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Original Article

India and China in Manufacturing GVCs: Participation, Gains, and Comparative Advantage

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Abstract

The restructuring of global production through Global Value Chains (GVCs) deeply alters trade patterns in addition to comparative advantage. This paper undertakes a comparative assessment of India's and China's manufacturing integration into GVCs between 1995 and 2020, also it employs OECD, WTO TiVA data to decompose gross exports into domestic and foreign value-added components. This analysis studies participation using forward and backward linkages, measuring gains through the forward-to-backward linkage ratio. It also examines competitiveness at the time when it uses the customary "Revealed Comparative Advantage" (TRCA) and also the "Normalized Revealed Comparative Advantage" (NRCA) indices. The results highlight divergent trajectories within. India did participate much more in GVC, as participation went up from 25 to 34 percent. It was backward linkages that mainly drove this increase since they reflected a growing reliance upon imported intermediates. Gains fell sharply before a slight rebound, and this implies weak local knock-ons. China, in contrast, consistently integrated itself much more deeply since gains rose quite steadily since industries that are technology-intensive shifted in competitiveness. Sectoral evidence does indicate that domestic value-added shares declined in India's employment-intensive industries, while China structurally upgraded toward capital- and knowledge-intensive sectors. The findings underscore that India has integrated broadly but shallowly, whereas China has integrated to a deeper and more helpful extent. Policy implications say India should strengthen local supply chains, encourage tech-heavy output, and advance obscure leaders for lasting GVC gains.

Keywords: Global Value Chains, Normalised Revealed Comparative Advantage, Manufacturing Sector, Domestic Value Added and Foreign Value Added.

JEL Classification: F14. F15. F23

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1. Introduction

Over the past three decades, the rapid expansion of Global Value Chains (GVCs) shaped the restructuring of international trade and production networks. Economies have been enabled through fragmentation of production processes across borders so as to integrate at different stages of value creation thereby redefining trade dynamics and comparative advantages. GVCs allow emerging economies to integrate, and industries can upgrade. This integration also causes technological spill-overs together with productivity grows as well. Due to expanding global trade roles plus manufacturing scale plus industry diversity, China and India have a prominent position in these economies. However, their involvement level and type in GVCs stay structurally different. That participation is shaped by divergent policy choices, institutional capacities, and development strategies.

In order to centrally measure GVC integration, we decompose the trade flows into domestic value added (DVA) and foreign value added (FVA) components. The customary trade statistics do tend to overstate a country's contribution through capturing only gross exports. However, the value-added approach distinguishes in exports the share of domestic production and identifies dependence on imported intermediates. For economies like India and China, export growth has been a major driver of industrialization, so understanding the evolution of DVA shares offers important perceptions into the depth of their production capabilities along with their exposure to external supply chain shocks. If we examine the changes in DVA shares across manufacturing sub-sectors at the same time, a more granular picture results regarding how different industries have positioned themselves within GVCs over time.

India and China both did witness substantial manufacturing structure transformations in the period from 1995 to 2020. China did rapidly emerge as the "factory of the world" because it invested on a large-scale and integrated into global production networks then leveraged preferential trade agreements so it could expand its manufacturing exports. India adopted a more gradual trajectory in contrast, with a strong performance but a relatively limited penetration. Considering this backdrop, it becomes necessary that we analyse their respective GVC participation rates, their forward and backward linkages' indices, and the gains associated, so we can assess how the two economies benefited from integration and determine if they converged or diverged in industrial competitiveness.

This paper does a sector-level assessment comparing manufacturing GVC linkages for India and China. It analyses all of the linkages throughout the period from 1995 to 2020, contributing to the literature. The analysis consists of multiple stages. It first shows DVA content evolution graphically in gross exports for both economies at aggregate and sub-sectoral levels. Second, it also measures the percentage changes that occur in DVA shares across manufacturing industries. It thereby identifies the sectors that have strengthened or that have weakened their domestic content in exports. Third, the study tracks the overall participation of India and China in GVCs from 1995 until 2020, and it highlights structural differences in their integration paths. It constructs and compares participation indices as well as gains at only the sub-sector level during 1995 and, also 2020, capturing long-term shifts within industrial specialization. Using

this framework, we find sectors with reliably greater GVC involvement, giving us chances to study more complex features of vertical production.

Further, the paper does an analysis of relative trade linkages between India and China with leading economies from BRICS, as well as South Asian and, also Southeast Asian countries. This analysis serves to broaden the paper's scope, and it contextualizes their GVC participation in terms of such calculated dependencies and market concentration. A key contribution of this paper is utilizing Revealed Comparative Advantage (TRCA) and Normalized Revealed Comparative Advantage (NRCA) indices at the detailed industry level. TRCA highlights sectors that are appearing competitive in gross exports, but NRCA adjusts in order to measure value-added, and it thereby uncovers hidden strengths and corrects distortions that are caused through imported content in exports. This dual approach enables a more accurate identification of sectors where India, along with China hold enduring competitive advantages or face vulnerabilities inside GVCs. Cross-country and even cross-sectoral comparisons are therefore much stronger.

Therefore, the study fills a key scholarly void. Comparative, sectoral, as well as policy-linked analyses of both India and China have gained some limited attention since much of the existing literature has focused either on aggregate linkages or on single-country perspectives. This study provides a thorough account of GVCs by integrating sectoral decomposition, econometric analysis of determinants, and graphical representation of how the two largest emerging economies in Asia have benefited from participation. The findings should shape academic debates as value-chains are integrated with policy discussions as industry is upgraded for trade diversification that builds resilience after the global pandemic. By combining sectoral decomposition of value-added trade with TRCA as well as NRCA measures at a disaggregated level, this study not only uncovers the structural differences in how India and China integrate into GVC but also helps derive policy perceptions on just how India can strengthen domestic capacities, leverage hidden comparative advantages, also achieve more sustainable gains from global production networks.

2. Literature Review

Global value chains (GVCs) emerged within and transformed the organization of production and trade. Comparative advantage as well as international competitiveness have been reshaped because of all of this. Conventional trade statistics based upon gross exports often obscure the role of domestic and foreign inputs in exports, thereby overstating the contribution of national industries. For addressing this, a growing body of literature stresses value-added measures of trade because these measures disentangle domestic value added (DVA) from foreign value added (FVA) and thus provide a more accurate comprehension of GVC participation and gains.

For measuring GVC participation, one strand of research does stress the methodological advances. Koopman, Wang, and Wei (2010) and Wang et al. (2017) created a framework decomposing gross exports to isolate DVA and FVA portions. Identification of forward and backward linkages is done by this framework. The OECD as well as WTO built upon such foundations at the time that they developed the Trade in Value Added (TiVA) database, which

has become a central tool when it comes to empirical studies done on global production fragmentation (De Backer & Yamano, 2012). These approaches have shown that trade for intermediates and production sharing are far more pervasive than gross export statistics suggest. In the range of 70 percent of all of world trade now takes place by way of GVCs.

At the country level, scholars have examined the degree to which GVC integrates emerging economies as well as what that integration implies. Gupta (2019) provides a detailed account about India's linkages within GVCs. India's DVA content declines amid rising export shares especially within manufacturing industries. This trend reflects an increasing reliance on imported intermediates, and it sparks some worries of a "hollowing-out" effect where domestic industries capture a shrinking share of value that is added. Likewise, Chawla and Kumar (2023) stress that India's GVC participation remains more modest compared with other Asia-Pacific economies, with stronger contributions arising from services than from manufacturing. They argue that functional specialization determines competitiveness inside GVCs, not product specialization. This underscores just how important upgrading of domestic capabilities can be.

Evidence from comparison also highlights different integration strategies. These strategies diverge on the outcomes they produce. China invested at large-scale, directed foreign investment (FDI), and integrated through policy to become a central hub in GVCs. Studies find China's DVA share dropped since it relied on inputs imported much. Its domestic contribution to exports has risen within time because of industrial upgrading as well as technology accumulation (Ceglowski, 2015). In contrast, India has participated to a lesser degree and unevenly across different sectors, with linking forward relatively strongly in services but with integrating weakly in manufacturing value chains.

Another line of literature focuses on how exports compete via revealed comparative advantage (RCA). Scholars have noted about the limitations of traditional RCA indices (Balassa, 1965) based upon gross exports in terms of the context of GVCs, which actually have been widely used for identification of comparative strengths. Yi (2001) and others argue that gross exports may not reflect true competitiveness if a large share of value originates from abroad. Normalized RCA (NRCA) measures are suggested to fix this since they permit symmetric comparisons across industries and they better reflect competitiveness regarding domestic value added (Ceglowski, 2015). These refinements reveal that sectors appearing competitive in gross exports may, in fact, contribute little domestic value, while others by modest trade shares may play important roles in building resilient value chains.

Empirical studies on China and India depict these dynamics. Banga (2014a) along with Gupta (2019) later showed for India that labor-intensive sectors such as textiles, metals, and machinery have falling DVA shares. This limits the generation of employment along with backward linkages. China's evidence shows structural transformation prevailed because competitiveness moved from usual labor-intensive exports toward sectors like electronics, chemicals, and transport equipment using capital plus technology intensively. This split highlights the ways GVC involvement paths might diverge. Outcomes that are industrial in the long term are shaped by these very trajectories.

In sum, this paper frames itself on the literature with three critical perceptions. Value-added trade statistics measure competitiveness more subtly and accurately than gross export data, first. Second, GVC participation must be evaluated through the distribution of gains between forward with backward linkages in addition to its extent. Experiences from India and China contrastingly underscore domestic industrial upgrading's importance plus policy strategies in determining how GVC integration translates to sustainable economic growth. This study uses sector DVA/FVA share analysis plus TRCA/NRCA measures; it thus builds on existing literature to newly compare manufacturing GVC participation evidence in two large emerging economies.

3. Research Methodology

The OECD and also the WTO did produce collaboratively the newly released Trade in Value-Added (TiVA) database that this research makes use of. An international input-output model yields estimates from the TiVA database of value added by source in export goods and services. It presents the global total along with a residual for the rest of the globe also estimated monetary values of several trade value-added metrics for 56 countries. For this study TiVA metrics are used for gross exports. For domestic value added, the study also utilizes these metrics in foreign final demand. Value added from all sources is included via the former as well as commonly utilized to compute RCA for exports. The former compares with domestic value-added exports (OECD, 2025). Every value-added metric has documentation for both the aggregate and 18 industrial categories in each country. Being industry-specific, each of the 18 categories are based on estimates from each industry-level input-output table. Countries' RCA relates to industries not to products. This is the analysis.

This paper compares and analyzes India’s and China’s participation, and it assesses their gains in global value chains (GVCs) inside the manufacturing sector from 1995, 2020. This method combines value-added trade analysis and revealed comparative advantage measures. Because it exists, this integration allows a finer comprehension of structural dynamics and sectoral competitiveness.

3.1 Data Sources

The OECD, WTO Trade in Value Added (TiVA) Database is the 2023 version. This database is the main data source for this research. Harmonized multi-country input and output tables are provided through TiVA as they decompose gross exports into both domestic value-added or DVA plus foreign value-added or FVA components. This dataset suits GVC analysis well because it captures forward connections. Backward linkages that have foreign value that is embedded in domestic exports are also captured. For UN Comtrade and WTO statistics for the conventional revealed comparative advantage indices construction, there has been data for global export used for the purpose of complementing this. For sectoral classification, there is a following of the ISIC Rev.3 framework since it covers 19 manufacturing sub-sectors.

3.2 Analytical Framework

The methodology adopted in this paper is divided into three major steps:

3.2.1 Decomposition of Gross Exports into Value-added Components

Domestic value added (DVA) and Foreign value added (FVA) constitute Gross exports using the TiVA framework that Koopman, Wang, and Wei (2010) proposed. This allows assessment about trends in domestic content in exports. It also allows for assessment of foreign dependence. Structural shifts within manufacturing industries get highlighted when considering aggregate levels and sub-sectoral ones.

3.2.2 Measurement of Participation and Gains in GVC

(a) GVC Participation Index

$$Participation\ Index = \frac{Forward\ Linkage + Backward\ Linkage}{Gross\ Exports}$$

Where, forward linkage (FL) is domestic value added used in other countries' exports, and backward linkage is foreign value added embodied in a country's exports.

(b) Gains in GVC

$$Gains = \frac{Forward\ linakges}{Backward\ linakges}$$

Where, a higher ratio indicates stronger **domestic spill-overs** from GVCs, and a lower ratio reflects greater dependence on imported intermediates.

3.2.3 Normalised Revealed Comparative Advantage (NRCA)

The concept of Revealed Comparative Advantage (RCA), introduced in 1965 by Balassa, uses actual export patterns to identify products with a country's comparative advantage. A country has an RCA in some product when its export share exceeds its share of world exports for this product. RCA reflects real trade outcomes, also it is an ex post indicator. However, theoretical measures depend on production costs or unobservable autarky prices. Thus, trade barriers, transport costs, home bias, and market distortions influence upon it. Yi (2001) thus suggested that RCA may better be seen as gauging export competition instead of giving a basic edge. RCA is still, despite limits like these, a simple tool used a lot when analysing export performance. The ratio that is of a product's share in a country's total exports to its share in world exports formally expresses Balassa's original RCA index like BRCA.

$$BRCA_{ij} = \frac{x_{ij}/x_i}{x_{wj}/x_w}$$

Exports of product j from country i are represented by Xij/Xi here, total exports from country i are denoted by Xi, exports of product j from around the world are indicated by Xwj/Xw, and total exports worldwide are Xw. In the event that an RCA index value is found as greater than 1, that certainly implies that the share of product j within a country's exports exceeds its share within global exports which in turn signifies a revealed comparative advantage. Conversely, a value that is below 1 indicates a revealed comparative disadvantage. That disadvantage is within that product there. However, scholars have identified several shortcomings with the original Balassa index. This has occurred throughout time. Meaningful comparisons as those noted by Yeats (1985) lack both the cardinal and ordinal properties. It also behaves in an asymmetric manner, bounding at zero though it does not define some upper limit (De Benedictis & Tamberi, 2004), and furthermore, it is sensitive to each aggregation level and it does not add (Hoen & Oosterhaven, 2006). The limitations do constrain the index's use for assessing the degree of competitiveness either across countries or across time, though the index acts as a useful binary indicator of whether a country has comparative advantage in a given product at a specific point in time. BRCA usually shows relative strength.

For overcoming these issues, this study uses the Normalized Revealed Comparative Advantage (NRCA) index that Yu et al. (2009) proposed, which gives a basis stronger for comparative analysis of competitiveness in GVC-related industries.

$$NRCA_{ij} = (VAX_{ij}/ VAX_j)/ VAX_{wj}/VAX_j$$

VAXij represents the domestic value-added exports of industry j of country i. VAXi represents the total domestic value-added exports of country i then. VAXwj represents worlds domestic value-added exports from industry j. VAXi represents worlds total domestic value-added exports too. Normalized Revealed Comparative Advantage has key advantages over Balassa RCA. NRCA is symmetric, existing all around zero with it being comparable for products through time so it adjusts for any scale effects. BRCA, however, is in fact asymmetric, as well as unbounded, and even unsuitable for cross-sector or cross-country comparisons. Especially within a GVC context, this increases robustness to capture the true degree of competitiveness for domestic as well as foreign value-added shares need more accurate distinction.

4. Changes in India's DVA content of Exports

Using the TiVA database, we observe that India's domestic value-added (DVA) content for gross exports rose greatly by 1166.03 percent during 1995 to 2020. However, this expansion lagged behind the augmentation of the foreign value-added (FVA) content, with the foreign value-added (FVA) content escalating by about 2100 percent during the same period. India, notwithstanding this, disseminates a larger proportion of its indigenous value-added than value derived from abroad.

However, a key concern involves India's exports' diminishing proportion of DVA. Around 1995, almost 87 percent of all exports represented domestic value-added. This allocation diminished to 4.22 percentage points by 2020, and it approximated 83 percent. This trajectory evinces India's escalating reliance upon imported constituents, and the FVA proportion within

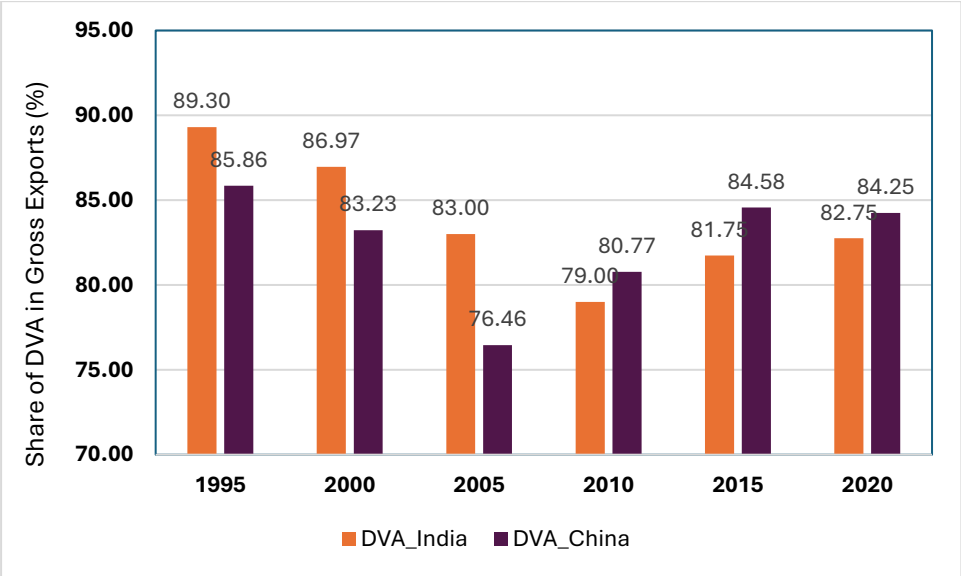
aggregate exports ascended from 10 percent in 1995 to 17 percent in 2020. The escalation materialized from this reliance.

The augmentation of China's DVA within exports ascended 1856.3 percent during 1995 and 2020 but was inferior to its FVA amplification of 2120.7 percent. China's pattern is unique: DVA began at 85 percent in 1995, decreased to 76 percent in 2005, yet subsequently rose to 84 percent in 2020, albeit still 1.61 percentage points less than in 1995. China's FVA proportion in exports augmented gradually meanwhile. It moved in magnitude from 14.14 percent up to 15.75 percent.

India's DVA shares reveal a popular downturn within 19 manufacturing sub-sectors examined sectorally, particularly about Electrical equipment (C27), Machinery, Fabricated metals, Basic metals, Rubber and plastics, Petroleum products, and Textiles. The Wood and cork products industry emerges as an outstanding anomaly. It manifested an outstanding 1413 percent surge.

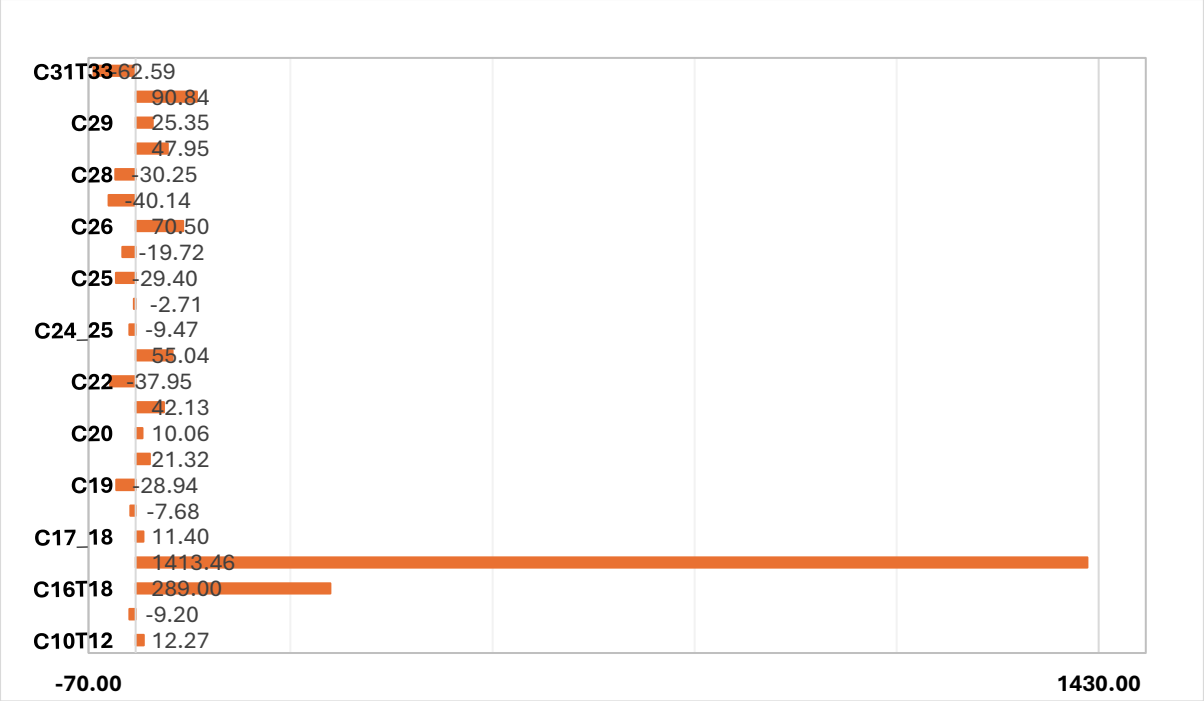
In summary, the DVA exports' decline looms considerably within employment-intensive industries like textiles, machinery, and metals. This mirrors how backward associations into global value chains (GVCs) expand, though it implies that depending further upon imported inputs can impair indigenous supply industries, diminish opportunities for work, plus supplant workers, jeopardizing Indian manufacturing's durable growth.

Figure 1: *Share of India's DVA content of exports in its gross exports (%): Total*



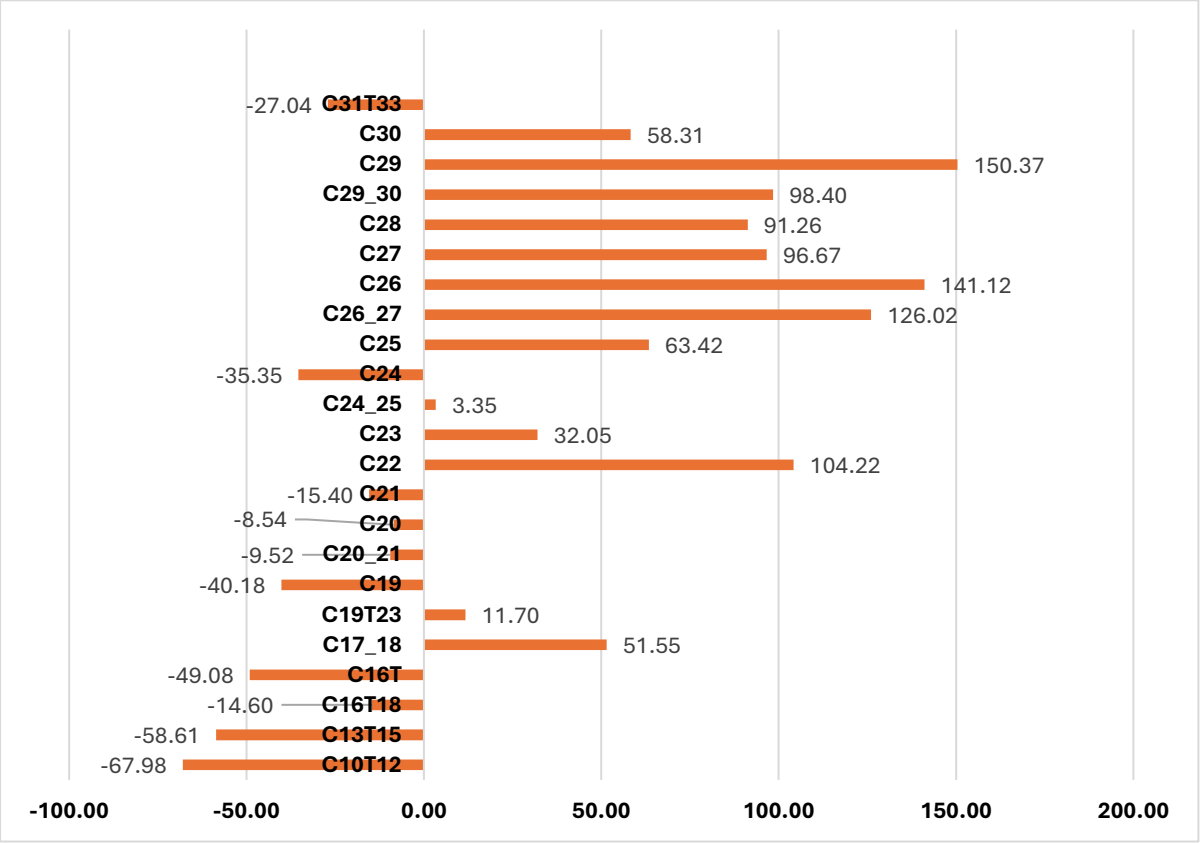
OECD-TiVA Database, 2023; Author's Calculations.

Figure 2: *Percentage changes in shares of India's DVA exports in Gross Exports for sub-sectors of Manufacturing*



OECD-TiVA Database, 2023; Author's Calculations.

Figure 3: *Percentage changes in shares of China's DVA exports in Gross Exports for sub-sectors of Manufacturing*



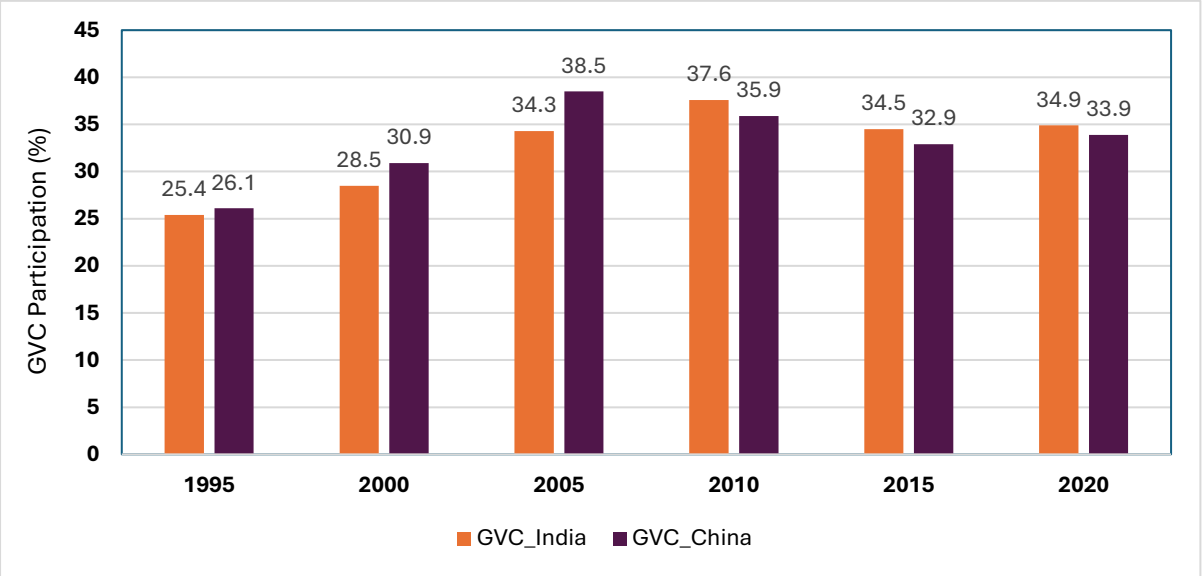
5. India's Participation and Gains in GVCs

This section evaluates India's degree of participation as well as corresponding gains that come from GVCs via analysing just how it links both backward and forward. The participation index, when expressed in the form of a ratio to gross exports, is measured as being the sum of forward linkages (FL) and also backward linkages (BL).

5.1 Results at the Aggregate Level

India participates in GVCs, and the results indicate about this participation having been low but gradually increasing (Figure). Researchers are measuring India's participation by way of the use of its value added within exports of other countries. India participated in GVC at around 25 percent in 1995 and rose 9.5 percentage points by 2020. This participation index is used often for international trade studies when calculating linkages as a share of gross exports (Koopman et al., 2010; UNCTAD, 2013). However, with such an approach this may misrepresent a country's true position. Misleading policy implications may also result because of it. India's share is less than 1 percent when assessed by total global value-added via GVCs, whereas China's share is 9 percent also OECD countries' share is 67 percent (Banga, 2014a).

Figure 4: *India and China's participation in GVCs (%): 1995 to 2020*

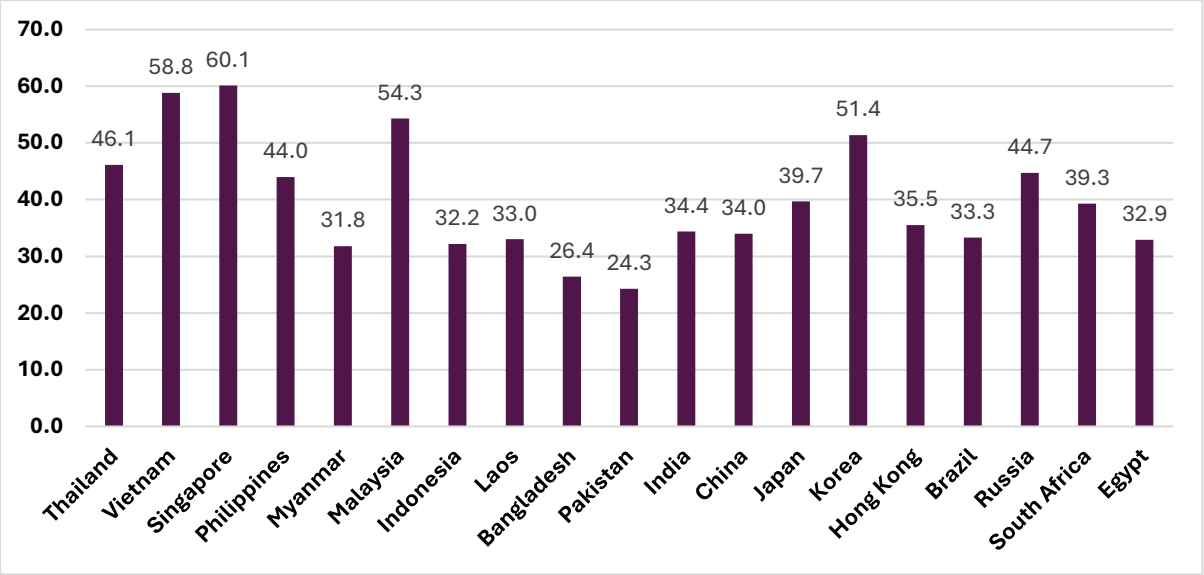


OECD-TiVA Database, 2023; Author's Calculations.

The figure highlights the relative position of India along with China in 2020, as a comparison was made with other groups of countries including BRICS, South Asia, and Southeast Asia. India participates within global value chains (GVCs) to an extent of around 34 percent. This is just a modest position now. India is beside highly integrated economies like Japan, China, Hong Kong, Thailand, South Africa, Indonesia, Myanmar, and Brazil, therefore. India's participation level does exceed that of Brazil and Indonesia, and this suggests India holds the potential to carve out a distinct niche in GVCs just like China within the BRICS framework. Nevertheless, several Asian economies such as Singapore, Vietnam, Malaysia, Korea, and the Philippines, among other economies, are far more deeply embedded within GVCs because that reflects much stronger regional integration.

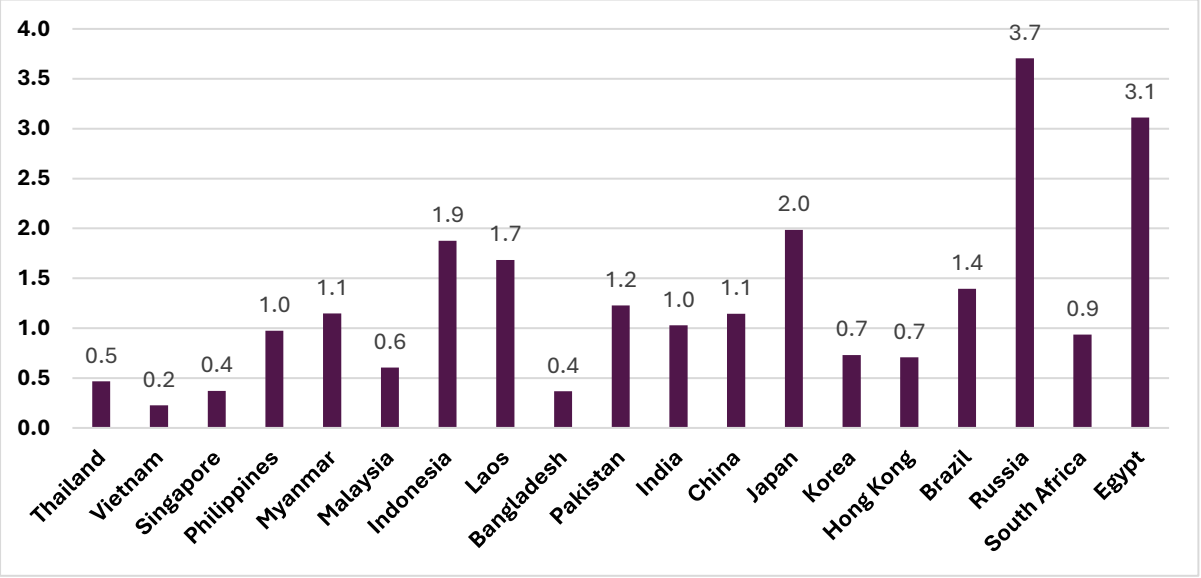
GVC engagement is valuable through participation and through its resulting gains. India's together with China's gains show different trajectories so we measure those gains as the ratio of forward linkages to backward linkages using TiVA data. India's gains decreased from 1.37 percent in 1995 to 0.65 percent in 2012. These gains then rose to 1.03 percent in 2020. China, on the other hand, followed more of a consistent upward path and its gains rose up from 0.85 percent in 1995 to 1.15 percent in 2020, albeit with some fluctuations. The comparative figure underscores these differences here. It situates India and China with their regional and global peers since they participate in and gain from GVCs.

Figure 5: Participation index of India and China *vis-à-vis* other countries (%): 2020



OECD-TiVA Database, 2023; Author's Calculations.

Figure 6: India and China's gains in GVC *vis-à-vis* other countries (%): 2020



OECD-TiVA Database, 2023; Author's Calculations.

India records relatively higher gains from GVCs compared with some well-known economies such as Vietnam, Singapore, Thailand, Malaysia, Korea, Hong Kong, and South Africa because its exports depend less on imported intermediates showing more domestic value-added. Yet, India still lags way behind other BRICS members and Japan. Gains are also greatly higher even in Egypt. India urgently needs to strengthen its industries plus value chains given that gap, for that ensures a bigger share of exports involves value-added products made domestically. Meanwhile, imports should be restricted on purpose to domestic goods that are unavailable plus local production that is uncompetitive. A similar situation exists in China. However, it performs slightly better since its gains register about one percentage point higher than India's. The contrast highlights that India must target policies for capturing greater benefits deriving from GVC participation as well as move closer in proximity to global leaders.

Table 1: *India's participation indices at sub-sector level: 1995 and 2020*

Industry Codes	1995			2020		
	BL	**FL**	**GVC**	**BL**	**FL**	**GVC**
C10T12	2.3	0.7	**3.0**	6.3	0.6	**6.9**
C13T15	3.3	1.4	**4.7**	15.9	0.8	**16.7**
C16T18	7.2	0.3	**7.5**	16.9	0.2	**17.1**
C16T	2.1	0.1	**2.2**	15.8	0.1	**15.9**
C17_18	8.4	0.2	**8.6**	20.5	0.1	**20.6**
C19T23	18.6	1.8	**20.4**	39.4	2.4	**41.8**
C19	24.4	0.2	**24.6**	58.5	0.4	**58.9**
C20_21	14.9	1.1	**16.0**	19	1.5	**20.5**
C20	17	0.9	**17.9**	21.9	1.1	**23.0**
C21	10.8	0.2	**11.0**	14.5	0.4	**14.9**
C22	7.6	0.4	**8.0**	22.4	0.4	**22.8**
C23	9.3	0.1	**9.4**	19.2	0.1	**19.3**
C24_25	11.8	1.4	**13.2**	25.4	1	**26.4**
C24	12.1	1	**13.1**	26.4	0.7	**27.1**
C25	10.9	0.4	**11.3**	20.9	0.3	**21.2**
C26_27	18.4	1.9	**20.3**	25.4	1.7	**27.1**
C26	19.7	1.4	**21.1**	27	1.3	**28.3**
C27	18.2	0.4	**18.6**	24.3	0.5	**24.8**
C28	16.3	0.9	**17.2**	21.7	0.8	**22.5**
C29_30	16.5	1.4	**17.9**	22.3	1.5	**23.8**
C29	17	1	**18.0**	22.9	1.2	**24.1**
C30	15.4	0.4	**15.8**	21.4	0.3	**21.7**
C31T33	8.5	0.5	**9.0**	32.1	0.5	**32.6**

OECD-TiVA Database, 2023; Author's Calculations.

The participation indices for 19 sub-sectors in India estimate selected years 1995 along with 2020. The indices for Indian manufacturing sector are compared to see their participation extent.

Table provides accounts for gains that come from linkages in the GVCs. These gains are shown as a ratio of forward and of backward linkages for all of the 19 sub-sectors of the Indian economy from 1995 until 2020.

Table 2: *China's participation indices at sub-sector level: 1995 and 2020*

Industry Codes	1995			2020		
	BL	**FL**	**GVC**	**BL**	**FL**	**GVC**
C10T12	6.8	0.5	**7.3**	8.3	0.5	**8.8**
C13T15	17.7	1.6	**19.3**	8.3	1.3	**9.6**
C16T18	14.1	0.2	**14.3**	11.8	0.2	**12.0**
C16T	13.1	0.1	**13.2**	11.1	0.1	**11.2**
C17_18	15.9	0.2	**16.1**	12.2	0.1	**12.3**
C19T23	15.4	1.1	**16.5**	16.9	1.8	**18.7**
C19	14.2	0.1	**14.3**	38.6	0.3	**38.9**
C20_21	15.2	0.6	**15.8**	16.2	1	**17.2**
C20	16.5	0.6	**17.1**	17.1	0.8	**17.9**
C21	6.4	0.1	**6.5**	9.7	0.2	**9.9**
C22	19.5	0.3	**19.8**	16	0.4	**16.4**
C23	12.3	0.1	**12.4**	10.9	0.1	**11.0**
C24_25	15.6	0.7	**16.3**	18.2	1	**19.2**
C24	15.5	0.5	**16.0**	22.4	0.7	**23.1**
C25	15.7	0.3	**16.0**	15.3	0.3	**15.6**
C26_27	21.7	2	**23.7**	23.8	4.5	**28.3**
C26	23.2	1.6	**24.8**	25.7	3.7	**29.4**
C27	18.7	0.4	**19.1**	18.9	0.8	**19.7**
C28	18.3	0.7	**19.0**	16.2	1.1	**17.3**
C29_30	20.4	1	**21.4**	15.8	2.3	**18.1**
C29	18.1	0.7	**18.8**	14.5	1.9	**16.4**
C30	22	0.3	**22.3**	17.2	0.5	**17.7**
C31T33	16.2	0.3	**16.5**	13	0.5	**13.5**

OECD-TiVA Database, 2023; Author's Calculations.

Table 3: *Gains under GVC for sub-sectors of India and China: 1995 and 2020*

Industry Codes	**India**	**China**

	Gain1995	Gain2020	Gain1995	Gain 2020
C10T12	0.30	0.10	0.07	0.06
C13T15	0.42	0.05	0.09	0.16
C16T18	0.04	0.01	0.01	0.02
C16T	0.05	0.01	0.01	0.01
C17_18	0.02	0.00	0.01	0.01
C19T23	0.10	0.06	0.07	0.11
C19	0.01	0.01	0.01	0.01
C20_21	0.07	0.08	0.04	0.06
C20	0.05	0.05	0.04	0.05
C21	0.02	0.03	0.02	0.02
C22	0.05	0.02	0.02	0.03
C23	0.01	0.01	0.01	0.01
C24_25	0.12	0.04	0.04	0.05
C24	0.08	0.03	0.03	0.03
C25	0.04	0.01	0.02	0.02
C26_27	0.10	0.07	0.09	0.19
C26	0.07	0.05	0.07	0.14
C27	0.02	0.02	0.02	0.04
C28	0.06	0.04	0.04	0.07
C29_30	0.08	0.07	0.05	0.15
C29	0.06	0.05	0.04	0.13
C30	0.03	0.01	0.01	0.03
C31T33	0.06	0.02	0.02	0.04

OECD-TiVA Database, 2023; Author's Calculations.

The analysis of India's and China's participation indices at that sub-sectoral level in relation to the benchmark years 1995 and 2020 (Tables B.2 and B.3) reveals that the two economies integrated into GVC along those contrasting trajectories. Across almost all manufacturing industries, backward linkages have broadly increased for India while forward linkages are still relatively marginal. India's backward linkages during 1995 were generally confined to single digits, and this indicated limited use of imported intermediates. However, by 2020, these values more than doubled in a number of industries like coke and refined petroleum products (C19: 24.6 to 58.9), basic metals (C19T23: 20.4 to 41.8), fabricated metals (C24_25: 13.2 to 26.4), also textiles (C13T15: 4.7 to 16.7). This steep incline in backward integration highlights India's rising reliance for export growth maintenance. In contrast, small forward linkages have persisted, often below one per cent, suggesting India's domestic value-added sees little use in other countries' exports. Between 1995 and 2020, India's overall GVC indices greatly rose; rising backward rather than forward participation largely drove the increase.

China gives a picture that is somewhat unclear. A more mixed picture exists over there. In 1995, most Chinese sub-sectors did already show higher backward linkages than their Indian

counterparts for the country had integrated earlier and also more deeply into global production networks. Some heavy industries strengthened this integration over time such as basic metals (C19: 14.3 to 38.9), coke and refined petroleum (C19T23: 16.5 to 18.7), and machinery and electrical equipment (C26: 24.8 to 29.4). Declines in backward linkages were indeed recorded, however, by some labour-intensive industries like textiles (C13T15: 19.3 to 9.6), apparel and leather (C16T18: 14.3 to 12.0), and also wood products (C17_18: 16.1 to 12.3). Structural upgrading within China is reflected even in this, as now a relative shift occurs away just from labour-intensive sectors of low-value and towards industries of technology and capital intensity. Forward linkages within China do remain modest as well, though generally they are higher than those within India specifically, particularly within machinery and electrical sub-sectors, so Chinese value-added is more embedded within global production networks.

Experiences of the two economies diverge further as highlighted through the measurement of gains from GVC linkages (Table B.4), expressed as the forward to backward linkages ratio. India's gains went down sharply in most sub-sectors from 1995 to 2020. Textiles (C13T15) fell down from 0.42 to 0.05 and fabricated metals (C24_25) fell from 0.12 to 0.04. Wood products (C17_18) dropped from 0.02 down to 0.00. The gain fell or stagnated even within relatively advanced sectors like machinery and transport equipment (C29_30). Though these sectors were advanced somewhat, stagnation happened there. GVC participation has been deepened by India as this shows. However, the net benefits accruing for the domestic economy have weakened because India reflects a pattern of import-dependent integration.

Notably, China's trajectory differs. There has been an improvement that occurred in various technology- and capital-intensive sectors, but gains still remain modest in different industries. Machinery as well as electrical equipment (C26_27) rose from 0.09 up to 0.19 for instance, transport equipment (C29_30) from 0.05 up to 0.15, and textiles (C13T15) from 0.09 up to 0.16. China has been able to move up within the value chain for securing of higher benefits from its GVC linkages within advanced industries since these improvements do suggest. However, gains in the customary labour-intensive sectors remained as limited.

In sum, the sub-sectoral analysis does reveal that India has integrated itself into GVCs with a rising participation but with falling gains. India remains susceptible to external supply chains this highlights with constrained internal value. China, in contrast, has selectively upgraded, thereby offsetting declining integration in labour-intensive industries via integrating more deeply also beneficially in heavy and technology-intensive sectors. This divergence highlights the importance that is in industrial policy. It shapes the way countries engage within global value chains benefiting from them.

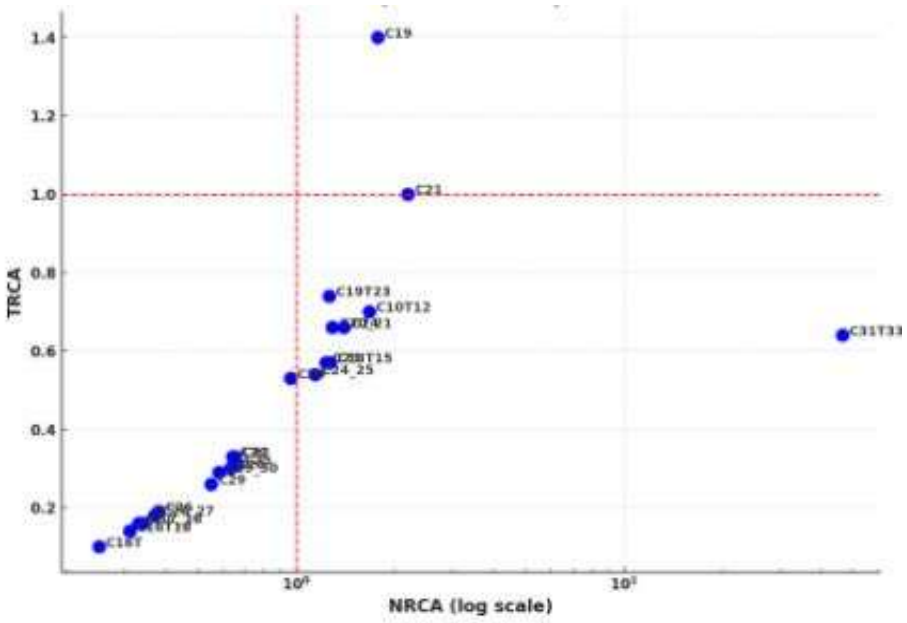
6. Comparative Advantages based on Gross Exports and Value-added Exports

RCA helps assess trade specialisation or an economy’s standing in global production is assessed (ADB, 2022). According to the customary revealed comparative advantage (TRCA) index (Balassa, 1965), an economy’s relative international competitiveness is revealed. This index is actually the ratio of sector i's share in economy (j)’s export as well as that sector's share in global exports in those sectors where that ratio exceeds one.

This crude export based TRCA index can mislead in gauging one economy's edge because all export value is not from inside. The GVC-adjusted Normalized Revealed Comparative Advantage index (ADB, 2022) gives a truer view of competitiveness using value-added exports instead. If a sector's NRCA is greater than one, it indicates upon something. That something is because of the fact that its own domestic value addition is represented in the actual exports. Exports do contain a more important amount of foreign value-added in sectors for which the revealed comparative index is less than one under the new method yet more than one before.

6.1 TRCA and NRCA in India, 2020

Figure 6: *Scatter-plot diagram of TRCA and NRCA for Manufacturing Sector of India, 2020*



OECD-TiVA Database, 2023; Author's Calculations.

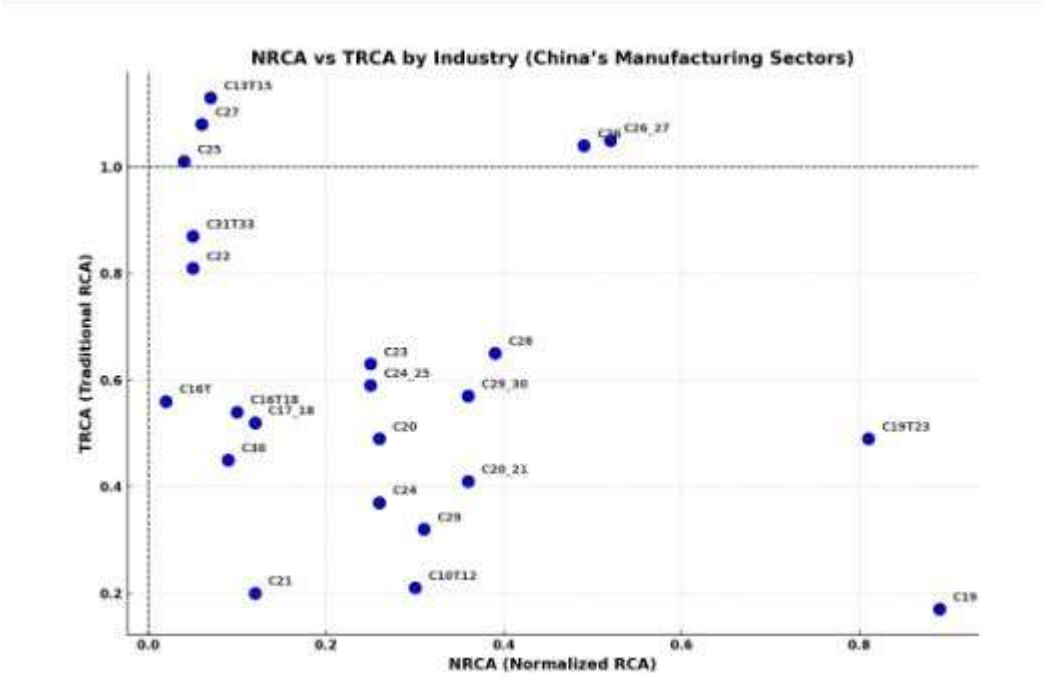
The comparative advantage of Indian manufacturing industries can be usefully evaluated through NRCA and TRCA which are based on exports. TRCA pinpoints industries involved heavily within global trade whereas NRCA better grasps how much export success stems from national value created. From the quadrant analysis of TRCA and NRCA, industries have a clearer classification. C19 (Coke and Refined Petroleum Products) is unique to Quadrant 1 (TRCA > 1, NRCA > 1). This sector shows strength both in global market share also in domestic value retention. Its dual competitiveness is underscored by the presence of this demonstration. It is indeed interesting that Quadrant 2 (TRCA > 1, NRCA < 1) still remains empty, which actually implies that there is no industry that is outwardly competitive in terms of gross exports while it is still weak when looking at domestic value addition. Sectors leading in global trade also tend to create a reasonable degree of value at home. Quadrant 3 includes a bigger group (TRCA < 1, NRCA > 1). Even with weaker global presence, industries such as C10T12 (Food, Beverages, Tobacco) along with C13T15 (Textiles and Apparel) show strong

domestic value-added competitiveness. C23 specifically (Non-metallic Minerals), C24 specifically (Basic Metals), and even C31T33 specifically (Furniture and Other Manufacturing) also display this competitiveness. These potential hidden champions that are critical to supply chains that are resilient and value-driven may not dominate trade flows. Sectors like C20 (Chemicals), C21 (Pharmaceuticals , standalone), C26, 27 (Electronics as well as Electrical Equipment), plus C29, 30 (Automobiles and Transport Equipment) are in Quadrant 4 (TRCA < 1, NRCA < 1). These industries are weak in the global market performance in addition to value-added terms given a double disadvantage. Therefore, these industries need structural upgrading, infusion of technology, or targeted policy support.

TRCA and NRCA contrasted do make it clear that while exports show some industries are shining, India's domestic economic base is strengthened by others. For sustainable growth policymakers must leverage Q1 and Q3 sectors. Restructuring of Q4 industries is also needed to improve India's global and domestic competitiveness.

6.2 TRCA and NRCA in China, 2020

Figure 7: *Scatter-plot diagram of TRCA and NRCA for Manufacturing Sector of China, 2020*



OECD-TiVA Database, 2023; Author's Calculations.

The scatter plot of NRCA and TRCA in China's manufacturing industries provides a subtle picture since it reveals the comparative advantage within global value chains (GVCs). Balassa RCA's customary form (TRCA) pinpoints numerous industries showing comparative advantage areas. These include textiles and wearing apparel (C13T15), electrical equipment (C27), fabricated metals (C25), and rubber plus plastics (C22), since their TRCA values exceed unity. However, a more balanced view does emerge when NRCA is normalized. For correcting of overstatements of competitiveness, NRCA, unlike TRCA which is unbounded above as well

as skewed toward larger export shares, places all of the values on a symmetric scale between −1 and +1. This reveals that while textiles as well as some labour-intensive sectors appear highly competitive under TRCA, for their NRCA values remain low or near zero because it suggests that their relative advantage is weaker once scale biases are accounted for. Under NRCA, key supply-chain sectors such as machinery (C26), petroleum as well as basic metals (C19, C19T23), transport equipment (C28, C29_30), chemicals as well as pharmaceuticals (C20_21), and combined machinery and electrical equipment (C26_27) exhibit strong or emerging comparative advantages. These findings are important for the reason that they underscore all that China structurally upgrades itself within GVCs, in which competitiveness shifts itself from labour-intensive exports and also to capital- and technology-intensive industries which form up the backbone within global supply chains. NRCA use is vital as it assesses advantage comparatively with greater accuracy since it avoids TRCA's overemphasis on customary sectors using intensive labour plus highlights China's long-term strengths in durable supply-chain-intensive industries.

Overall, India's comparative advantage analysis through TRCA and NRCA shows a fragmented structure. It is only C19 (Petroleum products) that is competitive in both areas. However, NRCA shows sectors like textiles, food, metals, and furniture have unseen domestic strengths though global presence is weak. Many industries do remain weak in those measures. Therefore, structural upgrading is needed. TRCA of China highlights sectors that are customary labour-intensive like apparel and textiles. However, NRCA does reveal a more calculated shift in regard to machinery, chemicals, metals, and transport equipment. This shows of China the transition from scale-driven exports to capital- and technology-intensive strengths, and this underscores of it the deeper integration in the global value chains.

7. Conclusion and Policy Recommendations

This study has examined the integration of India and China into Global Value Chains (GVCs) from 1995 to 2020 because it focused on participation, distribution of gains, and revealed comparative advantages across manufacturing sectors. Gross exports used OECD, WTO TiVA data; we decomposed them into domestic and foreign value-added components; we assessed GVC participation through forward and backward linkages; and we evaluated competitiveness using both the customary Revealed Comparative Advantage (TRCA) and the Normalized Revealed Comparative Advantage (NRCA) indices.

Participation patterns show both nations have deepened integration. Trajectories, however, diverge. India did participate within GVC even more, increasing it from 25 percent back in 1995 to roughly 34 percent within 2020, mainly as those rising backward linkages drove all this, signaling a growing reliance upon imported intermediates. Conversely, China reinforced its part in heavy and technology-intensive industries after showing high backward linkages previously in the mid-1990s while decreasing reliance on labour-intensive sectors. India participates relatively less than dynamic Asian economies such as Vietnam, Malaysia, and Singapore, but it participates more than Brazil and Indonesia within BRICS, which points to opportunities as it further integrates relative to peers.

Gains from GVCs are what reveal trajectories that do diverge. In 1995, the forward-to-backward linkage ratio for India was 1.37, but it then declined to 0.65 in 2012. Then it had a small rise up to 1.03 in 2020. Imports seem to be rising accordingly. This increase does not cause equal local effects. China's gains instead increased steadily from 0.85 in 1995 to 1.15 in 2020, and this underscored its ability to capture greater domestic value and consolidate technology-intensive production. India seems open to shocks from outside as China is better placed in worldwide commerce, per the analysis.

Evidence at a sectoral level reinforces these contrasting ideas. In India's domestic value-added shares have fallen in employment-intensive industries such as textiles, machinery, and metals, strengths persist in food processing, wood products, and petroleum refining. China did successfully transition toward machinery chemicals and transport equipment industries by comparison.

Comparative advantage analysis clarifies these dynamics further. TRCA identifies sectors competitive on gross trade terms through analysis. NRCA uncovers both hidden strengths and also hidden weaknesses by accounting for domestic value-added instead of something else. Petroleum products such as C19 exhibit competitiveness when it comes to both measures for India alone. Several industries do show a hidden competitiveness (TRCA < 1, NRCA > 1) that includes food, textiles, metals, and furniture. This indicates potential that is untapped in those industries. Others like chemicals, pharmaceuticals, electronics, and automobiles remain weak throughout both indices because they require policy intervention. The profile of China's NRCA confirms a deeper and a more sustainable type of competitiveness within technology-intensive industries since it is something that reflects structural upgrading.

India's engagement toward GVCs has been broad yet shallow, the findings show. China, however, has achieved a deeper and a more helpful integration. A well calculated policy agenda is what is required for improvement in India's position.

Policy recommendations are threefold. India must first of all strengthen domestic industrial capabilities for the purpose of ensuring global integration translates into local value creation through technology upgrading along with R&D investment as well as skill development in employment-intensive sectors.

Second, dependence of a nation on imports is something that should undergo planned management: while those inputs are imported in cases where producing all of them domestically turns out to be uncompetitive, such excessive reliance weakens all forward linkages. Durable supply chains are needed for pharmaceuticals, chemicals, and electronics. It is going to be necessary to build them up. Policymakers should then identify and support hidden champions that NRCA revealed, including textiles, food processing, and metals displaying strong domestic competitiveness though export shares are weaker. Targeting support to these sectors unlocks our potential instead. This potential had remained still untapped.

India should at last pursue deeper regional integration with ASEAN, Africa, and Latin America, and also pursue global integration through trade agreements, thus diversifying export markets and embedding Indian firms much more firmly into global production networks.

Ultimately, India can sustainably gain within GVCs if it participates more deeply and builds stronger domestic capacity. If India focuses upon upgrading structures, promotes hidden strengths, also reduces vulnerabilities, it can aspire to replicate the trajectory China achieved and consolidate its role as a major player in global manufacturing.

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