



REVISITING THE DETERMINANTS OF THE COUNTRIES' ECONOMIC TRANSFORMATION

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ABSTRACT

In this paper, the Economic Complexity Index (ECI) is considered in the context of the country's economy complexity increasing the chances for its successful economic development. The ECI evaluates how developed the country is, taking into account the presence of many and different sectors of the economy, and enables to compare more than 120 countries for almost 50 years, including large group of developing countries, which are often excluded from the databases. In the research, the indicator characterizing the degree of transformations is the Bertelsmann Foundation's Transformation Index (BTI) for the state of political and economic transformation (this indicator is calculated only for countries without the established democracies) is also used with the aim to find spatial autocorrelation between the mentioned indices. Thus, according to the results of the research among 102 countries of the world, which still do not have the established democracies, according to the calculations performed, have the biggest chances for diversifying their own economies, and, consequently, the successful development, the following can be noted: United Arab Emirates, Czech Republic, Estonia, Croatia, South Korea, Lithuania, Latvia, Poland, Singapore, Slovenia, Uruguay. Also, according to the study results, the connection between the components of the political and economic transformation and economies' complexity is confirmed, which enabled to defined such determining characteristics of economic transformation for the country as the level of the Socio-economic Development, the Welfare Regime, the Sustainability. At the same time, it is proved that the political transformation has significantly less effect on the success of development than economic one.

Keywords: GDP, Value added, Economic complexity, Economic transformation, Political and economic transformation economic growth

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1. INTRODUCTION

Due to the dynamic development of the world economy, globalization tendencies, informational and technological booms, which ensure the openness of world economies, exchange of resources between the countries for general economic growth, the researches that focus on the search of effective and efficient models of economic systems development in different countries of the world, are relevant. Thus, one countries develop very rapidly at the account of revolutionary innovations in the sphere of medicine, technics, engineering, etc., and other countries cannot overcome hunger, poverty, and ensure the economic and social conditions of the population development. Too uneven development of different regions of the world actually leads to the situation that on the difficult way of mankind global evolution there are one countries that irrevocably stay behind the general economic growth rates.

The reasons for the success of separate economies are (in the opinion of different authors): development of industrial production, export diversity, general political stability, complexity of product structure, etc. Thus, according to yearly UNO report "Human Development for Everyone", one of the determining factors is an indicator of population, human capital, welfare growth. But the "human development" growth rates are too different in different countries and regions of the world. Separate countries actually appear to be behind active development process, taking place in the world, having no time to adapt their own economic systems to technological, informational and other socio-economic transformations.

The diversity of approaches to defining the factors that lead to economic boom in one countries and economic decline in other countries determines the need for developing scientific and methodological approaches to the search of effective and efficient models of economic systems development in different countries of the world. Taking into account the possibility of finding the most effective instruments that influence the economic development in the country, the aim of this research is to find the determinants of the countries' economic development based on the ECI, which characterizes the structure of the countries' economy.

The economic growth of separate countries of the world will be compared with the help of spatial analysis, and the most relevant determinants in terms of population welfare growth, structural transformations and sectoral diversification will be defined in order to further ensure the stable positive economic growth rates in the countries.

In order to achieve the aim, there were used the data for the period 1991-2016 for the countries that do not have stable democracy.

2. OBJECTIVES OF THE STUDY

We use grouping of countries based on the World Bank approach; Europe, Central Asia, Latin America, Caribbean, Sub-Saharan Africa, Middle East, North Africa, South Asia, East Asia, Pacific. The time horizon of the study covers the period from 1991 to 2016. The objective of the study is to use parameters characterizing the state of the countries' economic growth based on the Economic Complexity Index (ECI).

3. MATERIALS AND METHODS

The study only applies to countries without sustainable democracy by virtue of existing methodologies for calculating the Bertelsmann Stiftung's Transformation Index (BTI). All the statistical information was formed on the basis of data provided by the World Bank, by the Bertelsmann Stiftung. The usage of this information allows comparing the development level of the economic system in different countries by the indexes developed and calculated using the same method that significantly improves the accuracy of the results.

4. RESULTS AND DISCUSSION

ECI is a measure of how many different products are near a country's current set of productive capabilities. The economic complexity of a country is dependent on the complexity of the products it exports. A country is considered 'complex' if it exports not only highly complex products (determined by the Product Complexity Index), but also a large number of different products. To calculate the economic complexity of a country, measure the average ubiquity of the products it exports, then the average diversity of the countries that make those products and so forth.

The indicator characterizing the degree of transformations is the Bertelsmann Stiftung's Transformation Index (BTI). The BTI has been published every two years from 2006. The BTI analyzes and evaluates whether and how developing countries and countries in transition are steering social change toward democracy and a market economy. Guided by a standardized codebook, geopolitical experts assess the extent to which the indicator's 17 criteria have been reached by of over 120 countries. The index inform about the current direction of development in terms of democracy and market economy in each of the examined countries.

Geovisualization and Data Classification (GeoDa) its geovisualization tools are used for descriptive statistics, spatial data analysis exercise, mapping, visualization, calculating Moran's Index and spatial regression. Reviews of these issues are represented in [1-8].

The main method of the visualization is the quantile mapping (QM), also called quantile transformation or distribution mapping. It is a popular method for postprocessing. The choice is based on the following reasons: the indicator is tractable, simple to interpret, and substantially broadens the scope of economic applications, because it allows for accounting heterogeneity through the quantiles. It clearly shows countries by group. Secondly, we followed [9, 10] to use the quintile preferences, such as robustness and ability to capture heterogeneity.

One of the first statistical indicators to analyze spatial autocorrelation was proposed by [11]. The index is a combination between a variable and its spatial lag. This variable is expressed in deviations from its mean. Moreover, we use too the spatial econometric approach which assumes that spatial variability is a relationship among discrete observations [2].

The main advantage of the proposed method lies in its simplicity and comparatively modest data requirements, which make it suitable for use by world organizations such as by the World Bank as a fairly way of screening large numbers of different indicators of economic development in the different countries of world [12].

The results of the indicators the Value Added by Industry (in % to total manufacturing) show that in order to be strong, the country's economy should be diverse and multidirectional [13]. Thus, in the economies of developed countries, for example, Germany and Israel, there are represented such industries as office, accounting and computing machinery, medical, precision and optical instruments, radio, television and communication equipment, recycling, which are not present in Ukraine and other countries from the group of the Emerging Industrial Economy. So, diversity is important for the economy's development.

The indicator that characterized the extent of economies' diversity is the ECI and the ECI value for many countries is characterized by quite strong fluctuations in time. But on average during the years of the Index publication (1991-2016, but for some countries there are data even from 1964), minimum and maximum values were in the following countries:

$ECI \leq -2$ (minimum): Nigeria, Angola, Guinea, Mauritania, Papua New Guinea, Sudan, Ghana;

$ECI \geq 2$ (maximum): Switzerland, Germany, Japan, Sweden, South Korea.

It is clear that the Economic Complexity Index fluctuated in the dynamics for each of 124 countries, for which it is published. Thus, the countries with the coefficient of variation more

that 33% are as follows: Brazil, Georgia, Jordan, Lebanon, New Zealand, Russia, Uruguay, South Africa, Bosnia and Herzegovina, China, Greece, India, Lithuania, Panama, Thailand, Turkey.

As a whole, the countries where the Economic Complexity Index has significantly changed are as follows:

> 0.5 scores: more than 30 countries have worsened their state, among them are: Yemen, Sudan, Mongolia, Moldova, Cuba, Tajikistan, etc.;

< 0.5 scores: more than dozen countries have improved their state: China, Hong Kong, South Korea, Malaysia, Iran, Estonia, Singapore, Kuwait, etc.

At the next stage of the research, the level of the ECI fluctuations in certain groups of countries will be determined (see Table 1 and Figure 1) [14].

Table 1 Data concerning the Economic Complexity Index (1991–2016)

| | Countries | min | max | average |
|-------------------------------|------------|--------------|-------------|----------|
| World | 124 | -2.64 | 3.16 | 0 |
| Europe & Central Asia | 41 | -1.77 | 2.65 | 0.81 |
| East and South Asia & Pacific | 20 | -2.41 | 3.16 | -0.03 |
| America & Caribbean | 23 | -1.40 | 2.12 | -0.20 |
| Middle East& North Africa | 16 | -2.64 | 1.41 | -0.44 |
| Sub-Saharan Africa | 24 | -2.64 | 0.25 | -1.10 |

Source: [14], authors' calculation

According to the Economic Complexity Index, the most uneven is the region East and South Asia & Pacific. Here are situated Papua New Guinea with the minimum indicator in the world and Japan with the maximum one.

The region with the most complex economies is Europe & Central Asia, where the average Economic Complexity Index was 0.81. In terms of economic complexity, the most prominent part of the region Europe & Central Asia is EU-28, where the Economic Complexity Index (ECI) for the period 1991-2016 has an average value from 1.31 to 1.16 (there was even a period of minimum in 2014 – 1.02). Such value is very high in comparison with other regions, but there is observed a negative tendency towards decrease, particularly in recent years [14].

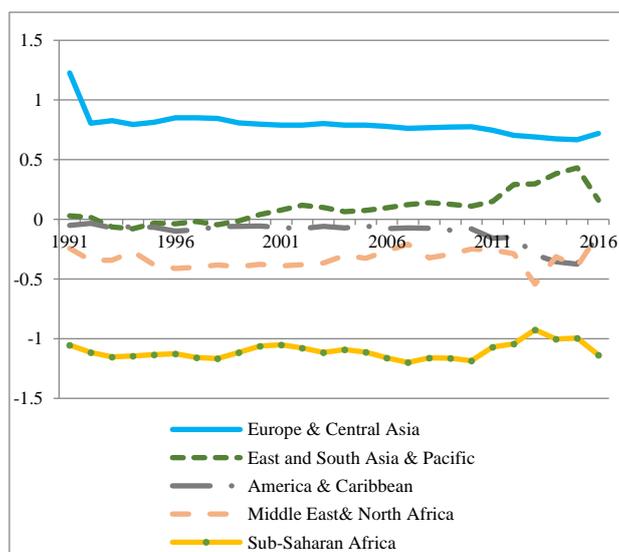


Figure 1 Dynamics of Economic Complexity Index for the regions (1991-2016) [14]

The region EU-28 itself is also quite uneven, and here the economic complexity depends on the belonging to EU-15 (old members) or EC-13 (new members). Let us remind that the countries that joined after May 1, 2004 are the new EU members. Namely, Figure 2 shows the difference between the clearly higher level of ECI for the countries EU-15 (old), which notably decreases, and lower for EC-13 (new), which has a tendency towards growth, i.e. the gradual approximation of the values of the Index within the EU-28 is observed.

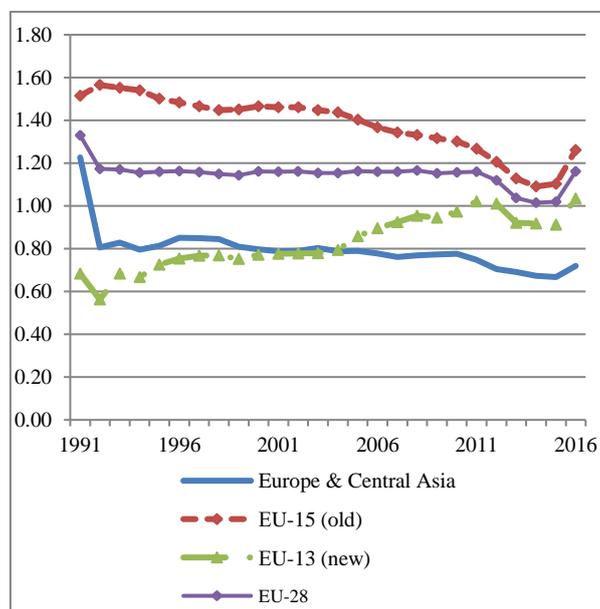


Figure 2 Dynamics of Average Economic Complexity Index for the region Europe & Central Asia (1991-2016) [14]

In order to measure the level of convergence / approximation of economic complexity of the countries of the region Europe & Central Asia, the simplest indicator will be chosen – coefficient of variation (here will be used the data from 1995, as namely 1991 witnessed the large change of political map of Europe). It is found that for EU-28, the coefficient of variation for the period from 1995 constantly decreases and is within the bounds from 0.59 to 0.36 (let us note that the ECI statistics is absent for Cyprus, Luxembourg, Malta. At the same time, for EU-15 (old), the value of the coefficient of variation ECI decreased from 0.41 to 0.35, and for EU-13 (new), decreased from 0.67 to 0.32. And it is on the background of significant growth of variation in the countries of the region Europe & Central Asia, which are not the EU members (Norway, Switzerland, Albania, Bosnia and Herzegovina, Macedonia, Serbia, Turkey, Ukraine, Moldova, Georgia, Azerbaijan, Belarus, Kazakhstan, Russia, Turkmenistan, Uzbekistan), but belong to Europe & Central Asia (see Table 2).

Table 2 Coefficient of variation of Economic Complexity Index for the region Europe & Central Asia (2002-2016)

| | 2002 | 2004 | 2006 | 2008 | 2010 | 2012 | 2014 | 2016 |
|-----------------------|------|------|------|------|------|------|------|------|
| Europe & Central Asia | 1.06 | 1.06 | 1.16 | 1.16 | 1.17 | 1.22 | 1.17 | 1.08 |
| EU-28 | 0.53 | 0.51 | 0.47 | 0.43 | 0.41 | 0.38 | 0.39 | 0.36 |
| EU-15 (old) | 0.41 | 0.40 | 0.43 | 0.39 | 0.39 | 0.38 | 0.39 | 0.35 |
| EU-13 (new) | 0.57 | 0.57 | 0.45 | 0.43 | 0.42 | 0.36 | 0.40 | 0.32 |
| non EU-28 | 1.25 | 1.15 | 1.26 | 1.05 | 0.95 | 1.40 | 1.78 | 1.32 |

Source: authors' calculation

So, the approximation of Economic Complexity Index values within the region Europe & Central Asia is the most typical for the group of countries EU-15 (old) and EU-13 (new).

Among the countries of the region Europe & Central Asia, but non-EU-28, there are Switzerland (average ECI: +2.187) and Turkmenistan (average ECI: -1.226). For other non-EU-28 countries, the average level is within the bounds from -1 to +1.

The countries of the region Europe & Central Asia that have notably increased the ECI value for the period 1995–2016 are as follows: Estonia, Lithuania, Latvia, Poland, Romania, Russia, Turkey, Belarus, Ukraine.

The decrease took place in: Azerbaijan (the most significant), Georgia, Kazakhstan, Moldova, Norway, Switzerland, Turkmenistan, Uzbekistan.

There also exists significant differentiation of ECI. Thus, the highest ECI values are expected to be in high income countries, lower values are in upper middle income and lower middle income. The lowest are in low income (see Figure 3).

Due to the uneven development of Economic Complexity Index in the world as a whole, and even for one geographic region Europe & Central Asia, let us suppose that there can exist the relationship between the economic complexity and the state of political and economic transformations taking place in the countries that embark on a path of democratic development.

The indicator characterizing the level of such transformations is the Bertelsmann Stiftung's Transformation Index (BTI). The BTI is published every two years from 2003. BTI analyzes and evaluates whether and how developing countries and countries in transition are steering social change toward democracy and a market economy [15]. Guided by a standardized codebook, country experts assess the extent to which a total of 17 criteria have been met for each of the 129 countries.

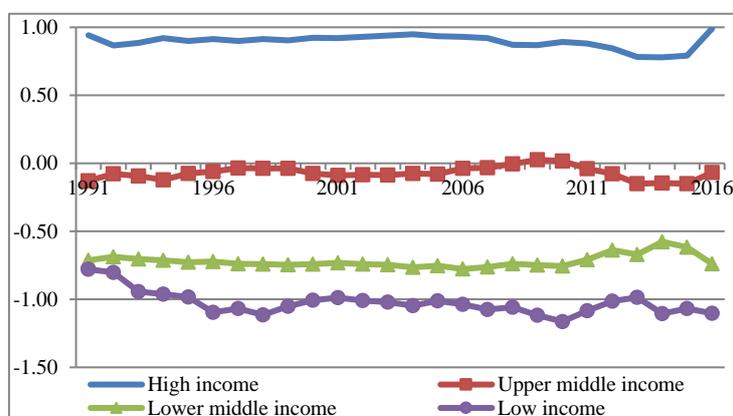


Figure 3 Dynamics of ECI in terms of income level in the countries for the period 1991–2016 [14]

Because the BTI focuses on transformation towards democracy under the rule of law and a market economy anchored in principles of social justice in its analysis, it excludes countries that might be considered long-consolidated democratic systems and in which economic development can be regarded as well-advanced.

Small states with fewer than two million residents are also not examined in the BTI (exceptions: Bahrain, Bhutan, Estonia, Kosovo, Mauritius and Montenegro).

Even notwithstanding the fact that in many countries there exists significant freedom of entrepreneurship (which also is manifested in terms of which goods and services to produce), such factors as Stability of Democratic Institutions, Organization of the Market and Competition, Currency and Price Stability, protection of Private Property and others have a

significant effect. So, taking this into account, one should find out the factors of political and economic nature that have the biggest influence on economic complexity.

It is logical that due to trade relations, mutual raw materials supply (first of all, among the neighboring countries) and other reasons, one can expect the presence of spatial correlations between the ECI indicators and separate constituents of BTI Index (Economic Transformation, Political Transformation and their constituents).

Before performing more detailed analysis, the possibilities of geovisualization, which are inherent in GeoDa software. Figure 4 represents the Quantile Map provided the creation of 3 quantiles (there exist the data for 102 countries, for which there exist simultaneously the ECI and BTI Index indicators) [14, 15].

The most popular definition of the notion spatial autocorrelation is that it helps understand the degree to which one object is similar to other nearby objects. Spatial autocorrelation assesses whether there exists clusterization of the objects or they are distributed accidentally.

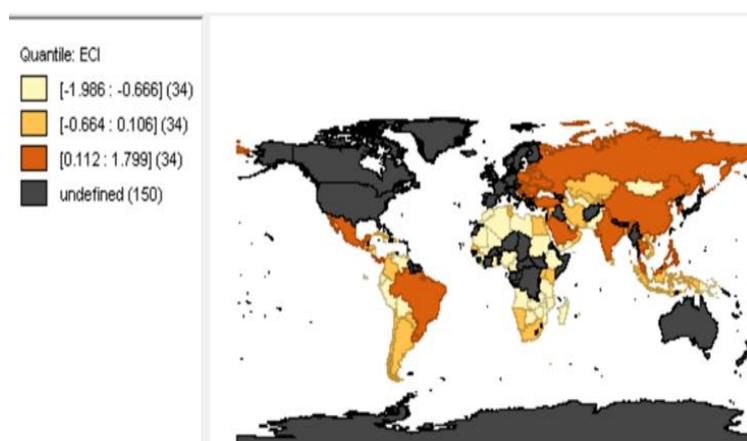


Figure 4 Geovisualization ECI with Quantile Map 2016 [14, 15]

Moran's I (Index) measures spatial autocorrelation and is calculated according to the formula [11]:

$$I = \frac{N \sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{W \sum_{i=1}^n (x_i - \bar{x})^2} \quad (1)$$

where N – number of spatial units (by i and j); x – variable; \bar{x} – the mean of; w_{ij} is a matrix of spatial weights with zeroes on the diagonal (i.e., $w_{ii}=0$); W is the sum of all w_{ij} .

In order to evaluate the index significance, p-value is also evaluated. Positive spatial autocorrelation occurs when Moran's I is close to +1. This means values cluster together.

We used GeoDa software and its geovisualization tools for descriptive statistics, spatial data analysis exercise, mapping, visualization, calculating Moran's Index and spatial regression.

With the help of the abovementioned methods, the spatial autocorrelation between two variables, ECI and separate constituents of the BTI Index according to 2016 data was evaluated:

- Political Transformation (5 constituents: Stateness, Political Participation, Rule of Law, Stability of Democratic Institutions, Political and Social Integration) and its Value;
- Economic Transformation (7 constituents: Level of Socioeconomic Development, Organization of the Market and Competition, Currency and Price Stability, Private Property, Welfare Regime, Economic Performance, Sustainability) and its Value.

The analysis performed showed that provided the usage of symmetric function type threshold, Euclidean distance metric, the Moran's indices were obtained and their significance was assessed.

From 12 pairs of variables (5+7) for correlations, only one is characterized by Moran's I, which is equal to +0.813 and is statistically significant with $p = 0,01$ (Figure 5). These are the ECI and the constituent of the Economic Transformation - Level of Socioeconomic Development - SOCIOEC_D. According to the authors' methodology, Score of SOCIOEC_D is a characteristics of the fact that the country's level of development permits adequate freedom of choice for all citizens. In order to define the scores, the authors of the BTI Index analyzed the answers to the question To what extent are significant parts of the population fundamentally excluded from society due to poverty and inequality?

• Bivariate Moran's I (World_Countries): SOCIOEC_D and lagged ECI

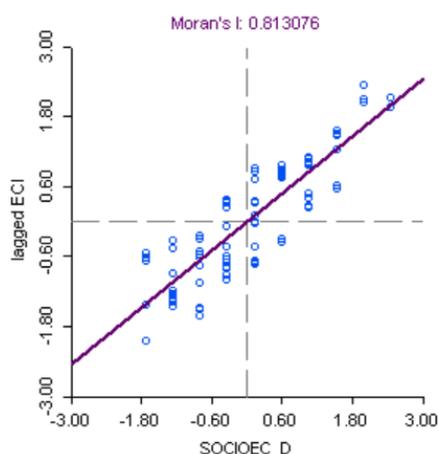


Figure 5 Moran's I (ECI and SOCIOEC_D)

So, the spatial positive autocorrelation between ECI and Socioeconomic Development was found, which indicates that non-accidental fact that low or, correspondingly, high values are being grouped in the space.

For other constituents of the index BTI, Moran's I is as follows:

- ECI and Welfare Regime: 0.745;
- ECI and Sustainability: 0.732.

For three abovementioned pairs of variables, Moran's Index is significant according to Z-test Fisher, as in all these cases, its value was $Z > 11$, which is far more than the critical $Z = +2.58$ (i.e. $p < 0.01$). Let us note that Welfare Regime (one of seven criteria in the Market Economy Status or Economic Transformation) is measured by normative statement: "There are viable arrangements to compensate for the social costs of the capitalist economic system". Welfare Regime is defined by 2 constituents: Equal opportunity and Social safety nets, which in turn are the results of giving answers to the following questions:

- Equal opportunity: "To what extent does equality of opportunity exist?"
- Social safety nets: "To what extent do social safety nets provide compensation for social risks?"

Sustainability (one of seven criteria in the Market Economy Status or Economic Transformation) has 2 constituents: Environmental policy and Education policy / R&D, the evaluation of which is the results of giving answers to the following questions:

- Environmental policy: “To what extent are environmental concerns effectively taken into account in both macro- and microeconomic terms?”
- Education policy / R&D: “To what extent are there solid institutions for basic, secondary and tertiary education, as well as for research and development?”

The main results are as follows: the factors affecting the ECI Value level are to a lesser extent the constituents of Political Transformation, and to a larger extent – the constituents of Economic Transformation, such as Level of Socioeconomic Development, Welfare Regime, Sustainability (they explain more than 50% of ECI Value dispersion). And such factors as Currency and Price Stability, Private Property, Economic Performance, Organization of the Market and Competition have an insignificant and average impact (within 12-45% of dispersion).

This relationship is mutual, i.e. the abovementioned factors also depend on the achieved level of ECI Value.

I.e. the perspectives of more active economic complexity are namely in the countries with high levels of Level of Socioeconomic Development, Welfare Regime, Sustainability.

Taking into account the high levels of all the three indicators at the same time (Level of Socioeconomic Development, Welfare Regime, Sustainability), such countries as United Arab Emirates, Czech Republic, Estonia, Croatia, South Korea, Lithuania, Latvia, Poland, Singapore, Slovenia, Uruguay can have the best chances for development.

And the chances for significant transformation of the economies of separate countries-candidates to be joined to the EU by way of diversification of the sectors of the economy in the medium term are small. Such situation is observed in Moldova, Ukraine, Georgia. Thus, the comparison of economic complexity (according to the ECI constituents) for Ukraine and Germany as the most successful economy of the European Union has enabled to make such findings: Ukraine has an under diversified economy, herewith with its export being oriented towards low-processed products (metals, agricultural products) and its import being oriented towards mineral products (oil, gas), machines, equipment, medicines, etc.

5. CONCLUSION

As a result of analyzing the economic complexity indicators and their transformations, the following research findings were made:

- the level of the countries’ economic development can be determined by many indicators, but the most informative is the economic sectors’ development diversification index that can be measured by the ECI;
- the countries significantly differ in terms of the ECI Value, but within the EU-28, there one can see the levels’ convergence (new EU members significantly increase the indicator’s value);
- there exists strong relationship between the ECI Value level and the BTI constituents, whereby the economic complexity is to a larger extent determined not by the constituents of the political transformation, but by the constituents of the Economic Transformation, such as the level of the Socioeconomic Development, the Welfare Regime, the Sustainability;
- in the medium term, the countries with high levels of Level of Socioeconomic Development, Welfare Regime, Sustainability have the best chances for increasing the diversification and/or economic complexity. These are United Arab Emirates, Czech Republic, Estonia, Croatia, South Korea, Lithuania, Latvia, Poland, Singapore, Slovenia, Uruguay;

- for some countries-candidates to be joined to the EU such as Ukraine, as well as Moldova and Georgia, significant economic diversification, reorientation of export towards high-processed goods and innovative technologies and solutions can be one of the best ways of successful convergence and increasing the level of economic development.

The following directions for future studies should be noted: (i) determining the duration of the time period, during which, after certain level of economic complexity, there takes place the growth of the welfare regime and the level of the socioeconomic development; (ii) substantiating the most effective (in terms of welfare) directions of the Emerging Industrial Economies development in order for the countries to ensure the growth not at the account of extensive development (for example, agriculture), but at the account of industries with more complex technologies; (iii) ECI correlation with the authoritarianism of the regime gives rise to possibility to form the hypothesis about some lag for transition to higher level of development after the moment of governance model change; (iv) defining the economic prospects of the countries' development (based on the level of economic complexity) with the aim to characterize the world economics mode in future (defining the leaders and outsiders of global economy rankings).

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