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A new industrial strategy for Europe – new indicators of the results of its implementation

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ABSTRACT

This paper discusses the experiences resulting from EU's adoption and implementation of a wide variety of policy measures in response to the COVID-19 crisis. These measures included stimulating the relocation and expansion of manufacturing to reduce vulnerability, depending on imports, ensuring the stability and development of industrial production. Using the example of the pharmaceutical industry in EU27 in the years 1995–2018, the study proposes and tests a new approach to assessing the consequences of relocation policies aimed at developing the local production potential, increasing the value added by activity, and expanding the share of local value added in industry exports. Specifically, the focus is on the formation of statistical analysis tools for assessing the changes of the specialisation and identifying the country's comparative advantages. The authors propose new indicators: RSP – coefficient of Revealed Specialisation of Production, CAVA – coefficient of Comparative Advantage in Value Added by Activity and EVA – coefficient of Comparative Advantages in the Domestic Value Added Exports. Additionally, formulas for their calculation are provided which allow the assessment of the position of Ukraine's industries among a reference group, widening the 'revealed comparative advantage' concept. Finally, a test of the new methodology showed that it can be used to identify the comparative advantages of EU member states supported by state assistance programmes involving the implementation of business projects which aim to develop domestic production.

Key words: indicators, specialization, comparative advantage, industrial production, value added activity, export.

1. Introduction and motivation

The COVID-19 pandemic has affected industrial production in all countries of the world more than any economic shock that has occurred over the past few decades (such as the crises of 1997-1998 and 2008-2009). The closure of foreign counterparty

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plants due to a lockdown; the introduction of a ban by the governments of individual countries on the export of goods of strategic importance; the blocking of air and sea transportation caused a shortage in the market of both intermediate and finished industrial goods (Barlow et al., 2021; Kumar et al., 2020; Vo et al., 2021). As the study showed (Tirivangani T. et al., 2021), weak pharmaceutical systems and supply chains turned out to be the most vulnerable in the control of COVID-19 pandemic, that has mostly devastated public health systems and livelihoods in resource-limited countries. The concentration of active pharmaceutical ingredients (API) production and certain medicines in the Asia-Pacific region also has led to interruptions in European health care systems. The crisis situation has clearly demonstrated European's pharmaceutical industries unpreparedness to face such challenges and threats (European Commission, 2020a). Analysis of the root causes of the crisis phenomena in industry has shown that they are a consequence of the delocalization of industrial production in Europe, which has taken place over the past few decades (European Parliament, 2020). The closure of many Europe-based facilities for the production of drugs, health products, API and other intermediate goods has made the health care system and industry hostage to a virtually single producer and supplier of certain goods - on China, significantly weakening the sovereignty of EU member states. The technological, human and manufacturing resources available in the EU are capable of expanding API production and therefore do not have a technological dependency. However, with globalization and offshoring, as well as the active policies of the Chinese government (Wang, 1999), such form of industry dependency developed, which can be called "component dependency".

Its implementation prompted the EU leadership to adopt a number of strategic documents focused on reducing the vulnerability and economy's dependence (Grumiller, 2021). In November 2020, the Pharmaceutical strategy for Europe was adopted, which should ensure synergy with the relevant EU policies on R&D, innovation and industrial production, in accordance with priorities of a New industrial strategy for Europe, adopted in March 2020. The latter was adjusted in May 2021 based on new challenges of the COVID-19 pandemic. In particular, among its new priorities is ensuring sustainability and reducing the dependence of industrial ecosystems, among them – health care, the foundation of which is pharmaceuticals (European Commission, 2020b, 2021). These are being implemented, inter alia, through strengthening the location-specific advantages (the so-called L-advantages) in accordance with the paradigm of OLI-advantages of J. Dunning (Dunning, 1993).

For implementation of priorities, the European Commission introduced, among other things, an investment assistance mechanism for the production of products related to COVID-19 (which allows compensating up to 80% of business costs for the project). This category of products includes not only those related to pharmaceuticals, such as medicines (including vaccines) and their intermediates, APIs and raw materials, but also products of other industries: medical devices, medical equipment and

necessary accessories for them; disinfectants and their intermediates, chemical raw materials, etc. Germany, France, Poland and a number of other countries interested in developing their own industry have received the consent of the European Commission to provide financial assistance to companies for R&D projects related to COVID-19, investments in the creation of appropriate research infrastructure, as well as investments in production facilities related to COVID-19 (European Commission, 2020c, 2020d, 2020e). It is obvious that the new EU state aid mechanisms, as well as decisions of business on the implementation of investment and innovation projects will form new capacities in European countries: contribute to increasing gross output by industry, to creating high added value, to raising exports. No doubt, these processes are going to influence structural shifts and specialization in the economy not only in Europe, but also in the world, and therefore new indicators are needed to adequately assess the impact of such policies.

The measurement of post-coronavirus economic transformations is a particular challenge for statisticians. Eurostat and the National Statistical authorities of the European statistical system have developed a number of guidelines and methodological notes in the context of the COVID-19 crisis for monitoring economic processes (Eurostat, 2021a). At the end of 2020, Eurostat launched a new tool related to the COVID-19 crisis in various EU member states. It contains monthly and quarterly indicators on a number of statistical areas that are important for tracking economic and social recovery after the pandemic. These are about 20 indicators covering such aspects as macroeconomic changes, business (including industrial production) and trade, as well as the labour market (Eurostat, 2021b). At the same time, in our view, new approaches are also needed to assess the impact of measures (taken by the EU and Member States) aimed at developing local productive capacities, adding value and increasing the share of local value added in exports, strengthen competitive advantage.

The object of this paper is to provide a toolkit for assessing the positions of countries in the international division of labour: changes in the specialization, in the creation of value added and exports by relying on local resources and location advantages of industries in EU. To analyse the current and future advantages of EU member industries, the author's tools is proposed (the foundation of this tool is laid in the work devoted to new approaches to determining international comparative advantages (Salikhova, 2012).

3. Methodical approaches

Traditionally, RCA (Revealed Comparative Advantage) has been used to measure the comparative advantages identified, calculated from a formula proposed by B. Balassa in 1961 (Balassa, B. 1961, 1989; Dunning, 1992). A number of studies indicate

that the development of foreign trade is a proof of the formation of international competitive position and at the same time international competitiveness of the national economy, its key industries, including pharmaceuticals (Falkowski, 2018a, 2018b; Motoryn et al., 2020).

In essence, the approach to calculating RCA is based on the concept of advantages in the Ricardian understanding of economics, which is inspired by free trade and perfect competition. But the modern world economy, and especially activities in fostering local pharmaceutical industry in developing countries, is based on other principles. The market of medicines is characterized by imperfect competition; states intervene in economic processes through various regulators, incentives, covert protectionist instruments. A number of countries have established strong pharmaceutical industries with a high export potential thanks to TNC investment and the transfer of technologies. The classical RCA in that case allows to estimate more visible than Revealed (or real) comparative advantages in the trade of goods, because the indicator does not take into account the local value added in export.

To assess the advantages of the location of firms and industries in the country, the authors propose to introduce into scientific circulation the coefficient of *Revealed Specialization of the country's Production* (*RSP*). *RSP* characterizes the extent of specialization of a country in the production of a particular product (or products of a particular industry) compared to the industry structure of the reference group. It shows structural change in the country's manufacturing specialization and is calculated using the formula:

$$RSP_{ij} = \frac{P_{ij}}{\sum_{i=1}^{I} P_{ij}} \div \frac{\sum_{j=1}^{J} P_{ij}}{\sum_{j=1}^{J}\sum_{i=1}^{I} P_{ij}}, \quad (1)$$

where P_{ij} - production (gross output) of j-th industry of i-th country;

$\sum_{i=1}^{I} P_{ij}$ – total production of j-th industry of I reference group countries (EU, OECD, World) $i = \overline{1, I}$;

$\sum_{j=1}^{J} P_{ij}$ – total production of J industries of i-th country $j = \overline{1, J}$;

$\sum_{j=1}^{J}\sum_{i=1}^{I} P_{ij}$ – total production of J of industries of I reference group countries.

A relative location advantage of a production in a country exists if the value of *RSP* > 1, that is, the country's share in the gross output of a particular industry is greater than the share of the country's total output in the total indicator of the reference group (EU, OECD, World). The RSP indicator measures the extent to which a country has the

advantages of an industry location (in line with the OLI advantages paradigm of J. Dunning) compared to other countries in the reference group.

To reflect the value added created as a result of the goods' production, the indicator "value added by activity" is used, measured as the cost of products less the cost of intermediate consumption. To assess the advantages of the country in creating added value in the conditions of relocation of production of goods and components, the authors suggest using the coefficient of *Comparative Advantage in Value Added by Activity* (*CAVA*), calculating it using the formula:

$$CAVA_{ij} = \frac{VA_{ij}}{\sum_{i=1}^{I} VA_{ij}} \div \frac{\sum_{j=1}^{J} VA_{ij}}{\sum_{j=1}^{J}\sum_{i=1}^{I} VA_{ij}}, \tag{2}$$

where VA_{ij} – added value of j-th industry of i-th country;

$\sum_{i=1}^{I} VA_{ij}$ – total value added of j-th industry of I countries of the reference group (EU, OECD, World) $i = \overline{1, I}$;

$\sum_{j=1}^{J} VA_{ij}$ – total value added of J industries of i-th country $j = \overline{1, J}$;

$\sum_{j=1}^{J}\sum_{i=1}^{I} VA_{ij}$ – total value added of J industries of I countries of the reference group.

There is a relative advantage if the value $CAVA > 1$, i.e. the share of value added of a particular industry in a country in the value added of that manufacturing in the reference group countries, exceeds the share of total industry value added that country in the total manufacturing value added of the countries of reference group.

To assess the value added created by the country's activities in the production of goods for export, the OECD accumulates statistics of foreign trade on value added (TiVA database). This database accumulates, among other things; data from the indicator "domestic value added in gross exports" (labelled as EXGR_DVA). This indicator is calculated as the difference between gross output in core prices and intermediate consumption in purchase prices. Internal value added can be decomposed into the following components: employee remuneration; gross operating income; mixed income; production taxes less production subsidies (OECD, 2021). The scientists named this indicator "Value-Added Exports" and used as a measure of the domestic value added embodied in exports (Johnson, 2014).

To assess the comparative advantages of a country in a particular industry export of goods, the authors suggest using coefficient of Comparative Advantage in Embodying Domestic Value Added in Exports (*EVA*), calculating it using the formula:

$$EVA_{ij} = \frac{ExDVA_{ij}}{\sum_{i=1}^{I} ExDVA_{ij}} \div \frac{\sum_{j=1}^{J} ExDVA_{ij}}{\sum_{j=1}^{J}\sum_{i=1}^{I} ExDVA_{ij}}, \quad (3)$$

where $ExDVA_{ij}$ – domestic value-added exports of *j*-th industry of *i*-th country;

$\sum_{i=1}^{I} ExDVA_{ij}$ – total domestic value-added exports of *j*-th industry of I countries of the reference group (EU, OECD, World) $i = \overline{1, I}$;

$\sum_{j=1}^{J} ExDVA_{ij}$ – total domestic value-added exports of J industries of *i*-th country $j = \overline{1, J}$;

$\sum_{j=1}^{J}\sum_{i=1}^{I} ExDVA_{ij}$ – total domestic value-added exports of J industries of I countries of the reference group.

Relative advantage of *i*-th country in embodying domestic value added in exports of *j*-th industry exists if the value of $EVA > 1$. That is, when the industry export of goods with added value of the country in the structure of industry exports of the reference group is higher than the total industrial export of goods with added value of the country in the structure of total industrial exports of the reference group. This indicates that the country is making more effective use of its comparative advantages in creating added value based on local resources, translating it into export-oriented goods.

3. Empirical analysis

At first glance, the EU27 pharmaceutical industry shows a strong position: in terms of value added in 2019 EU ranked first in the world, ahead of its main competitor, the United States, with $174,832 million against $168,517 million (OECD, 2021). The lockdown in early 2020 and supply problems pharmaceuticals (on both the export and import sides) came as a shock to the EU27 pharmaceutical industry. However, at the year-end the industry did not lose but increased export of drugs and medical devices by 5% (Table 1).

Table 1. Dynamics of extra-EU exports of basic pharmaceutical products and preparations from 2019 to 2020, EUR million

Country	2019	2020	2020/2019, %
Germany	48 412	50 086	3.5
Ireland	38 629	40 249	4.2
Belgium	28 910	33 180	14.8
Netherlands	22 437	22 159	-1.2
France	17 794	17 748	-0.3
Italy	15 974	15 578	-2.5
Denmark	6 863	7 345	7.0
Sweden	6 621	6 805	2.8
Spain	4 972	4 995	0.5
Austria	4 524	4 976	10.0
Slovenia	3 100	4 557	47.0
Hungary	1 809	2 041	12.8
Poland	1 151	1 260	9.5
Other EU countries	4 046	4 369	8.0
EU27	205 242	215 348	4.9

Source: Eurostat's data, https://ec.europa.eu/eurostat/data/database.

Taking into account the statistics of trade on added value (OECD, 2021), from Figures (1 and 2) it can be seen that since 1995 EU27 the upward trend in gross pharmaceutical exports. At the same time, the share of foreign value added in it increased from 7.0% (1995) to 17.8% (2018), while this indicator for the main competitors, the United States, China, India, is 10.8%, 11.4% and 15.0%, respectively.

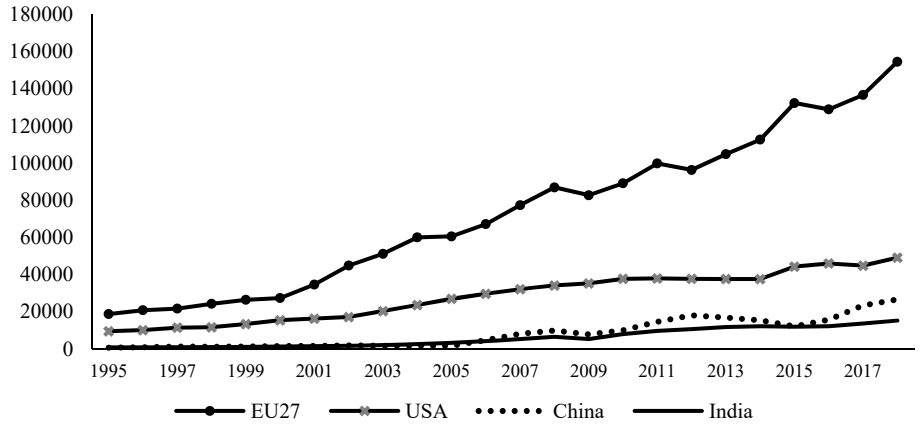

Figure 1. Dynamics of gross exports pharmaceuticals US Dollar, Millions.

Source: TiVA database OECD, www.oecd.org/

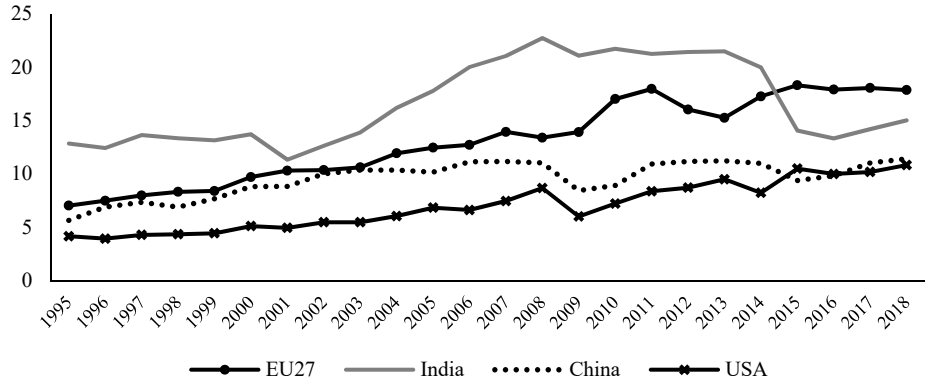

Figure 2. Dynamics of foreign value added share of gross exports, %.

Source: TiVA database OECD, www.oecd.org/

Increase in foreign value added share of gross exports confirms the hypothesis that RCA allows to estimate more visible than revealed comparative advantages in the trade of goods; that RCA cannot be an indicator that uniquely characterizes international competitiveness of the national economy in the face of the globalization with a outsourcing and offshoring of production; and that new approaches are needed to evaluate comparative advantages.

In the calculation of the author's indicators, formulas 1-3 use statistics of indicators from the TiVA database (OECD, 2021) for industry D21 Pharmaceuticals, medicinal chemical and botanical products:

for P_{ij} : PROD indicator: Production (gross output),

for VA_{ij} : VALU indicator: Value added,

for $ExDVA_{ij}$: EXGR_DVA indicator: Domestic value added content of gross exports.

The EU27 countries were selected as the reference group. The calculation results indicate the following.

RSP of pharmaceutical industry in the countries of EU27 shows (Figure 3, the author's calculations of Formula (1)) that in 1995 12 countries of this reference group had an indicator value more than 1, that is, they were specialized in the production of pharmaceutical products. But by 2018, most of them had lost that advantage. Only the industries of Ireland, Denmark, Belgium, Slovenia and Malta remained specialized, and changes in Cyprus' economic policy in terms of increasing the advantages of location to attract foreign investment in the development of pharmaceutical enterprises in the country contributed to obtaining advantages in this industry.

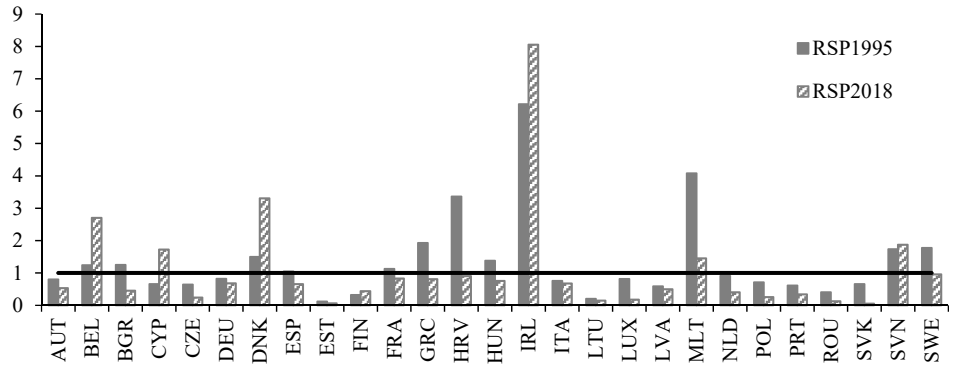

Figure 3. RSP of pharmaceutical industry in the countries of the EU27 reference group for 1995 and 2018.

Source: The author's calculations according to formula (1) based on the OECD TiVA Database.

EU27 countries pharmaceuticals' CAVA shows (Figure 4, the author's calculations of Formula (2)) that in 1995, 10 out of 12 countries that had a production specialization in this industry according to the RSP, showed advantages in creating added value. Two countries (Bulgaria and Spain) did not show any advantages, that is, the local industry relied heavily on foreign pharmaceuticals substances and value-added created abroad. By 2018, Ireland, Denmark, Belgium and Slovenia still had the advantage. Cyprus also joined them.

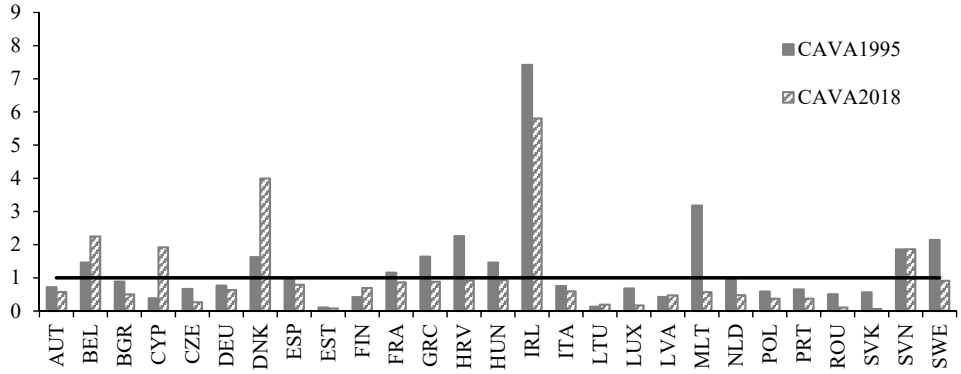

Figure 4. CAVA of pharmaceutical industry in the countries of the EU27 reference group for 1995 and 2018.

Source: The author's calculations according to formula (2) based on the OECD TiVA Database.

But the loss (or absence) of a country's advantage on CAVA of pharmaceuticals in the EU27 reference group does not necessarily mean the loss (absence) of such an advantage in the global economy (Figure 5, the author's calculations of Formula (2)).

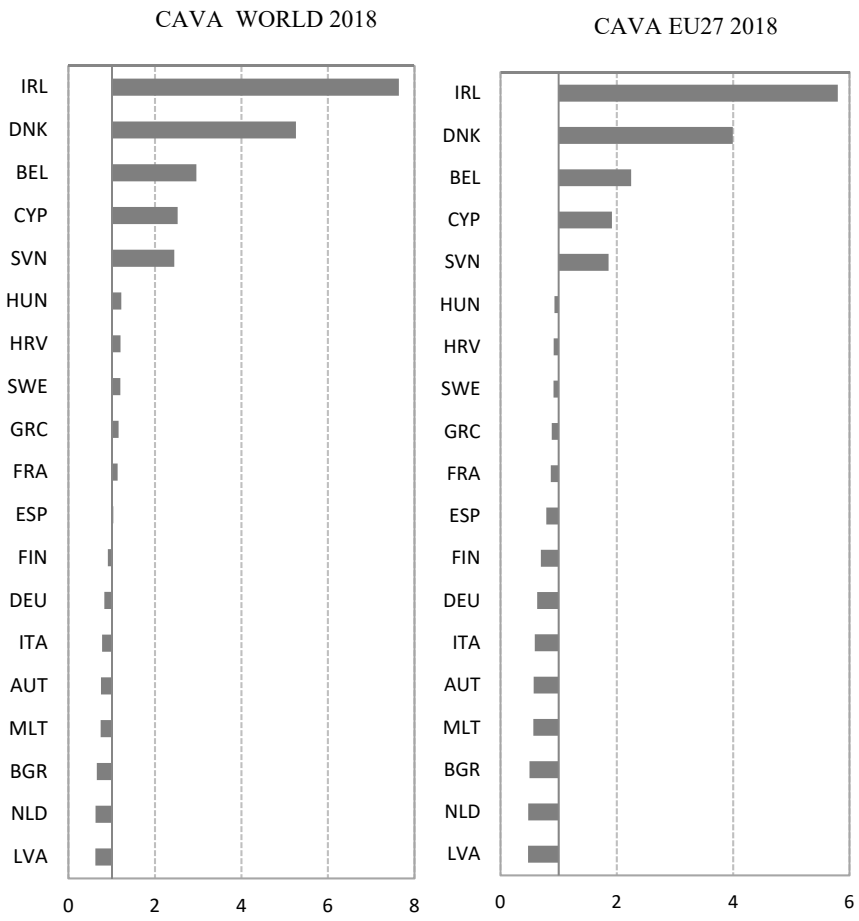

Figure 5. CAVA of pharmaceutical industry in the countries of the reference group: WORLD and EU27.

Source: The author's calculations according to formula (2) based on the OECD TiVA Database.

As an example, France has different values of the CAVA of pharmaceuticals for different reference groups (Figure 6, the author's calculations of Formula (2)). Against the background of countries around the world (the OECD provides statistics in TiVA Database for 66 countries and "other" countries around the world (OECD, 2021), France continues to have advantages in creating added value by pharmaceuticals (from 2013 there was a downtrend), while inside the EU27 the country no longer has advantages.

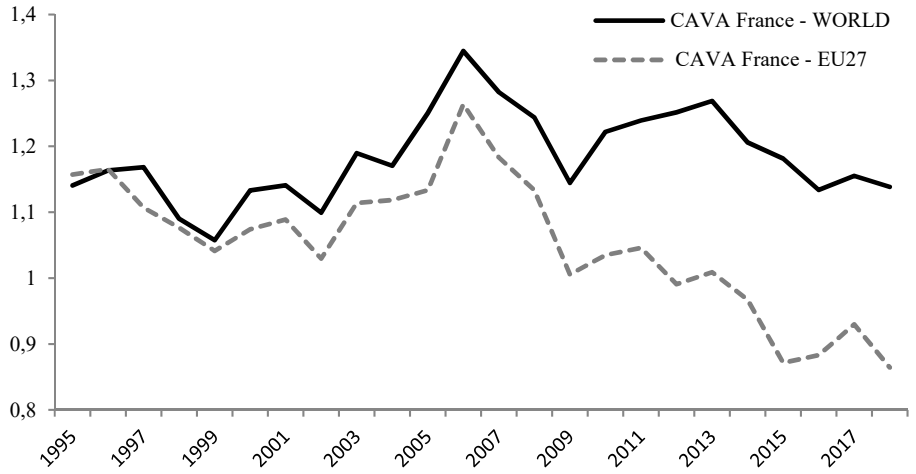

Figure 6. Trend *CAVA* pharmaceuticals industry France by reference groups of WORLD and EU27.
Source: The author's calculations according to formula (2) based on the OECD TiVA Database.

The *EVA* revealed the comparative advantages of 10 EU27 countries in the export of pharmaceutical products in 1995. But by 2018, Bulgaria, Italy, France, Croatia and Sweden reduced the volume of domestic value added embodied in exports, having increased the content of foreign components, which resulted in the loss of their positions (Figure 7, the author's calculations of Formula (3)). Only 6 countries – Ireland, Denmark, Belgium, Slovenia, Malta held and Cyprus increased their comparative advantages in domestic value added export compared to other EU27 countries.

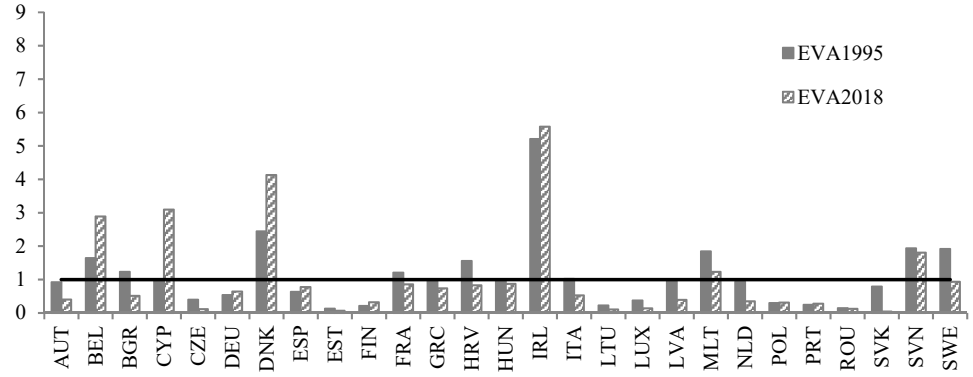

Figure 7. EVA of pharmaceutical industry in the countries of the EU27 reference group for 1995 and 2018.

Source: The author's calculations according to formula (3) based on the OECD TiVA Database.

For a better graphical representation of the calculated coefficients of RSP, CAVA, and *EVA* of pharmaceutical industry in the countries of the EC27 reference group in 1995 and 2018, the natural logarithm of their values was used. Belgium, Denmark, France, Croatia, Ireland, Malta, Slovenia and Sweden had advantages in the production, value added and export of pharmaceuticals in 1995 (Figure 8, the author's calculations of the Formula (1), (2), (3)). A number of countries, the like of Bulgaria, Hungary, and Greece, demonstrated advantages in the pharmaceutical industry only by two coefficients.

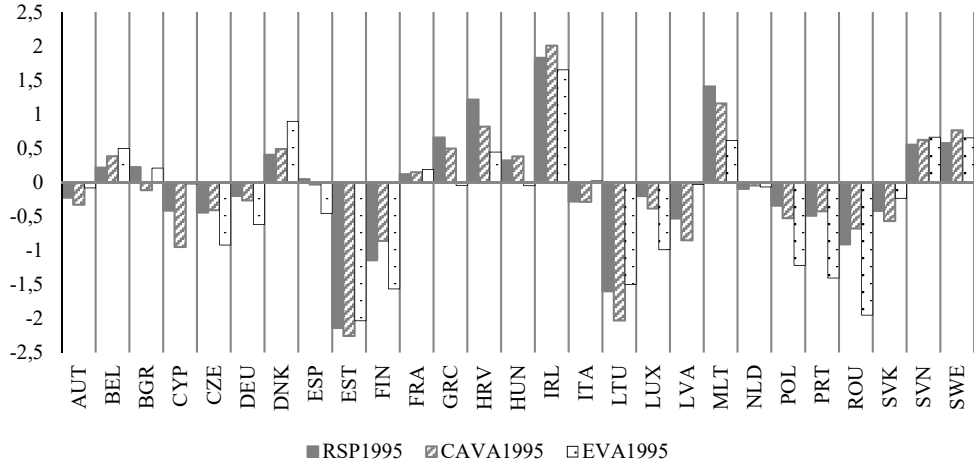

Figure 8. Diagram of RSP, CAVA, EVA of pharmaceutical industry in the countries of the EU27 reference group (1995), filed on a logopharific scale.

Source: The author's calculations according to formula (1-3) based on the OECD TiVA Database.

According to the results obtained (Figure 9, the author's calculations of the Formula (1), (2), (3)), today EU27 has formed a narrow circle (Belgium, Cyprus, Denmark, Ireland, Slovenia) of undisputed leaders in terms of specialization and comparative advantages in pharmaceuticals' production, value added and exports against the background of other industries. Malta has no advantages in creating added value in pharmaceuticals.

Summarizing the above, we can say that on the eve of the crisis phenomena in the economy caused by the pandemic and changes in the European policy with the adoption of "A new industrial strategy for Europe", six EU27 countries showed the specialization of pharmaceuticals industry and the ability of the sector to obtain higher added value (based on local resources) compared to the values of the indicators of other manufacturing of the reference group. Although many issues remain unresolved in the statistical tools for analysing countries' positions in the global economic system,

applying the author's approach to assess the consequences of the new mechanisms of EU industrial policy will reveal changes in the specialization and increase of competitive advantages of industries by increasing domestic value added.

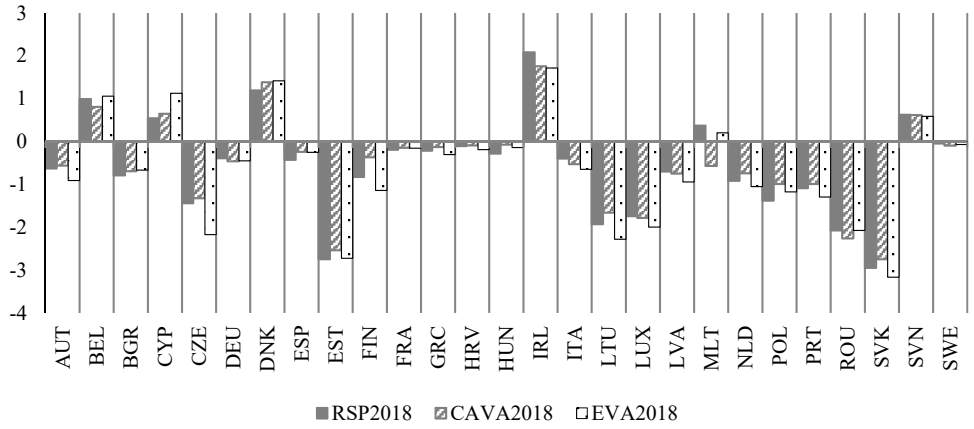

Figure 9. Diagram of RSP, CAVA, EVA of pharmaceutical industry in the countries of the EU27 reference group (2018), filed on a logopharific scale.

Source: The author's calculations according to formula (1-3) based on the OECD TiVA Database.

4. Conclusions

According to the study, the new industrial policy of the EU and member states regarding pharmaceuticals manufacturing and the adoption of a number of relevant strategic documents provide for implementation of mechanisms to eliminate the consequences of the delocalization strategy and reduce dependence on offshore production of both API and finished medicines. The introduced tools for providing state financial assistance for the implementation of investment and innovation projects for the development of production capacities related to COVID-19, encourage the expansion of the "product portfolio" of existing companies, the creation of new enterprises "from scratch" and/or reshoring (in some cases – backshoring) of pharmaceutical industries from Asia to the territory of EU member states. The toolkit created by the authors (the introduction of indicators into scientific turnover: RSP – coefficient of revealed productive specialization, CAVA – coefficient of comparative advantage of the country in the creation of value added and EVA – coefficient of comparative advantage in the domestic value added exports) would permit analysis of the position of industries in the country to assess changes in specialization and location advantages of industries in Europe as a result of the outcome of the priority goals for the EU.

Calculation of RSP, CAVA, EVA indicators for pharmaceuticals industry based on the results of the first 3 years of implementation of the new EU goals on production relocation and comparative analysis of data from 2013 to 2018 are considered by the authors as areas of further research. At the same time, the proposed author's approach should be used in assessing not only pharma, but also other high-tech manufactories that are the basis of industrial ecosystems identified as priorities in "New industrial strategy for Europe" and also to complement it by the approaches to study trends in the globalization of high-tech production through monitoring and analysis of foreign trade in intermediate high-tech goods.

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