

Original Article

India's Trade in Value-Added in Selected Industries: An Empirical Analysis

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Abstract: This study examines India's long-term assessment of export competitiveness by using Balassa's revealed comparative advantage (RCA) indices in gross exports and upstream value-added exports at the aggregate and disaggregate levels of manufacturing and service industries, utilizing the OECD-TiVA database for the periods 1995, 2008, and 2018. The findings indicate that India's RCA patterns in selected industries differ noticeably when measured in gross export versus value-added terms. The results show that, at the aggregate level, service industries based on gross exports and value-added (VA) demonstrate RCAs for all the selected years, while, at the disaggregate level, value-added shows more industries holding RCAs than the gross exports in manufacturing. The study also uses the Spearman rank correlation coefficient for all RCA indices to assess dynamic structural changes over a period of time. The findings indicate a minor structural change based on gross exports as well as value added. It may be concluded that developing domestic supply chains, local intermediate industries, technological upgrading, industry-specific incentives, infrastructure support, and trade facilitation will improve VA creation and competitiveness in the country.

Keywords: Gross Exports, VA, RCA, Global Value Chains, Structural Change, India.

I. INTRODUCTION

The growth of Global Value Chains (GVCs) has changed international trade in a big way by breaking up production processes across borders. Consequently, gross export statistics progressively exaggerate the genuine contribution of domestic industries to trade, as a substantial portion of exported goods contains foreign intermediate inputs. The literature has stressed the need to measure trade in value-added terms to get a better picture of how much countries are really involved in GVCs and how much they benefit from them (Hummels, Ishii, and Yi, 2001; Johnson and Noguera, 2012). Gross export data is usually used to figure out traditional trade competitiveness indicators like Balassa's (1965) Revealed Comparative Advantage (RCA). Gross-export-based RCA can be helpful, but it may not give an accurate picture of competitiveness in a time when production is vertically fragmented because it doesn't separate domestic and foreign value-added content in exports. A nation may seem competitive in a sector in general, but it may only get a small part of the value created along the value chain (Koopman, Wang, and Wei, 2014). To address these concerns, the OECD Trade in Value Added (TiVA) framework lets you break down gross exports into parts that add value in the home country and parts that add value in other countries. In particular, the domestic value added that is included in foreign final demand is a better way to measure how much income from domestic production meets external demand. By using TiVA indicators, we can reevaluate how competitive exports are based on how well the country can produce goods, not just how much trade it does (OECD, 2023). Recent research has increasingly utilized value-added metrics to examine comparative advantage and export competitiveness. Ceglowski (2017) and Fertő (2018) illustrate that patterns of revealed comparative advantage can vary significantly when derived from domestic value-added exports rather than gross exports, underscoring the significance of value-chain positioning and domestic linkages. These results indicate that assessing competitiveness exclusively through gross exports may conceal significant structural attributes of an economy's trade performance.

India is a very good example for this kind of study. India has become more connected to global markets over the past 30 years, while at the same time, its manufacturing and service sectors have gone through major structural changes. But there are still worries about how much India's export growth has led to more value added at home, especially since some industries are becoming more dependent on imported parts. Analyzing revealed comparative advantage in both gross and value-added metrics can yield significant insights into India's genuine export competitiveness and its role within global value chains. In this context, this paper examines India's export competitiveness by calculating Balassa's revealed comparative advantage indices based on both gross exports and the upstream value-added exports reflected in domestic value added embodied foreign final demand (FFD_DVA). This study covers a wider set of disaggregated industries and uses a newly expanded TiVA data set to



provide a comprehensive three-period (1995, 2008, 2018) comparison and document significant phases of India's trade integration preceding and succeeding major global economic transformations.

The paper is arranged in five segments. Segment II comprises a review of the literature. Segment III research methodology and data sources, and segment IV reports results and analysis, while segment V addresses closing thoughts. VI includes references.

II. REVIEW OF LITERATURE

A) *Theoretical Foundation of Comparative Advantage*

To evaluate how nations trade and specialize in commodities over which they have a competitive edge, the concept of comparative advantage is commonly used in economic literature. David Ricardo (1817) explains how comparative advantage in the cost of production promotes international trade. The original Heckscher-Ohlin (H-O) model provides an explanation for trade in final consumer goods that is an indication of fragmentation.

B) *Emergence of GVC and Measurement of Comparative Advantage*

Porter also introduced the value chain as a concept for a product in his 1985 book, "*Competitive Advantage*". He described value chains in the form of different activities that are interconnected with each other. Kaplinsky and Morris (2001) explained the value chains as "the full range of activities that are required to bring a product or service from conception through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use". The concept of GVC was further developed in the work of Gereffi (1999). Balassa (1965) first calculated the RCA index empirically, but he has made several changes over time (1977, 1979, and 1986). The rationale for Balassa's 1986 change is that "if a country exports more of a product than it imports in a period, its combination of productivity and differentiation with respect to that product can be deemed superior to that of the other countries in the trade zone in question. This makes the index compatible with a flexible interpretation of comparative advantages. Furthermore, this study also resolves the symmetrical problem and overcomes the small-country bias with a neutral value of 0, a bottom bound of -1, and an upper bound of 1. One of the studies by Balassa (1977) on industrial countries' comparative advantage patterns from 1953 to 1971 was conducted on manufactured goods. The data in the study support the existing data on trade in intensive research goods, showing that the product cycle is continuously renewed and that the US is continuing to maintain its ever-widening technological edge. Yeats (1985) evaluated Balassa (1965) for trade, development, and structural adjustment issues. The results indicate that the RCA supports the predictions when tested at the industry or sectoral level, but it does not support the assumption of a cardinal or ordinal measure of the RCA for the country.

C) *Empirical Studies on Comparative Advantage and Global Value Chains*

Hummels et al. (2001) have examined the characteristics and expansion of vertical specialization (VS) within a 14-country sample. The authors utilize national input-output data to ascertain the value of exports. They do these calculations both directly and indirectly, considering how imported inputs move through different stages of domestic production. They discover that the export-weighted VS share for OECD countries rose from 0.165 to 0.198 between 1970 and 1990, which is almost 30%. Some smaller and more open economies like Denmark and the Netherlands have higher VS shares (about 0.30–0.35), while larger economies like the United States and Japan exhibit lower shares (about 0.05–0.10). Utkulu and Seymen (2004) evaluated the trade specialization through RCA from Turkey to the EU on sectoral levels for the period 1993–2003. According to the results, Turkey has demonstrated comparative advantages across all the indices examined. Fruits and vegetables, along with clothing products, are the commodity classifications that have the highest RCA values. However, with time, these goods appear to lose some of their competitive advantages.

Batra and Khan (2005) compared China and India's comparative advantage with factor intensity. The results demonstrate that China and India both have a significant edge in the manufacturing sector, mostly due to their raw materials, followed by agricultural and related products. India has a stronger edge in agricultural and related products, whereas China has a greater advantage in the manufacturing sector. There was no noticeable structural change for either China or India between 2000 and 2003. Burange (2008) has shown a comparative edge in exporting Heckscher-Ohlin's (H-O) and Ricardo's goods based on their production, as well as scale-intensive items such as iron, steel, chemicals, and textiles, as labor-intensive items. In contrast, there hasn't been any progress shown in Product Cycle (PC) items within the RCA universe. Bhattacharya and Ruma (2012) compared India's horticulture to other Southeast Asian, EU, and North American markets, estimated Comparative Export Performance (CEP), and Revealed Comparative Advantage (RCA) for the same. The results show that India had an exceptionally high RCA and Comparative Export Performance (CEP) in the EU vegetable and fruit markets, but not in the other markets. Hassan (2013) looked at the global competitiveness of Pakistan's agricultural exports to significant Asian rivals employing the revealed comparative advantage (RCA) method. The findings reveal that rice has a strong comparative advantage over all other commodities, with all other commodities showing an increasing trend and significant potential for export growth in the global market. Kathuria (2013) has shown that India gained a competitive advantage over

Bangladesh from 1995 to 2003, outperforming Bangladesh by 29 products. To maintain this advantage, India needs to reduce costs, improve infrastructure, and adjust policies.

Addison-Smyth (2014) posited that Ireland possesses a significant comparative advantage, particularly in the broad chemicals sector and in sectors predominantly controlled by foreign entities. On the other hand, the mostly indigenous sectors appear to be losing their comparative advantage, most likely as a result of a combination of continuous structural changes in the economy and a decline in their level of competitiveness. Ceglowski (2017) and Fertó (2017) have conducted a comparison of the export competitiveness of manufacturing, service, and agri-food export-based industries using the gross exports value-added indicators and TiVA database. They discovered that taking value-added into account causes many countries to lose their apparent advantage when value added is considered. However, Germany (machinery) and Japan (transport equipment) remain competitive under both measures, while agri-food export bases (e.g., Brazil, Argentina) remain strong in value-added terms. Policies suggest that there must be competitiveness policies to incorporate value-added trade to avoid misleading conclusions.

Nath and Goswami (2018) examined India's service items. The study shows a comparative edge in business services and computer information over the study period. Together, these two service categories made up over two-thirds of India's total exports of commercial services. Deb and Sengupta (2017) examined the distribution of RCA indices like Balassa's RCA, RSCA, ARCA, NRCA, and log-of-Balassa using GX and sectoral VAX data from 2008 to 2011. They found significant stability in log-of-Balassa across countries, but not in Balassa and RSCA. Ismail and Ahmed (2022) examined the static and dynamic RCA studies of China and India at the levels of grouping for the years 2000, 2010, and 2018. Particularly at the six-digit level, the results indicate that China and India have a comparative advantage across all product categories. The analysis indicates that comparative advantage patterns at the HS 6-digit level of classification undergo more dynamic changes. Furthermore, it unveils a marginal structural transformation in RCA over the course of time in both economies; however, it does not suggest a complementary or competitive relationship in the context of the global economy.

D) Research Gap

The literature on revealed comparative advantage indicates that most empirical studies focus on gross exports, with few comparing gross exports and value-added RCA. Existing studies have employed limited sector-level GVC analyses for manufacturing and services and have considered only a short time frame for RCA analysis. This study, for the first time, addresses this gap by conducting a long-term assessment of gross exports and, in particular, upstream value-added exports, using the newly expanded TiVA dataset across a broader range of disaggregated levels.

III. METHODOLOGY AND DATA SOURCE

This study uses the OECD-TiVA database (revision 4, 2023) and covers the years 1995, 2008, and 2018 to differentiate between the years following the advent of liberalization of the Indian economy, the global trade collapse, and the subsequent changes in trade. The study analyses export competitiveness in terms of Balassa's revealed comparative advantage (BRCA) in *upstream* value-added exports alongside asymmetry revealed comparative advantage (SRCA) to address asymmetry in BRCA/RCA. The study examines total manufacturing (D05T39) and services (D41T98) as aggregate sectors outlined in the TiVA database; at the disaggregated level, it includes 42 industries, comprising 22 from manufacturing (including mining and quarrying) and 20 from services (such as electricity and construction). The selection of the industries is based on concentration on their GVC participation to assess export competitiveness based on gross exports (EXGR) and domestic value added embodied in foreign final demand (FFD_DVA). For simplicity, this study uses the terms "gross exports" and "EXGR", and "domestic value added embodied in foreign final demand (FFD_DVA)" and "value added (VA)," and "industry" and "sector" interchangeably. The study also uses the abbreviated names of the industries in the analysis along with their corresponding codes. Appendix 1 displays full names.

A) RCA Index

The study employed RCA, which is the original Balassa's (1965) index. The formula is the ratio of a country's total exports of product j to the total exports of the world of product j .

$$RCA = \frac{\frac{X_{Ai}}{\sum_{j \in P} X_{Aj}}}{\frac{X_{Wi}}{\sum_{j \in P} X_{Wj}}} \geq 1$$

Here, P represents the collection of entire products ($i \in P$). X_{Ai} represents the exports of product I from nation A . X_{wi} represents the global exports of product i . $\sum_{j \in P} X_{Aj}$ represents the aggregate exports of a nation (comprising all products j in P), and $\sum_{j \in P} X_{Wj}$ denotes the global exports (comprising all products j in P). According to the formula, for a country to be a competitive producer and exporter, the revealed comparative advantage ($RCA > 1$) for the products and services must be greater than 1. When a country has established a comparative advantage in a particular product, it is said to possess export capability in that product. Based on the assessments of Wosiek Roman (2021), Deb and Sengupta (2017), and Hinloopen and Van

Marrewijk (2001), the present study posits that RCA index values below 1 signify the absence of a comparative advantage for an economy, values ranging from 1 to 2 indicate a weak advantage, values between 2 and 4 indicate a moderate comparative advantage, and values exceeding 4 indicate a strong comparative advantage. Theoretically, comparative advantage is founded upon unobserved autarkic prices and production costs. Nevertheless, in practice, RCA reflects actual trade prices as an ex-post metric. This study also uses the Symmetric Revealed Comparative Advantage (SRCA) measure, which is defined as

$$SRCA = \frac{RCA-1}{RCA+1}$$

because the Balassa RCA index is asymmetrical and unbounded by nature, the SRCA transformation maps all values to a symmetric interval [-1,1], making it easier to compare products and making the statistics easier to understand.

B) Spearman Rank Correlation (SRC)

This study used the SRC coefficient to analyze dynamic structural changes for India based on EXGR and DVA from 1995 to 2018. SRC ranges from -1 to +1, indicating a perfect negative monotonic relationship, a perfect positive relationship, and zero, implying no monotonic relationship. It is used over a period to investigate the dynamic change in the rank of comparative advantage within a specific country. The closer the value is to +1, the less significant the change in comparative advantage rank. Conversely, -1 indicates a greater and more significant change in comparative advantage rank (Widodo & Tri, 2009). In our research, a high correlation indicates that a country’s industry position in terms of comparative advantage has changed slightly over time. A low coefficient indicates that the ranking has changed significantly, implying a quick change. The study will calculate the SRC using the following formula:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

C) Pearson’s Correlation Coefficient

The Karl Pearson correlation coefficient, or r, is used to evaluate the degree of association and test the robustness of SRC. A stronger correlation exists between two or more variables when the absolute value of the correlation coefficient is larger. The correlation coefficient of Karl Pearson yields a value ranging from -1 to 1. One can express a perfect correlation between two variables as +1 or -1 (perfect positive or perfect negative). Number zero denotes the total lack of association. The correlation coefficient is calculated using the following formula, where x and y represent the deviation values of the two variables:

$$r = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{[\sum(x-\bar{x})^2(\sum(y-\bar{y})^2)]}}$$

Table 1: RCA for GVC Manufacturing Industries Based on EXGR and VA at the Aggregate Level

Industry code	GVC Industries	RCA1995	RCA2008	RCA2018
D05T39	EXGR manufacturing	-0.01	-0.08	-0.07
D05T39	VA manufacturing	-0.02	-0.15	-0.13

Source: Authors’ calculation based on TiVA database, 2023; GVC (global value chain); RCA (revealed comparative advantage); EXGR (Gross Exports); VA (Value added)

Table 2: RCA for GVC Service Industries Based on EXGR and VA at the Aggregate Level

Industry code	GVC Industries	RCA1995	RCA2008	RCA2018
D41T98	EXGR service aggregates	0.02	0.14	0.12
D41T98	VA service aggregates	-0.15	0.05	0.05

Source: Author's calculation based on TiVA database, 2023

IV. AGGREGATE RCA ANALYSIS

Tables 1 and 2 report revealed comparative advantages (RCA) for gross export-based manufacturing (D05T39) and service (D41T98) sector GVC aggregates for the years 1995, 2008, and 2018. These indices of RCA give us an idea of how sectoral competitiveness has changed over the years.

A) RCA Dynamics in Manufacturing GVC Industries

Based on EXGR, the manufacturing sectors show a persistent revealed comparative disadvantage. But the intensity and trends between the two measures differ significantly. The RCA values fell from -0.01 in 1995 to -0.08 in 2008; the values slightly improved to -0.07 in 2018. The pattern suggests that gross-export competitiveness declines somewhat until the middle of the 2000s and then improves thereafter.

The SRCA based on VA provides a more noticeable outlook. Disadvantages in manufacturing continue to deepen; the values decline from -0.02 in 1995 to -0.15 in 2008, then slightly improve to -0.13 in 2018. Compared to the EXGR index, the VA index shows a largely weaker competitive edge, indicating a limited domestic value capture within manufacturing GVC activities. This disparity indicates growing dependency on imported intermediates and weaker domestic upgrading, regardless of persistent involvement in global value chains.

B) RCA Dynamics in Service GVC Industries

Unlike manufacturing, service industries report a stronger competitive edge, though the depth and trajectory depend on the measurement method. The EXGR-based RCA values for service grow from 0.02 in 1995 to the highest point, 0.14, before settling at 0.12 in 2018. This stable rising trajectory indicates a thriving revealed comparative advantage in service-related GVC exports, consistent with the global expansion of business, information, and professional services.

VA-based RCA indices show a more dramatic shift. The indicators begin at a sizable comparative disadvantage of -0.15 in 1995 and increase to a positive 0.05 in 2008, where they are maintained until 2018. This transition signals a substantial structural improvement in the domestic economy's ability to create and uphold value within service industries. Unlike manufacturing, the VA measures advocate successful upgrading in high-value service segments, for instance, knowledge-intensive activities.

C) Disaggregate RCA Dynamics in the Manufacturing Sector

Table 3 represents the revealed comparative advantage of selected manufacturing industries over the periods 1995, 2008, and 2018 based on gross exports and value added. Most of the industries show heterogeneous RCA patterns and repeatedly significant differences between EXGR and VA measures. Mining and products (D05T06) exhibit a constantly comparative disadvantage under EXGR (-0.93 to -0.99), indicating very low export specialization. However, VA relatively shows lesser negative values (-0.23 to -0.57), suggesting no export competitiveness. Mining and non-energy (D07T08) depict a mild EXGR advantage (0.13 in 1995) to a significant disadvantage in 2018 (-0.63). Similarly, VA shows a similar pattern but less severe trajectory, indicating a decrease in competitiveness, possibly due to global commodity price cycles or depletion of high-value reserves. Mining support services (D09) reports a consistent comparative disadvantage under EXGR but a consistent comparative advantage (0.40, 0.23, 0.21) in VA, implying the sector's participation in value chains. This comparison advocates that even with limited export orientation, mining and support can remain locally embedded and generate high domestic value addition.

The food and beverages (D10T12) have a moderate and persistent advantage (0.11, 0.17) under EXGR-based RCA. However, the VA-based RCA shows a negative result, which means that the industry exports competitively but relies heavily on imported inputs, which lowers the creation of domestic value added in the sector. Textile and apparel (D13T15) exhibit a significant and persistent comparative advantage in both approaches (EXGR and VA) across all years, suggesting the sector is competitive and capable of generating domestic value-added, likely due to labor-cost gains and well-established value-chain networks. Wood and cork (D16) show RCA, but with a declining trend (0.39-0.10, 0.56-0.21) in both indicators (EXGR and VA); however, this still indicates the sector's ability to create value added. D17T18 (paper & printing) shows no RCA. D19 (coke and petroleum) shows strong RCA on both metrics, which indicates India's capacity to process imported crude oil and supply refined products competitively to global markets. D20 improved from -0.30 to -0.07 and from -0.14 to 0.01, showing improvement from disadvantage to a weak advantage. This suggests an increase and improvement in creating value added. But, in Pharmaceuticals (D21), both indicators show a stable comparative advantage with values of 0.30 and 0.22. So, the sector seems to be getting better and more focused on adding value added. Rubber and plastics (D22) reported a dramatic jump in EXGR RCA in 2018 (0.95), but VA has shown a persistent disadvantage (-0.08 to -0.13). This mismatch shows that the export structure is focused on assembly, which means that being competitive in gross exports doesn't mean adding value to the economy. Other Non-Metallic mineral products (D23) consistently perform poorly in both EXGR and VA metrics, but EXGR values do get a little better over time. VA RCA stays the same, but it's still negative, which means that structural weakness is still there. Basic metals (D24) demonstrate positive RCA values as regards EXGR and VA in all years, but values decline over time. In 1995, EXGR stays slightly positive (0.19) while VA RCA declines closely to zero (0.05). This pattern suggests declining but still moderate competitiveness in the sector.

In fabrication metal products (D25), VA RCA changes from a trivial advantage in 1995 to a disadvantage in 2018, whereas EXGR RCA stays negative and continues to deteriorate. This suggests a decline in both domestic value generation and export specialization. Computers and electronics (D26) are still very negative (about -0.70 to -0.80). Electrical equipment (D27) and machinery (D28) also have disadvantages with little change over time. Motor vehicles (D29) stay negative every year. But Other Transport Equipment (D30) in VA goes from -0.32 to -0.16, which suggests that things are slowly getting better. The Other Manufacturing and Repair Activities (D31T33) consistently have a substantial EXGR advantage, while VA RCA stays positive, but after 1995, it starts to decline. This implies that domestic value capture has diminished while export

specialization is still high. Electricity and Gas (D35) have very negative values, but VA RCA goes up and down around zero and turns positive in 2018 (0.03). This means that even though the sector doesn't export well, it's keeping more value in the country, probably because of high fixed costs and operations that are mostly in the country. Water and waste management (D36T39) EXGR RCA stays at a comparative disadvantage across all years under study.

D) Disaggregate RCA Dynamics in the Service Sector

Table 4 shows that Construction (D41T43) shows a strong disadvantage (-1.00) in EXGR across all years, but it exhibits a moderate comparative advantage (0.19 to 0.10) in VA across those years, indicating high sector participation in value chains. Wholesale and retail trade (D45T47) depicts a steady improvement in both EXGR from -0.43 to -0.28 and VA from -0.23 to -0.06, with no comparative advantage across all years. Land transport (D49) shows a comparative disadvantage in EXGR; the values improve slightly, from -0.13 to -0.08, while VA turns positive in 2008 (0.06). This suggests slow strengthening of domestic logistics capabilities in value-added. Water transport (D50) reports persistent negative values in both EXGR and VA, with little improvement, indicating continued reliance on foreign shipping capabilities. In air transport (D51), the EXGR disadvantage gets better (-0.38 to -0.18), but the VA stays negative, which means that foreign carriers or imported aircraft and fuel don't add much value to the economy. Warehousing (D52) EXGR goes up (-0.06) a lot in 2008, but then goes back down (-0.18) in 2018. VA also stays negative. This result means that competition is likely to change a lot because of trade cycles.

Postal and courier services (D53) show a strong disadvantage with both metrics. Accommodation and Food (D55T56) witness EXGR turn positive (0.05) in 2018, which means that tourism is making exports more competitive. VA is still negative, but it's getting better slowly (-0.34 to -0.24). This means that exports will be in higher demand, but the country will still need to import things like food and transportation. Publishing & broadcasting (D58T60) EXGR goes down (0.16) after going up from a small advantage (0.06) to a big advantage (0.32). VA doesn't change much; it goes from positive (0.05) in 2008 to negative (-0.12) in 2018. This is a sign of digital disruption, which is when traditional media still has some advantages even though competitors are putting pressure on it. Telecommunications (D61) EXGR goes up from -0.24 to -0.07. VA goes from -0.31 to a little bit positive in 2008, then back to negative. This could mean inconsistent competitiveness, maybe because of changes in the law or competition from other countries.

Computer Programming & IT Services (D62T63) EXGR RCA is very strong between 0.87 and 0.77. VA is also highly positive, with a range of 0.65 to 0.71. This sector is the best in the whole service economy. This means that it has a lot of exports, a lot of technological know-how at home, a lot of value capture at home, and it is a leader in GVC upgrading through digital and knowledge-based activities. Financial and Insurance Activities (D64T66) EXGR RCA stays negative over the whole period, but it gets a little better in 2008 and then gets worse again by 2018. VA SRCA, on the other hand, stays close to zero, going from 0.02 in 1995 to 0.09 in 2008 and then going negative by 2018. This means that the country is making a considerable amount of value addition, but has weak export competitiveness. Real estate (D68) has a small advantage in EXGR values in all years but a high disadvantage in VA RCA values. This difference shows that the sector is mostly focused on domestic markets and isn't very well connected to international services. Professional services (D69T75) EXGR becomes negative in 2008 but goes a bit positive (0.02) in 2018. VA stays negative the whole time, although it does get better. This means that exports are becoming more important, but domestic value-added creation is weak, possibly due to the dependency on imported inputs and foreign expertise. Administrative and support services (D77T82) EXGR starts off with a strong comparative advantage (0.48-0.56) but drops quickly by 2018 (0.07). VA also performs a lot better (-0.06, 0.29, 0.21). This shows that the domestic value capture is going up even though the export specialization is going down. This is because automation and outsourcing services are moving to domestic providers.

Public administration (D84) affirms the absence of a competitive advantage. Education (D85) in EXGR remains very negative, but VA (value added) goes from -0.72 to -0.31, which indicates education services are predominantly domestically consumed. Health and social work (D86T88) are also negative, but VA is even more negative, indicating that the work is labor-intensive, has little potential for export, and doesn't capture much value at home. Arts & Entertainment (D90T93) also has a consistent disadvantage in EXGR and VA each year. The ongoing disadvantage is the result of limited internalization in cultural and recreational services. Other Service activities (D94T96) also have negative RCA values for both EXGR and VA. Even though VA RCA gets a little better over time, the sector is still structurally disadvantaged in international service markets. These patterns support the idea that traditional social services aren't meant to make a country more competitive in the global market, but they are important for creating value, increasing productivity, and improving welfare in the country.

Table 5: Rank Correlation and Karl Pearson Correlation between RCA Values for Gross Exports

RCA	RCA1995 INDIA	RCA2008 India	RCA2018 INDIA
RCA1995 INDIA	1.00	0.94	0.87
RCA2008 INDIA	0.94	1.00	0.91
RCA2018_INDIA	0.87	0.91	1.00

	Karl Pearson Correlation		
RCA1995 INDIA	1.00	0.96	0.86
RCA2008 INDIA	0.96	1.00	0.88
RCA2018_INDIA	0.86	0.88	1.00

Source: Authors' calculations based on TiVA database

Table 6: Rank Correlation and Karl Pearson Correlation between RCA Values for Value Added

RCA	RCA1995 INDIA	RCA2008 India	RCA2018 INDIA
RCA1995 INDIA	1	0.91	0.88
RCA2008 INDIA	0.91	1	0.93
RCA2018 INDIA	0.88	0.93	1
Karl Pearson Correlation			
RCA1995 INDIA	1.00	0.91	0.90
RCA2008 INDIA	0.91	1.00	0.94
RCA2018 INDIA	0.90	0.94	1.00

Source: Authors' calculations

Table 5 displays the SRC for gross exports among the Revealed Comparative Advantages (RCAs) in the years 1995, 2008, and 2018 for all selected industries. The rank correlation coefficients between the RCA in 1995 and 2008 and the RCA in 1995 and 2018 are 0.94 and 0.87, respectively. These values indicate marginal structural change in 2008 and 2018 over 1995. The estimated SRC value of 0.91 between the RCAs of 2008 and 2018 also suggests a marginal structural change in 2018 over 2008. Table 6 shows that the SRC results for value added between the RCAs of 1995 and 2008 and 1995 and 2018 are 0.91 and 0.88, respectively. These coefficients also show a small structural change in 2008 and 2018 over 1995. The rank correlation between RCA 2008 and 2018 is 0.93, signifying that there is a small structural change in 2018 over 2008. To ensure the robustness of the findings, the Karl Pearson correlation supports the RCA results, highlighting that EXGR and VA report little structural change during 2008 and 2018 compared to 1995.

V. CONCLUSION AND POLICY IMPLICATIONS

The present study analyzes India's long-term assessment of export competitiveness by using Balassa's revealed comparative advantage (RCA) indices based on gross exports and domestic value added embodied in foreign final demand (upstream value-added exports) at the aggregate and disaggregate levels of manufacturing and service industries, using the OECD-TiVA database for the periods 1995, 2008, and 2018. The results show that India's comparative advantage patterns in manufacturing and services differ noticeably when measured in gross export versus value-added terms. Some sectors report RCA in textiles and apparel (D13T15); wood and cork (D16); petroleum and coke (D19); chemicals and pharmaceuticals (D21); rubber plastic (D22); basic metals (D24); manufacturing nec (D31T33); publishing and audiovisual (D58T60); computer programming & IT services (D62T63); administrative and support services (D77T82); etc. Computer programming & IT (D62T63) remain exceptionally high and stable (EXGR: 0.87, 0.85, 0.77; VA: 0.65, 0.79, 0.71) in the entire RCA index in both indicators.

The study finds no RCA in manufacturing industries at the aggregate level, while service industries in gross exports as well as in value added have a higher number of RCAs. At the disaggregate level, manufacturing industries have a higher RCA (26) in VA terms than in EXGR (23), indicating a small lead for VA over EXGR, while service industries have a slightly higher (15) RCA in EXGR than in VA (14). Also, the total number of year-wise RCAs at the disaggregate level is 29 in 1995, 25 in 2008, and 27 in 2018, indicating that there is no significant difference in the year-wise RCAs. From the results, it can be inferred that there is no significant difference in the total number of RCAs between EXGR and DVA at the disaggregate level in manufacturing and service industries, nor a substantial year-wise difference in RCAs. The results of the Spearman rank coefficients (SRC) show that gross exports and DVA for the entire industries under investigation exhibit minor structural changes in 2008 and 2018 compared with 1995. The Karl Pearson correlation confirms the RCA results, showing little structural change in gross exports as well as in DVA in 2008 and 2018 in comparison with 1995.

The results show that most sectors have a comparative advantage in gross exports, but not in domestic value added embodied in foreign final demand. This highlights the dependence on intermediate imports. The policies should prioritize upgrading supply chains, advancements in technology, and local intermediate industries to create a substantial amount of export value. Given the heterogeneous nature of comparative advantage, a one-size-fits-all approach will not work. So, the targeted policies will work, for instance, infrastructure support, industry-specific incentives, and trade facilitation. The comparative advantages in EXGR and VA differ, which reflects India's position in the assembly stages of global value chains.

Policies should focus on skill development and advanced technologies, particularly in manufacturing, R&D, and innovation. Value added does not overstate trade statistics, so policies should incorporate value-added indicators for planning export strategies, assessing sectoral performance, and negotiating trade agreements.

VI. REFERENCES

- [1] Addison-Smyth, D. (2005). Ireland's revealed comparative advantage. *Central Bank of Ireland Quart. Bull.*, 1, 101-114.
- [2] Burange, L. G., & Chaddha, S. J. (2008). India's revealed comparative advantage in merchandise trade. *Artha Vijnana*, 50(4), 332-363.
- [3] Balassa, B. (1965). Trade liberalization and "revealed" comparative advantage I. *The Manchester School*, 33(2), 99-123.
- [4] Balassa, B. (1977). 'Revealed' comparative advantage revisited: An analysis of relative export shares of the industrial countries, 1953-1971. *The Manchester School*, 45(4), 327-344.
- [5] Ceglowski, J. (2017). Assessing export competitiveness through the lens of value added. *The World Economy*, 40(2), 275-296.
- [6] Fertó, I. (2018). Global agri-food trade competitiveness. *AGRIS online Papers in Economics and Informatics*, 10(4), 39-47.
- [7] Gereffi, G., & Fernandez-Stark, K. (2011). Global value chain analysis: a primer. *Center on Globalization, Governance & Competitiveness (CGGC), Duke University, North Carolina, USA*, 33.
- [8] Gol. (2023). Economic Survey. *Economic Survey*, 1-414. <https://www.taylorfrancis.com/books/9781136513947>
- [9] Goldar, B., Das, D. K., Sengupta, S., & Das, P. C. (2017). *Domestic value addition and foreign content: An analysis of India's exports from 1995 to 2011* (No. 332). Working paper.
- [10] Hinloopen, J., & Van Marrewijk, C. (2001). On the empirical distribution of the Balassa index. *Weltwirtschaftliches archiv*, 137(1), 1-35.
- [11] Hummels, D., Ishii, J., & Yi, K. M. (2001). The nature and growth of vertical specialization in world trade. *Journal of International Economics*, 54(1), 75-96.
- [12] Ismail, S., & Ahmed, S. (2022). Static and dynamic RCA analysis of India and China in world economy. *International Studies of Economics*, 17(2), 228-260.
- [13] Johnson, R. C. (2014). Five facts about value-added exports and implications for macroeconomics and trade research. *Journal of Economic Perspectives*, 28(2), 119-142.
- [14] Johnson, R. C., & Noguera, G. (2012). Accounting for intermediates: Production sharing and trade in value added. *Journal of International Economics*, 86(2), 224-236.
- [15] Kaplinsky, R., & Morris, M. (2001). A manual for value chain research. *Recuperado de http://www. Ids. Ac. Uk/ids/global*.
- [16] Koopman, R., Wang, Z., & Wei, S. J. (2012, January). The value-added structure of gross exports: Measuring revealed comparative advantage by domestic content in exports.
- [17] Lanz, R., & Piermartini, R. (2018). *Specialization within global value chains: The role of additive transport costs* (No. ERSD-2018-05). WTO Staff Working Paper.
- [18] OECD (2016), "Trade in value added", in OECD Factbook 2015-2016: Economic, Environmental and Social Statistics, OECD Publishing, Paris.
- [19] OECD. (2023, February). *Trade un Value Added*. Retrieved February Tuesday, 2024, from [Oecd.org](https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm): <https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm> *Management*, 11(5), 29-34.
- [20] Stellan, R., & Danna-Buitrago, J. P. (2022). Which revealed a comparative advantage Index to choose? Theoretical and empirical considerations.
- [21] UNCTAD. (n.d.). *Revealed Comparative Advantage*. Retrieved April Monday, 2024, from unctadstat.unctad.org: <https://unctadstat.unctad.org/EN/About.html>
- [22] Utkulu, U., & Seymen, D. (2004). *Trade and competitiveness between Turkey and the EU: time series evidence* (No. 2004/8). Discussion Paper.
- [23] Widodo, T. (2009). Dynamic comparative advantages in the ASEAN+ 3. *Journal of Economic Integration*, 505-529.
- [24] Wosiek, R., & Visvizi, A. (2021). The VWRC index: measuring a country's comparative advantage and specialization in services. The case of Poland. *Economies*, 9(2), 48.
- [25] Yeats, A. J. (1985). On the appropriate interpretation of the revealed comparative advantage index: implications of a methodology based on industry sector analysis. *Weltwirtschaftliches Archiv*, 121(1), 61-73.
- [26] Yu, R., Cai, J., & Leung, P. (2009). The normalized revealed comparative advantage index. *The annals of regional Science*, 43, 267-282.

Appendix 1

RCA (SRCA) for Disaggregated GVC Manufacturing Industries for Gross Exports and Value Added

Industry	RCA EX 1995	RCA EX 2008	RCA EX 2018	RCA VA 1995	RCA VA 2008	RCA VA 2018
D05T06- Mining and quarrying, energy producing products	-0.93	-0.98	-0.99	-0.23	-0.61	-0.57
D07T08-Mining and quarrying, non-energy producing products	0.13	-0.09	-0.63	0.05	-0.11	-0.32
D09-Mining support service activities	-0.43	-0.37	-0.17	0.40	0.23	0.21
D10T12-Food products, beverages and tobacco	0.11	0.17	0.13	-0.21	-0.30	-0.18
D13T15-Textiles, wearing apparel, leather and related products	0.35	0.45	0.40	0.39	0.31	0.38
D16-Wood and products of wood and cork	0.39	0.15	0.10	0.56	0.20	0.21
D17T18-Paper products and printing	-0.68	-0.51	-0.48	-0.31	-0.16	-0.18
D19-Paper products and printing	0.61	0.35	0.45	0.52	0.24	0.32
D20-Chemical and chemical products	-0.30	-0.14	-0.07	-0.14	-0.08	0.01
D21-Pharmaceuticals, medicinal chemical and botanical product	0.30	0.14	0.17	0.11	0.15	0.22
D22-Rubber and plastics product	-0.05	-0.08	0.95	-0.08	-0.02	-0.13
D23-Other non-metallic mineral products	-0.25	-0.21	-0.09	-0.08	-0.10	-0.10
D24 Basic metals	0.19	0.01	0.06	0.42	0.17	0.05
D25-Fabricated metal products	-0.07	-0.08	-0.18	0.05	-0.13	-0.22
D26-Computer, electronic and optical products	-0.80	-0.78	-0.71	-0.84	-0.74	-0.75
D27-Electrical equipment	-0.04	-0.09	-0.26	-0.34	-0.13	-0.31
D28-Machinery and equipment n.e.c	-0.28	-0.24	-0.28	-0.36	-0.23	-0.30
D29-Motor vehicles, trailers and semi-trailers	-0.46	-0.41	-0.45	-0.52	-0.49	-0.50
D30-Other transport equipment	-0.31	-0.21	-0.22	-0.32	-0.21	-0.16
D31T33-Manufacturing nec; repair and installation of machinery and equipment	0.63	0.48	0.44	0.55	0.20	0.21
D35-Electricity, gas, steam and air conditioning supply	-0.85	-0.89	-0.52	0.11	-0.07	0.03
D36T39-Water supply; sewage, waste management and remediation activities	-1.00	-1.00	-1.00	-0.25	-0.36	-0.11

Appendix 2

RCA for Disaggregated GVC Service Industries for Gross Exports and Value Added

Industry	RCA_EX_1995	RCA_EX_2008	RCA_EX_2018	RCA_VA_1995	RCA_VA_2008	RCA_VA_2018
D41T43 Construction	-1.00	-1.00	-1.00	0.19	0.01	0.10
D45T47 Wholesale and retail trade; repair of motor vehicles	-0.43	-0.34	-0.28	-0.23	-0.13	-0.06
D49 Land transport and transport via pipelines	-0.13	-0.06	-0.08	-0.03	0.06	0.03
D50 Water transport	-0.73	-0.63	-0.67	-0.65	-0.54	-0.62
D51 Air transport	-0.38	-0.20	-0.18	-0.62	-0.68	-0.40

D52 Warehousing and support activities for transportation	-0.40	-0.06	-0.18	-0.26	-0.18	-0.20
D53 Postal and Couriers	-0.93	-0.90	-0.90	-0.28	-0.33	-0.36
D55T56 Accommodation and food service activities	-0.03	-0.07	0.05	-0.34	-0.44	-0.24
D58T60 Publishing, audiovisual, and broadcasting activities	0.06	0.32	0.16	-0.07	0.05	-0.12
D61 Telecommunications	-0.24	-0.08	-0.07	-0.31	0.01	-0.06
D62T63 Computer programming, consultancy and information services activities	0.87	0.85	0.77	0.65	0.79	0.71
D64T66 Financial and insurance activities	-0.28	-0.17	-0.24	0.02	0.09	-0.01
D68 Real estate activities	0.07	0.08	0.04	-0.53	-0.54	-0.51
D69T75 Professional, scientific and technical activities	0.13	-0.09	0.02	-0.68	-0.59	-0.48
D77T82 Administrative and support services activities	0.48	0.56	0.07	-0.06	0.29	0.21
D84 Public administration and defense; compulsory social security	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
D85 Education	-0.54	-0.67	-0.59	-0.72	-0.67	-0.31
D86T88 Human health and social work activities	-0.27	-0.32	-0.25	-0.58	-0.59	-0.55
D90T93 Arts, entertainment, and recreation	-0.37	-0.39	-0.34	-0.51	-0.57	-0.52
D94T96 Other service activities	-0.26	-0.28	-0.16	-0.74	-0.73	-0.57