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CONCENTRATION AND REGIONALIZATION
OF AGRICULTURE IN THE WORLD

Key words: agriculture, world, concentration, regionalization, agricultural production

ABSTRACT. The main purpose of the article was to assess the regionalization of agricultural production in the world and the changes occurring in this aspect. The article presents the concentration level of agricultural production in the world by continent. The source of materials was data from FAOSTAT. The research period covered the years 2004-2016. In the analyzed period, the value of gross agricultural production doubled. Various trends were observed within the period studied. In the years 2004-2010, in all regions of the world, there was an increase in gross production of agriculture, while in the period 2010-2016 only in two – North America and Asia. It was noted that there was a high concentration of agricultural production, mainly concentrated in Asia and Europe. In the analyzed period, there was a relative increase in the share of agricultural production in Asia and South America as compared to other regions. Individual groups of agricultural products, such as cereals and animal production, were also analyzed. In both cases, concentration was different. The pace of concentration in animal production was higher than in plant production.

INTRODUCTION

Agriculture is the oldest branch of the economy covering plant and animal production, and, in a wider range, also processing plant and animal products. Agriculture is an extremely complex system in which natural, economic, social, cultural and also political factors combine. The development of agriculture is conditioned by many external and internal factors. External factors include the level of economic development of a country, employment opportunities in other sectors, the level of food demand as well as income or export of goods to other markets. Internal factors include farm area, labor productivity, technical equipment and level of investment outlays [Wiatrak 1980, Szczukocka 2015].

Agriculture plays a major role in the economy of all countries, although it is not the same everywhere and not everyone is aware of it [Runowski 2015]. Agriculture is a key element

of agribusiness and the entire bioeconomy. It is a branch with multiple functions, not limited to production tasks [Manteuffel 1979, Rychlik, Kosieradzki 1981, Klepacki 1996].

An important measure determining the importance of agriculture is its share in the creation of gross domestic product [Mrówczyńska-Kamińska 2008]. In world agriculture, the economic regularity is that with an increase in the level of economic development of individual countries, the share of agriculture in the GDP structure decreases and labor productivity in agriculture increases per employee [Sapa 2014]. According to Andrzej Czyżewski and Jakub Staniszewski [2018], when assessing the importance of agriculture in the richest countries in the world only through the share of this sector in creating GDP, it can be concluded that it is marginal and is continuing to decline. According to United Nations data [UN 2015], in the years 1970-2014, the share of agriculture, hunting, forestry and fishing in GDP fell, for example, in Australia from 5.93 to 2.29%, in Canada from 4 to 1.6%, in France from 6.96 to 1.5%, in Germany from 2.94 to 0.61%, in Great Britain from 2.16 to 0.61%, and in the USA from 2.34 to 1.24%. Among 176 countries for which the United Nations has data, this share decreased from 20.1 to 11.1% on average.

The processes of globalization and regionalization are important factors influencing the development of agriculture [Sapa 2010].

At the end of the 20th century, as a result of the use of modern technologies in agricultural production, changes in the distribution and sale of agricultural products, and changes in the way they are consumed, a global production system was developed. Food products are delivered to the global market in a highly processed form. Products with extended food shelf life appear. As the trade was mastered by large corporations, the product brand became more and more important. The most important element shaping the new agricultural production system for the global market is the sales network created by hypermarkets [Czerny 2005]. Large farms produce for their needs, using modern cultivation technologies to obtain the uniform quality of the product, corresponding to high standards in terms of appearance and packaging. There is an increasing geographical distance between producers and consumers in the agricultural sector, which was characteristic of industrial production. Global corporations controlling food trade are looking for new producers that are cheaper and located in zones that guarantee production throughout the year. It is about the possibility of a continuous supply of fresh products (fruit, vegetables and shrimps) to regions with high consumption. This especially applies to fruits, not only traditional citrus and bananas, but also those from Southern and Eastern Europe and Mediterranean countries, or the more exotic (mango, papaya, pineapples and avocados) from the subtropics. Hence, a clear change in the regional system of agricultural production has been visible in recent years among the so-called Non-European countries, such as Brazil, Mexico, Argentina, China, and Kenya, whose share in the global food trade has significantly increased [Kaczmarek 2014].

RESEARCH MATERIAL AND METHODS

The main purpose of the article was to assess the degree of concentration of agricultural production in the world. The specific objectives were to identify regions with a dominant share of agricultural production in the world and determine the directions and strength of changes in agricultural production. The areas selected for analysis were continents (Africa, South America, North America, Asia, Europe and Oceania). The paper is important from a cognitive point of view, as it answers the question concerning which regions of the world dominate agricultural production and what changes are taking place in this respect. The process of concentration of agricultural production in the world is a dynamic phenomenon, therefore, continuous and up-to-date analyzes of this phenomenon are needed. The study is an extension and supplementation of research by Tomasz Rokicki and others [2017]. Adopting a longer period of research makes it possible to make more accurate conclusions based on more data. The work uses a comparative method. Dynamics indices were used, the Gini coefficient was calculated and the concentration degree was presented using the Lorenz curve. The curve shows the cumulative percentage of production for successive continents, ranked from those with the highest production to those with the lowest (Figure 1). In the case when production of all continents is equal, the Lorenz curve takes the form of a straight line inclined at an angle of 45 degrees to the X-axis (absolute equality curve). However, as inequality increases, the Lorenz curve deviates more and more from the curve of absolute equality. The quantitative measure of this inequality is the Gini coefficient, which is twice the area between the real curve and the curve of absolute equality.
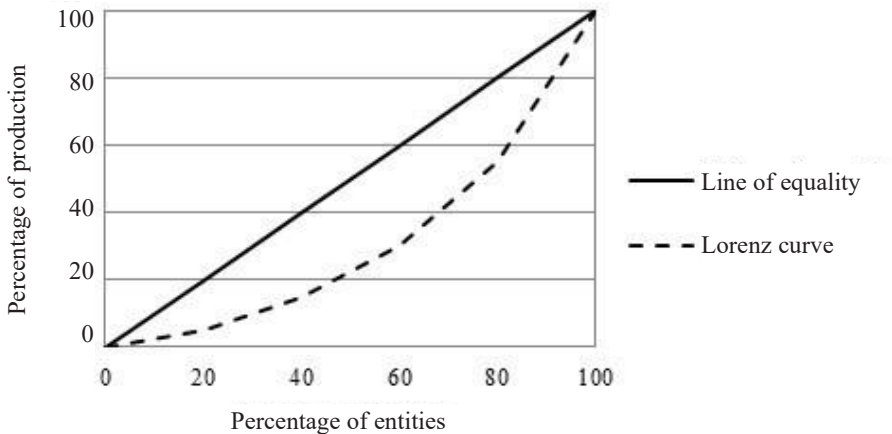
Figure 1. Lorenz curve
Source: own study based on [Stiglitz 2004]

The Gini coefficient is a measure of the concentration (non-uniformity) of distribution of a random variable, and one of its formal approaches is presented by the formula [Dixon et al. 1987, Damgaard, Weiner 2000]:

$$G(y) = \frac{\sum_{i=1}^{n}(2i-n-1) \times y_i}{n^2 \times \bar{y}}$$

where:

n – number of observations,

y_i – value of the i-th observation,

$\bar{y}$ – mean value of all observations, i.e. $\bar{y} = \frac{1}{n}\sum_{i=n}^{n} y_i$.

The Gini coefficient ranges from 0 (when there is absolute equality of production) to 1 (when all production is concentrated in one country). This coefficient meets the Pigou-Dalton transfer principle, the symmetry principle, the homogeneity principle and the replication principle, however, it does not meet the decomposition principle [Lissowski et al. 2008].

The sources of the materials were data published by FAOSTAT. The research period was 2004-2016. Descriptive, tabular and graphic methods were used to present the research results.

RESEARCH RESULTS

Agriculture is present practically all over the world and, depending on the region, it differs in the structure of production, technological advancement and efficiency. Countries and regions of the world produce food of both plant and animal origin. Many indicators can be used to assess the volume of production and its changes. One of the measures is the value of gross agricultural production. Between 2004 and 2016, the value of world gross agricultural production increased by 95%, from USD 1.9 trillion to USD 3.7 trillion. In each of the six regions studied, the level of change varied greatly, from 18% growth in Europe to 147% in Asia. It should be noted that different trends were observed throughout the period considered. In the years 2004-2010, in all regions of the world, there was an increase in gross production of agriculture, while in the period 2010-2016 only in two regions - North America and Asia (Table 1).

Equally important as the dynamics of changes is the share of individual regions in total agricultural production in the world. In the analyzed period, the highest value of agricultural production was recorded in Asia. In 2004, this value accounted for approximately 50%, and in 2016 over 60% of world production (Figure 2). Europe was second, but its share decreased from almost 22% in 2004 to 13% in 2016. A similar trend was observed in other regions, except for South America.

Table 1. Indexes of dynamics with a variable base for the value of agricultural production in the world in 2004, 2010 and 2016

Region	Indexes of dynamics			
	2004	2010 (2004 = 100)	2016 (2004 = 100)	2016 (2010 = 100)
The World	100	178.97	195.05	108.99
Africa	100	188.49	152.30	80.80
North America	100	148.81	153.47	103.13
South America	100	246.24	230.30	93.52
Asia	100	201.82	247.00	122.39
Europe	100	129.21	118.14	91.43
Oceania	100	134.98	131.89	97.71

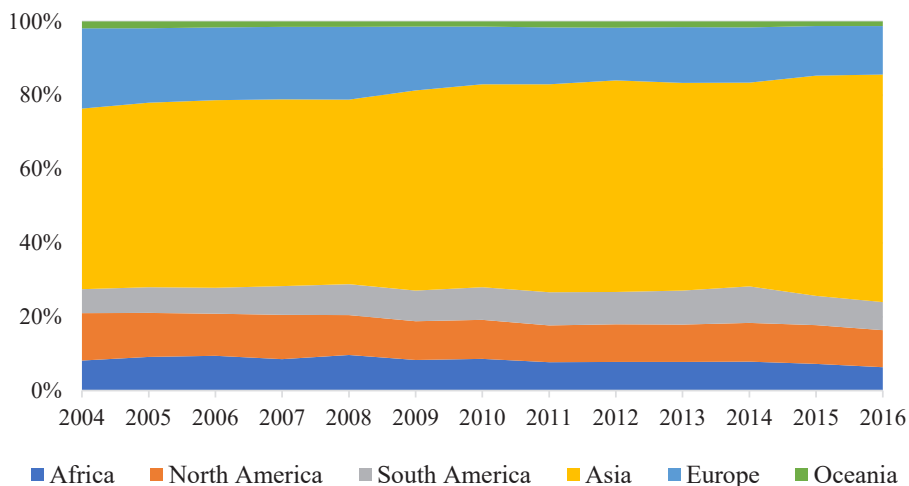Source: own study based on [FAOSTAT 2020]

Figure 2. Share of world regions in the value of gross agricultural production in 2004-2016
Source: own study based on [FAOSTAT 2020]

The Gini coefficient was used to assess changes in the process of agricultural production concentration in the world. Considering that the zero value of the coefficient indicates full uniformity of the distribution and bearing in mind that the value of the coefficient may be in the range [0; 1], in the case under examination, the value of the indicator should be considered average, which indicates significant disproportions in the distribution of agricultural production in different regions of the world. The observed increase in the
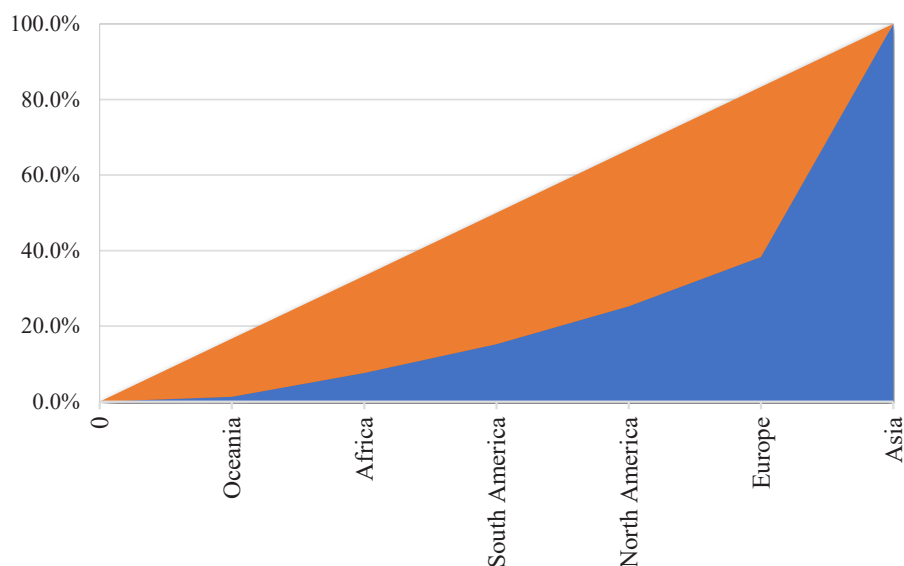
Figure 3. The Lorenz curve for the value of gross agricultural production in world regions in 2016
Source: own study based on [FAOSTAT 2020]

coefficient in the analyzed period gives grounds to believe that the concentration of agricultural production is increasing. It should be emphasized that, in 2016, Europe and Asia accounted for over 70% of the value of agricultural production in the world (Figure 3).

In agricultural production, cereals are the group of products of dominant importance. Their production value in the world increased by 90% in the years 2004-2016 from

Table 2. Indexes of dynamics with a variable base for the gross production value of cereals in the world in 2004, 2010 and 2016

Region	Indexes of dynamics			
	2004	2010 (2004 = 100)	2016 (2004 = 100)	2016 (2010 = 100)
The World	100	165.57	189.61	114.52
Africa	100	188.38	162.29	86.15
North America	100	222.55	181.60	81.60
South America	100	188.20	178.70	94.95
Asia	100	164.85	214.81	130.31
Europe	100	122.61	123.05	100.35
Oceania	100	104.61	117.14	111.97

Source: own study based on [FAOSTAT 2020]

USD 392 billion to USD 744 billion. The value of cereal production doubled in Asia (by 115%). There was also strong growth in North America (81%) and South America (79%). The observed increases were mostly determined by an increase in the production value in the first of the analyzed sub-periods. Taking the years 2010-2016 into account, the growth for the whole world was only 14.5%. In three regions: Africa, North America and South America, the value of cereal production after 2010 fell by 14%, 18% and 5%, respectively (Table 2).

In the case of cereals, the production concentration process also progressed. The Gini coefficient calculated for 2004 was 0.56, and for 2016 – 0.61. The share of Asia in global production almost reached 70% in 2016 and was higher than in 2004 by 9 p.p. (Figure 4). The importance of Europe declined systematically (from 16.1% to 10.4%). The share of Africa, the Americas and Oceania in the production of cereals was stable.

The clear domination of Asia in cereal production is shown by the Lorenz curve for 2016 (Figure 5).

Animal production is an essential part of agricultural production. Its value in the world increased by 77.8% in 2004-2016, from USD 714 billion to USD 1,236 trillion. This production doubled in South America (an increase of 141%) and Asia (by 143%), with the smallest increase in Europe (by 10%) and North America (by 53%). As for total production and cereals, the greatest drops in the value of animal production occurred in 2010-2016. Only in Asia and North America during this period did the trend reverse and the value of animal production increase by 23% and 9%, respectively (Table 3).
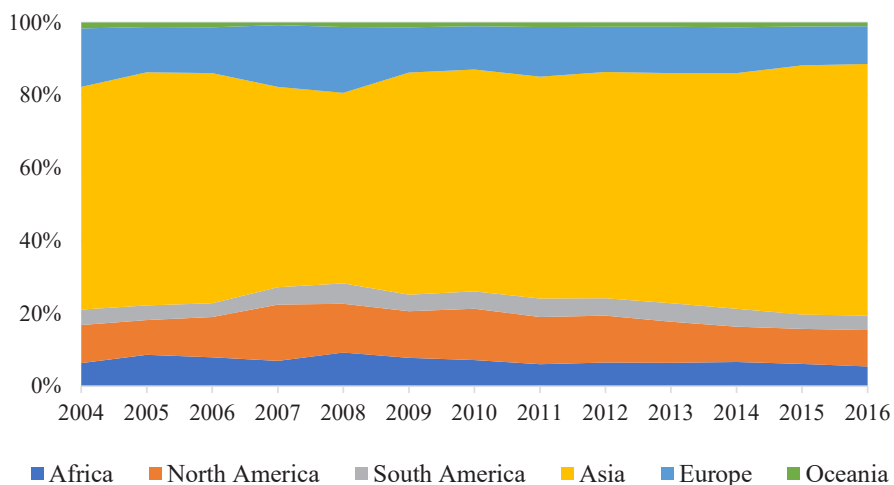

Figure 4. Share of world regions in the gross production value of cereals in 2004-2016
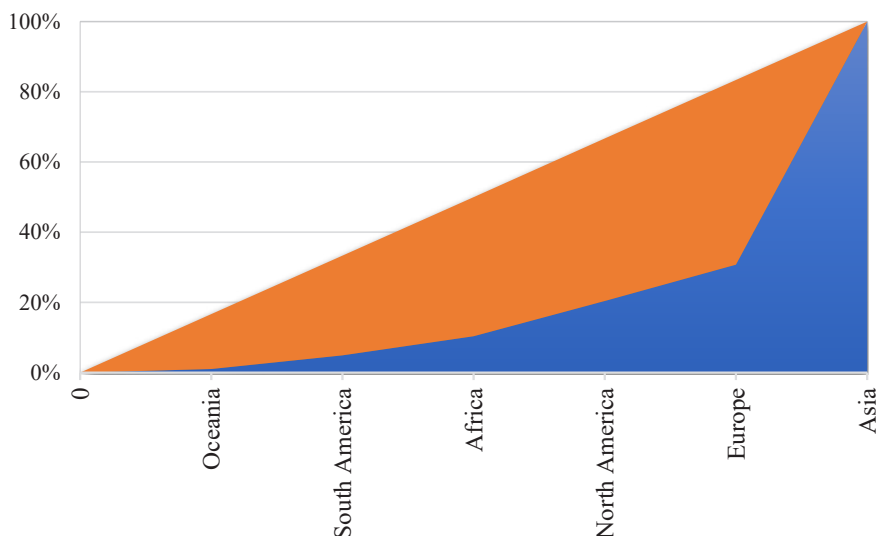Source: own study based on [FAOSTAT 2020]

Figure 5. The Lorenz curve for the value of cereal production in world regions in 2016
Source: own study based on [FAOSTAT 2020]

Table 3. Indexes of dynamics with a variable base for the value of animal production in the world in 2004, 2010 and 2016

Region	Indexes of dynamics			
	2004	2010 (2004 = 100)	2016 (2004 = 100)	2016 (2010 = 100)
The World	100	166.82	177.82	106.59
Africa	100	187.40	153.03	81.66
North America	100	118.97	129.54	108.89
South America	100	253.83	241.23	95.04
Asia	100	198.55	243.78	122.78
Europe	100	130.42	110.02	84.36
Oceania	100	141.87	128.51	90.58

Source: own study based on [FAOSTAT 2020]

Animal production was concentrated in Asia, but the advantage of this region was not as great as in the case of cereals (Figures 6 and 7).

The Gini coefficient for animal production was 0.44 in 2004, and 0.50 in 2016. The share of Asia in world animal production averaged around 46% in the analyzed period. Europe was also of great importance, with a share of 22%. Since 2014, only Asia's share has increased, unlike other regions of the world.
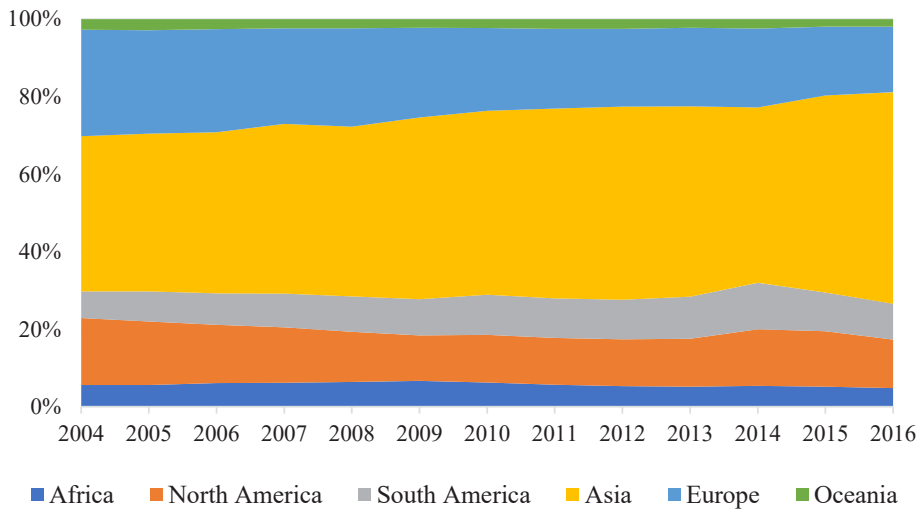
Figure 6. Share of world regions in the value of animal production in 2004-2016 (%)
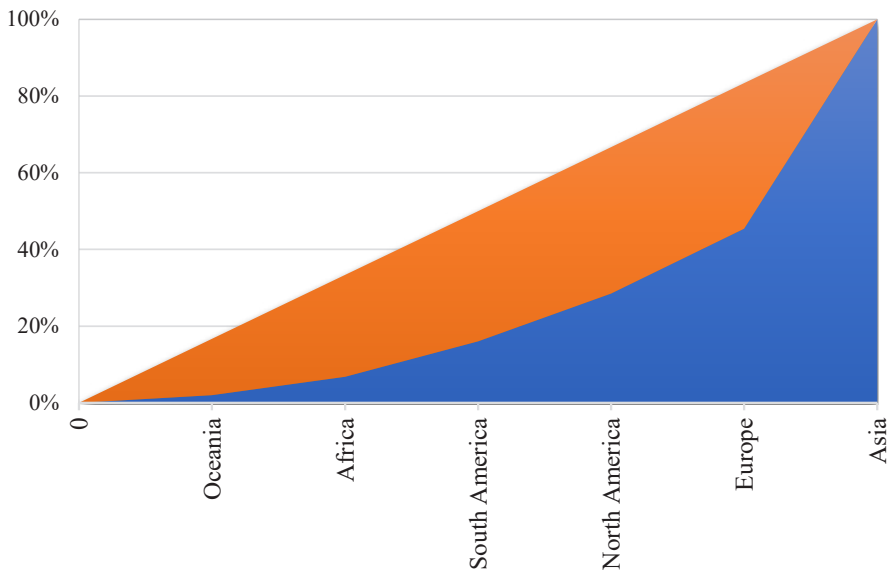Source: own study based on [FAOSTAT 2020]

Figure 7. The Lorenz curve for animal production in world regions in 2016
Source: own study based on [FAOSTAT 2020]

CONCLUSIONS

The value of global gross agricultural production increased steadily in all surveyed regions in the years 2004-2010, in the period 2010-2016 only in two - North America and Asia. A large concentration of agricultural production in the world was observed, the Gini index reached 0.54 in 2016. Two regions, Europe and Asia, accounted for over 70% of the world's agricultural production value. In the analyzed period, there was a relative increase in the share of Asia and South America compared to other agricultural production regions. It can be assumed that this was influenced by agricultural policy, on the one hand more restrictive in the EU (promoting ecological production systems characterized by lower productivity and the ban on the use of GMOs) and, on the other hand, liberal in individual Asian and South American countries, giving greater opportunities to use fertilizers or plant protection products. It can be assumed that lower production costs could be another factor conditioning the dynamic growth of agricultural production in the region of Asia, South America, and Oceania.

Agricultural product groups, such as cereals and animal production, were also analyzed. In 2016, the concentration of cereal production was greater than that of animal production. Asia's share of world cereal production has reached a level of almost 70%. Nevertheless, throughout the analyzed period, the concentration process progressed faster in the case of animal production than cereal production.

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KONCENTRACJA I REGIONALIZACJA ROLNICTWA NA ŚWIECIE

Słowa klucze: rolnictwo, świat, koncentracja, regionalizacja, produkcja rolnicza

ABSTRAKT

Celem głównym badań była ocena regionalizacji produkcji rolniczej na świecie oraz zmian występujących w tym aspekcie. Przedstawiono poziom koncentracji produkcji rolniczej na świecie według kontynentów. Źródłem materiałów były dane z FAOSTAT. Okres badań dotyczył lat 2004-2016. W badanym okresie wartość produkcji rolniczej brutto na świecie podwoiła się. W latach 2004-2010 we wszystkich regionach świata doszło do wzrostu produkcji brutto rolnictwa, przy czym w okresie 2010-2016 tylko w dwóch – Ameryce Północnej i Azji. Zauważono, że występowała duża koncentracja produkcji rolniczej, która była skupiona w Azji i Europie. W badanym okresie następował relatywny wzrost udziału Azji i Ameryki Południowej w produkcji rolniczej względem pozostałych regionów świata. Analizie poddano także poszczególne grupy produktów rolnych, takich jak zboża i produkcja zwierzęca. W obu tych przypadkach koncentracja przebiegała inaczej. Tempo koncentracji w produkcji zwierzęcej było większe niż w przypadku produkcji roślinnej.

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