Journal of Global Change Data & Discovery. 2023, 7(3): 290-297
www.geodoi.ac.cn

Dataset of Changes in the Global Supplier Distribution of Apple's Products (2012–2021)

Kang, J. J.[1*] Ning, Y. M.[2]

1. Institute of Applied Economics, Shanghai Academy of Social Sciences, Shanghai 200020, China;
2. School of Urban and Regional Science, East China Normal University, Shanghai 200241, China

Abstract: Based on the list of suppliers and their subsidiaries published by Apple Inc. from 2012 to 2021, this study maps Apple's suppliers and subsidiaries onto the countries and cities where they are located, in addition to outlining the overall data of the distribution and changes in the global value chains of Apple's parts. Simultaneously, we using the Herfindahl index and location entropy to further characterize the degree of distribution concentration and the position of different countries/regions within the global value chains of Apple's parts. Additionally, it displays the microscopic distribution characteristics of different cities within the global value chains of Apple's parts and outlines the corresponding data. Its dataset adopts the .xlsx table storage format, with a data size of 876 KB, including raw data and result data. The dataset primarily includes the following: (1) The headquarters data of Apple's suppliers and its components classification by value chain in the 2012–2021 period; (2) Apple's supplier subsidiaries address data and components classification by value chain in the 2012–2021 period; (3) Cumulative distribution of Apple's suppliers in the 2012–2021 period; (4) Changes in the Herfindahl index with regard to different links of Apple's parts in the 2012–2021 period; (5) The changes in the location quotient of different countries and regions in global value chains of Apple's products in the 2012–2021 period; (6) The micro-distribution changes in global value chains of Apple's products in the 2012–2021 period.

Keywords: supplier; subsidiaries; global value chains; Apple's parts

DOI: https://doi.org/10.3974/geodp.2023.03.07

CSTR: https://cstr.escience.org.cn/CSTR:20146.14.2023.03.07

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2023.08.08.V1 or https://cstr.escience.org.cn/CSTR:20146.11.2023.08.08.V1.

1 Introduction

The division of labor in global value chains, as the dominant mode and the primary form of the current international division of labor, is an important way of strengthening global in-

Received: 26-07-2023; **Accepted:** 01-09-2023; **Published:** 25-09-2023

Foundations: National Natural Science Foundation of China (42101213); Ministry of Education of P. R. China (17JJD790007)

***Corresponding Author:** Kang, J. J., Institute of Applied Economics, Shanghai Academy of Social Sciences, jjkang@sass. org.cn

Data Citation: [1] Kang, J. J., Ning, Y. M. Dataset of changes in the global supplier distribution of Apple's products (2012–2021) [J]. *Journal of Global Change Data & Discovery*, 2023, 7(3): 290–297. https://doi.org/10.3974/geodp.2023.03.07. https://cstr.escience.org.cn/CSTR:20146.14.2023.03.07.

[2] Kang, J. J., Ning, Y. M. Dataset of global supplier distribution changes of Apple's e-parts (2012–2021) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2023. https://doi.org/10.3974/geodb.2023.08.08.V1. https://cstr.escience.org.cn/CSTR:20146.11.2023.08.08.V1.

dustrial layout and promoting the integration of each country/region into the division of labor within the global industrial realms[1]. In recent years, due to the impact of many uncertainties generated by trade conflicts, epidemics, and the deepening of anti-globalization, the global industrial layout has shifted from the long-distance expansion emphasizing "cost and market orientation" to the near-shore contraction of "safe and controllable and ideological consistency", resulting in its local contraction. In other words, the global industrial layout appears to be marked by a slowdown in expansion[2]. Indeed, the division of labor in global value chains is currently undergoing a profound test created by the unprecedented global economic changes in this century[3]. Owing to lack of dominance in the field of core technologies within the global electronic information manufacturing industry, the China's leading high-tech enterprises are caught in the predicament of "precise decoupling," which is affecting the rise of Chinese enterprises within the extant framework of the division of labor in global value chains. However, active participation in the division of labor within global value chains remains a key channel through which one can open up the international market and promote technological upgrading. It is also one of the main ways in which China can implement the construction of a new development pattern that foregrounds the domestic macro-cycle as the main cycle and ensures that the domestic and international double-cycle promotes both of its constituent cycles[4, 5]. Further, in this new developmental stage, China still need to actively promote the participation of its enterprises in global free trade and holistic development in global value chains.

In this context, it is of great practical significance to study the distribution and change-related characteristics of global value chains of the electronic information manufacturing industry. For instance, in order to reduce China's key industries' degree of dependence on the outside world and to build a new double-cycle development pattern (with the main internal cycle and a supplementary external cycle). At the outset, it is also important to ask the following questions: what are the new changes and trends in the geographical distribution of global value chains? Considering the continuous development and ongoing expansion of the modernized global industrial system, does China still find itself at the low end in global value chains? In this light, the micro-distribution of different value chain segments of the electronic information manufacturing industry at the global municipal level is worth studying in depth. In this regard, what are the changing trends of this industry? Hence, we can observe a resultant lack of in-depth analysis at the global information manufacturing industry. Thus, it is impossible to visualize the characteristics of the geographic pattern of this industry, its changing trends, and China's position within them, all of which need to be analyzed comprehensively.

This study uses the global supplier data of Apple's products to address the abovementioned research gaps. The reason for using such data is that Apple outsources the production of all its components to its suppliers, most of which are leading global tech enterprises, and thus, the value content of each component produced by each supplier is different. Hence, using such data, we can more precisely measure the status of and changes in the division of labor in the value chain of the global electronic information manufacturing industry that involve different countries/regions[6–10]. As these global suppliers themselves maintain partnerships with their production subsidiaries around the world, the production of Apple's products consequently has very typical globalization-oriented characteristics. At the same time, this study also compares the abovementioned data with the product global supplier data of Samsung, Lenovo, Hewlett-Packard, and Dell. The global supplier data of Apple's products can more clearly reflect the basic pattern of and the distribution changes in the value chain of the global electronic information manufacturing industry. Moreover, considering the increasing participation of Chinese enterprises and the gradual rise in their position within the global value chains of this industry that is investigated by this study, such data

can also reflect the changes of China's position with respect to the pattern of the global value chains. Thus, this study's dataset can provide a more robust support for the study of the distribution of and changes in the value chain of the global electronic information manufacturing industry.

2 Metadata of the Dataset

The metadata of the Dataset of global supplier distribution changes of Apple's e-parts (2012–2021) [11] are summarized in Table 1.

Table 1 Metadata summary of Dataset of global supplier distribution changes of Apple's e-parts (2012–2021)

Items	Description
Dataset full name	Dataset of global supplier distribution changes of Apple's e-parts (2012–2021)
Dataset short name	AppleSupplierDistribution2012-2021
Authors	Kang, J. J., Institute of Applied Economics, Shanghai Academy of Social Sciences, jjkang@sass.org.cn Ning, Y. M., School of Urban and Regional Science, East China Normal University, ymning@re.ecnu.edu.cn
Geographical region	World, China Year 2012–2021
Data format	.xlsx Data size 876 KB
Data files	(1) The headquarters data of Apple's suppliers and its components classification by value chain in the 2012–2021 period; (2) Apple's supplier subsidiaries address data and components classification by value chain in the 2012–2021 period; (3) Cumulative distribution of Apple's suppliers in the 2012–2021 period; (4) Changes in the Herfindahl index with regard to different links of Apple's parts in the 2012–2021 period; (5) The changes in the location quotient of different countries and regions in global value chains of Apple's parts in the 2012–2021 period; (6) The micro-distribution changes in global value chains of Apple's parts in the 2012–2021 period
Foundations	National Natural Science Foundation of China (42101213); Ministry of Education of P. R. China (17JJD790007)
Data publisher	Global change research data publishing and repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(1) ***Data*** are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use ***Data*** subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute ***Data*** subject to written permission from the GCdataPR Editorial Office and the issuance of a ***Data*** redistribution license; and (4) If ***Data*** are used to compile new datasets, the 'ten per cent principal' should be followed such that ***Data*** records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[12]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS

3 Methods

3.1 Data Sources

Figure 1 illustrates the database building process. First, the data samples are mainly collected from Apple' official website[1]. Since 2012, Apple has annually published a list of its top 200 suppliers in the preceding year and the locations of specific subsidiaries that produce its components. Second, data regarding the headquarters address, the main business, and the product type of each supplier are obtained by using the information given in the official website of each supplier, and the positions of different companies in global value chains of Apple's parts are also described according to the technical content and the value content of the components they supply. Furthermore, the geographical distribution patterns in global value chains of Apple's parts are further described by mapping the supplier address data

[1] https://www.apple.com.

onto the specific city or even the country where each supplier is located. Importantly, during 2020–2021, the address data of Apple's supplier subsidiaries are relatively crude, only revealing the provinces where these subsidiaries are located and bereft of detailed address-related information. Thus, by collecting information regarding each supplier through its official website and calibrating the same with the available data during 2012–2018, the detailed addresses of these subsidiaries are determined, thus reducing the possibility of data deviation. It should be noted that Apple has not released its supplier data (of 2019) in 2020 on its official database.

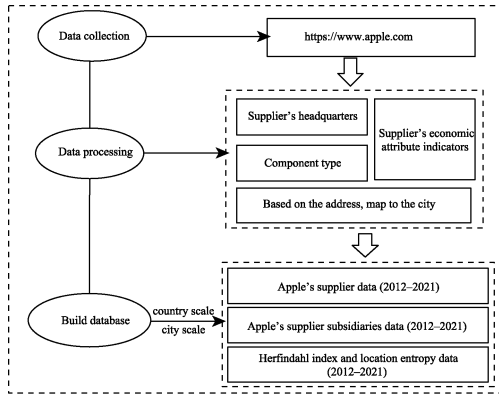

Figure 1 Building process for global suppliers of Apple's products

3.2 Technical Route

(1) Value chain classification

This study refers to the existing research results and related research reports[6–10] to classify Apple's parts in terms of various value chain grades. Among them, the high-value parts mainly include chips, LCD panels, camera modules, and other parts with high-level value content and technology. The middle-value parts mainly include printed circuit boards, batteries, chargers, and other relatively important parts. Finally, the low-value parts mainly include chip packaging and testing, shell, keyboard, structural components, assembly foundry and other parts with relatively low-level value content and technology.

(2) Herfindahl index

The Herfindahl index is used to reflect the degrees of country-wide or regional concentration and distribution of Apple's supplier subsidiaries in the different links of its global value chains[9].

(3) Location entropy

The location entropy is used to measure whether certain countries or regions have comparative advantages regarding the quantity distribution of Apple's supplier subsidiaries within the global value chains[9].

4 Data Results

4.1 Data Composition

The dataset includes 6 sub-dataset during 2012–2021: (1) The headquarters data of Apple's suppliers and its components classification by value chain; (2) Apple's supplier subsidiaries address data and components classification by value chain; (3) Cumulative distribution of Apple's suppliers; (4) Changes in the Herfindahl index with regard to different links of Apple's parts; (5) The changes in the location quotient of different countries and regions in global value chains of Apple's products; (6) The micro-distribution changes in global value chains of Apple's parts. The dataset is archived in.xlsx format with a data size of 876 KB.

4.2 Data Results

(1) The distribution of global value chains of Apple's products is marked by a high-concentration characteristic. During 2012–2021, there are 388 suppliers have reportedly supplied various parts for Apple Inc. Based on the home countries of each supplier and the concomitant value chain classification standard, the visualized data results are shown in Figure 2. There is a high concentration of suppliers of Apple's parts in certain locations, that is, mainly in the U.S., Japan, China, and Taiwan, all of which together account for 83.7% of

Apple's full list of suppliers. At the same time, there are relatively more Apple's suppliers in Hong Kong, Korea, Germany, Singapore, and the Netherlands, while only a few suppliers from Switzerland, Finland, Ireland, and other countries have entered the global value chains of Apple's parts. Furthermore, the suppliers in high-value parts are mainly from U.S., Japan, Taiwan, and Korea, while the other suppliers in China, Germany, and specifically Hong Kong are significantly less involved in global value chains of Apple's parts. In particular, over the past decade, there have been only six suppliers in high-value parts were came from China. Regarding the suppliers in middle-value parts, Taiwan and Japan are the two core regions, while China and the U.S. constitute the sub-core regions. The number of suppliers from Korea, Singapore, and other countries entering the middle-value parts remains quite low, revealing the characteristics of a "double main, double auxiliary, and peripheral" supplier structure. Low-value parts, on the other hand, are characterized by a "dual-core, three-strong, and peripheral" structure, with China and Taiwan as the core regions, the U.S., Hong Kong, and Japan as the second core regions, and other countries as the peripheral regions.

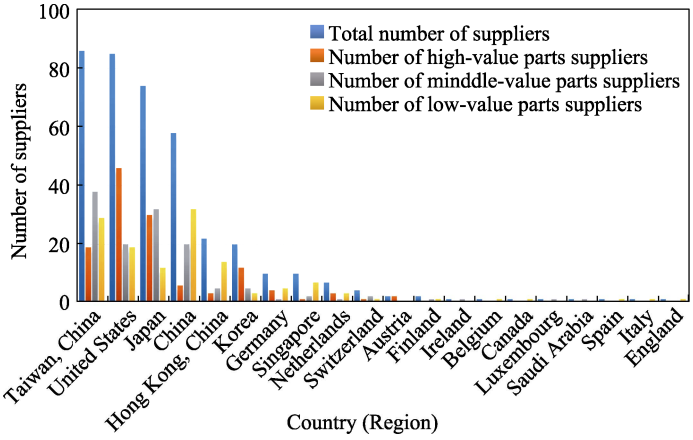

Figure 2 Cumulative distribution of suppliers of Apple's products from 2012 to 2021

(2) The geographical pattern in global value chains of Apple's parts shows a new trend of diffusion. Based on the data of Apple's supplier subsidiaries, the Herfindahl indices of the top four countries are calculated from the total number of countries/regions in the high-value, middle-value, and low-value parts[2] (Figure 3). The results show that the global distribution of Apple's supplier subsidiaries reveals their high concentration in a few countries but outlines a general trend of decline in fluctuation. With regard to the distribution of supplier subsidiaries in the different value chain links, the Herfindahl indices also show a trend of fluctuation and decline; notably, the concentrations of supplier subsidiaries with respect to high-value parts and low-value parts decrease significantly. For example, the Herfindahl index in high value parts at 2021 is 0.086,5, as compared with a steady decline of around 0.12, indicating that the global distribution of high-value parts shows a trend of spreading to countries/regions outside the top three countries. Similarly, the Herfindahl index in low-value parts at 2021 is 0.447,6, while it remains stable (above 0.50) before this year and even reaches 0.64 in 2014, thus revealing a significant decline. This indicates that the global distribution of low-value parts also shows a trend of spreading to regions other than China.

[2] As far as the distribution of suppliers' subsidiaries is concerned, they are concentrated in China, Japan, the United States and Korea, high-value parts are concentrated in China, Japan and the United States, medium-value parts are concentrated in China and Japan, and low-value parts are concentrated in China, the remaining countries are not included in the analysis because of their small distribution.

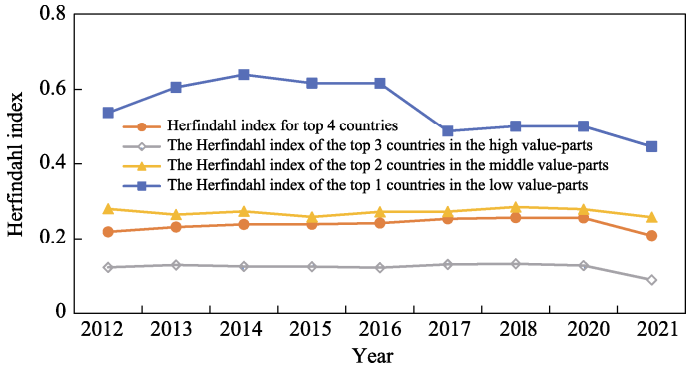

Figure 3 Changes in the Herfindahl index according to different links in the global value chains of Apple's products from 2012 to 2021

(3) Different countries or regions have obvious differences in terms of the comparative advantage of quantity distribution in global value chains of Apple's parts. Thus, the location entropy method is used by this study to calculate the comparative advantage of the distribution quantities of high-value, middle-value, and low-value parts of each country or region; the top ten countries or regions of Apple's supplier subsidiaries are selected for analysis, the results of which are shown in Table 2.

Table 2 Changes in the comparative advantage of the number of supplier subsidiaries in different countries and regions from 2012 to 2021

Classification	2012	2015	2018	2021
High-value parts	Philippines, Germany, United States, Korea, Malaysia, Singapore, Japan, China's Taiwan	Germany, Philippines, Korea, United States, Malaysia, Singapore, China's Taiwan, Japan, Thailand	Singapore, Philippines, Korea, Germany, United States, Malaysia, Japan, Taiwan	Singapore, Malaysia, Vietnam, Korea, Philippines, Germany, United States, China's Taiwan, Japan
Middle-value parts	Vietnam, Thailand, Japan, China, China's Taiwan	Vietnam, Thailand, Japan, Singapore, Malaysia, China	Thailand, Vietnam, Japan, Malaysia, China	Thailand, Japan, Vietnam, China
low-value parts	China, Germany	China	India, China	India, China, Vietnam

Clearly, there are differences in the comparative advantage of distribution quantity based on different countries and regions. Among them, the countries or regions with comparative advantages in the quantity distribution of high-value parts are mainly by the U.S., Japan, Taiwan, Korea, Singapore, Philippines, and Malaysia. In terms of the middle-value parts, Japan, China, Thailand, Vietnam, and some other countries have comparative advantages regarding quantity distribution. In terms of low-value parts, China has comparative advantages in quantity distribution, but India and Vietnam have also begun to gain such comparative advantages in recent years. The classification can be made regarding the global supplier subsidiaries of Apple's parts: high-value parts are mostly produced in developed countries or regions and in Southeast Asia, while middle-value parts and low-value parts are mainly produced in China. Although Southeast Asian countries such as Thailand, Malaysia, and the Philippines do not have local suppliers who can act as Apple's suppliers, they have attracted more suppliers in middle- and high-value parts from other countries. In the recent years, Vietnam and India have particularly shown a strong ability to attract such supplier subsidiaries, which also indicates an acceleration in the restructuring of the industrial distribution pattern of the global electronic information manufacturing industry.

(4) Developed cities involved in the electronic information industry serve as the core distribution areas of Apple's supplier subsidiaries, and the level of production in high-value parts

tend to converge with the level of development of overseas cities. After the address of each supplier subsidiary is mapped to the city where it is located, this study describes the micro-distribution characteristics of the global value chains of Apple's parts in the 2012–2021 period based on the value chain classification standard of components, as shown in Table 3.

Table 3 Changes in the microscopic distribution of global value chains of Apple's parts (2012–2021)

Classification	2012	2015	2018	2021
All subsidiaries	Suzhou, Shanghai, Shenzhen, Dongguan, Singapore, Wuxi, Silicon Valley, Tianjin, etc	Suzhou, Shenzhen, Dongguan, Shanghai, Wuxi, Silicon Valley, Guangzhou, Singapore, Chengdu, etc	Suzhou, Dongguan, Shenzhen, Shanghai, Wuxi, Hsinchu, Singapore, Chengdu, Huizhou, Taoyuan, Guangzhou, Kaohsiung, Silicon Valley, Tainan, etc	Suzhou, Shanghai, Dongguan, Shenzhen, Taoyuan, Hsinchu, Silicon Valley, Singapore, Wuxi, Tainan, Chengdu, Chongqing
High-value parts	Suzhou, Silicon Valley, Shanghai, Singapore, Shenzhen, Dongguan, Wuxi, Tianjin	Suzhou, Silicon Valley, Dongguan, Shanghai, Dallas, Singapore, Hsinchu, Shenzhen	Suzhou, Silicon Valley, Dongguan, Singapore, Gumi, Shenzhen, Wuxi, Tainan, Dallas	Singapore, Silicon Valley, Hsinchu, Taoyuan, Tainan, Suzhou, Shenzhen, Shanghai, Dongguan, Gumi
Middle-value parts	Suzhou, Dongguan, Shenzhen, Shanghai, Singapore, Tianjin	Suzhou, Shenzhen, Dongguan, Shanghai, Wuxi	Suzhou, Dongguan, Shenzhen, Shanghai and Wuxi	Suzhou, Shanghai, Shenzhen, Dongguan, etc
Low-value parts	Suzhou, Shanghai, Shenzhen	Suzhou, Shenzhen, Dongguan, Shanghai, Chengdu, etc	Suzhou, Shanghai, Dongguan, Shenzhen, Wuxi, Chengdu	Suzhou, Shanghai, Dongguan, Shenzhen, Wuxi, Chengdu, Zhengzhou

From 2012 to 2021, the subsidiaries of the global suppliers of Apple's products are concentrated in a few cities, such as Suzhou, Shanghai, Dongguan, Shenzhen, Taoyuan, Silicon Valley, Tainan, and so on, where the electronic information manufacturing industry is relatively developed. From the perspective of different links in global value chains, high-value parts are mainly produced in Suzhou, Silicon Valley, Taoyuan, Gumi, and other cities that are termed as developed cities within the global electronic information industry. However, in 2021, overseas cities such as Singapore, Silicon Valley, Hsinchu, and Taoyuan tend to have a concentration of Apple's supplier subsidiaries. Although Chinese cities such as Suzhou, Shenzhen, Dongguan, and Shanghai still occupy an important position in this regard, the status of overseas cities regarding the production of high-value parts has significantly improved. Moreover, the supplier subsidiaries producing middle-value parts are mainly clustered in Suzhou, Shanghai, Shenzhen, Dongguan, and a few other cities that possess a developed electronic information industry. The supplier subsidiaries producing low-value parts are also concentrated in Suzhou, Shanghai, Dongguan, and Shenzhen, but they are found to be spreading in Chengdu, Zhengzhou, Wuxi, Chongqing, and some other cities.

5 Discussion and Conclusion

Based on the data of suppliers and subsidiaries published by Apple Inc., this study analyzes the geographical distribution characteristics and the change-related trends in global value chains of Apple's parts, using methods such as Herfindahl index and location entropy. The dataset shows that during 2012–2021, the global suppliers of Apple's parts remained mainly concentrated in the U.S., Japan, China, Taiwan of China, and Korea. Specifically, the U.S., Japan, and Korea have advantages in terms of supplying the high-value parts, while China has advantages supplying in the middle- and low-value parts. Second, the global value chains of Apple's products show a strong diffusion trend. For example, some suppliers in high-value parts are again establishing themselves in Japan, Taiwan, or Southeast Asia, while the suppliers in low-value parts are spreading to Vietnam, India, and other places. Third, Apple's suppliers tend to locate their subsidiaries in the cities with developed electronic information industries. The supplier subsidiaries in high-value parts show a trend of

concentrated expansion toward overseas locations like Singapore, Silicon Valley, Hsinchu, Taoyuan, Tainan, etc., while the supplier subsidiaries of middle- and low-value parts are still mainly concentrated in Suzhou, Shanghai, Shenzhen, Dongguan, and some other cities. Importantly, the levels of attraction toward Chengdu, Zhengzhou, Chongqing, Yancheng, and other cities producing middle- and low-value parts have improved their status.

The data of Apple's suppliers and subsidiaries used in this study to analyze the geographical pattern and changes in global value chains of electronic information manufacturing industry are more advanced than the existing overall data analysis of inter-country trade. This is because the former data can be used to observe more microscopic geographical characteristics. However, such data also have some problems. For example, the value chain classification of Apple's parts mainly combines research reports and published papers, owing to the lack of detailed data on the value of the Apple's parts provided by specific suppliers. Thus, in the future, the value chain classification standards must be improved further. At the same time, in combination with the data regarding the electronic information manufacturing enterprises among the global 2,000 enterprises and suppliers such as Samsung, Huawei, Lenovo, HP, Dell, etc., both the geographic pattern of and changes in global value chains of the electronic information manufacturing industry are more comprehensively displayed by this study.

Author Contributions

Ning, Y. M. designed the algorithms of dataset; Kang, J. J. contributed to the data processing, analysis and wrote the data paper.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Tang, H. Y. Global value chain specialization, new development paradigm and new transformation of foreign economic development mode [J]. *Journal of East China Normal University* (*Humanities and Social Sciences*), 2021, 53(5): 212–225, 242.

[2] Lun, R., Guo, H., Pu, X. M. Shortening of value chains of international production and its industry performance, actual impact and China's response [J]. *Economic Review Journal*, 2023, (2): 63–72.

[3] Wu, D. China's strategic choice to achieve a high level of opening up in the context of global value chain restructuring [J]. *Economist*, 2023(2): 15–24.

[4] Kang, J. J., Ning, Y. M. The distribution and changing trend of global supply chain of consumer electronics in post-globalization era and implications to China-Based on the data of Apple' parts suppliers [J]. *Shanghai Economy*, 2023, 310(1): 12–28.

[5] Xing, Y. Q. The mystery of China's Exports: Decoding "Global Value" [M]. Beijing: Life, Reading, New Knowledge Triple Bookstore, 2022: 1–6.

[6] Grimes, S., Sun, Y. China's evolving role in Apple's global value chains [J]. *Area Development & Policy*, 2016, 1(1): 94–112.

[7] Kang, J. J., Zhang, F., Ning, Y. M. Value allocation and China's evolving role in the global value chains of iPhone parts [J]. *Progress in Geography*, 2019, 38(3): 395–406.

[8] Kang, J. J., Lin, B. Q., Ning, Y. M. Spatial organization and influencing factors of Apple's component supply chain in China [J]. *Economic Geography*, 2021, 41(7): 138–145.

[9] Kang, J. J., Ning, Y. M. Geographical evolution and driving mechanism of global value chains of Apple's parts [J]. *Geographical Research*, 2023, 42(3): 617–635.

[10] Liu, Q., Yang, Y. C., Jiang, X. R. Spatial organization of global value production: a case study of supply chain of Apple's iPhone [J]. *Geographical Research*, 2020, 39(12): 2743–2762.

[11] Kang, J. J., Ning, Y. M. Dataset of global supplier distribution changes of Apple's e-parts (2012–2021) [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2023. https://doi.org/ 10.3974/geodb.2023.08.08.V1.

[12] GCdataPR Editorial Office. GCdataPR data sharing policy [OL]. https://doi.org/10.3974/dp.policy.2014.05 (Updated 2017).