

ON CLUSTERING DURING AND AFTER CRISIS AS THE TOOL FOR ANALYZING THE GLOBAL ECONOMIC ARCHITECTURE

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Kobylanska A. V. On Clustering during and after Crisis as the Tool for Analyzing the Global Economic Architecture

The article is aimed at analyzing the development of global economy from the viewpoint of formation of ideas of its aggregation by means of the cluster analysis. It is found that during 1995-2014 in the world there were about 20 countries which GDP in total amounted to 80% of the global GDP. According to these data Japan, the USA, Germany, China, and Brazil formed a kernel of global economy. Further results of the cluster analysis have allowed to draw conclusions that during the observation period the United States and the Russian Federation remained the main centrodes of global economy. Despite the crisis of 2008, integration of global economy continued, most notably from the viewpoint of monetary indicators. The subsequent researches should be concerned with studying the economic policy directed to the internal economic development, the external relations, and formation of global economic policy, as well as to analyzing economic relations between the identified centrodes and other countries. This will help to understand the reasons of the contemporary global economic integration and to prognosticate its development in the future.

Keywords: economic development, global economy, global economic policy, cluster, GDP.

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Кобильанська А. В. Щодо кластеризації в період кризи та після неї як інструменту аналізу глобальної економічної архітектури

Метою статті є аналіз розвитку глобальної економіки з позиції формування уявлень щодо її агрегації за допомогою кластерного аналізу. Виявлено, що протягом 1995–2014 рр. у світі існувало 20 країн, ВВП яких сукупно дорівнював 80% глобального ВВП. Відповідно до цих даних Японія, США, Німеччина, Китай і Бразилія формували ядро глобальної економіки. У подальшому результати кластерного аналізу дозволили дійти висновків, що протягом періоду спостереження Сполучені Штати та Російська Федерація залишалися основними центроїдами глобальної економіки. Незважаючи на кризу 2008 р., інтеграція глобальної економіки продовжувалася, найбільш відчутною вона була з позиції монетарних показників. Подальші дослідження мають бути присвячені вивченню економічної політики, спрямованої як на внутрішній економічний розвиток, зовнішні зв'язки та формування глобальної економічної політики, так і на аналіз економічних зв'язків між виявленими центроїдами та іншими країнами. Це допоможе зрозуміти причини сучасної глобальної економічної інтеграції та спрогнозувати її розвиток у майбутньому.

Ключові слова: економічний розвиток, глобальна економіка, глобальна економічна політика, кластер, ВВП.

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Кобильанская А. В. О кластеризации в период кризиса и после него как инструменте анализа глобальной экономической архитектуры

Целью статьи является анализ развития глобальной экономики с позиции формирования представлений о ее агрегации с помощью кластерного анализа. Выявлено, что в течение 1995–2014 гг. в мире было порядка 20 стран, ВВП которых в совокупности равен 80% глобального ВВП. В соответствии с этими данными Япония, США, Германия, Китай и Бразилия формировали ядро глобальной экономики. В дальнейшем результаты кластерного анализа позволили сделать выводы, что в течение периода наблюдения Соединенные Штаты и Российская Федерация оставались основными центроидами глобальной экономики. Несмотря на кризис 2008 г., интеграция глобальной экономики продолжалась, наиболее ощутимой она была с позиции монетарных показателей. Последующие исследования должны быть посвящены изучению экономической политики, направленной как на внутреннее экономическое развитие, внешние связи и формирование глобальной экономической политики, так и на анализ экономических связей между выявленными центроидами и другими странами. Это поможет понять причины современной глобальной экономической интеграции и спрогнозировать ее развитие в будущем.

Ключевые слова: экономическое развитие, глобальная экономика, глобальная экономическая политика, кластер, ВВП.

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There have been made a lot of attempts to analyze the global economy, including its structure. Among various tools, clustering is considered as a powerful means to confirm or reject the hypothesis on global economy segregation.

Literature review. Generally clustering is studied in relation to specific markets or market players (most commonly, companies) either at the national or international level. Thus, M. E. Porter [1] discusses new reasons for clustering in the fast developing world. He approaches cluster as “a geographically proximate group of interconnected companies and associated institutions in a particular field,

linked by commonalities and complementarities”. However, despite the proved tight linkages between the economies belonging to the same geographical region, nowadays the geographical criterion in economic regionalization has less importance than before. Thus, we could somehow accentuate the last part of Porter’s definition stressing the interconnectedness of economies [2].

Ye. A. Islankina et al. [3] in their turn make a step ahead presenting theoretical grounds of internationalization of regional clusters and stressing its importance for increasing the efficiency of cluster activity in the inevitably globalized world.

Current paper considers cluster in the proper mathematic sense and a tool to analyze the structure of the global economy and afterwards to enrich the internationalization phenomenon of clusters formed upon classic conditions (production, value creation, institutions [4]).

The paper proceeds as follows.

First, from the whole dataset of countries we choose twenty of those with the highest value of GDP for the last available year (2015).

Then, we analyze the share of their GDP in the global one for three specific years:

- ✦ 1995 (as the year with more complete data for each country and after collapse of USSR),
- ✦ 2008 (as the year of global economic crisis)
- ✦ 2014 (the last available year with complete data)

in order to derive the hypothesis on possible global economic centers/leaders.

Second, we include in our analysis main macroeconomic indicators describing this set of countries, in particular:

- ✦ CPI (2010 = 100) (as an indicator that not only measures inflation but consequently influences the profitability of investments, investment climate in general as well as movement of goods and services);
- ✦ broad money (% of GDP) (as an indicator proven to be highly related to economic growth);
- ✦ employment in services (% of total employment) (as a model for structural shifts in respective economies);
- ✦ GDP growth (as an indicator that helps to evaluate the general economic development).

The evaluation of those parameters will help to analyze the changes in the state of global economy better.

Third, on the basis of the available dataset obtained during the previous steps and using clustering methods, we derive the changes in the structure of global economy, accept or reject the hypothesis and draw conclusions for future researchers.

As a clustering tool we use k-mean clustering. Using this approach, general set of observations is divided into several groups.

The most applied k-centroid technique is the k-means (also HCM – hard c-means) algorithm (Mac-Queen, 1967) [5], which analyzes the dataset with the aim to minimize the objective function

$$J_{HCM} = \sum_{h=1}^k \sum_{i=1}^n u_{hard, ih} d_{ih}^2 \quad (1)$$

At the end, we will consider the set of groups in global economy having highest potential for economic aggregation.

While analyzing the global GDP, one could find that some countries have the highest values of this indicator. The following table shows the share of the national GDP in the global one (Table 1).

First of all, during the years under the consideration the GDP of these 20 countries in aggregate amounted to about 80% of the global GDP. While, taking into account the regional criterion, Japan, United States, Germany, China and Brazil (shaded in grey) seem to form the core of global economy.

Table 1

The distribution of countries by their share in the global GDP

No.	Country	1995	2008	2014	2015
1	Japan	17.7	8.0	6.2	5.9
2	United States	24.8	23.2	22.1	24.3
3	United Kingdom	4.3	4.5	3.8	3.9
4	Saudi Arabia	0.5	0.8	1.0	0.9
5	Korea, Rep.	1.8	1.6	1.8	1.9
6	China	2.4	7.3	13.3	14.8
7	Russian Federation	1.3	2.6	2.6	1.8
8	Canada	2.0	2.4	2.3	2.1
9	Turkey	0.5	1.2	1.0	1.0
10	India	1.2	1.9	2.6	2.8
11	Netherlands	1.4	1.5	1.1	1.0
12	Germany	8.4	5.9	4.9	4.5
13	Italy	3.8	3.8	2.7	2.5
14	Spain	2.0	2.6	1.8	1.6
15	France	5.2	4.6	3.6	3.3
16	Australia	1.2	1.7	1.9	1.8
17	Mexico	1.1	1.7	1.7	1.5
18	Indonesia	0.7	0.8	1.1	1.2
19	Switzerland	1.1	0.9	0.9	0.9
20	Brazil	2.5	2.7	3.1	2.4
	Rest of the World	16.1	20.4	20.6	20.0

Source: calculated by the author based on WDI [6]

Let's analyze the available data more thoroughly (Table 2).

The results presented in Table 3 allow us to conclude that even despite the crisis the deviation in the chosen macro-indicators diminishes from year to year, except for that of broad money as % of GDP. China holds the position of the leader in terms of the pace of economic growth.

The geometric representation of countries mapping in Fig. 1 only supports this observation. It is clearly seen, that with the time the "circles" of broad money as % of GDP, GDP growth, % of employment in services (in total) become smoother.

Now, let's proceed to the third stage of the research and cluster the global economy based on the chosen indicators. The subsequent figures, thus, represent the change in the global economy clustering from 1995 to 2014.

Fig. 2 shows that in 1995 the global economy was rather nonintegrated and there existed numerous economic centers. The Russian Federation as a successor of the USSR continued to stay aside from the seemingly interrelated USA and Europe, as well as the Eastern part of our globe.

Respectively, Fig. 3 depicts the drastic changes in the global economy related to the global economy crisis. Not surprisingly the Western Hemisphere was tightly interrelated, while China showing positive economic growth opposed

The deviation of the main macro-economic indicators for the 20 largest economies

	1995			2008			2014		
	max	min	stdev	max	min	stdev	max	min	stdev
CPI (2010 = 100),%	101.1	1,2	28.6	102.1	80.5	5.8	140.8	99.3	11.4
M* (% of GDP)	202.8	19,3	46.7	201.2	38.3	51.0	237.4	39.5	61.1
Employment in 3d sector (% of total)	73.3	12,2	15.7	78.6	40.8	10.2	79.1	44.8	10.8
GDP growth, % yoy	10.9	-5.8	4.1	9.7	-1.1	3.0	7.3	0.1	2.1

	1995		2008		2014	
	max	min	max	min	max	min
CPI (2010 = 100), %	Japan	Turkey	Japan	Indonesia	Canada	Switzerland
M* (% of GDP)	Japan	Russian Federation	Japan	Indonesia	Japan	Indonesia
Employment in 3d sector (% of total)	Canada	China	United States	Indonesia	United Kingdom	Indonesia
GDP growth, % yoy	China	Mexico	China	Japan	China	Italy

Source: calculated by the author based on WDI [6].

Note: M* – broad money, stdev – standard deviation.

the general situation being the centroid for other big Eastern economies like those of India and Japan.

Our cluster analysis ends up with consideration of the global economy in 2014. Fig. 4 shows that the progress in the economic integration persists and we could observe more linkages between the countries with respectively more centroids. Partly this could be attributed to the continuing financial integration, which severely influences the scope and depth of economic interrelations [7].

For example, if we exclude from our consideration the GDP growth, which could accentuate the degree of the real sector cooperation, we get Fig. 5. This Figure, on the contrast to the previous one constructed also for 2014, represents the global economy as a purely polycentric world with three main centroids — the Russian Federation, United States and China. This is only proved by various observations of global economy functioning [8].

Summarizing the above, we can see that the represented dendrogrammes demonstrate that a significant centralization of the global economy had place during 1995–2014. More relative similarities between the countries under consideration appeared even despite (or even may be due to) the crisis. The specific centroids are mentioned in Table 3.

One could mention that regardless the year, the United States and the Russian Federation remained the centroids of the global economy.

CONCLUSIONS

The analysis conducted in the paper allows us to come to the following conclusions:

- ✦ during the period under consideration (1995–2014) the GDP of these 20 countries in aggregate amounted to about 80 % of the global GDP. Taking into account the regional criterion, Japan, United States, Germany, China and Brazil seem to form the core of the global economy;
- ✦ the deviation in the chosen macro-indicators (CPI, GDO growth, broad money as share of GDP, % of employment in the third sector) diminishes from year to year, despite that of broad money as % of GDP. China holds the position of the leader in terms of the pace of economic growth;
- ✦ according to the cluster analysis results, in 1995 the global economy was rather nonintegrated, and there existed numerous economic centers. The Russian Federation as a successor of the USSR continued to stay aside from the seemingly inter-related USA and Europe, as well as the Eastern part of our globe;

Table 3

The centroids of the global economy

1995	2008	2014
Germany	Russian Federation	United Kingdom
United Kingdom	India	Russian Federation
United States	Japan	Brazil
Russian Federation	China	China
Indonesia	United States	Germany
India		United States
Japan		
Saudi Arabia		

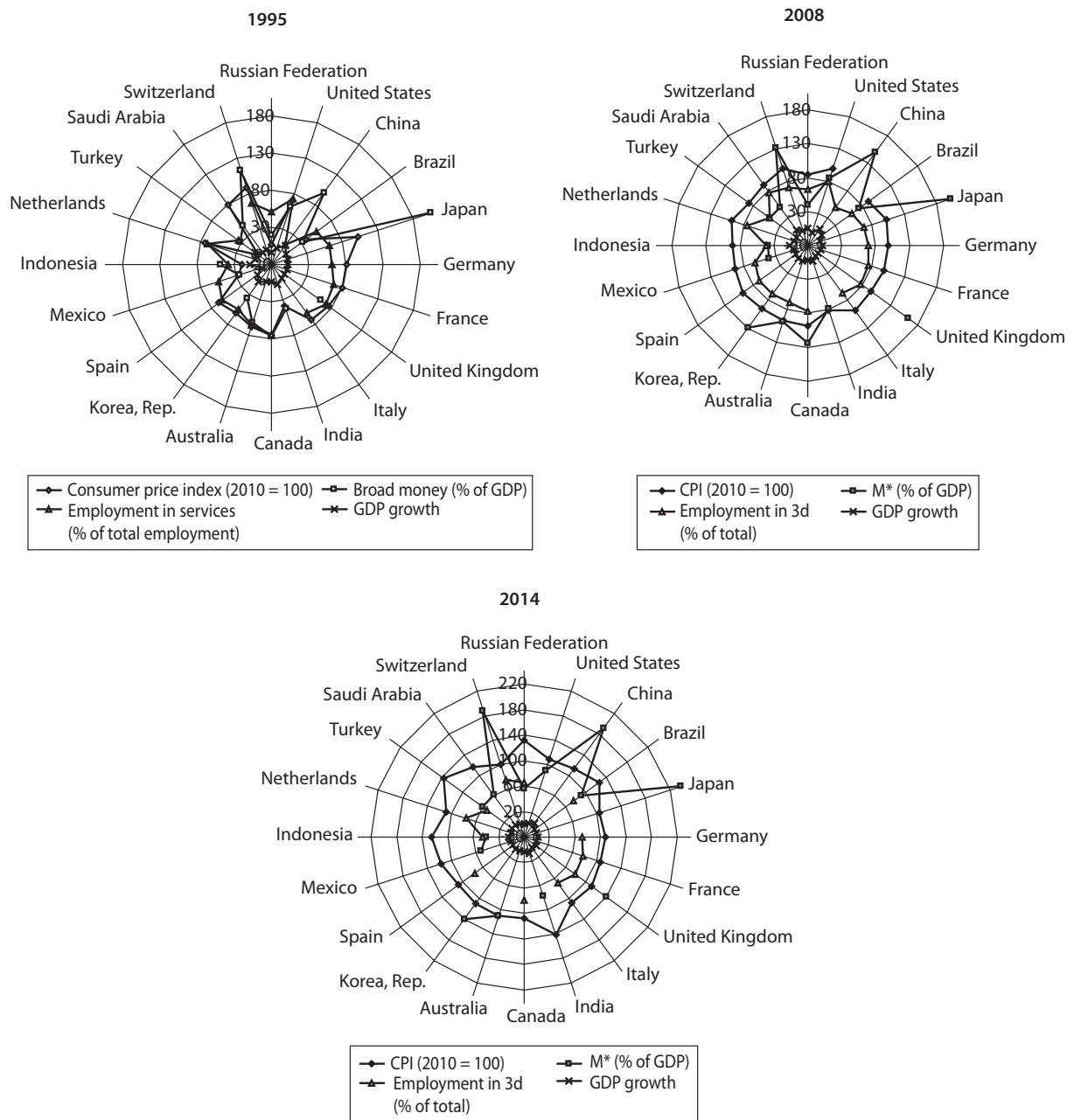


Fig. 1. The mapping of the 20 largest world economies

Source: constructed by the author based on WDI [6].

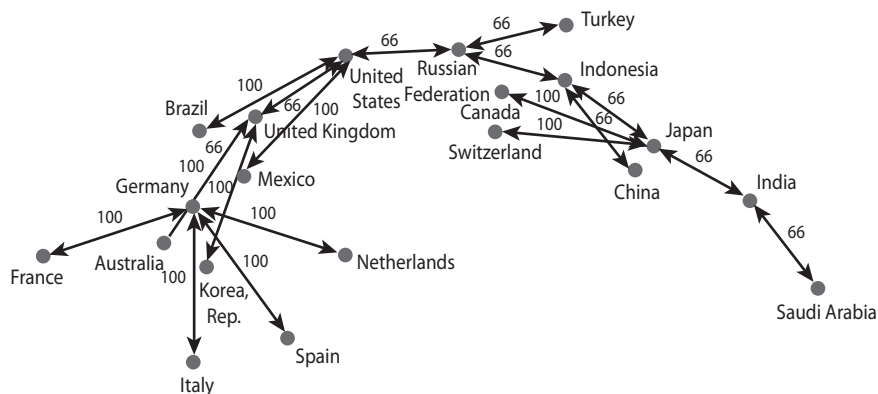


Fig. 2. The dendrogramme of the global economy clustering for 1995

Source: estimated* by the author based on WDI [6].

Note: * – the number by the arrow represents the tightness of the linkage between the countries (varies from 0 to 100, where 100 is the maximum value).

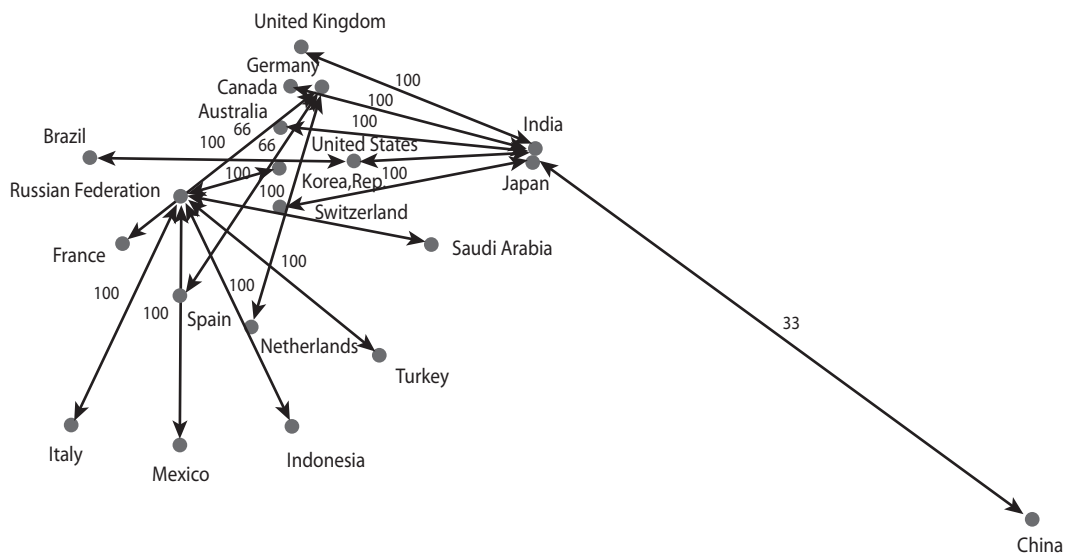


Fig. 3. The dendrogramme of the global economy clustering for 2008

Source: estimated by the author based on WDI [6].

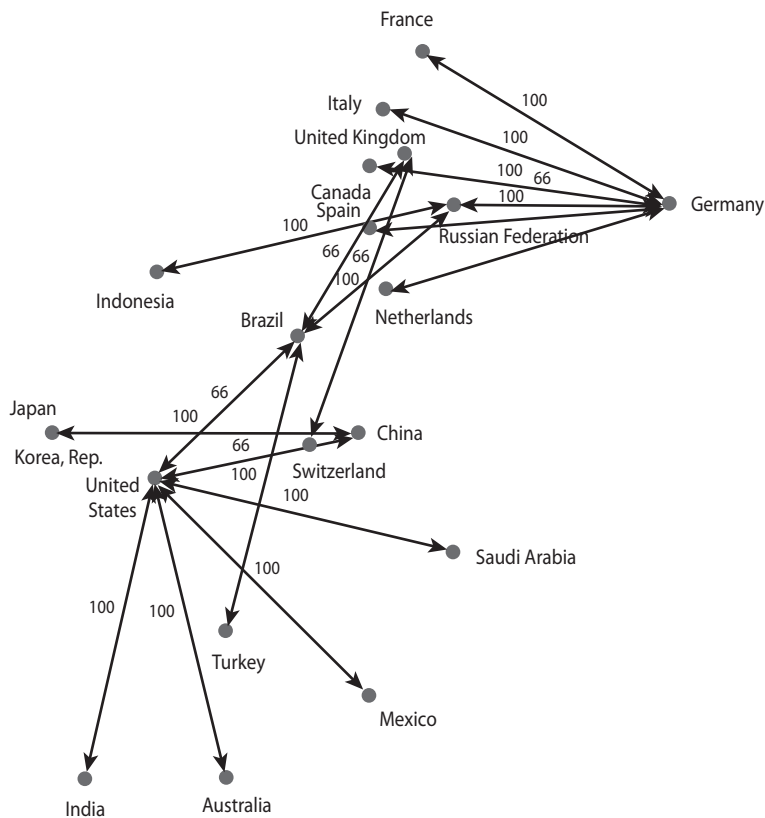


Fig. 4. The dendrogramme of the global economy clustering for 2014 (including the GDP growth as a clustering criterion)

Source: estimated by the author based on WDI [6].

✦ in 2008 the drastic changes in the global economy related to the global economic crisis occurred. While the economies of the Western Hemisphere were tightly interrelated and damaged by the crisis, while China showing positive economic growth opposed the general situation being the centroid for other big Eastern economies like those of India and Japan;

✦ in 2014, six years after the global economic crisis began, the progress in the economic integration persists and more linkages between the countries with respectively more centroids are observed. Partly this could be attributed to the continuing financial integration, which severely influences the scope and depth of economic interrelations.

✦ if we exclude from our consideration the GDP growth, which could accentuate the degree of the

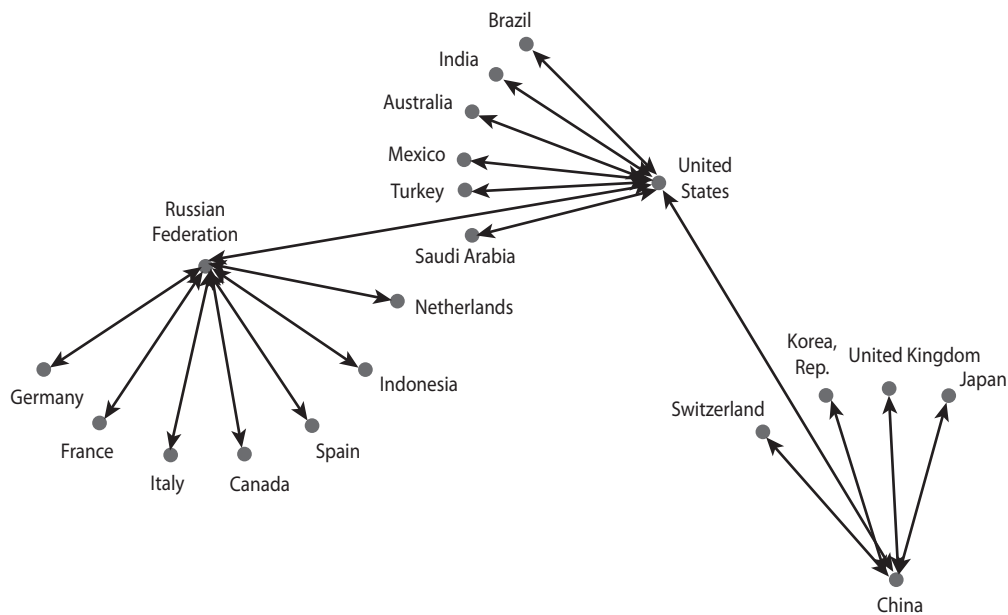


Fig. 5. The dendrogramme of the global economy clustering for 2014 (excluding the GDP growth as a clustering criterion)

Source: estimated by the author based on WDI [6].

real sector cooperation, the global economy will be represented as a purely polycentric world with three main centroids – Russian Federation, United States and China.

The results obtained and some other considerations permit to derive a hypothesis that could be used in the further researches.

Thus, the main economic policies regarding internal economic development and international relationships, and global economic policies of global centroids should be analyzed as well as the economic linkages between centroids and other countries. This will help both to determine the reasons of modern global economic integration and to predict its evolution in future. ■

LITERATURE

1. Porter M. E. Location, Clusters, and Company Strategy. Oxford Handbook of Economic Geography. 2000. P. 253–274.
2. Воскресенский А. Д. Концепции регионализации, региональных подсистем, региональных комплексов и региональных трансформаций в современных международных отношениях. *Сравнительная политика*. 2012. Т. 3, № 2 (8). С. 30–58.
3. Исланкина Е. А., Назаров М. Г., Фияксель Э. А. Интернационализация кластеров как инструмент повышения национальной конкурентоспособности: европейский опыт. *Инновации*. 2013. № 2. С. 86–95.
4. Steinle C., Schiele H. Limits to global sourcing?: Strategic consequences of dependency on international suppliers: Cluster theory, resource-based view and case studies. *Journal of Purchasing and Supply Management*. 2008. № 14.1. P. 3–14.
5. MacQueen J. Some methods for classification and analysis of multivariate observations // *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability Statistics*. California: University of California Press, Berkeley, 1967. Vol. 1. P. 281–297.
6. WDI. URL: <http://data.worldbank.org/data-catalog/world-development-indicators/> (last access: 01.03.16).

7. Шпенюк О. Є. Вплив фінансової глобалізації на розвиток національної економіки. *Економіка і прогнозування*. 2014. № 1. С. 145–159.

8. Валлерстайн И. Конец знакомого мира: Социология XXI века/пер. с англ. В. Л. Иноземцев. М.: Логос, 2003. 355 с.

REFERENCES

Islankina, E. A., Nazarov, M. G., and Fiyaksel, E. A. "Internationalizatsiya klasterov kak instrument povysheniya natsionalnoy konkurentosposobnosti: yevropeyskiy opyt" [Internationalization of clusters as a tool to enhance national competitiveness: the European experience]. *Innovatsii*, no. 2 (2013): 86-95.

MacQueen, J. "Some methods for classification and analysis of multivariate observations". In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability Statistics*, 281-297. Vol. 1. California: University of California Press, Berkeley, 1967.

Porter, M. E. "Location, Clusters, and Company Strategy". In *Oxford Handbook of Economic Geography*, 2000. 253-274.

Steinle, C., and Schiele, H. "Limits to global sourcing? Strategic consequences of dependency on international suppliers: Cluster theory, resource-based view and case studies". *Journal of Purchasing and Supply Management*, no. 14. 1 (2008): 3-14.

Shpeniuk, O. Ye. "Vplyv finansovoi hlobalizatsii na rozvytok natsionalnoi ekonomiky" [The impact of financial globalization on the development of national economy]. *Ekonomika i prohozuvannia*, no. 1 (2014): 145-159.

Voskresenskiy, A. D. "Kontseptsii regionalizatsii, regionalnykh podsystem, regionalnykh kompleksov i regionalnykh transformatsiy v sovremennykh mezhdunarodnykh otnosheniyakh" [Concepts of regionalization, regional subsystems, regional complexes and regional transformations in contemporary international relations]. *Sravnitel'naya politika*. Vol. 3, no. 2 (8) (2012): 30-58.

Vallerstayn, I. *Konets znakomogo mira: Sotsiologiya XXI veka* [End of the familiar world: Sociology of the XXI century]. Moscow: Logos, 2003.

WDI. <http://data.worldbank.org/data-catalog/world-development-indicators/>