

Manufacturing Divergence of National Economies

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Abstract — The development of the world economy with a predominantly service-oriented focus transforms the understanding of the importance of the manufacturing sector within the framework of updating the high-tech trends. Declining in the scale of the global economic system, industrial production is of great importance in selected national economies, enabling them to develop their real sector, generating high added value and ensuring the sustainability and competitiveness of the relevant national economic model. As part of the development of ideas of industrial areas in economic science, this paper introduces the concept of "manufacturing divergence", as well as divergent "alpha-countries" and "omega-countries". The functioning of these countries is characterized by a significant deviation from the global average for the production component. There was developed a methodological approach to the study of differentiation of production development of national economies, which summarizes the grounds that indicate a high level of production in the national economy, and there were proposed indicators of the classification of national economies to "alpha-countries". Through the application of calculating and analytical method of study and available analytical data there were revealed divergent "alpha countries", in some of them there was considered the specifics of individual production.

Keyword — *manufacturing; manufacturing divergence; gross domestic product; divergent «alpha-countries» u «omega-countries; high-tech manufacturing*

I. INTRODUCTION

Transformation of the global economy that took place at the turn of the century has shaped the structure of the global economic system. During the period of 2005-2016, world GDP increased 1.6 times and reached 75.5 trillion USD in 2016, 4% of which was provided by agriculture, 27% – by industry and 69% – by services. The share of the industrial sector (including extractive industry, manufacturing, construction, electricity, gas and water) decreased by 3% during this period, while the share of the manufacturing sector alone showed only a 1% reduction, amounting to 17% at the end of the period [21].

On the one hand, these statistics confirm the continuing downward trend in the contribution of industry (and, in particular, manufacturing) to the formation of world GDP and the corresponding increasing dominance in its structure of the service sector. The service sector of the economy is experiencing rapid development, the attractiveness of

information, financial and other service-oriented markets is growing, in turn, manufacturing industries are less attractive to investors because of the prolonged period of return on investment and, accordingly, cannot provide an increase in value added, commensurate with the scale of the service sector.

On the other hand, production of manufacturing enterprises meets the needs of the world economy, manufacturing remains the main component of the real sector, the source of high-performance jobs important for any national economy and the most important basis for taxation. In sectoral composition of top 100 multinational enterprises (MNE) 55 of them represent the manufacturing sector [22]. In 2015 foreign direct investments (FDI) in manufacturing (mainly in chemical products, food and beverages, electronics, motor vehicles and petroleum products) amounted to 7 trillion USD, that increased on 40 % since 2007 [22]. Processing is the basis of the whole industry, it serves as a basis for the development of its other sectors, increasing dependence of agriculture and the service sector on technical and technological innovations, giving them the opportunity to fight for the consumer more successfully. At the same time, the generalized indicators do not reveal the so-called "economy of differences" in the production sector, including in national models.

II. RELEVANCE AND SCIENTIFIC SIGNIFICANCE

The issues of development of manufacturing, determining its place and role in the global economic system, identifying techno trends-leaders who are the backbone "locomotives" for other industries and sectors of the economy, are today extremely relevant for both theoretical economists and for the subjects that determine the strategic development of national states.

The industrial-technocratic course of economic thought, which emerged half a century ago and was well represented by the leader of the "industrial branch" of institutionalism of J. Galbraith [3], substantiated the theory of "industrial society". This theory, developing the technocratic ideas of T. Veblen on industrial entrepreneurship as the driving force of industrial society [20] and based on the concepts of "industrial system" and "techno structure", defines in economic development the priority of a high rate of production with a mandatory active

role of the state, including strategic planning and close cooperation with corporations.

Modern authors, in accordance with the ideas of J. Schumpeter on the role of new technologies in the transformation of the world economy [16], consider the world industrial development in the economic and historical context as a consistent change in the basic technological stages ("technical and economic paradigms" by K. Freeman and C. Perez [12], "technological ways" by S. Glazev [4]), each of which provides humanity with another breakthrough in production technologies that have unique capabilities and dramatically increase productivity.

Identification of technical and technological innovation-oriented component as a basis for the development of modern industrial production determines the emergence of economic literature relevant theories, concepts and approaches.

E. Reinert, based on historical and evolutionary approaches, explains the economic prosperity of countries through the development of their manufacturing industry. According to the author, the rich countries have made great strides precisely because for decades and even centuries they founded and defended promising industries, developing production structures in sectors with a high concentration of technological progress. The development of processing industries, achieved through the combination of increasing returns (decreasing cost with increasing production volume), technological progress and the synergy provides the backbone for the economy of the country effect, forming the basis for taxation that promotes the growth of living standards of the population, the support of other sectors of the economy and spheres of public life – agriculture, social welfare, infrastructure, health, etc. E. Reinert concludes the following about the best economic policy that ensures the prosperity of the country: organization of production and export of products of manufacturing industries with rapid technological development and import of products of raw materials industries (agriculture, raw materials industries) [14]. Historical experience confirms the decisive role of strategic investments in the implementation of this policy [9].

S. Bodrunov holds similar positions on the role of industry in economic development, justifying the concept of a new industrial society of the second generation, where the dominant role of material production is the constant of the modern economy. Against the background of continuing traditional approaches to the production, the main features of industrial society-2 are the introduction of advanced technologies (nanotechnology, 3D-printing, robotics, industrial "Internet of things"), the development of remote methods of organization and management of production, the formation of network models of industrial structuring, updating the formats of interaction "state-industrial entities". At the same time, modern trends in economic development are not limited solely to reindustrialization or neoindustrialization, but represent a new industrial society of the 2nd generation based on the combination of high-tech production, science and education [2]. The introduction of the Internet of things in production processes is becoming wider due to the opportunities to improve productivity [5].

G. Kleiner believes that modern economic science needs to develop a new theory of industrial development, based on a systematic approach. The author considers the industrial activity realized at the modern hi-tech stage of the world development, as interaction of various systems including both subjects and processes, and institutes. Accordingly, the new industrial theory is based on the use of the system analysis of the theory of systems [8].

Deepening of the study of practices of deindustrialization and reindustrialization of national economies stimulated the interest in theoretical- methodological and organizational-practical issues of design and implementation of industrial policy. Currently, the understanding of the development of industrial policy as an important component of the regulatory framework for the development of industry and the need to implement such a policy through the interests of economic entities is achieved [6, 11, 19].

The importance of manufacturing production for the world economy and its individual regions, as well as the heterogeneity of the development of production systems that arises as a result of the influence of various economic factors, is of research interest [1, 15, 18]. Thus, the trade and development report (UNCTAD, 2003), based on a comparative analysis of trends in capital accumulation, economic growth and industrialization since the early 1980s in Latin America and Asia, proposes a classification of "mature industrializers", "fast industrializers", "enclave industrializers" and "deindustrializers" in relation to the countries of these regions of the world [18].

III. PROBLEM STATEMENT

The conducted study involved the solution of 2 tasks:

- To justify theoretically the understanding of "production divergence».
- To identify divergent "alpha countries" of the modern world industrial development.

There were used the following research methods:

- method of constructing the concepts (for the development of the conceptual framework for the production divergence);
- comparison method (to compare objects (countries) in order to find similarities or differences between them);
- calculation-analytical method (for implementation of calculations and systematization of data in analytical tables).

Initial analytical materials for the study:

- World Bank database (The World Bank) on world development indicators;
- Rating of the most profitable companies in the world Industry Week 2017.

IV. THEORETICAL PART

On the basis of the points of view of modern economists considered above, as well as the economic practice of organizing the national production sphere implemented by the countries, it is possible to form priority grounds that indicate a high level of development of manufacturing industries in a particular country.

The first group of such grounds includes contribution of manufacturing industries to national GDP and the dynamics of the increase in their value added. In a modern service-oriented economy dominated by a service sector that produces relatively rapid returns on relatively low investment, the share of processing in the structure of GDP of one fifth or more should be considered as high. In this case, it is possible to estimate the scale of the presence of the production sector in the national economy, the productive part of its real sector, which determines the development of other sectors, including service and socially-oriented. In turn, the multiplicity of the increase in the total value added of manufacturing, for example, in the 10-15-year retrospective, in absolute terms shows the real result of the operation of manufacturing in terms of support for the national economy.

However, the above grounds are clearly insufficient for an objective assessment of the national productive sector. Using only these criteria for analysis mistakenly classifies countries (often small ones) that have significant in volume, but from the point of view of the world economy, low-tech industries with primitive methods of production to highly developed production countries. Of course, it will be incorrect in the conditions of actualization of the prospective techno trends and techno trend that are demanded by world consumers.

Therefore, the second group of grounds should include the dynamics of the average annual growth of manufacturing industries and the share of high-tech exports in the structure of industrial exports. The average annual growth of manufacturing industries in previous years makes it possible to talk about the development potential of this sector of the economy, the use of organizational-managerial and technical-technological approaches that can meet consumer demand and provide increased returns. In turn, the level of high-tech manufacturing exports is evidence of the high competitiveness of the country, the use of modern technologies in manufacturing, which form a high added value of the final product and the availability of demand for these products in the world market.

The use of the second group of grounds without the first is also undesirable, otherwise high-tech and steadily growing, but the single production for the country with little presence of other actors in the manufacturing sector, may mistakenly be considered as an evidence of the high production development of the country.

The substantial differentiation of countries among themselves and in comparison with the global values observed on these grounds makes it possible to identify these deviations as the manufacturing divergence of national economies in world development.

Manufacturing divergence is the level of development of manufacturing industries in national economies that deviates relatively to the world average or average in a group of countries (by income). Divergent "alpha-countries" and "omega-countries" are countries that deviate from divergence points in different polar directions as much as possible on the production level. Divergence points (in the context of this study) are the global and intercountry (comparable income) levels in terms of the share of manufacturing in national GDP, the average annual percentage increase in manufacturing (value added), the change in the volume of value added in manufacturing industries (in monetary terms) and the share of high – tech exports in the structure of manufacturing exports.

Manufacturing "alpha-countries" of the world production development are the national states with the dominating hi-tech level of development of the processing sector of the industry which are significantly deviating from the average world level. Manufacturing "alpha-countries" include states that demonstrate the highest possible exceedance of all of the following national indicators relatively to the world average and the corresponding group of countries in terms of income (by the World Bank classification):

- indicator 1 (I 1): share of manufacturing in national GDP
- indicator 2 (I 2): average annual growth in manufacturing
- indicator 3 (I 3): change in value added in manufacturing
- indicator 4 (I 4): share of high technology exports in the export structure of the manufacturing industries

V. RESULTS OF RESEARCH

As it was already mentioned, the production sector forms one sixth of the world's GDP, but in terms of the national economy, its value is divergent.

Based on the available World Bank database [21], it follows that in 2016 in about 20% of the countries with total GDP, which is 40% of the world's total, the share of processing in national GDP was from 17% to 35%, including 8 G20 member countries among them.

In the period of 2005-2016, the share of manufacturing in national GDP increased (in some cases, it has not changed) in almost 50 countries, in over three dozen countries with GDP of at least 10 billion USD (as of 2016) the contribution of refining to GDP increased from 1% to 13 %. In every third country where the manufacturing sector grew at an average annual rate during the period under review, the growth rate was higher (or equal) than the growth rate of the relevant national service sector. Moreover, in the vast majority of these countries manufacturing industries have also grown faster than overall national GDP.

The solution of the problem of identification the divergent "alpha-countries" of the modern world production development with use of the calculation and analytical method

of research as well as method of comparisons, has led to obtaining the following results (table. 1).

TABLE I. INDICATORS OF MANUFACTURING DIVERGENCE OF «ALPHA-COUNTRIES», %

Countries	I 1	I 2	I 3	I 4
	2016	2000-2016	2015 relatively to 2000	2016
Ireland (hi)	35	5	332	29,8
China (umi)	29	10,7 ^a	744	25
South Korea (hi)	29	5,7	156	26,6
Singapore (hi)	20	5,5	120	67,4
World	17	2,1	105	19,2
Countries of the upper middle income (umi) group	21	...	381	19,8
Countries of the high income (hi) group	15	1,5	40	19,6

^a All industry

As it can be seen from the data of table 1, at the moment 4 countries – Ireland, China, South Korea and Singapore – can be attributed to the divergent "alpha countries". Countries such as Switzerland, Malaysia, Philippines, Thailand and Vietnam are also very close to these indicators.

Ireland is one example of divergent "alpha countries". During the period under review in Ireland the share of processing industries in GDP has increased from 22 % to 35 %, this allowed it to become a world leader among countries with income from "below average" to "high" on this indicator. Why a European country that is one of the least industrialized and has the average income has shown such a result?

One of the reasons is strategically set priorities in the selection of key sectors for national development. Some time ago in Ireland there was placed a bet on the chemical and electronic industry, which eventually form today two thirds of the national industry (chemicals and chemical products – 12 %, basic pharmaceutical products and preparations – 43.7 %, computer, electronic, optical and electronic equipment - 11 %). At the same time, almost a half of the Irish industry is pharmaceuticals, which largely determines the 5% annual growth of manufacturing industries since 2005 and the mentioned overall high contribution of processing to GDP.

The second reason is a purposeful and consistent policy of attracting investments, mainly foreign ones, into rapidly developing high-tech and knowledge-intensive sectors of the national economy. Thus, in 2015, the Irish economy attracted more than 188 billion FDI, which corresponded to the second place in the world and amounted to almost 40% of the inflows of FDI to the EU [22].

The rapid development of pharmaceuticals and electronics in Ireland led to an unusual phenomenon for the current stage of the global economy – a reduction in the share of the service sector in GDP (from 64% to 60%). This was largely influenced by the increase (in 2000-2015) of the total value

added generated by the manufacturing industry by 4.3 times (by 2016 in absolute value it was equal to almost 100 billion USD), including its 30% high-tech exports. It is not surprising that such industrial development has had an impact on national productivity. Thus, in Ireland, GDP growth per employed person (labor productivity) amounted to 10.6% at the global level of 1.8 % – this is the highest figure in the world, the nearest value is in China (6.4 %).

It is significant that, for example, Singapore has the same "top three" of similar industries in the national manufacturing industry, but with a different ratio (2017): computer, electronic and optical products – 32.9 %, chemicals and chemical products – 16.2 %, pharmaceutical and biological products – 13.6 %, i.e., these sectors account for almost 63% of the entire manufacturing industry [10].

The fact that one of the most dynamically developing and high – value-added industries are pharmacology and electronics confirms the annual rating of the world's most profitable companies Industry Week-2017. Thus, in 2017, every fifth company out of the first hundred of this rating works in the field of production of computers, electronic equipment and products, 7 companies are pharmaceutical companies, and they rise higher every year according to the criterion of profitability [17]. In the rating Industry Week-2017 the most profitable pharmaceutical company out of the first hundred took 38th place.

In turn, one of the most important reasons for the increasing production capacity of China and South Korea and their ranking among the divergent "alpha-countries" is the development of promising global techno trends, including robotics. At the present stage, China and South Korea consume half of the industrial robots from the total volume of the 15 largest national markets (2016), and only China consumes a third (87 thousand units) [13].

Of course, the high level of production of "alpha-countries" is the result of the work of large companies of the relevant manufacturing industries with both national and foreign jurisdiction. In China, Singapore and Ireland there is quite a large number of foreign affiliates of MNE that form to the national economy value added in manufacturing.

The developed methodological approach to the study of differentiation of production development of national economies is based not on the selection of countries with a predominant contribution to the technical and technological production development of the world economy and the countries-the primary sources of technological innovation, but on the identification of countries with a significant scale of high – tech and export-oriented manufacturing, ensuring the sustainability of development for a particular national economy. Distinctive feature of such countries ("alpha-countries") is the classification of their own production sector (including foreign affiliates with foreign jurisdiction) as one of the priorities in the structure of the national economy, focusing on the production of high-tech products based on modern methods and advanced technologies, as well as creating conditions for attracting investment in manufacturing.

VI. CONCLUSION

The introduction of the concept "manufacturing divergence" develops technical and industrial concepts, theories and paradigms of modern economic thought, allows a deeper understanding of the "economy of differences" in the world of industrial development. The selection of "alpha-countries" on the basis of criteria I1, I2, I3 and I4 within the framework of the developed methodological approach makes it possible to identify the best national practices in the organization of the production sector and the choice of technical and technological priorities, which allows to generalize the basic laws in this area for their subsequent consideration in the development and implementation of plans and programs of global economic development. The identification of "omega-countries" increases the targeting of such global programs.

According to the study, the intensification of the production sector is now typical for many states, but the functioning of manufacturing industries as the dominant of the real sector of the national economy from the standpoint of the maximum positive deviations in the scale in the GDP structure, growth potential and high-tech is observed in the "alpha-countries". High-tech and medium to high-tech manufacturing occupy a large share in the overall structure of manufacturing in "alpha-countries" with a significant potential for creating added value.

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