ARTICLES

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G-7 AND BRICS COUNTRIES IN GLOBAL VALUE CHAINS

Abstract

G-7 and BRICS countries play important roles in the world economy and global politics. The aim of the article is to answer the research question: "How participation of G-7 and BRICS countries in global value chains has been changing since 1995?". To answer this question global value chains participation indexes were calculated. They were derived from Inter-Country Input-Output Tables. The value-added of this study stems from employing Input-Output Tables delivered by two institutions (Organization for Economic Co-operation and Development and Asian Development Bank). Consequently, article presents indexes calculated on the basis of two datasets. Combining two databases enabled to conduct study for quite long period (1995-2022). Analyzing the changes of global value chains participation indexes of G-7 and BRICS countries, we can distinguish following phases of internationalization: period of rapid globalization (1995-2008), global crisis and economic rebound (2009-2011), period of slowbalization somewhat strengthened by coronacrisis (2012-2020), and another recovery (2021-2022). This finding lead us to the conclusion that fast internationalization came to a halt in 2008 and since global financial crisis globalization has been quite slow despite some periods of recovery. Thus, there is an implication for more detailed research on slowbalization – its grounds, tendencies and prospects (whether fast internationalization is possible in the future; what is the role of economic policy in stimulating the pace of globalization).

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Introduction

The aim of the article is to answer the research question: "How participation of G-7 and BRICS countries in global value chains has been changing since 1995?". Nowadays, G–7 countries (USA, Germany, France, United Kingdom, Italy, Japan and Canada) account for about 43% of world GDP (2022, US dollars in current prices), 28% of global gross exports (2022, US dollars in current prices) and 19% of global value-added exports (2022, US dollars in current prices). The figures for BRICS countries (Brazil, Russia, India, China and South Africa) are 25%, 21% and 18% respectively[3]. Thus, the study on G-7 and BRICS countries brings some knowledge how the participation in global value chains has been changing generally since 1995 (the changes in participation of G-7 and BRICS countries in global value chains as a proxy of changes in speed of globalization). Moreover, G-7 appears to be a good representation of developed economies and BRICS representation of developing economies respectively as both groups consist of the countries which play important roles in the world economy and global politics.

The research is based on data delivered by the Organization for Economic Co-operation and Development (OECD) and the Asian Development Bank (ADB). Both institutions deliver Inter-Country Input-Output Tables which are used for calculating trade in value-added (value-added exports and value-added imports) and indicators based on it (for example indices of backward and forward participation in global value chains). As recently the OECD has published statistics for years 1995-2020 and the ADB has published statistics for years 2000 and 2007-2022, the research on G-7 and BRICS countries covers the period 1995-2022.

The value-added of the article stems from employing Inter-Country Input-Output Tables delivered by the OECD and the ADB. Consequently, paper presents indexes calculated on the basis of two datasets. Additionally, combining two databases enabled to conduct study for quite long period (almost 30 years).

1. GVC participation index as a measure of internationalization degree

Nowadays transnational corporations work with and integrate their geographically dispersed partners, suppliers and customers into complex international structures knowns as global value chains (GVCs), global

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[1] The shares were calculated based on UNCTAD's and ADB's statistics.

production networks (GPNs), global commodity chains (GCCs) or global factories (for a comprehensive review of the multidisciplinary studies on GVCs/GPNs/GCCs/global factories see Kano et al. (2020)).

Global value chains are a phenomenon in the period of economic research after the New Trade Theory. This principle has indicated how product completion is fragmented in countries, regions, and continents. Companies outsourcing and offshoring product assembly activities subsequently benefit from comparative advantages in countries where they relocated such activity. GVCs depend on the fragmentation of production and trade in intermediates to take advantage of the cost advantages of each site or stage in the chain up to the stage of assembly (Černá et al., 2022, 14).

The best-known measure of a country's position in GVCs was created by Koopman et al. (2010) who introduced the GVC participation index. The index summarizes foreign value-added in domestic exports (backward participation) and the domestic value-added in foreign exports (forward participation).

GVC backward participation index for country i is calculated based on the formula (1):

$$GVC \ backward \ participation \ index_i = \frac{FVA \ embodied \ in \ the \ total \ gross \ exports_i}{total \ gross \ exports_i} \cdot 100\% \qquad (1)$$

where:

GVC backward participation index$_i$ – GVC backward participation index of country i,

N – number of countries,

K – number of industries,

FVA embodied in the total gross exports – foreign value added content of gross exports, so the sum of elements of matrix $\left(\widehat{\mathbf{V}}\mathbf{B}e_i\right)$ corresponding to all industries in all countries apart from country i (matrix $(\widehat{\mathbf{V}}\mathbf{B}e_i)$ is of size $(K \cdot N) \times 1$),

v – a $1 \times (K \cdot N)$ row vector with domestic value added shares of output for each industry in country i,

$\widehat{\mathbf{V}}$ – a diagonalised matrix of vector v, i.e. a $(K \cdot N) \times (K \cdot N)$ matrix with elements of vector v on the diagonal and 0 elsewhere,

B – the global Leontief inverse matrix with $(K \cdot N) \times (K \cdot N)$ dimensions,

e$_i$ – a $(K \cdot N) \times 1$ vector with all entries equal to zero except those corresponding to total (all industries) gross exports of country i,

total gross exports$_i$ – total (all industries) gross exports of country i.

Thus, GVC participation index is a 'foreign value-added intensity measure' often referred to as 'import content of exports' (OECD, 2022).

GVC forward participation index for country *i* is calculated based on the formula (2):

$$GVC\ forward\ participation\ index_i = \frac{DVA\ embodied\ in\ the\ total\ foreign\ gross\ exports_i}{total\ gross\ exports_i} \cdot 100\% \quad (2),$$

where:

GVC forward participation index$_i$ – GVC forward participation index of country *i*,

DVA embodied in the total foreign gross exports$_c$ – the country *i* domestic value added content embodied in the gross exports of all industries in foreign countries (all countries apart from *i*), so the sum of elements of matrix $(\hat{\mathbf{V}}\mathbf{B}e_{-i})$ corresponding to all industries in country *i* (matrix $(\hat{\mathbf{V}}\mathbf{B}e_{-i})$ is of size (*K·N*)×1),

$\hat{\mathbf{V}}$ – a diagonalised matrix of vector v, i.e. a (*K·N*) ×(*K·N*) matrix with elements of vector v on the diagonal and 0 elsewhere,

B – the global Leontief inverse matrix with (*K·N*) ×(*K·N*) dimensions,

e_{-i} – a (*K·N*)×1vector with elements corresponding to the total (all industries) exports of all countries except for country *i* (for country *i* elements equal to zero),

total gross exports$_i$ - total (all industries) gross exports of country *i*.

In other words, GVC forward participation index is estimated as being the value-added contents of exports originated in the source country, and embodied in the exports of the foreign countries, divided by the gross exports of the source country (OECD, 2022).

$$GVC\ participation\ index_i = GVC\ backward\ participation\ index_i + GVC\ forward\ participation\ index_i \quad (3)$$

The higher the value of GVC participation index (see equation (3)), the higher the country's participation in GVCs, i.e. trade in intermediaries is more prevalent in total trade and the production process is more internationalized and usually more fragmented. In addition to world trade and FDI, a major role in globalization is played by the processes of production internationalization, related to production fragmentation and the functioning of GVCs. Those processes intensified from the 1990s, as *signum temporis* of the accelerating globalization at the end of 20th century and at the beginning of 21st century. Imports and exports of intermediate goods and services, reflecting international trade in parts, components, semi-finished products, seem to be an appropriate measure for analyzing

the trends in the internationalization of production. Thus, the GVC participation index appears to be a good measure of country's degree of internationalization. It provides an estimation of how much a country is connected to GVCs got its production and foreign trade.

2. G-7 countries

On the basis of Inter-Country Input-Output Tables delivered by the OECD and the ADB, and employing formula proposed by Koopman et al. (2010), the values of GVC participation index were calculated. The lines on the Figures 1-12 illustrate these values – blue lines represent the results of calculations basing on OECD's datasets and orange line represents the results of computations basing on ADB's databases.

According to the OECD's statistics, during 1995-2008, GVC participation index of USA increased from ca. 29% to around 37% (see Figure 1). Year 2009 brought the collapse of index. Period 2010-2011 can be described as a fast recovery and years 2012-2015 as a stagnation (according to the ADB's statistics) or a decline (according to the OECD's statistics). For sure period 2012-2015 cannot be classify as a growth phase. Year 2016 can be named as the beginning of increase (ADB) or the end of decline (OECD). Years 2017-2018 brought a noticeable growth. According to the ADB's statistics a visible fall happened in 2019 (the last year before pandemic) and in 2020 was continued by a slight decline in 2020. According to the OECD's statistics, in 2019 index grew and in 2020 decreased noticeably, but no so sharply as in 2009. According to the ADB's statistics, since 2020 the index has grown from ca. 37% to about 42% (the highest value in history).
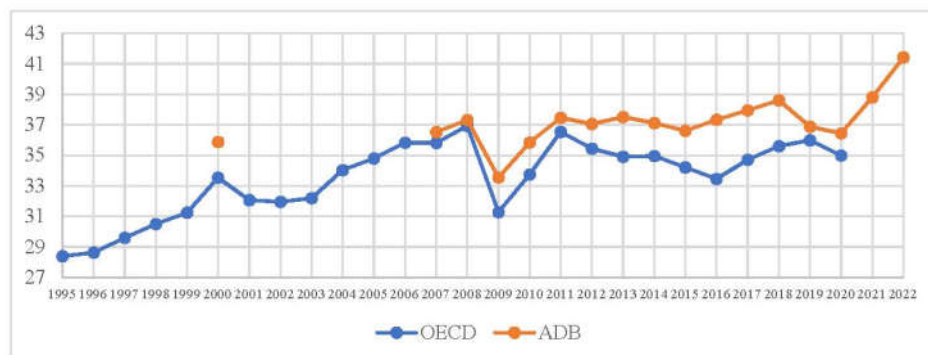

Figure 1. GVC participation index of USA during 1995-2022 (percentage)
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

According to the OECD's statistics, during 1995-2008, GVC participation index of Japan increased from ca. 27% to around 43% (see Figure 2). Year 2009 brought the slump of index. Period 2010-2011 can be described as a quite fast recovery. After that rebound index showed fluctuations (years 2012-2018). In 2019, just before the pandemic, the index dropped noticeably. In 2020 stagnation (OECD) or slight fall (ADB) was observed. According to the ADB's statistics, since 2020 the index has increased from ca. 36% to around 46% (the highest value in the history).
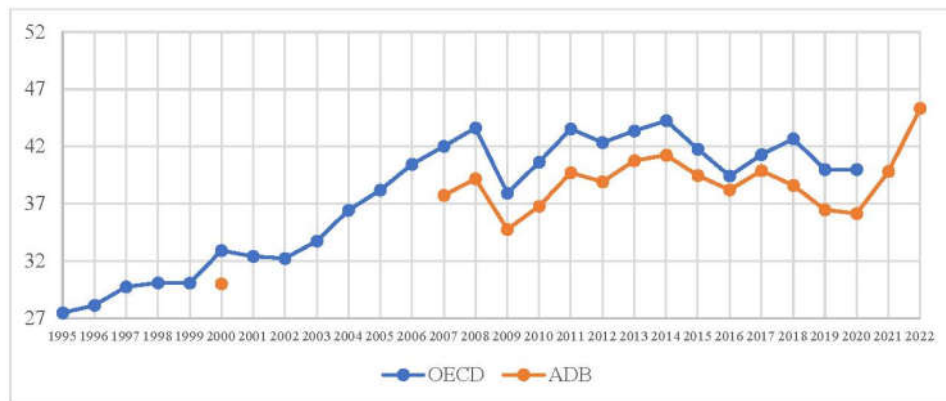

Figure 2. GVC participation index of Japan during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

The values of GVC participation index of Germany before 2017 calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are very close to those derived from the Input-Output Tables prepared by the ADB. We can distinguish four periods: growth (1995-2008), collapse in 2009, recovery (2010-2011) and post-recovery stagnation (2012-2016). According to the OECD's statistics years 2017-2019 brought a moderate increase of index which was ended by the pandemic in 2020. According to the ADB's statistics, sharp increase occurred in 2017, later there was a stagnation and sharp fall in 2019 (the last year before the pandemic), and finally the index grew from around 45% in 2019 to ca. 53% in 2022 (the highest value in history).
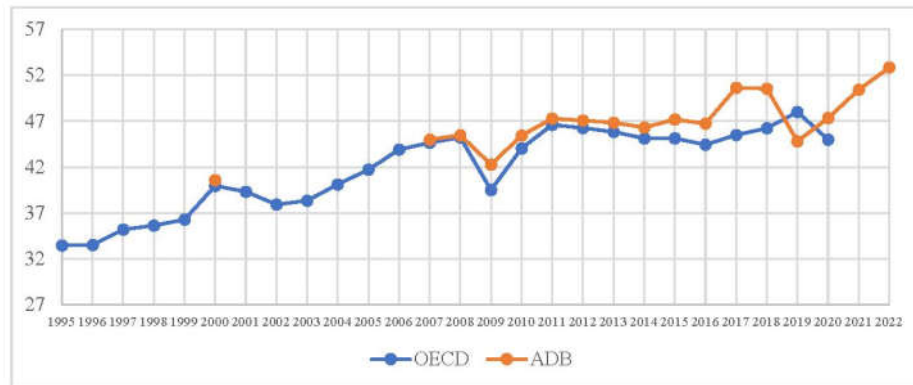
Figure 3. GVC participation index of Germany during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September
15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-
tables.htm; and on ADB MRIO. Retrieved on September 15, 2023,
from https://kidb.adb.org/mrio

According to the OECD's statistics, during 1995-2008 GVC participation index of the UK grew from ca. 32% to around 42% (see Figure 4). Year 2009 brought the crash of index. Period 2010-2011 can be described as a quite fast recovery. After that rebound, index was falling until 2013 (ADB) and until 2016 (OECD). Years 2017 and 2018 brought quite high increase after that index dropped in 2019 (just before the pandemic). It is debatable whether year 2020 bring another fall as basing on the OECD's statistics small increase was observed, but on the basis of the ADB's dataset we can notice decrease. Finally, according to the ADB's statistics, since 2020 the index has sharply grown to the highest value in the history (more than 46% in 2022).
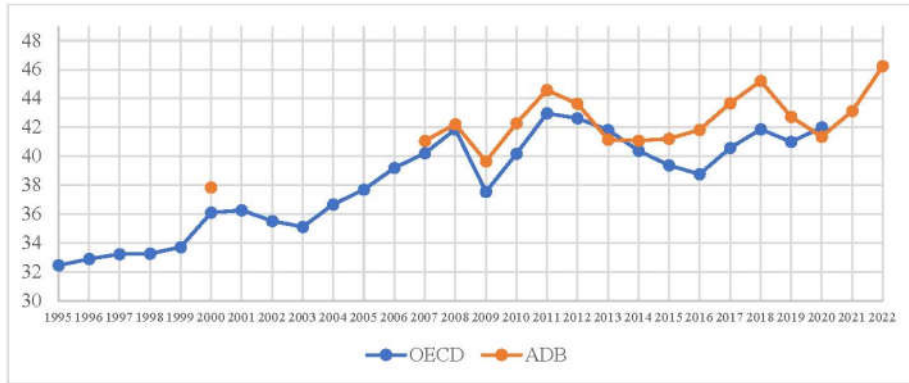
Figure 4. GVC participation index of UK during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Trends in GVC participation index of France basing on the OECD's and the ADB's datasets are very similar, but the values of index are not so close to each other as in the case of Germany. We can distinguish five periods: growth (1995-2008), collapse in 2009, recovery (2010-2011), post-recovery stagnation (2012-2019) and fall in 2020. According the ADB, sharp increase occurred after 2020 and in 2022 index reached the record value of almost 53% (see Figure 5).
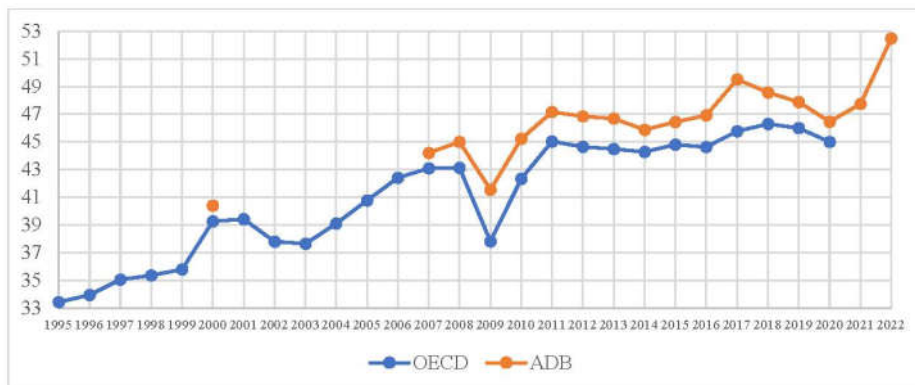

Figure 5. GVC participation index of France during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

The values of GVC participation index of Italy before 2020 calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are quite close to those derived from the Input-Output Tables prepared by the ADB (see Figure 6). We can distinguish four periods: growth (1995-2008), collapse in 2009, recovery (2010-2011) and post-recovery stagnation (2012-2019). The situation in 2020 is ambiguous as the fall (OECD) or slight growth (ADB) was noticed. According to the ADB's statistics, after 2020 sharp increase can be observed and in 2022 the index reached record value of ca. 53%.
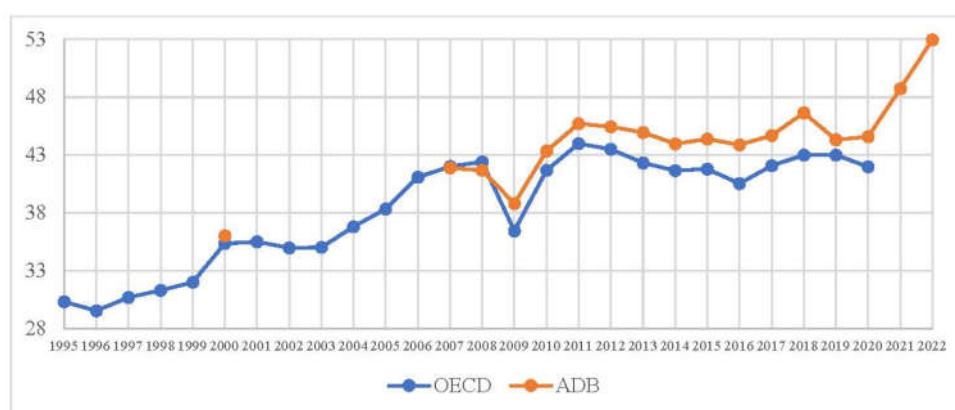

Figure 6. GVC participation index of Italy during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Also the values of GVC participation index of Canada before 2020 calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are quite close to those derived from the Input-Output Tables prepared by the ADB (see Figure 7). In 2020 there was fall of the value of index for Canada. However, fall illustrated by the ADB's line is much more stronger than this illustrated by OECD's line. According to the ADB's statistics, year 2021 brought another decrease, but this time it was rather slight. In 2022 index grew significantly from ca. 37% to about 40%. But still it was not the highest value in the history as in the years 2018-2019 the index reached the value of almost 41%.
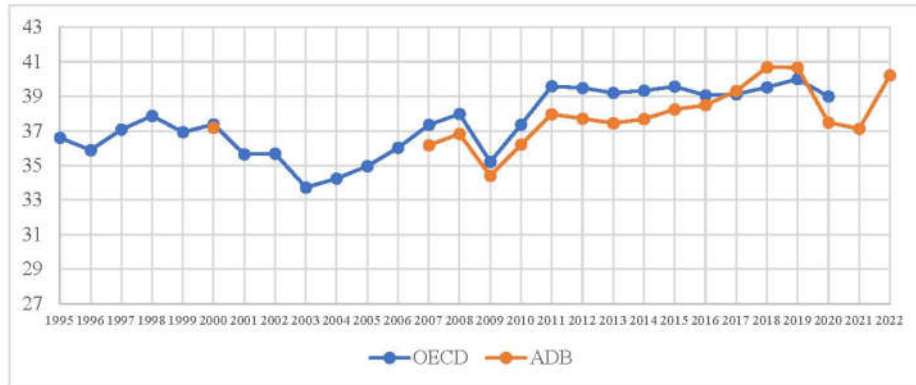
Figure 7. GVC participation index of Canada during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September
15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-
tables.htm; and on ADB MRIO. Retrieved on September 15, 2023,
from https://kidb.adb.org/mrio

To sum up, we can distinguish period of rapid globalization (1995-2008), global crisis and economic rebound (2009-2011), period of slowbalization somewhat strengthened by coronacrisis (2012-2020), and another recovery (2021-2022). The term slowbalization has recently appeared in economic literature. It means changes in the global economy slowing down or even ceasing the process of internationalization of economic activity.

For example, In January 2019, The Economist (2019) announced that globalization had entered a new stage – a path of sluggishness – and referred to the new era of globalization as slowbalization. As the turning point in globalization, The Economist indicated the financial crisis of 2008-2009, having caused cross-border investment, trade, bank loans and value chains to shrink or stagnate relative to global GDP. The issue of slowbalization was also raised in PWC (2020) report.

Additionally, Folfas and Odrobina (2020) scrutinized the symptoms and characteristics of slowbalization. They argue that slowbalization was demonstrated during the period 2012-2018 by the stagnation or even regression of world exports to world GDP ratio, global FDI inflows to world GDP ratio, and share of foreign value added in world exports of goods and services.

Moreover, slowbalization in the context of US-China decoupling is examined by Garcia-Herrero (2022). She claims that slowbalization started in 2008 and can be captured by decelerating trade and investment, as well as smaller global value chains. Also according to Aiyar and Ilyina (2023), slowbalization started in 2008 and is characterized by a slower expansion of cross-border lending and trade.

In case of G-7 countries, the slowbalization is noticeable especially for years 2012-2016. After that period, some growths in GVC participation index happened but usually there were stopped by pandemic (2020) or even earlier in 2019. Apart from Canada, years 2021-2022 brought sharp recovery but it is too early to state that this is the end of slowbalization.

3. BRICS countries

According to the OECD's statistics, GVC participation index of China grew from ca. 29% in 1995 to around 40% in 2008. Since 2008 the index has fluctuated and there has been quite big difference between the values calculated on the basis of the OECD's dataset and the ADB's database (see Figure 8). The common regularities refer to year 2009 (collapse), to years 2010-2011 (recovery) and to year 2020 (noticeable fall). According to the ADB's statistics, since 2020 the index has been growing, but it did not reach the highest value in history (37% in 2007).
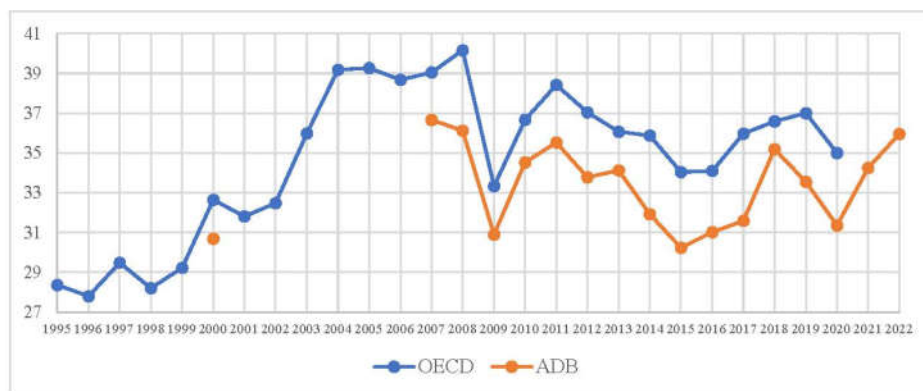

Figure 8. GVC participation index of China during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

According to the OECD's statistics, GVC participation index of India increased from ca. 24% in 1995 to almost 40% in 2008 (see Figure 9). Year 2009 brought the sharp fall to around 35% and year 2010 recovery to 37%. After 2010, we can observe quite strong fluctuations in values of the index, and also quite high differences between values calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD and values derived from Input-Output Tables prepared by the ADB. We are even not able to state whether in 2020 there was a fall or an increase. Moreover, it is ambiguous when the index reached the highest value in history (2012 or 2022).
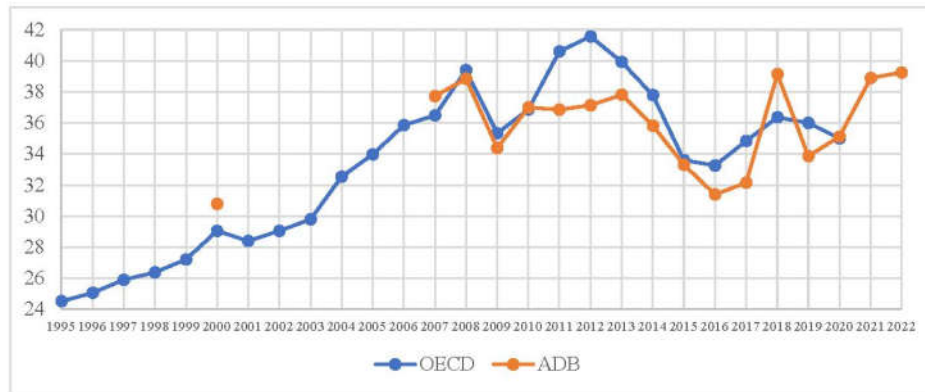
Figure 9. GVC participation index of India during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Apart from year 2011, the values of GVC participation index of Brazil calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are very close to those derived from the Input-Output Tables prepared by the ADB (see Figure 10). We can distinguish five periods: growth (1995-2008), collapse in 2009, recovery (2010-2011), post-recovery stagnation (2012–2018) and growth (2019-2022). We do not observe any fall of the index during pandemic.
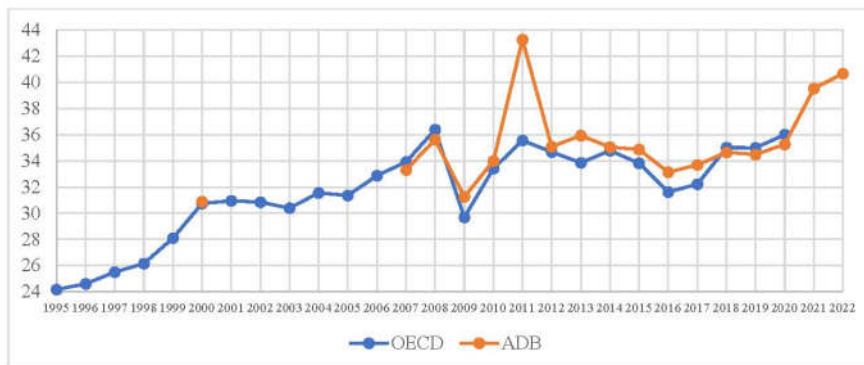

Figure 10. GVC participation index of Brazil during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

According to the OECD's statistics, GVC participation index of Russia grew from ca. 33% in 1995 to around 46% in 2008 (see Figure 11). Year 2009 brought the collapse to around 41% and years 2010-2011 recovery to 47%. (the highest level in history). After 2011, we can observe some fluctuations in values of the index. According to the ADB's statistics, the index fell significantly from around 41% in 2017 to almost 40% in 2020. Year 2021 brought short recovery, but in 2022 the index again dropped.
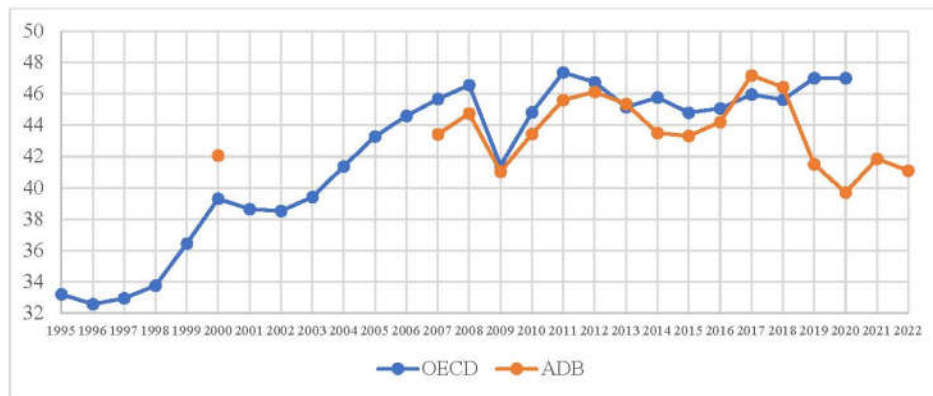

Figure 11. GVC participation index of Russia during 1995-2022
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Unfortunately, the South Africa is not included in Inter-Country Input-Output Tables delivered by the ADB. Thus, Figure 12 shows only the index calculated on the basis of Input-Output Tables prepared by the OECD for years 1995-2020. Similarly to other countries, there was a growth during the period 1995-2008. Year 2009 brought collapse and years 2010-2012 recovery. Since 2013 the index has been decreasing. The value in 2020 (42%) was only slightly higher than value in 1995 (41%). The highest value in history refers to year 2008 (53%).
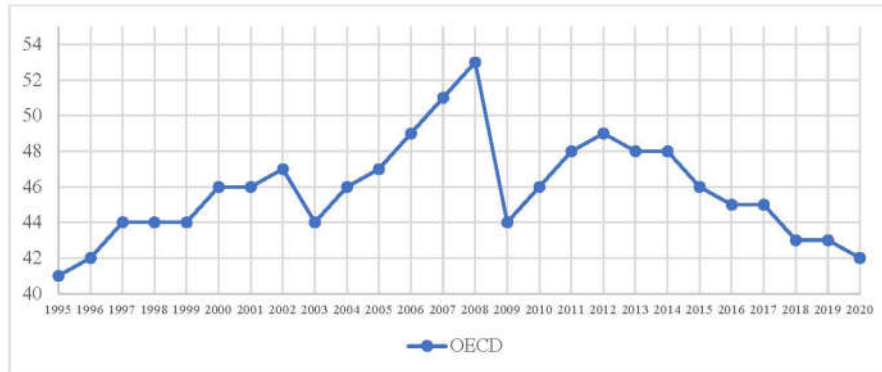
Figure 12. GVC participation index of South Africa during 1995-2020
Source: Own elaboration based on OECD ICIO Tables. Retrieved on September
15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-
tables.htm.

To sum up, we can again distinguish period of rapid globalization
(1995-2008), global crisis and economic rebound (2009-2011), period
of slowbalization partly strengthened by coronacrisis (2012-2020),
and another recovery (2021–2022). It is worth to notice that the values
of indexes for India and Brazil did not fall in 2020 (during the lockdowns).
Additionally, drop in the value of index for Russia in 2022 is probably
connected with sanctions imposed due to Russian attack on Ukraine
in February 2022.

Additionally – referring to the combining two datasets (delivered by the
OECD and the ADB) – we can make a conclusion that values of GVC
participation index calculated on the basis of Inter-Country Input-Output
Tables delivered by the OECD go more or less together with the values
derived from Input-Output Tables prepared by the ADB. For years
2007-2020, Pearson' s correlation coefficient can be calculated as a measure
(probably very unperfect, but quite illustrative measure) of accompaniment.
In case of G-7 countries, and also China and India, the values of Pearson's
correlation coefficients (the correlation coefficient was computed for each
country separately) are higher than 0.65 what confirm quite strong
accompaniment. Thus, the combining of two datasets appears to be rational.

Conclusion
If we treat the changes in the values of GVC participation index of G-7
and BRICS countries as a proxy of changes in speed of globalization, we can
state that fast internationalization came to a halt in 2008. Since global
financial crisis globalization has been quite slow despite some periods

of recovery. Additionally, noticeable slowdown of globalization was somewhat strengthened by coronacrisis.

Even though in case of G-7 countries the values of GVC participation indices in 2022 were higher than in 2008, but they were not significantly higher (apart from France and Italy). Typical growth by about 5 percentage point during almost 15 years appears to be lacklustre.

In case of BRICS countries the situation is even worse as only the values of indices for India and Brazil were in 2022 higher than in 2008. Moreover, the value of GVC participation index of South Africa in 2020 (last available year) was lower than in 2009 (the bottom of the world crisis).

To sum up, study on GVC participation indexes of G-7 and BRICS countries confirmed the phenomena of slowbalization. Nowadays, it is hard to say whether and when phase of slowbalization will end. After coronacrisis we can notice quite sharp recovery of internationalization, but it is debatable whether this is a permanent tendency in the world economy. Thus, there is an implication for more detailed research on slowbalization – its grounds, tendencies and prospects (whether fast internationalization is possible in the future; what is the role of economic policy in stimulating the pace of globalization). In terms of slowbalization international value chains seems to be rather regional than global. This is another area of concern for further research.

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