, and tobacco manufacturing	102.5	91.3	98.1	104.3	102.9	106.3	105.5
Manufacture of textiles, sewing of clothes, leather, leather articles and other materials	98.6	95.1	102.7	112.6	108.8	100.6	94.5
Wood product manufacturing, paper manufacturing and printing	96.0	74.3	73.3	79.8	81.5	77.3	75.1
Furniture manufacturing	98.4	87.3	90.4	108.8	110.5	121.9	116.3
Other product manufacturing	91.5	66.0	66.4	70.6	74.9	76.7	70.1

* (2014 = 100%)

Source: calculations based on State Statistics Service of Ukraine data. URL: http://www.ukrstat.gov.ua/

The common feature of the leaders in terms of growth rate, which are activities of different technological spectrum, is the focus on meeting primarily Ukraine's domestic demand. About 75% of the total volume of products sold in this group is consumed in Ukraine's domestic market (2020), while the rest is exported. The share of exports by product type ranges from 12% (non-metallic mineral products) to 53% (furniture). Prospects for further growth of these industries depend on opportunities to enter new markets, which requires government assistance, particularly in dealing with the number of freight shipments across the border and freeing Ukrainian exporters from intrusive "tutelage" (for

example, it is known that Ukrainian furniture exports are de facto controlled by Polish and German companies, who simply re-export Ukrainian products [36]).

Another characteristic is the high dependence on imports of components for intermediate consumption, including dependence on a single supplier. In particular, the share of imported components from the category of industrial products in intermediate consumption expenditure ranges from 35% in the manufacture of fabricated metal products (NACE C25) to 75% in the manufacture of rubber and plastic products (C22) [23]. The high dependence of industrial production on technological imports increases its vulnerability to changes in external markets and suppliers' requirements. Therefore, a focus on import substitution as part of government structural policy should include the development of domestic production with a broadly diversified product range.

The group of industries that have reduced output is highly dependent on external markets - more than 53% of their output is exported (including 66% of metallurgy products, 99% of components, assemblies, motor vehicle parts and accessories, etc.). Revival of these industries requires both increased competitiveness of their products and, consequently, investment in modernization and expansion of Ukraine's domestic demand, and building long, closed production chains - from the processing of raw materials to the output of final products, which would increase income for Ukrainian producers.

To be continued in the next issue.

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СТРУКТУРНІ ЗРУШЕННЯ: ВПЛИВ НА ПРОДУКТИВНІСТЬ І ЗРОСТАННЯ ЕКОНОМІКИ УКРАЇНИ

Провідною ознакою сучасного світу стали глибокі структурні зрушення, викликані докорінними перетвореннями його індустріального ландшафту. Відповідні перетворення були спричинені змінами у внутрішній будові національних секторів промисловості і відбувалися на основі технологій "четвертої промислової революції", поява яких надала додаткового імпульсу зміні структури світової економіки, загострivши конкуренцію на світових ринках. Криза COVID послужила каталізатором прискорення змін у міжгалузевих пропорціях світової економіки, ускладнення структурних проблем, що існували раніше.

Проведене дослідження показало, що ключова особливість моделі структурних змін, які відбувалися в економіці України після світової фінансової кризи, полягала у прискореному зменшенні ваги індустріального сектора, особливо ж внаслідок втрати частини потенціалу переробної промисловості, її технологічного спрощення та звуження різноманіття видів виробництв. Зазначене супроводжувалося посиленням домінування третинного сектора та зростанням первинного. Надмірну частку у структурі виробництва посідають галузі, режим відтворення яких здатний викликати тільки відносно невисокі темпи економічного зростання – видобування корисних

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копалин і пов'язані з ним галузі первинної переробки у промисловості, сільське господарство. Така траєкторія структурних зрушень не спроможна генерувати необхідне прискорення економічного зростання, ще й обтяжена ризиками поглиблення структурної невідповідності національної економіки тим кардинальним змінам, що відбуваються у світовій економіці.

Порівняння параметрів і тенденцій структурних зрушень в економіці України та у зіставній групі країн та світі загалом засвідчило, що зміни у структурі національної економіки мали значно вищу інтенсивність, проте не зумовили створення достатнього потенціалу для стійкого економічного зростання. Проаналізовано розриви у продуктивності праці між видами економічної діяльності та секторами економіки, а також їх зсуви у динаміці, що дало підстави для висновків щодо співвідношення темпів технологічного розвитку секторів економіки та про поступове уповільнення і без того недосконалого технологічного розвитку національної індустрії з подальшою втратою нею конкурентоспроможності. Оцінено ступінь впливу таких чинників, як інвестиції та технологічні інновації, а також зрушення у структурі зайнятості на підвищення продуктивності праці в економіці. З використанням апарату економетричного моделювання оцінено параметри залежності динаміки зростання ВВП від зміни індексів фізичного обсягу ВДВ секторів економіки.

Ключові слова: *структурні зрушення, індекс структурних змін, продуктивність праці, економічне зростання, індустріальний сектор, переробна промисловість, технологічний розвиток*