The Regulatory Determinants of Economic Growth under Pandemic Challenges: Regional Cluster Issues and Patterns

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Abstract

The main objective of this paper is to discover the impact of the COVID-19 pandemic and regulatory conditions of doing business on economic growth of different economies, particularly in terms of the combined co-effect of the two mentioned factors. An econometric cluster model using the k-means method is developed. 172 economies were distributed between clusters based on three parameters: 1) rates of GDP growth for individual economies in 2020, as provided by the World Bank; 2) the World Bank Doing Business rating for 2020; and 3) the COVID-19 pandemic factor that is represented by the total accumulated number of cases officially fixed per 100,000 of population, as provided by the World Health Organization. The study proves that the COVID-19 pandemic appeared to be a substantial factor of economic growth for the vast majority of economies, which is reflected by the drop in their GDP even despite favourable conditions of doing business in some countries. Substantial compensating reciprocal influences are observed between the set of doing business factors and the COVID-19 pandemic factor.

Keywords

regulatory environment, Doing Business rating, GDP, economic growth, COVID-19, k-means clustering

Introduction

Economic growth is not simple; it is a multifaceted macroeconomic phenomenon. It is difficult to fully explain which determinants influencing economic growth are the most important (Khan et al., 2022). As noted by OECD experts, the regulation of product market substantially matters for sound functioning of an economy and for economic growth. However, if untimely and ineffective, the regulation of product market may restrict or disrupt competitiveness among the existing firms (OECD, 2018). Possible response to European challenges may be the true common market, since it has the growth potential (Tusinska, 2014). Economic and financial crisis as well as growing pressure from competing countries with cheap labour are among factors that inspire the transition to the new stage of development. Under the latter, regional economies structure is relying on usage of such instruments as clusters, innovation centres, technological incubators, and their networks (Habanik et al., 2016).

Some time ago economic growth in many countries was considered to be promoted by exogenous factors mostly, while nowadays more and more studies develop endogenous models of economic growth (Romer, 1994; Acemoglu, 2009). One of the key goals of national economic policy is to find new sources of economic growth.

The core objective of this study is to discover the impact of the COVID-19 pandemic as well as regulatory conditions of doing business on economic growth of different economies particularly in terms of the combined co-effect of the two mentioned factors. The paper offers an analysis of dependencies between the set of regulatory environment factors (the World Bank Doing Business rating), individual economies GDP growth rates, and the degree of the COVID-19 pandemic spread. For these purposes, we develop an econometric cluster model using the k-means approach and actually clusterise 172 economies by three selected criteria as of 2020 and 2021, which makes it possible to identify three consistent patterns of dependencies between selected parameters. The model makes it possible to determine consistency between selected parameters in the framework of three identified patterns as well as for the global economy as a whole. The study proves significant influence of the COVID-19 pandemic factor on economic growth. The paper specifies that the building-up of a favourable business environment is necessary for long-term economic growth and discovers that the role of doing business environment in promoting economic development is especially important during crisis periods and phases of decline as much as the latter lead to fiscal restrictions and the worsening of market environment; thus, traditional macroeconomic tools will not be enough to hold up further development of an economy.

Supporting theory and background

Contemporary economic science does not offer single all-around approach to unambiguously decide on main factors and sources of economic growth. Different scholars study particular determinants that can become drivers of economic growth in one time or another. In particular, Solow (2016) refers to the main three factors of economic growth: the importance of natural resource inputs; the degree of substitutability between nonrenewable resources and other inputs in the production of final output; and the pace and bias of technological progress. Many authors (North, 1989; Rodrik, 2008; Acemoglu et al., 2009) believe that stagnant factors of socioeconomic development are predominantly associated with a deficit of institutional change. Therefore, for example, Grgurevic (2022) identified the main inhibiting factor of economic development in the countries of Southeast Europe as the lack of institutional changes with the parallel action of alternative institutions and quasi-monistic neoliberalism.

Until recently, the achievement of high quantitative economic indicators was considered a strategic goal of the state's economic policy. At the moment, this priority has lost its relevance. Today, one of the modern explanations for the differences between the level of economic development in different countries lies in the different level of the regulatory environment. At the time of dynamic changes in the conditions of the unfolding of the Fourth Industrial Revolution as well as global environmental problems and social tensions against the background of the global COMID-19 pandemic, there is a need for such a strategy of economic growth which would provide anticipatory development for the economy and equal opportunities for the growth of the well-being of every citizen. For most countries, the correct definition of the dominant development and its determinant will make it possible to effectively transform the national economy in the direction of new trends of the world economic system with further integration into their environment. The strategy on the way to achieving such goals should be focused on a significant change in the functions and role of the state in regulating economic processes. The basis is built on institutional components such as: effective competitive environment; innovative orientation of the economy; and the effectiveness of institutional structures.

Some studies justify that governments should create regulatory environment which will promote favourable market competition through the introduction of fair taxation systems in order to stabilise the economic situation in a country (Damayanti et al., 2021; Gokalp et al., 2017; Shin & Park, 2019). The impact of competition on shadow economy size is also explored (Karlinger, 2014) and the interrelation between corruption and market competition level in post-communist economies is

studied (Diaby & Sylwester, 2015). Positive influence of inward investments on economic growth renewal as well as on specific monetary indicators also appears to be unchallenged (Blikhar et al., 2021; Rogach & Dziuba, 2017).

The interrelation between innovations and market competition as well as their impact on economic growth has been intensively studied. Among those scholars undertaking the task, few (Heredia et al., 2017) explored the effect of informal competition on innovations efficiency using the case of the Pacific Alliance (McCann & Bahl, 2016) and examined the impact of competition with informal enterprises on new products development. The importance to consider the institutional determinants of innovative economic development in the 21st century is also emphasised (Lagutin & Yasko, 2020). Science-driven and knowledge-intensive innovative industries are perceived as the primary driving force of economic growth. On the other hand, developed and competitive economies can create welcoming environment for further introduction of newest technologies and become the storage of the most promising innovations (Braja & Gemzik-Salwach, 2020).

The role of competition in promoting economic growth is especially substantial during crisis and decline periods, when fiscal restrictions and worsening market conditions arise, and, thus, macroeconomic measures would not be enough to support further economic development. Marwa (2014) analysed the impact of competition on economic development and tested if this impact could be transformed in conformity with technological gap between an economy under question and technologically-leading economy. Such test of 115 countries of the Middle East and Africa testifies that intensive internal competition resulting from business freedom typically slows down the growth of an independent economy. Sustainable development of a national economy implies not only the achievement of maximum possible GDP growth rates, but also qualitative structural changes in an economy via support of sound competition between businesses (Pyroh, 2017).

Notwithstanding the existing differences as to the identification of optimal set of regulatory determinants, major representatives of contemporary economic schools agree on the dominant role of this type of national economic policy in achieving strategic development goals. The impact of the COVID-19 pandemic on various issues of regulatory environment, particularly in financial sector, is studied by Dziuba and colleagues (2021). Significant impact is mostly confirmed.

Notwithstanding the high level of available scientific research as to the matter of long-term economic growth, the issue of short-run post-crisis renewal driven by the development of country's efficient regulatory environment remains poorly studied. The latter, in turn, might become the key trigger to creating efficient business environment with highly effective offsetting effects of adverse drivers brought about by favourable factors.

Methodology and data

The hypothesis and clusterisation framework

For developing the cluster model, we use three parameters. The first one includes individual economies GDP growth rates (GDP parameter of the model). The data on this factor is derived from the World Bank database (World Bank, 2021-2). It represents the percentage rates of GDP growth as measured in USD in current prices for 2020. As a result of such clusterisation analysis, conclusions regarding the influence of one parameter on the others can be drawn foremost when the discovered statistical relation can be well confirmed by one or two descriptive criteria and the actual impact can be justified. This is the particular methodological approach we are going to use in our study. This factor stands as a (implied) dependent variable given the above-mentioned requirements are met.

The second clusterisation factor is the value of the rating of Doing Business (DB in terms of the model parameters). It should be mentioned that we shall use the value of this rating for individual economies as of 2020 rather than their actual rankings (World Bank, 2020). They fluctuate in the range between 0 and 100. As it was noted, this rating demonstrates the set of factors of doing business in a country.

The third clustering factor is associated with the COVID-19 pandemic factor. We are using the total cumulated quantity of official COVID-19 cases fixed per 100,000 of population provided by the

World Health Organization as of 13th October, 2021 (World Health Organization, 2021). It should be emphasised that we might note a slight temporal mismatching between clustering factors, particularly the pass ahead dynamics of the last parameter. However, considering the above-mentioned, this does not represent a problem for the model development, especially in our case, since the index used is cumulative and it had been generating not only in 2021, but also during 2020 and even 2019. Actually, the data used reflects not just the statical impact of the parameter given, but also the dynamics of this impact generating.

Finally, out selection covers 172 economies. During the generation of the selection, some countries were excluded mostly for two reasons. The first one was the absence of data for 2020. Typically, this reason deals with the GDP parameter where some economies were represented by 2019 data only. Second, for some countries, the GDP data provided by the World Bank was available, but it was not covered by Doing Business rating.

The major hypothesis we are going to justify or reject using the developed model is that there are consistent patterns of interrelation/dependence between GDP growth rates of individual economies, the set of their doing business factors defining regulatory environment, and the level of the COVID-19 pandemic spread for a given country that ground on quantitatively- and qualitatively-defined regularities in their co-dynamics. This, in turn, would open opportunities to analyse particular economies and use the discovered regularities to define common and distinctive features between them, uppermost in terms of how the two factor groups co-define economic growth. We expect that a positive effect of one factor might appear to be offset by a negative effect of another one.

Model specification and the identification of the number of clusters

For developing the model, we use the multi-criteria clusterisation using the k-means method. It implies minimisation of the total squared deviation of points coordinates from its centre. These coordinates are not set beforehand and are not constant. Rather, they are computed (and re-computed) as relative to other points and centre being found until the optimal relation between points' coordinates and the centre itself is found. At the same time, the quantity of clusters is set in advance. The mathematical basis for this method implies calculating Euclidean distances of clusters points from their centres and minimising these distances in multidimensional Euclidean space. The formula of Euclidean distance between two points is the following:

$$d(a,b) = \sqrt{(a_1 - b_1)^2 + (a_2 - b_2)^2 + \ldots (a_n - b_n)^2} = \sqrt{\sum_{n=1}^{k} (a_n - b_n)^2} \quad (1)$$

$d(a,b)$ – Euclidean distance between points *a* and *b* in multi dimensional space

a_n – value of point *x* on the *n-th* dimension

b_n – value of point *y* on the *n-th* dimension

To utilise the k-means method, we shall carry out the computation following the next procedure.

First, we have to define the quantity of clusters. It depends uppermost on the study goals and objectives as well as on the quantity of cases being clustered. All in all, the optimal quantity of clusters is often been set empirically via testing different possible quantities. In order to define this quantity in our study, we carried out a preliminary assessment for the case of three, four, five, six, seven, eight, and nine clusters. A larger or smaller cluster number is unreasonable in our opinion, since two clusters for 172 economies would hardly allow making relevant conclusions, while 10 or more would diffuse the regularities under question, as well as their common and distinctive features that permit to discover and analyse them. With regard to preliminary assessment, the following should be noted. For example, three and four clusters unite quite different economies, such as the USA, the UK, Belarus, Belgium, Kazakhstan, and others. Although such grouping is detected statistically, it is not univocal in terms of its descriptive identification. For a number of reasons, we are not satisfied by six, seven, and nine clusters as well. From the viewpoint of general logic and possible description opportunities, five and eight clusters appear to be attractive. It is difficult to select their specific definite number, since the general algorithm implies analysing another number of clusters in the case of unsatisfactory results for the first number of clusters. Thus, we are going

to take the five clusters number as the basic working version. Such quantity also implies intuitively understandable number of countries considering their general selection of 172. All computations are carried out in the Stat Soft Statistica 12 software environment.

The second step is to set Euclidian space parameters, which, in fact, has already been done. Clustering factors have been selected and justified.

The mechanics of generating clusters is as follows. Initially, centres of clusters are being set. They can be set randomly, although it is usually done on the basis of the maximisation of distance between them. The belonging of cases to a particular cluster is defined based upon the minimal Euclidean distance from the centre. Generating clusters is being performed on the basis of permanent recalculation of their centres coordinates while the coordinates of cases remain unchanged. This recalculation is being made until the clusters are generated and centres' coordinates do not change any more.

However, for running clusterisation, the available data set should be somewhat transformed. The matter is that the selected parameters have completely distinct measurement units that substantially differ in their absolute values. To solve this statistical and methodological problem, the data needs to be standardised – all values must be adjusted with respect to the meaning of an average and standard deviation. This can be done using the formula:

$$a_i = \frac{A_i - \overline{A_i}}{\sigma(A_i)} \tag{2}$$

a_i – standardised value of A_i

$\overline{A_i}$ – average value of A_i

$\sigma(A_i)$ – standard deviation of A_i

This exactly standardised data was used to apply the k-means method. Descriptive criteria to be used for the analytical screening of developed statistical clusters is the level of income per capita following the World Bank classification (World Bank, 2021-1). Following this criterion, all countries of the world are distributed between four groups: high-income economies (HI), upper-middle-income economies (UMI), lower-middle-income economies (LMI), and low-income economies (LI).

Considering the proposed hypothesis and model specification as well as following the scheduled track of the present study, we strongly anticipate that the hypothesis will be justified. If so, we shall manage to contribute to the existing literature in the field with particular empirical implications. The added value of the study grounds on the developed approach to identify consistent patterns of dependence between GDP growth rates, the set of doing business factors, and the COVID-19 pandemic factor. One of the most essential points of this approach is the identification of specific set-off effect between the set of doing business factors and the pandemic factor. This effect lies in the fact that even substantial absolute values of the pandemic parameter may not bring about considerable losses in economic growth rates because of the favourable doing business environment and *vice versa*. The empirical implications of the study and developed approach are implied to generate consistent patterns of the mentioned dependence and will be generated in the concluding part of the paper should the hypothesis be justified.

Results and discussion

The influence of competition and competitiveness on economic growth

One of significant reasons of why the studies of competition impact on economic growth rates are scarce is the complexity of this ratio assessment. Remarkable in these terms is the problem of the absence of necessary statistical data as well as the availability of non-quantitative competition that cannot be relevantly reflected by specific figures and indices. The estimates of the market concentration level are often substantially simplified. The above-mentioned shortcomings also bring about distorted results and, as a consequence, lead to wrong conclusions as to the level of competition in a specific industry.

Considering the imperfection of the statistical methods of the competition level estimation, some countries began to use the polling of business executives, which, along with quantitative data, made it possible to obtain more complete and comprehensive information. Notably, such polling has been carried out in several European countries since the 1990s on a regular basis.

Nowadays, the competitiveness of national economies is defined by a broad set of factors that together represent a complex hierarchic but structured system of impact that has direct as well as indirect implications. Such aggregate ratios (the World Economic Forum Global Competitiveness Index, the World Bank Doing Business ranking) as well as other similar indices (e.g. the World Competitiveness Ranking provided by IMD World Competitiveness Centre and others) consider major factors of macroeconomic competitiveness. However, the current stage of world economy development is substantially defined by the new factor, the impact of which was not observed before. We mean the COVID-19 pandemic. Although humanitarian in nominal terms, this factor is absolutely overwhelming from the viewpoint of its impact. Its impact has been lately felt by all countries of the world, all components of their economic systems, and all players of the global economy. That is why, in our opinion, currently, the pandemic factor must be considered along with other traditional factors of economic growth.

The impact of the COVID-19 Pandemic on economic growth and clustering results

It is worth considering clusters generated as a result of model development. The most numerous of them is the fourth model cluster comprising of 47 economies (Table 1).

Table 1. Clustering results – cluster 4 (destandardised data)

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22192.85]
1	Argentina	UMI	-9.91	59	11,652.14
2	Armenia	UMI	-7.60	74.5	9,283
3	Austria	HI	-6.59	78.7	8,540.69
4	Bahrain	HI	-5.81	76	16,208.69
5	Belgium	HI	-6.28	75	11,013.31
6	Botswana	UMI	-7.89	66.2	7,707.47
7	Brazil	UMI	-4.06	59.1	10,153.74
8	Bulgaria	UMI	-4.15	72	7,592.65
9	Chile	HI	-5.77	72.6	8,704.62
10	Colombia	UMI	-6.85	70.1	9,774.06
11	Costa Rica	UMI	-4.54	69.2	10,729.92
12	Croatia	HI	-8.37	73.6	10,375.55
13	Cyprus	HI	-5.10	73.4	13,704.88
14	the Czech Republic	HI	-5.60	76.3	15,948.59
15	Estonia	HI	-2.93	80.6	12,628.37
16	France	HI	-8.11	76.8	10,523.91
17	Georgia	UMI	-6.16	83.7	16,173.64
18	Hungary	HI	-4.96	73.4	8,503.23
19	Ireland	HI	3.42	79.6	8,177.56
20	Israel	HI	-2.44	76.7	15,136.33
21	Italy	HI	-8.87	72.9	7,887.66
22	Jordan	UMI	-1.55	69	8,193.26
23	Kosovo	UMI	-6.89	73.2	8,931.06

Table 1. – cont.

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22192.85]
24	Latvia	HI	-3.62	80.3	9,220.12
25	Lithuania	HI	-0.87	81.6	12,805.64
26	Luxembourg	HI	-1.31	69.6	12,665.55
27	Malaysia	UMI	-5.59	81.5	7,271.76
28	Moldova	UMI	-6.97	74.4	7,653.12
29	Mongolia	LMI	-5.34	67.8	9,883.84
30	Montenegro	UMI	-15.16	73.8	21,647.7
31	the Netherlands	HI	-3.74	76.1	11,657.5
32	North Macedonia	UMI	-4.53	80.7	9,366.13
33	Poland	HI	-2.70	76.4	7,713.93
34	Portugal	HI	-7.56	76.5	10,454.23
35	Qatar	HI	-3.67	68.7	8,246.26
36	Romania	UMI	-3.86	73.3	7,234.08
37	Serbia	UMI	-0.98	75.7	14,693.83
38	Seychelles	HI	-10.72	61.7	22,192.85
39	Slovakia	HI	-4.75	75.6	7,876.44
40	Slovenia	HI	-5.53	76.5	13,970.77
41	Spain	HI	-10.84	77.9	10,515.9
42	Sweden	HI	-2.82	82	11,227.79
43	Switzerland	HI	-2.87	76.6	9,798.63
44	Turkey	UMI	1.76	76.8	8,903.32
45	the United Kingdom	HI	-9.79	83.5	12,125.39
46	the United States	HI	-3.49	84	13,351.8
47	Uruguay	HI	-5.86	61.5	11,230.44
Average			-5.27	74.34	11,047.90
Cluster Range			[-15.16 – 3.42]	[59 – 84]	[7,234.08 – 22,192.85]

Notes:
1. The figures are calculated and the table is composed by the authors.
2. Computations are carried out in the framework of the StatSoft Statistica 12 software environment.
3. The countries are placed in alphabetic order.

From the descriptive criterion (income level) perspective, this cluster is homogeneous enough. It covers economies with high (12,696 USD or more) and upper-middle (4,096 to 12,695 USD) level of income except just one country – Mongolia – for which the income level is lower than the middle. This economy – considering the discovered statistical and analytical homogeneity – can be treated as statistical outlier. This cluster also distinctly differs from others according to the pandemic criterion – the average value equals to 11,047.90 infected people per 100,000 of population (Table 1 & Table 6). Apparently, this is the worst range according to the criterion under question. On the one hand, this can be explained by the fact that the current cluster includes mostly developed countries and, as a result, there is high level of development in the health care field and society in general. Consequently, the official quantity of cases is fixed much more often and the extent of the pandemic spread is substantial at the same time. On the other hand, it can be acknowledged than the impact of this factor on GDP growth is not substantial. The cluster is located approximately in the middle of the range, according to the first criterion, considering the mean value and the relative location of countries all over the range. As to the doing business parameter, this cluster is presented by economies having the best environments for doing business. By and large, we can summarise that

countries with relatively high level of income and very high level of regulatory environment are described by relative tolerance to the pandemic factor in terms of its impact on economic growth that can be substantially explained by favourable conditions for doing business. With regard to the large number of economies and the significant homogeneity of the cluster according to the descriptive criterion, it can be considered to be consistent and representative.

The second cluster includes 46 economies. They represent all four possible ranges of income level, with the majority representing the high-income, upper-middle-income, and lower-middle-income economies (Table 2). Only one country from this cluster (Rwanda) has low level of income. These countries have high level of doing business rating and moderate level of the pandemic spread. GDP growth rates for these economies are negative – the second worst value of the mean (Table 6).

Table 2. Clustering results – cluster 2 (destandardised data)

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22192.85]
1	Albania	UMI	-3.31	67.7	6,104.11
2	Australia	HI	-0.28	81.2	515.22
3	Azerbaijan	UMI	-4.31	76.7	4,872.85
4	Belarus	UMI	-0.90	74.3	5,944.9
5	Bhutan	LMI	-6.77	66	338.64
6	Bosnia and Herzegovina	UMI	-4.33	65.4	7,374.57
7	Canada	HI	-5.40	79.6	4,386.02
8	China	UMI	2.30	77.9	8.5
9	Denmark	HI	-2.73	85.3	6,269.38
10	Dominican Republic	UMI	-6.72	60	3,380.48
11	Ecuador	UMI	-7.75	57.7	2,902.24
12	El Salvador	LMI	-7.94	65.3	1,659.89
13	Finland	HI	-2.77	80.2	2,690.75
14	Germany	HI	-4.90	79.7	5,206.72
15	Greece	HI	-8.25	68.4	6,366.47
16	Honduras	LMI	-8.96	56.3	3,738.28
17	Iceland	HI	-6.65	79	3,374.31
18	India	LMI	-7.96	71	2,463.89
19	Indonesia	LMI	-2.07	69.6	1,546.87
20	Jamaica	UMI	-10.20	69.7	2,919.66
21	Kazakhstan	UMI	-2.60	79.6	5,252.68
22	Kenya	LMI	-0.31	73.2	467.37
23	Korea, Rep.	HI	-0.96	84	654.86
24	Kyrgyz Republic	LMI	-8.62	67.8	2,751.18
25	Lesotho	LMI	-11.06	59.4	1,002.73
26	Malta	HI	-7.00	66.1	7,263.43
27	Mauritius	UMI	-14.87	81.5	1,295.2
28	Mexico	UMI	-8.24	72.4	2,889.29
29	Morocco	LMI	-7.12	73.4	2,546.49
30	Namibia	UMI	-7.98	61.4	5,040.33
31	New Zealand	HI	0.98	86.8	91.24
32	Norway	HI	-0.76	82.6	3,614.98
33	Peru	UMI	-11.15	68.7	6,625.88

Table 2. – cont.

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22192.85]
34	Philippines	LMI	-9.57	62.8	2,448.75
35	the Russian Federation	UMI	-2.95	78.2	5,387.13
36	Rwanda	LI	-3.36	76.5	763.1
37	Saudi Arabia	HI	-4.11	71.6	1,573.23
38	Singapore	HI	-5.39	86.2	2,259.78
39	South Africa	UMI	-6.96	67	4,911.49
40	Sri Lanka	LMI	-3.57	61.8	2,464.53
41	Thailand	UMI	-6.09	80.1	2,493.45
42	Trinidad and Tobago	HI	-7.83	61.3	3,776.17
43	Tunisia	LMI	-8.60	68.7	6,008.28
44	Ukraine	LMI	-4.02	70.2	5,895.66
45	Vanuatu	LMI	-9.24	61.1	0.98
46	Zambia	LMI	-3.02	66.9	1,139.01
Average			-5.53	71.75	3,275.67
Cluster Range			[-14,87 – 2,30]	[56,3 – 86,8]	[0.98 – 7,374.57]

Notes: The figures are calculated and the table is composed by the authors.

In our opinion, this cluster is difficult to be considered as consistent or sustainable because of the high level of heterogeneity. It can be tracked even from the viewpoint of cluster structure assessment – it covers such highly developed economies as Germany, Denmark, Canada, as well as countries with relatively low level of development such as Zambia, Namibia, and Kenia. Hard intuition allows placing them in one row with relevant arguments. The fifth cluster comprises 32 economies (Table 3). Unlike the previous one, this cluster is much more homogeneous according to the descriptive criterion. Economies with low (1,045 USD or less) and lower-middle (1,045 to 4,095 USD) income levels mostly stand for this cluster. Only two countries (Equatorial Guinea and Gabon) have upper-middle income level. From the economic perspective, they can be considered as exceptions, while from the computation viewpoint, they can be regarded as statistical outliers.

Table 3. Clustering results – cluster 5 (destandardised data)

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22,192.85]
1	Afghanistan	LI	-1.93	44.1	399.71
2	Algeria	LMI	-5.48	48.6	467.01
3	Angola	LMI	-4.04	41.3	188.02
4	Bangladesh	LMI	2.38	45	949.36
5	Bolivia	LMI	-7.82	51.7	4,318.68
6	Burundi	LI	0.30	46.8	163.5
7	Cambodia	LMI	-3.14	53.8	689.85
8	Cameroon	LMI	0.73	46.1	370.69
9	Central African Republic	LI	0.00	35.6	237.46
10	Chad	LI	-0.89	36.9	30.82
11	Congo. Dem. Rep.	LI	0.77	36.2	63.94
12	Congo. Rep.	LMI	-7.95	39.5	276.45
13	Equatorial Guinea	UMI	-4.89	41.1	911.34
14	Gabon	UMI	-1.32	45	1,463.61

Table 3. – cont.

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22,192.85]
15	Gambia	LI	0.00	50.3	411.43
16	Guinea-Bissau	LI	-2.40	43.2	311.03
17	Haiti	LMI	-3.37	40.7	198.32
18	Kiribati	LMI	2.54	46.9	0
19	Lao PDR	LMI	0.44	50.8	404.07
20	Liberia	LI	-2.87	43.2	114.72
21	Madagascar	LI	-4.20	47.7	157.49
22	Mali	LI	-1.65	52.9	76.6
23	Mauritania	LMI	-1.49	51.1	784.25
24	Myanmar	LMI	-9.99	46.8	884.45
25	Nicaragua	LMI	-1.98	54.4	183.7
26	Sao Tome and Principe	LMI	3.09	45	1,660.44
27	Sierra Leone	LI	-2.16	47.5	80.18
28	Solomon Islands	LMI	-4.32	55.3	2.91
29	Somalia	LI	-1.50	20	133.82
30	Sudan	LI	-1.56	44.8	89.21
31	Timor-Leste	LMI	-8.70	39.4	1,493.43
32	Zimbabwe	LMI	-8.00	54.5	888.22
Average			-2.54	45.19	575.15
Cluster Range			[-9.99 – 3.09]	[20 – 55.3]	[0 – 4,318.68]

Notes: The figures are calculated and the table is composed by the authors.

The lowest possible level of the pandemic spread and the worst environment for doing business are peculiar for economies of this group. At the same time, the GDP growth rates for these countries are the second best among all clusters. Regarding the pandemic, such low extent of its spread can be explained by the fact that countries with low level of development also have low level of the health care field. The pandemic factor for this group of economies does not have substantial impact on GDP. The conditions of doing business and the general level of these economies competitiveness had already been low before the pandemic, resulting in low rates of economic growth. Consequently, the new negative impact factor (the COVID-19 pandemic) did not bring about such substantial negative effect as it did for countries with better launch conditions.

The third cluster consists of 31 economies. Like the previous one, it comprises mostly low-income and lower-middle-income economies, although the number of upper-middle-income economies is slightly higher, and one country (Brunei Darussalam) belongs to the high-income group (Table 4).

Table 4. Clustering results – cluster 3 (destandardised data)

No	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22,192.85]
1	Benin	LMI	3.85	52.4	202.59
2	Brunei Darussalam	HI	1.20	70.1	2,165.13
3	Burkina Faso	LI	2.02	51.4	69.59
4	Comoros	LMI	4.91	47.9	479.88
5	Cote d'Ivoire	LMI	1.82	60.7	230.79
6	Djibouti	LMI	0.50	60.5	1,348.18
7	Egypt	LMI	3.57	60.1	306.95

Table 4. – cont.

No	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22,192.85]
8	Eswatini	LMI	-1.64	59.5	3,991.94
9	Ethiopia	LI	6.06	48	309.53
10	Ghana	LMI	0.41	60	413.12
11	Guatemala	UMI	-1.52	62.6	3,245.77
12	Guinea	LI	6.99	49.4	232.44
13	Guyana	UMI	43.48	55.5	4,290.63
14	Iran	LMI	1.66	58.5	6,821.75
15	Malawi	LI	0.80	60.9	322.5
16	Mozambique	LI	-1.28	55	483.17
17	Nepal	LMI	-2.09	63.2	2,758.98
18	Niger	LI	1.50	56.8	25.29
19	Nigeria	LMI	-1.79	56.9	100.89
20	Pakistan	LMI	0.53	61	570.25
21	Papua New Guinea	LMI	-3.88	59.8	264.1
22	Paraguay	UMI	-1.00	59.1	6,452.37
23	Samoa	LMI	-2.74	62.1	0.5
24	Senegal	LMI	0.87	59.3	441.01
25	St. Vincent and the Grenadines	UMI	-2.73	57.1	5,023.86
26	Tajikistan	LMI	4.50	61.3	183.32
27	Tanzania	LMI	2.00	54.5	43.58
28	Togo	LI	1.75	62.3	311.73
29	Uganda	LI	2.86	60	272.98
30	Uzbekistan	LMI	1.65	69.9	535.93
31	Vietnam	LMI	2.91	69.8	869.37
Average			2.49	58.89	1,379.62
Cluster Range			[-3.88 – 43.48 (6.99)]	[47.9 – 70.1]	[0.5 – 6,821.75]

Notes: The figures are calculated and the table is composed by the authors.

For many economies from this cluster, we observe the GDP growth even despite the pandemic; the average cluster value by this parameter is 2.49. This is the only cluster for which the average GDP growth rate is positive. Among 31 economies of the cluster, positive GDP growth rates are observed for 22 individual countries. With respect to the pandemic parameter, this cluster is similar to the previous one – the extent of its spread is low (average cluster value is 1,379.62). However, it should be underlined that such low rates can be explained by low level of health care development in many countries; consequently, infection cases are not officially fixed. Nevertheless, the previous cluster conclusion regarding the unessential impact of the pandemic factor on economic growth is also confirmed statistically for this group of countries. It can be also agreed upon considering the mentioned analytics. As to the doing business factors parameter, this cluster has the moderate value, although among absolute DB values for individual economies its level 58.89 is much closer to the lower range. We argue that this cluster group of countries represents such a case when the pandemic factor produces lower impact on economic growth compared to other economies. The reason behind this is the following. The expected rates of GDP growth should have been negative just as for most countries of the world because of the pandemic. However, for this cluster, the low level of its spread brought about a positive effect and the GDP growth rate finally appeared to be positive.

The last cluster includes 16 countries (Table 5). They are mostly high-income and upper-middle-income economies, while the first subgroup includes primarily offshore domiciles as well as two countries with lower-middle-income level.

Table 5. Clustering results – cluster 1 (destandardised data)

No.	Country	Income Level	Model Parameters		
			GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22,192.85]
1	Antigua and Barbuda	HI	-15.97	60.3	3,851.77
2	Bahamas	HI	-16.28	59.9	5,487.69
3	Barbados	HI	-17.61	57.9	3,873.68
4	Belize	LMI	-14.04	55.5	5,770.97
5	Cabo Verde	LMI	-14.78	55	6,820.3
6	Dominica	UMI	-16.71	60.5	5,675.71
7	Fiji	UMI	-19.05	61.5	5,748.82
8	Grenada	UMI	-11.23	53.4	5,023.86
9	Iraq	UMI	-10.37	44.7	5,037.85
10	Lebanon	UMI	-20.30	54.3	9,244.09
11	Libya	UMI	-31.30	32.7	5,055.29
12	Maldives	UMI	-31.98	53.3	15,860.32
13	Panama	UMI	-17.95	66.6	10,874.05
14	St. Kitts and Nevis	HI	-10.74	54.6	4,577.76
15	St. Lucia	UMI	-20.21	63.7	6,544.24
16	Suriname	UMI	-14.50	47.5	7,649.26
Average			-17.69	55.09	6,693.48
Cluster Range			[-31.98 – -10.37]	[32.7 – 66.6]	[3,851.77 – 15,860.32]

Notes: The figures are calculated and the table is composed by the authors.

The country-by-country structure of this cluster can be considered rather homogeneous, considering the descriptive criterion. They have the lowest (negative) GDP growth rates (the mean is -17.69), the low quality of doing business environment, and the high level of the pandemic spread. The interrelation between model parameters within this cluster is quite reasonable. The lowest average GDP growth rate is determined by the low level of regulatory environment as well as by the high extent of pandemic spread. For this cluster, both parameters played out simultaneously and did not create mutual offset effect.

Table 6 presents aggregate statistical results of clusterisation. The overall assessment of these results makes it possible to conclude that all three parameters used are significant according to the *F*-criterion (respective values are approaching zero) and substantially influence the clusterisation results.

Table 6. The analytical identification of clusters statistics

Cluster	Income Level	Composition	GDP [-31.98 – 43.48 (6.99)]	DB [20 – 86.8]	COVID [0 – 22,192.85]
1	HI / UMI / LMI	16	-17.69 (↓↓)	55.09 (↓)	6,693.48 (↑)
2	HI / UMI / LMI / LI	46	-5.53 (↓)	71.75 (↑)	3,275.67 (↕)
3	HI / UMI / LMI / LI	31	2.49 (↑↑)	58.89 (↕)	1,379.62 (↓)
4	HI / UMI / LI	47	-5.27 (↕)	74.34 (↑↑)	11,047.90 (↑↑)
5	LI / LMI / UMI	32	-2.54 (↑)	45.19 (↓↓)	575.15 (↓↓)

Notes:
1. The figures are developed by the authors.
2. Cells represent averages for the group for respective parameters.
3. Arrows demonstrate the cluster location in the range of the parameter: "↑↑" – very high value, "↑" – high value, "↕" – intermediate value, "↓" – low value, "↓↓" – very low value. These notations are intuitive.
4. The columns reflect respective ranges for parameters.

An analytical assessment of developed cluster model results makes it possible to identify three consistent patterns of dependence between the set of regulatory factors including the most up-to-date pandemic spread index and rates of economic growth of different countries of the world. The first pattern covers 47 economies from the fourth cluster of the developed model. It implies very high values of DB and pandemic parameters, and moderate (negative) rates of GDP growth. While the cluster model is not a factor model, the statistical grouping of countries and clusters filtration using the significant descriptive criterion imply (at least do not exclude) the existence of impact of one factor (factors) of the model on the other (others). Our model includes the pandemic and the set of doing business factors as implied independent variables, while GDP growth rates is the implied dependent variable. For this pattern, the negative impact of the pandemic factor can be regarded as relatively insignificant, which results from substantial positive set-off effect of the DB factor. This pattern – the pattern of relatively high-income economies – is typical of countries with high and upper-middle level of income according to the World Bank classification.

The second pattern covers 63 economies and – considering the substantial proximity of statistics and descriptive features – encompasses the third and fifth clusters of the developed model. This is the pattern with low and very low extent of the pandemic spread and above average rates of GDP growth. The pandemic factor impact for this pattern can be considered to be insignificant because of the low absolute values of the respective parameter. At the same time, a specific set-off or compensatory effect can be outlined for this pattern – GDP growth rates are not so low as they might have been as a result of unfavourable conditions of doing business due to the weak influence of the pandemic factor. However, as to the GDP growth rates within this pattern, two subgroups can be identified. The first subgroup (the fifth cluster) covers economies with the lowest level of the pandemic spread and the worst environment for doing business. The second subgroup (the third cluster) implies slightly higher level of the pandemic spread, but better environment for doing business at the same time. This, in turn, brought about even positive rate of GDP growth being the only among model clusters. For this case, the set-off effect is relatively high. All in all, this pattern covers economies where low and lower-middle level of income absolutely dominate.

The third pattern encompasses 16 economies with mostly high and upper-middle level of income, while the majority of them represent offshore domiciles. The low level of doing business factors as well as the high extent of the pandemic spread are typical of this pattern. The set-off effect is not being observed for these economies, since both parameters resulted in extremely low negative rates of GDP growth.

Therefore, under crisis environment and during decrease in economic growth that challenge contemporary economies, it is important to find key factors promoting long-term development. In periods of economic instability, governments should adjust regulatory measures to minimise negative consequences of crisis.

Conclusions

The present study reveals a relationship and commonness between the set of regulatory factors that, in turn, facilitate a favourable competitive environment (Doing Business rating), the COVID-19 pandemic factor, and growth of GDP in individual economies. The findings were generated via developing the econometric cluster model using the *k*-means method that made it possible to band 172 economies into five statistically distinct clusters. An analytical assessment of these clusters as well as their identification from the descriptive criterion (the level of income per capita) perspective enabled the discovery of three consistent patterns of dependence between GDP growth rates, the set of doing business factors, and the COVID-19 pandemic factor.

High and upper-medium economies patterns imply very high values of DB and pandemic parameters, as well as intermediate (negative) rates of GDP growth. The negative impact of the pandemic factor in the framework of this pattern can be regarded as relatively insignificant as it results from positive set-off impact of DB. The pattern for economies with low and lower-middle income level covers countries with low and very low extent of the pandemic spread and high rates of GDP growth. The influence of the pandemic factor on this pattern can be regarded as insignificant because of its low absolute values. Thereby, a specific set-off effect can be discovered for this pattern:

GDP growth rates are not as low as they might have been because of unfavourable conditions of doing business, since the pandemic factor impact is not so strong. The third pattern consists of economies with mostly high and upper-middle income level, representing many offshore domiciles. They have a low level of doing business factor and a high extent of the pandemic spread. In the framework of this pattern, the set-off effect is not observed, since both parameters brought about a simultaneous impact resulting in extremely low negative rates of GDP growth.

The developed model also enables the discovery of some particular general regularities of dependence between economic growth rates, the set of doing business factors, and the pandemic factor. First, the COVID-19 pandemic appeared to be an essential factor of economic growth for most economies, which resulted in a decrease in their GDP even despite favourable conditions of doing business in some countries. Second, a specific set-off effect between the set of doing business factors and the pandemic factor is identified. This effect consists in the fact that even substantial absolute values of the pandemic parameter may not bring about considerable losses in economic growth rates because of the favourable doing business environment and *vice versa*. Third, for economies with relatively high level of income, the impact of both factors looks to be more significant compared to countries with relatively low level of income. This peculiarity, however, is the least consistent in terms of our study results and requires further testing and investigation.

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