Faculty of World Economy and International Affairs

School of World Economy

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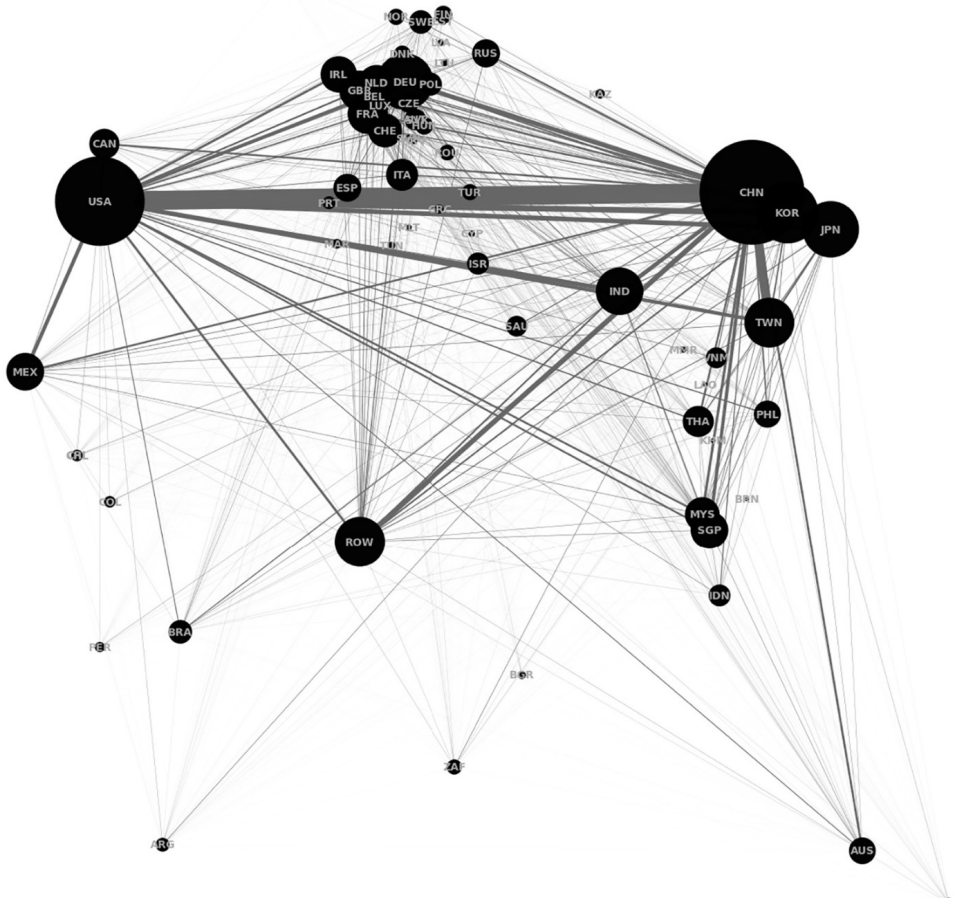
US-China Tech Rivalry’s Influence on Role of Developing Countries in GVCs in ICT Field

Author: Piskunov Danil

Introduction – US-Sino tech decoupling as a bottom line of the research

US and China are the most interdepend countries in GVCs



- US-China confrontation is one of the main research topics since the beginning of the “trade war” and the imposition of tech sanctions
- The trade has affected global production chains and resulted in the relocation of production facilities
- Effects of US-Sino tech decoupling are broadly investigated in the literature; however, **studies on implications for third countries in the ICT sphere are scarce**.
- Moreover, **few researchers pay attention to drivers of production facilities’ reshoring to other countries**;
- So present research’s goals are as follows:

1. Investigate the effects of two countries’ decoupling on global production chains in ICT

2. Outline some drivers for production reshoring in the ICT field

Methodology: three main steps

Inter-Country Input-Output tables, ICIO

- **The number of countries** is 76;
- **Industry for investigation** is D26D27, electronics, computers, and electronics equipment
- **The period of investigation is 2016-2020**, as ICIO has published a new version of the database, which allows use of new data.
- **Indicator - Origin of value added in gross exports** - helps to find out a country where work was done

Diagram of «Origin of value added in gross exports, EXGR_BSCI» indicator

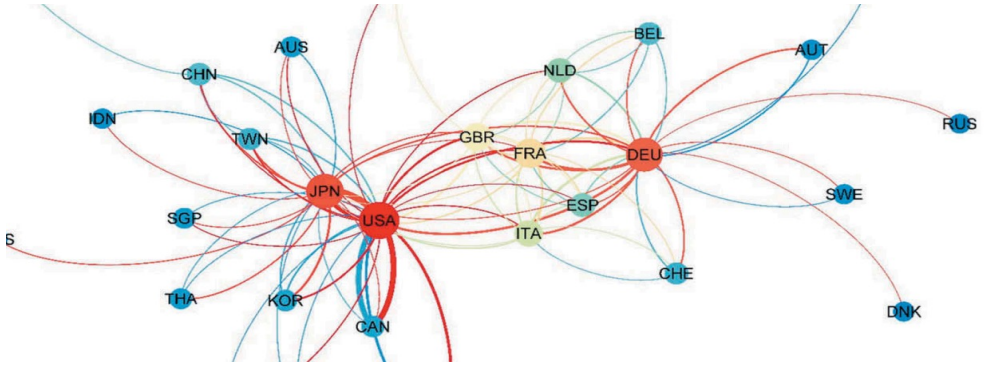
Indicators dimensions:
[VA src cou | VA src ind | Exp cou | Exp ind]

VA origin	Exports	Imports	Final Demand
Country (p)	Country (c)		
Industry (h)	Industry (i)		

Source: Guide to OECD Trade in Value Added (TiVA) Indicators, 2023 edition // OECD, 2023. 47 p.

Network analysis based on Gephi software

- After screening out countries with low volume of value added, the final number of nodes (countries) becomes 25-30 with 300 links
- As far as production links have a direction, the graph is also directed
- The greater the volume of trade between countries, the closer the countries are to each other
- The size of nodes and edges depends on the volume of value added



Methodology: three main steps

Production function, and its main components

- To define differences among countries the author uses R. Solow's macroeconomic approach
- Uneven development can be calculated **in technology level, capital intensity, human capital, and labor**. These indicators may highlight drivers and directions of facilities' reshoring.
- Solow's approach uses a production function and offers different ways for calculating development gaps, i.e., in terms of labor productivity and GDP in PPR

1) $$Y_i = A_i * K_i^{w_K} * (hc_i * L_i)^{w_L}$$

Production function, where are used following components

- A_i – technology level
- K_i – capital intensity,
- hc_i – human capital
- L_i – labor

2) $$p_i = A_i * k_i^{w_K} * hc_i^{w_L}$$

Production function adjusted to labor, where

- $P_i = Y/L$ – Labor productivity as GDP to total hours of labor
- A_i – technology level
- K_i – capital intensity,
- hc_i – human capital

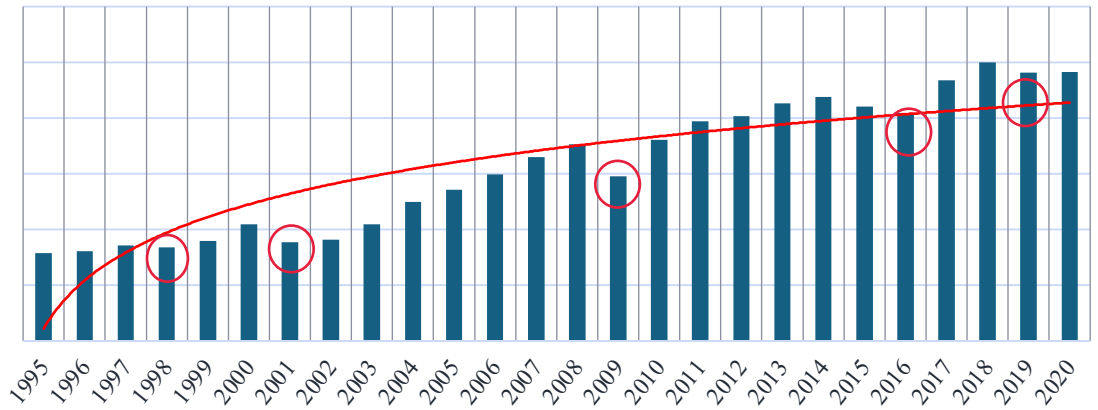
3) $$Ln\left(\frac{p_i}{p_{RUS}}\right) = Ln\left(\frac{A_i}{A_{RUS}}\right) + \overline{w_{K_i}} * Ln\left(\frac{k_i}{k_{RUS}}\right) + \overline{w_{L_i}} * Ln\left(\frac{hc_i}{hc_{RUS}}\right)$$

- Taking logarithms to define the final equation
- Find the difference between the taken country (RUS) and others.
- Use the Penn World Table (10.01) and obtain data for determinants.
- From equation 3 one can find the technology level of country A adjusted to the technology level of country B.

Global production chains' development in ICT from 1995

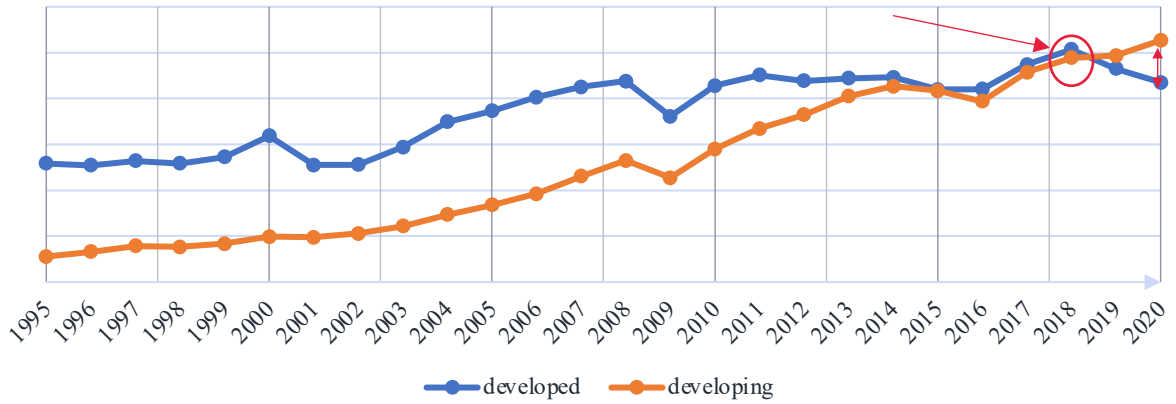
1. In spite of several crises' influence, volume of value added in ICT field has grown in 3 times
2. GVCs are highly adaptable to foreign shocks in supply chains as it is seen in diagram below. During 1-2 years volume of value added has recovered

Volume of value added in ICT filed, 1995-2020 г.



Source: made by author using TiVA Database.

Volume of value added for developing and developed countries, 1990-2020



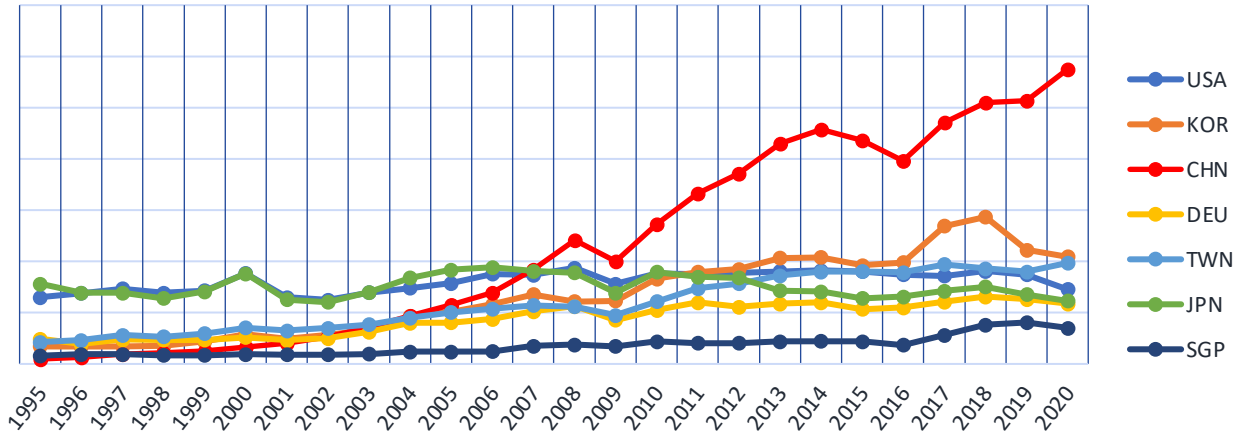
Source: made by author using TiVA Database.

1. In 2015, value added volumes for developed and developing countries became equal, and after 2018 volume of developing countries exceeded that of developed countries
2. In 2020, the difference in the volumes stands for USD 90 million

Global production chains' development in ICT field

1. In 2008. China surpassed the U.S. and Japan in this component;
2. Value added volume of developed countries in ICT remained unchanged, value added of Japan and the U.S. remained in the same range, passing through insignificant growth and decline

Value added in ICT field by countries, 1995-2020 г.



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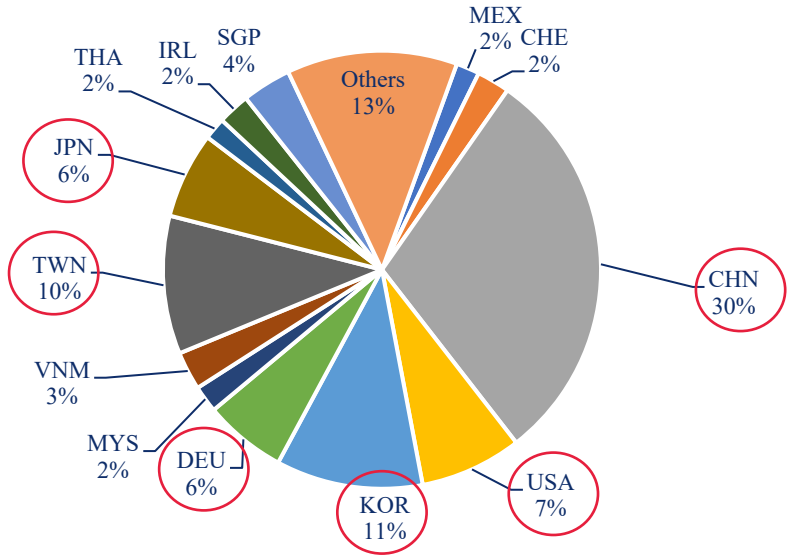

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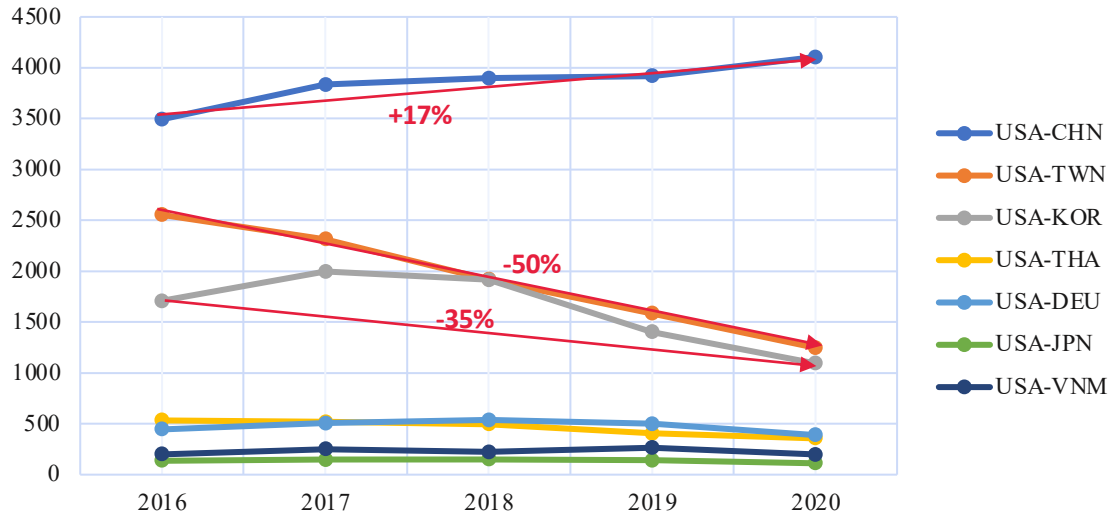
1. Asian economies generate up to 68% of global value added, while developed economies generate about 20%.
2. The most of ICT value added is generated in Asian economies, at the regional level

Analyzing effects of US-Sino tech rivalry on GVCs

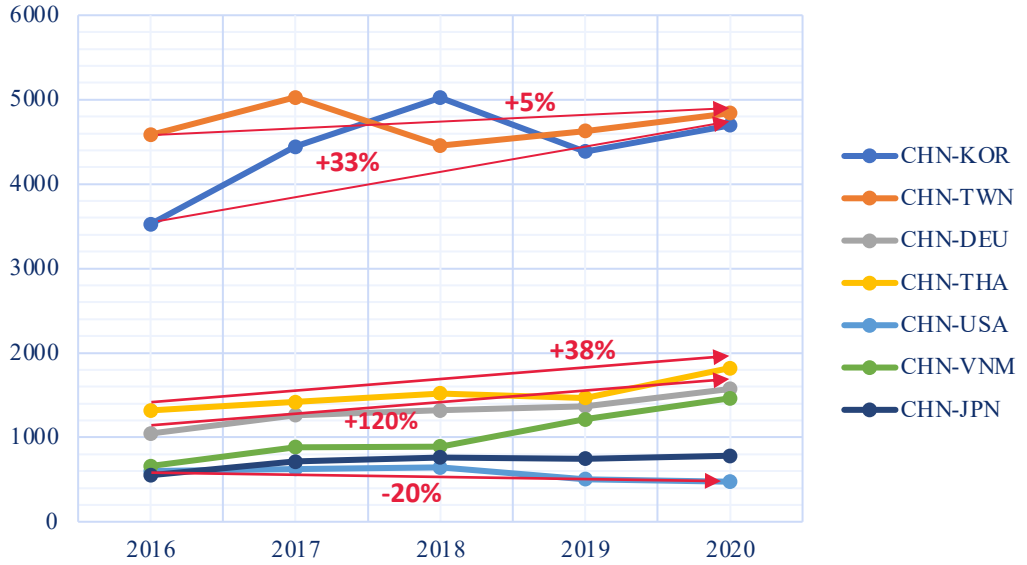
- The share of U.S. value added in the gross exports of key economies has mostly declined;
- The most declining trend was noted for South Korea and Taiwan, while value-added in China's export has increased;
- Sanctions have had a negative impact on U.S. participation in the GVCs in ICT;

US value added in the export of several countries



Source: made by author using TiVA Database

Chinese value added in the export of several countries

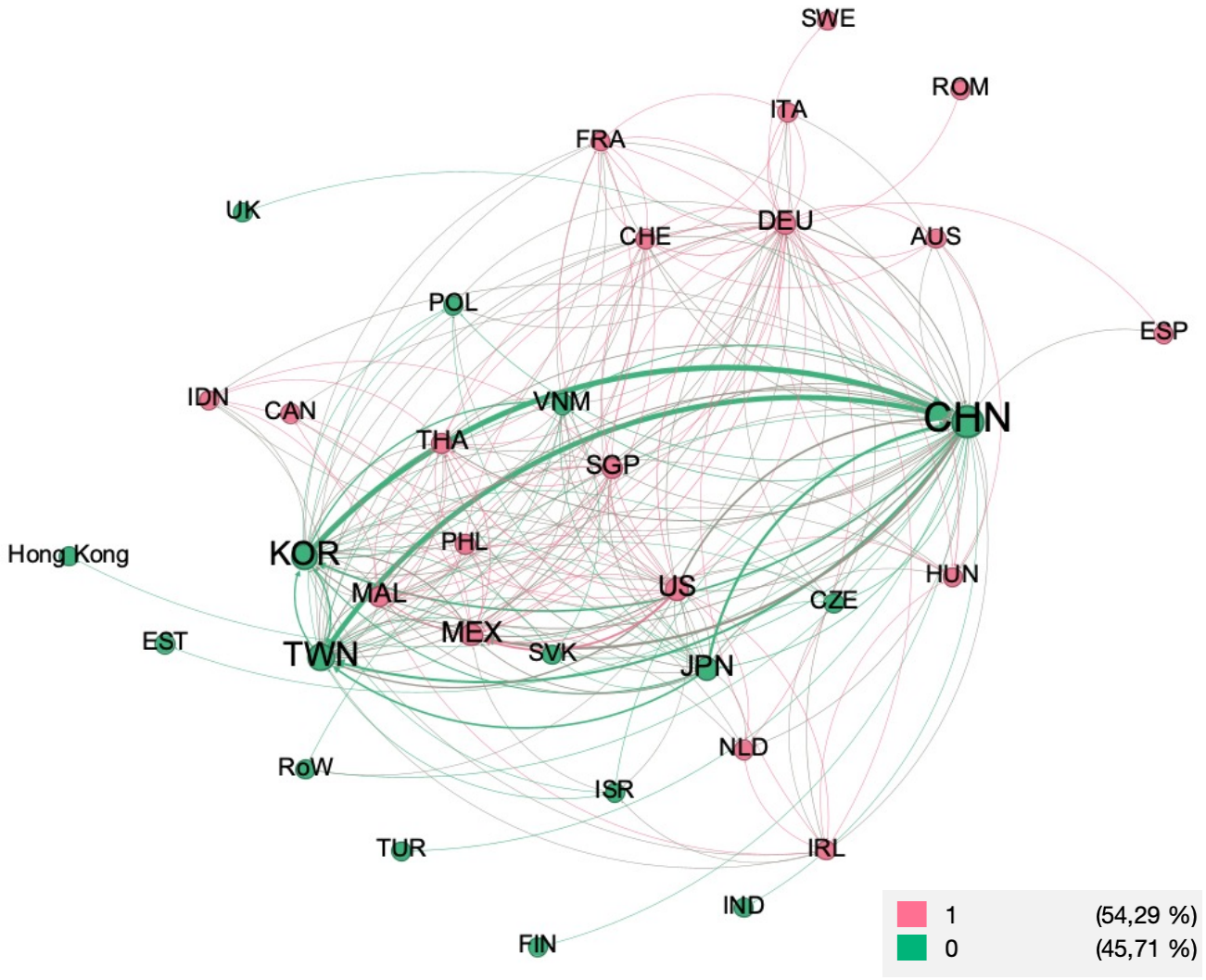


Source: made by author using TiVA Database

- The trade war negatively affected only the China's value added in the export of Japan and the US, while other Asian countries showed an increase.
- Significant growth of China's value added is observed in the gross exports of Vietnam and Thailand;

Network analysis of GVCs in ICT

- After screening out countries with low volumes of value added, **the final number of nodes (countries) became 25-30 with 300 links**
- While defining modularity, it was found out that there are 2 clusters in 2016, while there are 3 clusters in 2020.
- **In 2020 Gephi software identified 3 clusters**. The centers of the clusters are China, Taiwan, and Japan (cluster #0); Germany (cluster #2); Mexico, Malaysia, the USA, and Singapore (cluster #1).
- **The new cluster #2 includes exclusively European countries**, which may indicate an increase in the volume of value added produced in countries of the EU.
- **China plays the role of a manufacturer and assembly center and depends on intermediate component manufacturers**, mainly the Republic of Korea, Taiwan, the USA, and Japan



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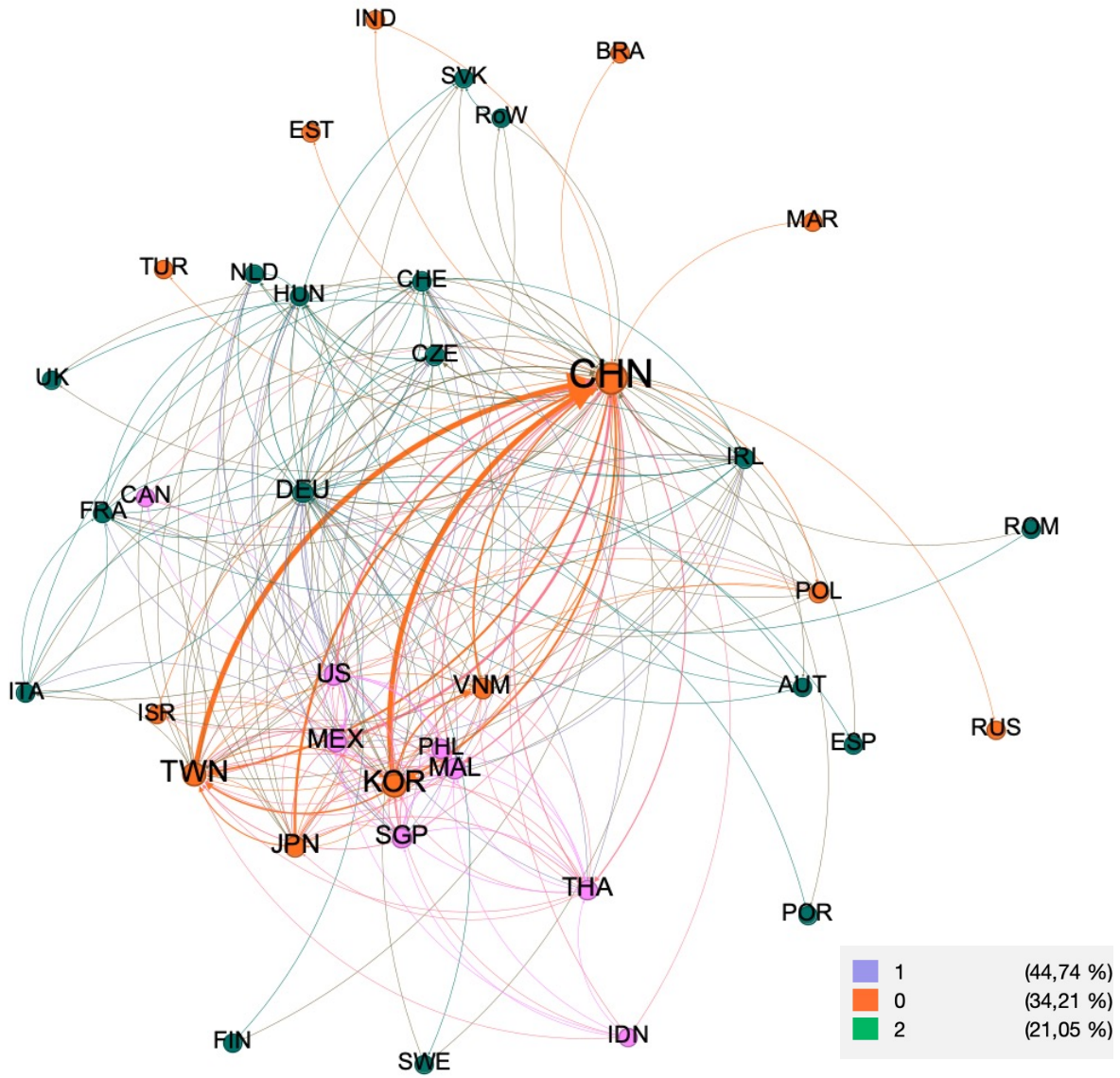

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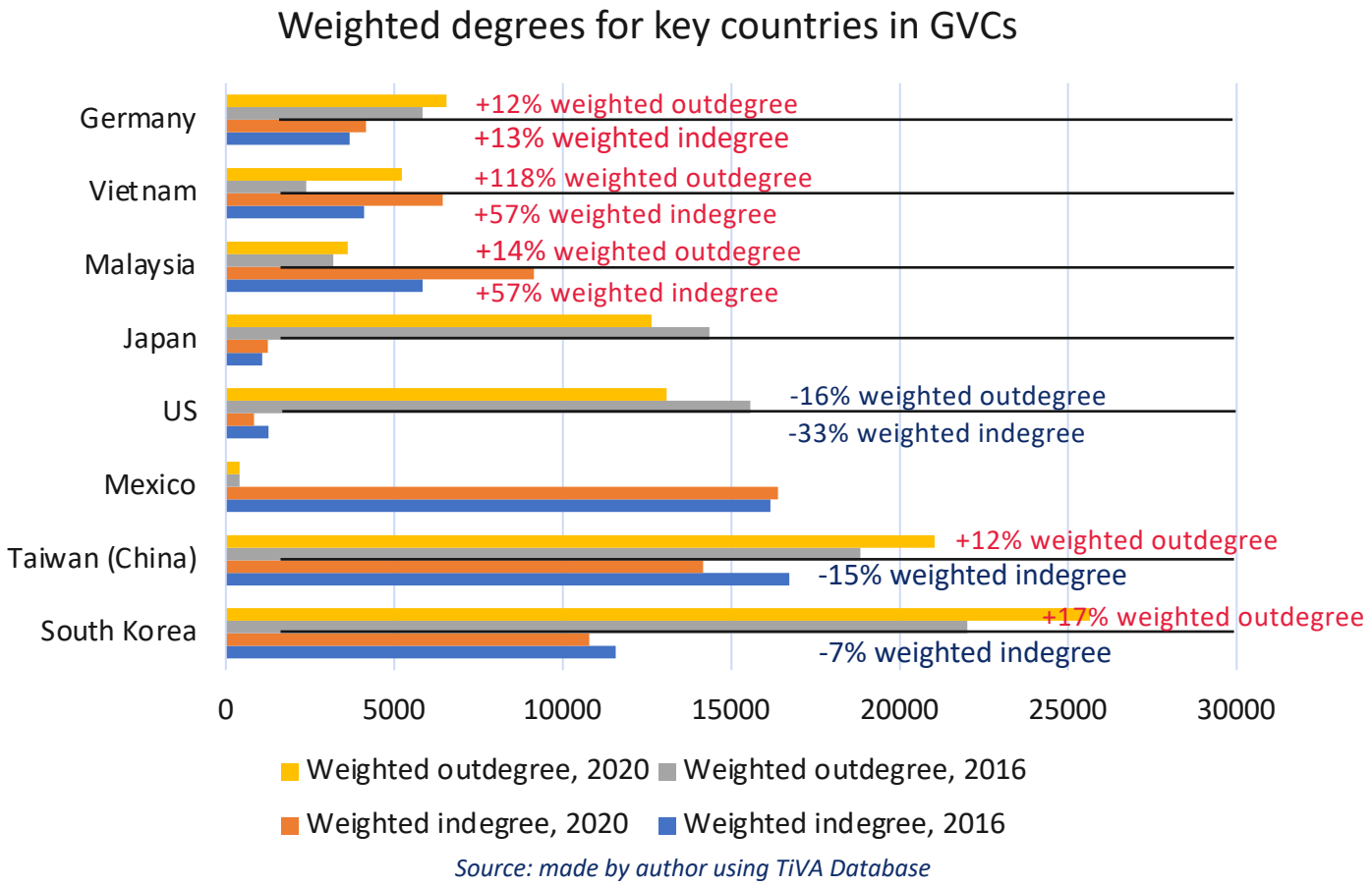
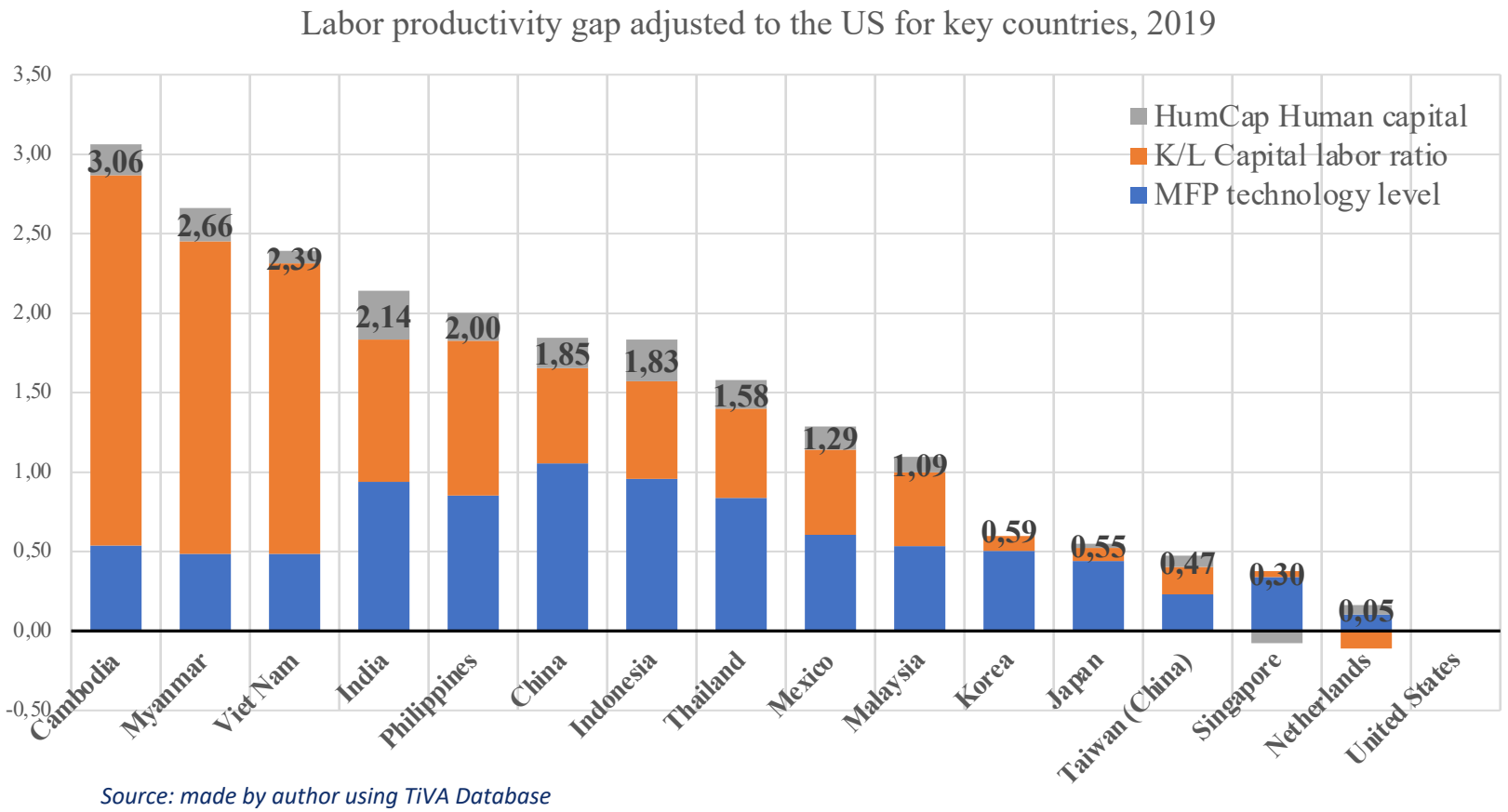
Network analysis of GVCs in ICT

- Developing countries demonstrated growth in terms of weighted degree, i.e. China (+37%), Malaysia (+41%), Vietnam (+71%), Singapore (+40%), Philippines (+15%)
- Taiwan and South Korea has probably experienced impact of sanctions, as two countries' weighted indegrees has declined
- Trade restrictions resulted in a decline in weighted degrees for the U.S. and Japan
- The weighted degrees for a number of European economies has increased, confirming the identification of a separate cluster in the graph and the possible relocation of production processes to Europe
- The growth of both weighted degrees for ASEAN countries may be a consequence of the US-China trade war and the relocation/creation of new GVCs in the region



Source: made by author using TiVA Database

Highlighting possible drivers of production facility reshoring



Source: made by author using TiVA Database

- Capital-intensive countries design and produce leading technologies, while developing countries participate more in labor-intensive processes.
- As far as China is a developing country, **the production processes are less capital-intensive and more labor-intensive**
- The most gap in labor productivity is defined by **capital ratio for several countries**, while **technology level is** main factor of the development gap for others
- MNCs are likely to choose countries **with labor productivity levels that are relatively comparable to China** (Philippines, Vietnam, and Malaysia)

Conclusions

- As a result of network analysis, **both China and developing countries have increased their volumes of value added in GVCs,** while developed countries' volume of value added has declined.
- The author has defined **gaps in countries' development in terms of capital ratio, technology level, and human capital**. More labor-intensive processes are located in developing nations, while more technology advances are in developed countries.
- As far as China is a developing country, **the production processes are less capital-intensive and more labor-intensive,** and for this reason, **MNCs are likely to choose countries with labor productivity levels that are relatively comparable to China** (Philippines, Vietnam, and Malaysia).
- Network analysis has proved that China increased its import of value added from Southeast Asian countries, including Vietnam, Malaysia, and Thailand. **Production processes have been moved to other countries, and it has consequently boosted the domestic VA output of developing countries and their share of value added in China's exports**.
- As US-China competition become more severe, **Southeast Asian countries can become a buffer zone for technology transfer from developed nations, and otherwise**
- It is likely that Chinese TNCs have established joint ventures in foreign markets to assemble electronics using both domestic and foreign intermediate products, It can lead to the transformation of GVCs

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