

Chapter 11

Rwanda and West Bengal, India—A comparative analysis of firm dynamics in global value chains

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Summary

This case study investigates the role of foreign direct investment (FDI) in the global value chain (GVC) participation of Rwanda and West Bengal, India. It analyzes the dynamics of multinational corporations (MNCs) and domestic firms across different GVC archetypes. The chapter first shows the current GVC participation and FDI performance of Rwanda and West Bengal, India. Next, it sets out the various approaches used in this chapter. Subsequently, it briefly explores the relationship between FDI inflows and GVC participation. It then considers the position and role of MNCs in production networks across different GVCs. Finally, it explores the firm characteristics that may predict domestic firms' GVC participation and considers how GVC participation affects firm performance.

Current global value chain participation and foreign direct investment performance of Rwanda and West Bengal

This study focuses on a single sector in each of the six GVC archetypes for both countries based on the size and importance of sectors in each country's economy. Table 11.1 shows focus sectors for each country and each archetype. The services sectors in West Bengal are not considered because data were unavailable.

Rwanda's global value chain and foreign direct investment performance

Using Rwandan customs data, figure 11.1 shows the contribution of the exporting firms in the four goods sectors to Rwanda's total export volume over the period 2008–17. As is evident from this illustration, firms in the four focus sectors in goods GVCs contribute significantly to Rwanda's export basket, with commodities (coffee and tea) being the largest foreign exchange earner in Rwanda's goods export portfolio. In 2017, the four goods GVCs together accounted for roughly one-third of total exports. Whereas agriprocessed goods as well as textiles, apparel, and leather have been a part of Rwanda's export mix for many years, the exporting of pharmaceuticals and chemicals is a relatively new occurrence.

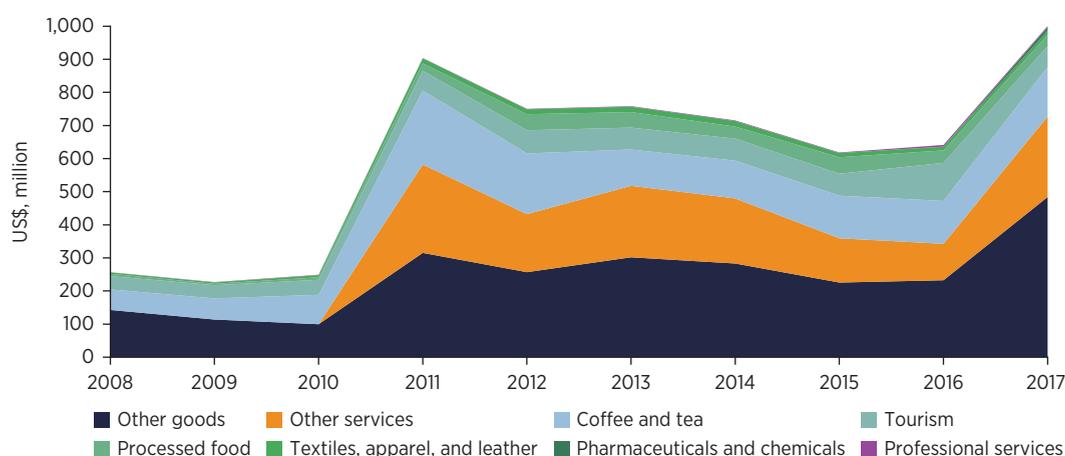
Tourism makes up close to half of all services exports using the set of firms in the data set. Tourism exports in 2017 were higher than textiles, apparel, and leather; processed foods;

TABLE 11.1 Focus sectors for Rwanda and West Bengal, India, across global value chain archetypes

GVC archetype	Focus sectors for Rwanda	Focus sectors for West Bengal
Commodity	Coffee and tea	Tea, rice, and oil seeds
Regional processing	Food products	Food products
Labor-intensive goods	Textiles, apparel, and leather	Textiles, apparel, and leather
Knowledge-intensive goods	Chemicals	Chemicals
Labor-intensive services	Tourism	—
Knowledge-intensive services	Professional services	—

Source: World Bank.

Note: GVC = global value chain; — = not available.

FIGURE 11.1 The contribution of global value chain archetypes to Rwanda's exports, 2008–17

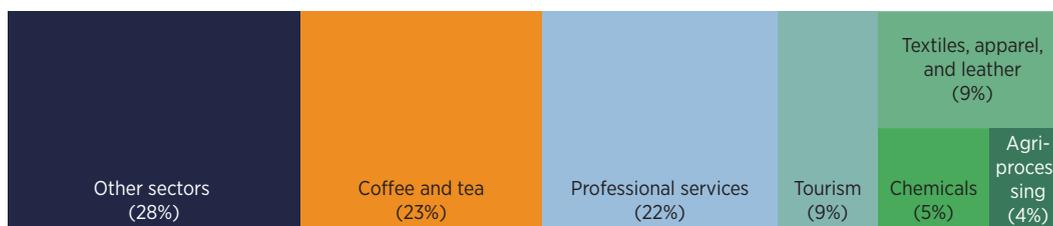
Source: World Bank calculations based on Rwandan customs data and value added tax data.

Note: Export flows behind the global value chain archetypes are limited to those by firms that exported at least 0.5 percent of all exports of a global value chain sector in any given year. US\$ values are in constant 2014 values. Most “Other goods” exports are in mining (including cassiterite, wolfram, coltan, and gold). Most “Other services” exports are in wholesale and retail trade.

and pharmaceutical exports combined. Professional services made up only about 1 percent of total services exports in 2017. Most of the “other” services exports are in wholesale and retail trade.

FDI stock in Rwanda increased steadily from 2011 through 2017. In 2011, FDI in Rwanda equated to about US\$495 million, or 7.5 percent of gross domestic product (GDP). By 2017, this figure had increased to almost US\$1.8 billion, or about 20 percent of GDP. The chapter uses data on announced investments by foreign-owned firms (in million US dollars and cumulative over the study period 2011–17) to provide a breakdown of FDI by the six focus sectors and “other” sectors (figure 11.2). The six focus sectors accounted for 72 percent of the total value of FDI announced in Rwanda. Coffee and tea and professional services received the highest FDI inflows. The services sectors attracted relatively less FDI than each of the four goods sectors included in this study, which is especially noteworthy given that tourism is one of Rwanda’s most important exports.

FIGURE 11.2 Announced foreign direct investment, cumulative 2011–17 (share of total foreign direct investment)



Source: World Bank illustration based on Rwanda Development Board investment announcements.

Note: Announced investments by firms usually cover several years of planned investments. “Other sectors” mainly include energy and mining.

West Bengal’s global value chain and foreign direct investment performance

West Bengal,¹ located on the east coast of India, is one of the country’s leading exporters of leather goods, tea, and rice. Despite its proximity to East and Southeast Asian economies, West Bengal’s overall GVC participation and FDI inflows are limited. West Bengal had the sixth-highest state domestic product (SDP) in 2017/18; its SDP accounted for 5.67 percent of India’s total GDP, but its exports represented only 3 percent of India’s total exports in 2017/18. Total exports from West Bengal have stagnated in recent years: exports reached a peak of more than US\$10 billion in 2013/14, then slumped to US\$7.47 billion in 2015/16. Its exports stood at US\$9.15 billion in 2017/18, a level lower than five years before. West Bengal’s share of India’s exports also declined from 3.2 percent to 3.0 percent.

West Bengal’s stagnant exports may reflect a shift away from manufacturing and toward services since the early 1980s. The share of manufacturing in SDP has declined from 22 percent in 1980 to less than 10 percent in 2010. Agriculture’s share in SDP has also shown a relative decline, dropping from 30 percent in 1980 to 24 percent in 2010 (Pal 2013).

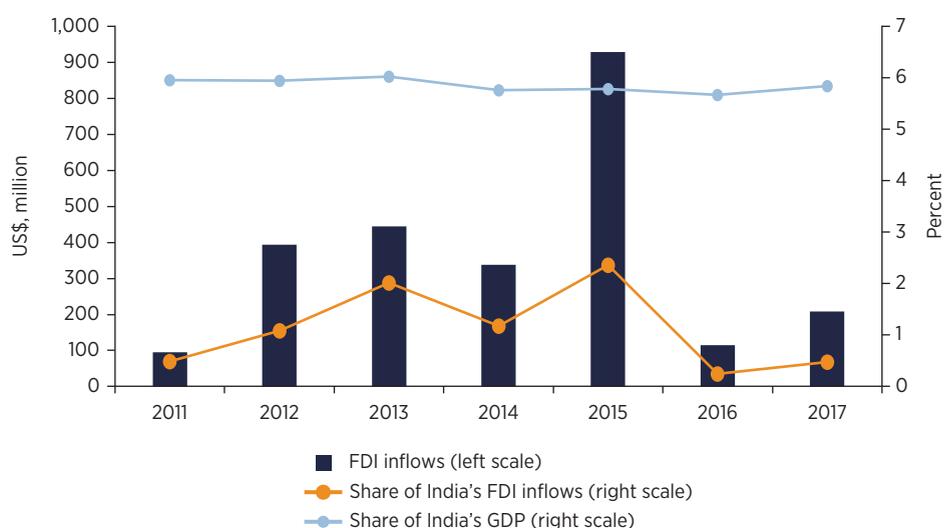
Using data from West Bengal’s major ports, table 11.2 shows that the four goods sectors made up more than 40 percent of West Bengal’s total exports in 2018. The textiles, apparel, and leather segment has the highest share of exports among the four focus sectors (17 percent), followed by agricultural goods² (11 percent), food products (9 percent), and chemicals (5 percent). Other sectors are mainly basic commodities such as iron and steel, aluminum, gold, and petroleum products.³

West Bengal has performed relatively poorly in attracting FDI. Figure 11.3 shows the overall value of West Bengal’s FDI inflows, together with its relative share of India’s FDI and India’s GDP. With the exception of 2015, West Bengal’s FDI inflows never exceeded US\$500 million. It is capturing only 1–2 percent of India’s total FDI inflows (despite making up about 6 percent of India’s GDP). Its performance also seems to be deteriorating over time, given that it accounted for only 0.2 percent and 0.5 percent of India’s total FDI inflows in 2016 and 2017, respectively. No data are available on sectoral FDI inflows.

TABLE 11.2 The contribution of global value chain archetypes to West Bengal's goods exports, 2018

Sectors	US\$, million	Share %
Focus sectors	4,996	41.6
Agricultural goods	1,275	10.6
Food products	1,078	9.0
Textiles, apparel, and leather	2,081	17.3
Chemicals and chemical products	563	4.7
Other sectors	7,007	58.4
Other agricultural goods	105	0.9
Other basic commodities	5,188	43.2
Other manufacturing	1,714	14.3
Total	12,003	100.0

Source: World Bank calculations using Directorate General of Commercial Intelligence and Statistics data for 2018 for all West Bengali ports (Ghajadanga, Petrapole, Mani Kanchan, Hili, TT Shed, Singabhad, Chengrabandha, Ranaghat, Kollam Port, Kolkata Sea, Kolkata Air, Falta, Mohedipur).

FIGURE 11.3 West Bengal's total foreign direct investment inflows and relative share of India's foreign direct investment, 2011-17

Source: World Bank calculations based on Reserve Bank of India region-based statements.
Note: FDI = foreign direct investment.

Firm-level data also show limited MNCs in West Bengal's productive sector. Figure 11.4 illustrates the number of publicly listed MNCs in West Bengal, and their percentage shares across sectors. The total has increased over time, growing from 188 in 2011/12, to 194 in 2013/14, and 205 in 2015/16. Yet, of those, just 20 percent (about 40 MNCs) are in the four selected sectors. Most MNCs in these sectors are in chemical products (11 percent); followed by textiles, apparel, and leather (5 percent); agricultural goods (4 percent); and food products (2 percent). Overall, these MNCs are very likely to be exporters: in aggregate between 50 percent and 60 percent of

FIGURE 11.4 Average number and sectoral share of multinational corporations, 2011–16

Source: World Bank calculations using Orbis database and value added tax data.

Note: Multinational corporations include foreign-owned firms, joint ventures, and domestic firms with overseas affiliates.

all MNCs export in GVC sectors. Other sectors are more domestically oriented, with about one-third of MNCs exporting.

Analyzing the dynamics between firms and global value chain participation—data and methodology

Many studies on GVCs ignore the roles of individual firms in global production networks. A firm participates in a GVC if it produces at least one stage in the value chain (Antràs 2020). GVC participation, however, is often defined at the country-industry level using world input-output tables (see chapter 1). This perspective ignores the roles of individual firms in global production networks. Even studies that consider firm-level GVC participation often limit their definition of participation to only firms that both import and export (Antràs 2020; Johnson 2018; and the Organisation for Economic Co-operation and Development’s Analytical Activities of MNEs (multinational enterprises) database). However, GVC participation does not always require that a firm directly export goods or services. Instead, firms may be integrated into GVCs indirectly by producing and supplying intermediates to exporting firms or by offshoring part of their production facilities (Cusolito, Safadi, and Taglioni 2016). Therefore, to get the most accurate representation of GVC participation, it is important to consider the wide variety of firms engaged in global production networks.

This study combines novel data sets and methodologies to analyze the dynamics of MNCs and domestic firms across different GVC archetypes. The data sets and methods vary in Rwanda and West Bengal, which are covered separately.

Rwanda

Data. The data set for Rwanda includes firm registration data, firm corporate income tax data, firm customs data, and firm-to-firm transactions data from 2008 to 2017. The rich data sets allow identification of exporters in each focus sector, firm ownership status (domestic or foreign), firm age, employment, industry, financials, imports and exports, and interfirm linkages.

Identifying exporters in each focus sector. Using transactions-level customs data on Rwanda's exports, firms in the four goods value chains (coffee and tea; processed foods; textiles, apparel, and leather; and chemicals) are identified through the Harmonized System (HS) codes in export transactions.⁴ Because only large formal firms that are likely to participate in GVCs are of interest, the data are restricted to firms that account for more than 0.5 percent of total exports of their respective GVCs. Because the customs data capture only goods exports, different identifying criteria are used for tourism and professional services. For tourism, all firms that self-register as "hotels" or "travel agents" in their annual corporate income tax returns are included.⁵ For firms active in professional services, all companies that report being active in International Standard Industrial Classification activities M (Professional, Scientific and Technical Activities) or J (Information or Communication) and that at the same time report nonzero exports in their monthly value added tax (VAT) declarations are included.

Network analysis of production networks. Network analysis is used to visualize GVCs at the firm level. This is a challenging task because all firms are interconnected through myriad transactions every day. Including all firm-to-firm linkages does not help provide an understanding of the key players and structure of the value chain. Conceptual mapping of selected value chains by industry experts is therefore used, and only key input suppliers are included for each value chain. For the ease of visualization and interpretation, data from 2017—the latest year for which data are available—are used.

First, the largest exporters for each focus sector based on customs data are identified. The network graphs (figures B11.1.1 and B11.2.1 in boxes 11.1 and 11.2) show the combination of destination country and HS 4-digit product code for top exporters. VAT data at the transaction level are used to identify tier 1 domestic suppliers of top exporters, and to trace them back to tier 2 and tier 3 suppliers. Only domestic suppliers that manufacture or sell key inputs for the focus sector are kept. Customs data are then used to show import suppliers for each relevant HS 4-digit product for top exporters and their tier 1 to tier 3 suppliers.

Sector- and firm-level regressions. The relationship between FDI and exports at the sector level, that is, the intraindustry effect of FDI on exports, is also considered. Formally, specifications of the following kind are estimated:

$$ExportShare_{st} = \beta_0 + \beta_1 FDI_{st} + \omega_s + \mu_t + \varepsilon_{st}, \quad (11.1)$$

where $ExportShare_{st}$ is the share of a sector's s output exported in year t , mirroring a sector's participation in (and reliance on) global market opportunities. FDI_{st} corresponds to one of four different proxy measures to consider the prevalence of FDI in a sector: the number of MNCs in a sector, the share of total domestic purchases of a sector made by MNCs in the sector, the share of total output of a sector generated by MNCs, and the share of a sector's total employment provided by MNCs. The terms ω_s and μ_t correspond to sector and year fixed effects, and ε_{st} captures other, unobserved characteristics at the sector level. Standard errors are clustered at the sector level in all estimations.

The analysis also considers how different firm types affect a firm's relationship with GVCs, and specifically its probability of becoming a direct exporter itself. Formally, the following specification is estimated:

$$\Pr(Exporter)_{ist} = \beta_0 + \beta_1 FirmType_{ist} + \omega_s + \mu_t + \varepsilon_{st}, \quad (11.2)$$

where $\Pr(Exporter)_{ist}$ is the probability that a firm i in sector s in year t has a positive export volume. $FirmType_{ist}$ corresponds to different firm characteristics that may explain GVC participation. These characteristics are either the firm's status as supplier to exporters or firm ownership (joint venture [JV] or foreign-owned firm). The terms ω_s and μ_t correspond to sector and year fixed effects, and ε_{st} captures other, unobserved characteristics at the sector level. Standard errors are clustered at the sector level in all estimations.

GVC participation event study. To study how GVC participation affects firm behavior, a simple event study is used that compares firms that started participating in GVCs with those that did not in the years preceding and following their GVC participation. The sample is first restricted to only those firms that are in the data set for at least six years (two years preceding GVC participation, the year GVC participation began, and three years following). Then, for the control group, only firms in the similar subsector are included. Unfortunately, each subsector cannot be observed directly, so the analysis instead relies on an aggregate set of "business activities" in which the exporting firms operate. Next, comparable age is used as the other main comparator. Simple descriptive statistics are then used to compare the behavior of GVC exporting firms *preceding* and *following* GVC participation. A number of key variables are presented and the analysis captures the difference in value with a domestic firm in the same sector of similar age.

West Bengal

Data. The data sets for West Bengal are more restricted than those for Rwanda and are mainly based on three types of VAT data. First, firm VAT registration data include information for 14 business types⁶ and the description and amount of the top three commodities sold by the firm. Second, firm VAT declaration data hold information on each firm's purchases (imported or purchased locally), total sales, and their total VAT. Third, firm VAT transaction data contain information on the total amount a supplier sold to a purchaser each year, and the overall taxes paid on these purchases. Finally, the

Orbis database is merged with West Bengal firm VAT registration data by firm name to identify foreign-owned firms, JVs, and domestic firms with foreign affiliates.

Identifying exporters in each focus sector. As a first step toward identifying the exporting firms across the four selected focus sectors, the names of all reported commodities were cleaned and a fuzzy matching algorithm was used to identify their closest matching HS commodity code (HS2, HS4, or HS6). Using several rounds of cleaning, matching, manual checks for accuracy, and finally manual lookups for remaining items, 1,394 out of 1,423 unique commodities (98 percent) were matched to a specific HS code. Across each commodity, the corresponding HS2 code was used as the basis for identifying focus sectors.

Next, total exports were identified by using the discrepancy between a firm's reported total sales and the VAT duty on its sales (because VAT is charged on domestic sales but not on exported goods). For this step, the total expected VAT from the firm's top three commodities was estimated by multiplying the amount sold by the commodity-specific VAT rate.⁷ Next, the resulting amount was compared with the actual VAT reported for the firm's top three commodities. The assumption is then made that this difference is entirely due to exports, and that goods are exported proportional to total sales. Firms that meet three criteria are considered main exporters in the respective focus sector in a given year: the firm operates in the focus sector, has nonzero exports in a given year, and exports at least 0.5 percent of that sector's total annual exports.

Sector- and firm-level regressions. Data constraints prevented a sectoral analysis of FDI and exports in West Bengal. However, an analysis was conducted of how different firm types affect a firm's relationship with GVCs, and specifically the firm's probability of becoming a direct exporter itself, following the same specification set out in equation (11.2). The only difference is that for firm ownership status the data show whether firms are JVs or foreign-owned firms or if a domestic firm has a foreign affiliate.

Network analysis of production networks. For each product, the analysis starts with the top exporting firms and traces back to their three tiers of suppliers. First, key products in the four sectors of interest are selected, and exporters in the respective sector are identified on the basis of main commodities reported by firms. The analysis then focuses on the top 10 firms by estimated export value. Because of the scarcity of MNCs, firms are included if they are MNCs and among the top 20 exporters. VAT data are used at the transaction level to identify tier 1 local suppliers of top exporters, and then to trace back to tier 2 and tier 3 suppliers. Only domestic suppliers that manufacture or sell key inputs for the selected final product are kept. For tier 2 and tier 3 suppliers, the sample is limited to manufacturing or two-way trading firms to avoid noise from small retailers.

GVC participation event study. To study how GVC participation affects firm behavior, a simple event study is used that compares firms that started participating in GVCs with those that did not in the years preceding and following their GVC participation. Unfortunately, only three time periods are available (2011/12, 2013/14,

and 2015/16) each with a yearly gap in between them. For that reason, the sample is restricted to those firms that did not export in the first year but started exporting in the middle year. For the control group, firms in the same subsector that did not export during the entire period are included. Simple descriptive statistics are then used to compare the behavior of GVC exporting firms *preceding* and *following* initial GVC participation. A number of key variables are presented and the difference in value with a domestic firm in the same sector is captured.

General limitations and caveats

Because of limitations in the data sets, this approach has certain caveats, especially in the West Bengal analysis. The analysis is only descriptive in both cases and, although suggestive, cannot establish a direct causal relationship between FDI and GVC participation, or GVC participation and firm performance.

Global firm-to-firm value chains and the full production stages cannot be mapped out because the data sets are confined to a certain country or state. In the West Bengal case, both exporting status and exports value are based on discrepancies between a firm's reported total sales for the top three commodities and the actual VAT duty. Firms often sell a range of products; the discrepancy could be the result of sales of other products not reported. Moreover, the analysis assumes that firms export the same proportion of all of the top three commodities, which will certainly not be true. "Import" has a slightly different meaning in the West Bengal case than is typical because a firm is deemed to be an importer if it purchases from suppliers in other states of India or abroad. There is no way to determine whether a firm is purchasing from other states of India or from foreign countries. In addition, reliance on the Orbis database to identify firm ownership means that only large companies are identified, which is another reason the analysis finds very few MNCs in West Bengal.

Finally, to compare firms' market power and profitability, the analysis assumes a firm's total purchases are equal to material costs and subtracts that from total sales to get gross profits. Gross profits are then divided by total sales to get gross margin. This method causes distortions in firms' profitability because firms also purchase capital goods and non-production-related goods and services.

The effect of aggregate foreign direct investment inflows on global value chain participation

A key question of interest in this study is whether FDI inflows foster GVC participation in Rwanda and West Bengal. The relationship between FDI and exports at the sectoral level is explored.⁸ Table 11.3 presents estimation results for the specification in equation (11.2) using an ordinary least squares regression with sector and year fixed effects for Rwanda.⁹

There is a positive and statistically significant relationship between number of MNCs in a sector and the share of output that is exported in the sector. Entry of an additional MNC into a sector is associated with an increase in that sector's export share by about 0.7 percentage point on average (column (1) of table 11.3). Similarly,

TABLE 11.3 The effect of foreign direct investment on a sector's participation in global markets in Rwanda

FDI variables	Share of output exported by sector			
	(1)	(2)	(3)	(4)
Number of MNCs in sector	0.00679*			
	(0.00404)			
Share of sector's local purchases by MNCs		0.00007		
		(0.000756)		
Share of sector's total output by MNCs			0.00193*	
			(0.00100)	
Share of sector's total employment by MNCs				0.00154*
				(0.000926)
Observations	1,123	1,123	1,123	1,123
R-squared	0.762	0.761	0.767	0.765
Sector fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Source: World Bank.

Note: Standard errors in parentheses. Standard errors are clustered at the sector ("main activity") level. Included sectors are manufacturing and services sectors following Reyes (2018). Foreign-owned firms are included in the calculation of export shares. FDI = foreign direct investment; MNC = multinational corporation. *** p<0.01, ** p<0.05, * p<0.1.

as evident from columns (3) and (4) of table 11.3, an increase in MNCs' share of output or employment is associated with a 0.2-percentage-point increase of a sector's export share on average. The point estimate on the effect of a sector's local purchases on participation in global markets is small and estimated imprecisely. However, the positive association between FDI and a sector's exports seems to be driven by the MNCs themselves rather than by domestic firm spillovers. No significant effect is found of foreign investment on the export share of domestic firms (see Steenbergen and Liu et al. 2021 for details), suggesting that most of the exporting is conducted by MNCs themselves.

Although data constraints prevented a sectoral analysis of FDI and exports in West Bengal, in both Rwanda and West Bengal a strong positive correlation was identified at the firm level between being a foreign-owned firm and being an exporter (see figure 11.7 later in this chapter).

The role of multinational corporations in production networks

This study uses network analysis and descriptive statistics to offer a snapshot of production networks and the role of MNCs in selected value chains in Rwanda and West Bengal. It highlights the positions of MNCs in the production networks and compares the length and complexity of production networks and exporters' market power across different GVCs.

The position and role of multinational corporations

Longer and more complex GVCs tend to have more foreign firms and two-way trading firms.¹⁰ This composition could be the result of both government policies and MNCs' competitive positioning. Two-way trading firms make up only 15 percent of total trading firms but contribute more than 80 percent of total trade in many countries (World Bank 2020). Empirical evidence also shows two-way traders are less likely to lose their exporting status (Díaz-Mora, Córcoles, and Gandoy 2015).

Visualizations of production networks are shown in box 11.1 for the textiles, apparel, and leather GVC in Rwanda and in box 11.2 for the chemicals and pharmaceuticals GVC in West Bengal. In both cases, the important role that foreign firms play in a country's GVC participation is illustrated. Foreign firms were more likely to be positioned at the end of domestic value chains because they are more likely to export and account for a disproportionately high share of total exports. This analysis can show which types of firms are engaging in GVCs as exporters and as suppliers (according to their ownership, size, and location). As such, it provides insights into the wide network of GVC actors that may be less easily observable using traditional stakeholder analysis (such as tier 2 suppliers). One downside of this approach, however, is that no data are available for firms not based within the country, so only the part of the GVC taking place within the country is observable.

Length and complexity of production networks

Another important dimension within GVCs is production length, which is defined as the number of firms (including cross-border intrafirm trade) a product or service must go through before reaching final demand (see chapter 2 of this book; Fally 2012; Wang et al. 2017). Production length captures the complexity and coordination intensity of GVCs. Complex products and services tend to go through more firms, requiring more specialization and coordination along the chain, thereby creating more opportunities for knowledge spillovers. Theoretically, production length can be measured as the sum of firm-to-firm links. Practically, however, firms can source the same input from multiple suppliers, so to calculate the precise production length on the basis of firm linkages data alone is impossible.

In both Rwanda's and West Bengal's cases, firms are engaged in only a few segments of the supply chain, so not all stages of production can be observed to estimate production length. Thus, some tentative indicators are used to compare production length across archetypes: In Rwanda, number of imported product types (type is defined as HS6 code) and number of key input suppliers for export firms are used. In West Bengal, the average number of suppliers at each stage is used. The rationale for these proxies is that complex products require more types of inputs, more suppliers, and higher degrees of specialization.

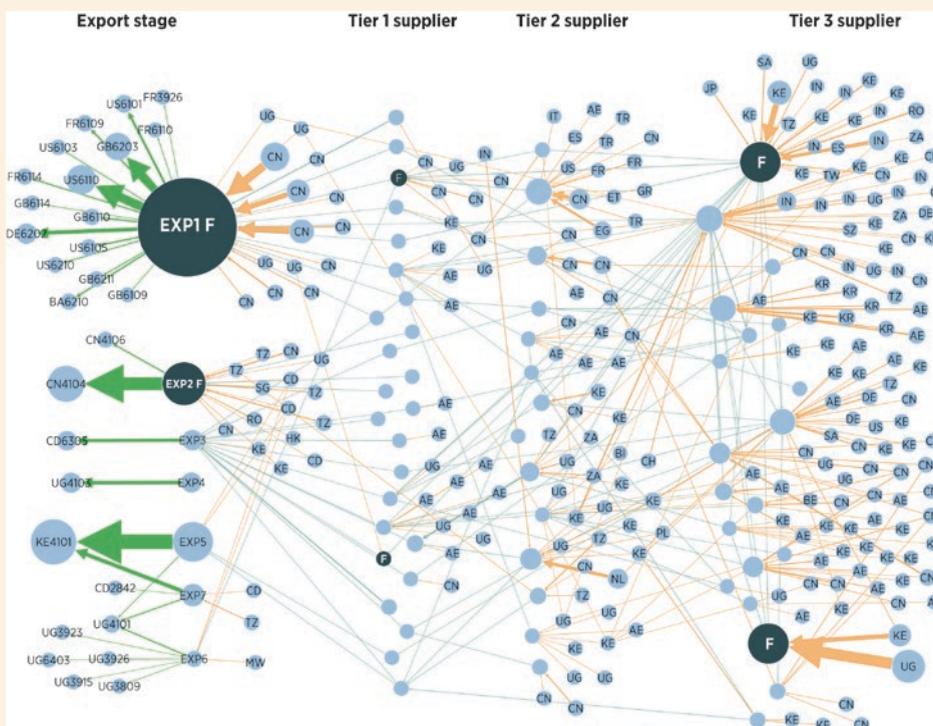
Production length is shortest in professional services and longest in the textiles, apparel, and leather value chain in Rwanda (table 11.4). Textiles, apparel, and leather and chemicals also have the highest number of tier 1 suppliers in West Bengal

BOX 11.1 The textiles, apparel, and leather value chain in Rwanda

Rwanda's textiles, apparel, and leather exports totaled US\$8 million in 2017. This exercise focuses on the top seven exporters for which data are available: one large garment exporter, one bag exporter, and five leather exporters (figure B11.1.1). Key inputs for the garment and leather value chain include yarn, fabrics, coloring matter, and textile and sewing machinery. The top garment and top leather exporter are both foreign owned. There are two foreign wholesalers among tier 1 suppliers, and two foreign-owned chemical firms among tier 3 suppliers. Unlike the coffee and tea value chain, many domestic suppliers import key inputs directly because the garment and leather sector requires more kinds of inputs, many of which are less available in Rwanda. The top garment exporter sells coats, T-shirts, and pullovers to Europe and the United States; it imports a wide range of inputs (including woven fabrics, yarn, synthetic fibers, sewing threads, buttons, glues, sewing machines, and labels) from China and fabrics from Uganda; and it sources other materials from local suppliers.

Production length in the textiles, apparel, and leather value chain is long (see chapter 2 of this report), but this fact is not directly obvious from figure B11.1.1 because the figure captures only three tiers of domestic suppliers. More important, the full production length of the textiles, apparel, and leather value chain cannot be observed because Rwandan firms do not carry out all the production stages by themselves—most of the raw materials and intermediate inputs are imported. Foreign-owned exporters also enjoy some market power over their domestic suppliers because they provide key inputs and source only relatively simple and standard inputs from local suppliers.

FIGURE B11.1.1 Textiles, apparel, and leather value chain in Rwanda



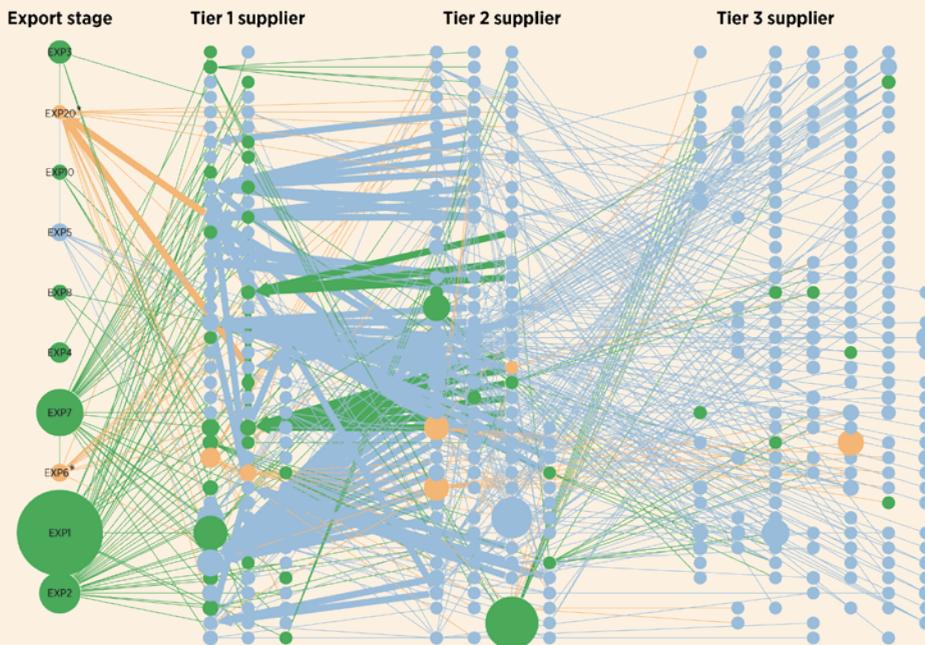
Source: World Bank calculations based on firm-to-firm value added tax data in 2017.

Note: Exports are denoted by green arrows; orange arrows represent imports. Each node represents a firm. Foreign-owned firms are dark blue, and domestic firms are light blue. The thickness of the edges between the nodes is proportional to the transaction amount between the two respective firms, and the size of each node represents the node's weighted degree in the network.

BOX 11.2 The chemicals and pharmaceuticals value chain in West Bengal, India

West Bengal is home to some of India's oldest and most successful chemical and pharmaceutical firms. Figure B11.2.1 shows the top 10 chemical product exporters. These firms produce a wide range of products, including industrial raw materials, fertilizers and pesticides, gases, washing detergent, chemicals, and medicines. Nine of the ten firms also import inputs from other states or foreign countries. Two exporters are multinational corporations (MNCs): exporter 6 is an Indian-owned multinational that sells fertilizers and pesticides; exporter 20 is a foreign firm producing rare gases. MNCs are present in all three tiers of suppliers, though MNCs are not the largest firms by sales. Unlike the textiles, apparel, and leather value chain, in which connections between tier 2 and tier 3 suppliers become sparse, tier 2 suppliers in the chemicals and pharmaceuticals value chain have far more tier 3 suppliers, and connections remain dense. The inputs provided by each tier of suppliers are also very diverse and include scientific equipment, metals, petroleum products, acids, oxides, carbonates and bicarbonates, adhesives, polyvinyl chloride goods, rubber and plastic, and pollution control equipment.

FIGURE B11.2.1 Chemicals and pharmaceuticals value chain in West Bengal



Source: World Bank calculations based on firm-to-firm value added tax data in 2015/16.

Note: Each node represents a firm. Foreign-owned firms are orange, and domestic firms are blue. Green nodes represent firms that both export and import. The thickness of the edges between the nodes is proportional to the transaction amount between the two respective firms, and the size of each node represents the node's weighted degree in the network. Multinational corporations that are also two-way traders are highlighted with an asterisk.

TABLE 11.4 Length and complexity of global value chains across archetypes in Rwanda, 2017

Focus sector	Average number of import types	Maximum number of import types	Typical imports	Average in-degree of exporters
Coffee and tea	0.63	4	Fertilizers; hand tools used in agriculture; agricultural machinery	3.4
Agriprocessing	1.38	10	Oil seeds; cereal groats; sugars; bakery and food and drink preparation machinery	4.4
Textiles, apparel, and leather	8.57	37	Tanning substance; raw hides and skins; clothing accessories; textile machinery; sewing machines; glues; acids; fabrics; sewing thread; yarn; twine; pigments; labels; buttons	9.1
Chemicals	19.50	30	Ammonia; iron, titanium, lead oxides; alcohols; acids; organic compounds; hydrogen peroxide; hydrocarbons; dyes; laboratory machinery and equipment; optical instruments and apparatus	19.5
Tourism	4.16	47	Mattresses; bed linen; rugs; lamps; curtains; furniture; soaps; ovens; cookers; glassware; chairs; seats; tricycles	2.6
Professional services	0	0	n.a.	2.0

Source: World Bank calculations.

Note: Type of imports is defined by number of different Harmonized System 6-digit products. "In-degree" measures how many incoming links a node has in a network, which indicates how many suppliers an exporter has in this case study. n.a. = not applicable.

(table 11.5). Production length based on micro measures is largely consistent with macro measures: goods-producing value chains have longer production lengths than services, and production length increases from commodities to knowledge-intensive goods. Supplier diversification is ubiquitous in all selected GVCs, though suppliers seem to be most diversified in the upstream coffee and tea value chain in Rwanda and in prepared food in West Bengal, where there can be dozens of suppliers for the same input. Generally, firms source the same input only from a few suppliers because identifying qualified suppliers and maintaining the relationship can be costly.

Market power of exporters and multinational corporations

To assess exporters' market power in Rwanda, this analysis compares total sales and gross margin between lead firms and their suppliers to show their power asymmetry.¹¹ In Rwanda, the coffee and tea value chain¹² sheds some light on power asymmetry between exporters and suppliers: the median business income for coffee and tea exporters is 6,138 million Rwanda francs (RF), but only 250 million RF for tier 1 suppliers; exporters also capture most of the value added along the chain (table 11.6). Median gross profit as a share of sales is 0.28 for exporters, 0.14 for tier 1 suppliers, and only 0.06 for tier 2 suppliers, which is consistent with the literature that exporting firms are more productive than firms serving only domestic markets.

Market power could not be fully compared across archetypes in Rwanda because such a comparison requires a large sample of key input suppliers (which is unavailable

TABLE 11.5 Length and complexity of global value chains across archetypes in West Bengal, India, 2015/16

Focus sector	Average number of tier 1 suppliers	Average number of tier 2 suppliers	Average number of tier 3 suppliers	Typical inputs sourced from local suppliers
Tea, rice	5.20	2.73	0.85	Agricultural inputs, machinery for tea industry, fertilizers, tools, chemicals
Prepared food	11.78	3.08	0.83	Animal or vegetable fats and oils, spices, chemicals, machinery for food and food processing
Textiles, apparel, and leather	14.40	1.92	1.86	Textile, yarn, fabrics, sewing thread, sewing machine, button, hides and skins, tailoring material, needle, textile machinery, labels, chemicals
Chemicals and pharmaceuticals	11.80	1.56	2.62	Organic chemicals, inorganic chemicals, metals, minerals, optical equipment, weighing machines

Source: World Bank calculations using value added tax data in West Bengal.

TABLE 11.6 Power asymmetry across global value chain archetypes in Rwanda, 2017

Focus sector	MNC contribution		Median sales (Rwanda francs, million)		Median gross margin (%)		
	Percentage of exporters	Percentage of exports	Exporters	Tier 1 suppliers	Exporters	Tier 1 suppliers	Tier 2 suppliers
Coffee and tea	31.3	46.0	6,138	250	28	14	6
Agriprocessing	25.0	76.3	921	1,029	10	10	7
Textiles, apparel, and leather	28.6	61.9	1,183	341	11	13	15
Chemicals	0.0	0.0	75	8,320	—	28	25
Tourism	5.3	6.2	658	366	70	49	—
Professional services	0.0	0.0	49	431	—	—	—

Source: World Bank calculations based on Rwanda firm-level data.

Note: Sales in million Rwanda francs captures a subset of high-value global value chain exporting firms for 2017 only, and so differs slightly from the descriptive statistics. — = not available; MNC = multinational corporation.

because Rwanda relies heavily on imports for most key inputs). It also requires data on lead firms' financial performance outside the country, which are also not present for this study. In addition, meaningful conclusions on exporters' market power in West Bengal could not be drawn because of data limitations.

The internationalization of domestic firms

To extend the productive benefits from GVC participation to the wider economy, local firms must also be integrated into these same global production networks. Integration can happen either by *supplying* exporters or by *becoming* direct exporters.

Rwandan firms' GVC participation is presented in table 11.7, which shows that the degree of GVC participation is relatively low across all GVCs (most firms are nonsupplier, nonexporting domestic firms). Overall, the largest number of GVC exporting firms are in tourism and professional services. Agriprocessing has the highest number of active MNCs, followed by coffee and tea and chemicals. The overall number of formal suppliers¹³ differs significantly, with large numbers in chemicals and textiles, apparel, and leather. In contrast, coffee and tea and tourism see a relatively small number of large suppliers.¹⁴

TABLE 11.7 Rwanda: The number of firms across global value chains—domestic, multinational corporations, and suppliers, 2008–17

Focus sector	All firms ^a	Number of firms		
		Suppliers to exporting firms ^b	Exporting firms (domestic)	Exporting firms (MNCs) ^c
Coffee and tea	902	40	41	6
Agriprocessing (food)	16,007	1,004	32	7
Textiles, apparel, and leather	4,992	224	37	2
Chemicals	13,941	1,299	42	5
Tourism (hotels and tour operators)	385	22	78	3
Professional services	8,675	535	60	2

Source: World Bank calculations.

Note: MNC = multinational corporation.

a. Each sector cannot be observed directly, so instead the full number of firms for an aggregate set of "business activities" in which the global value chain exporting firms operate is reported.

b. Suppliers to exporting firms are restricted to nonexporters.

c. MNCs include both fully foreign-owned firms and joint ventures.

TABLE 11.8 West Bengal: The number of firms across global value chains—domestic, multinational corporations, and suppliers, 2015/16

Focus sector	Number of firms			
	All firms ^a	Suppliers to exporting firms ^b	Exporting firms (domestic)	Exporting firms (MNCs) ^c
Agricultural goods	2,408	354	36	4
Food products	7,409	160	31	2
Textiles, apparel, and leather	11,170	617	43	6
Chemical products	13,072	683	20	9
Total	34,059	1,814	130	21

Source: World Bank calculations.

Note: MNC = multinational corporation.

a. Each sector cannot be observed directly, so instead the full number of firms for an aggregate set of "business activities" in which the global value chain exporting firms operate is reported.

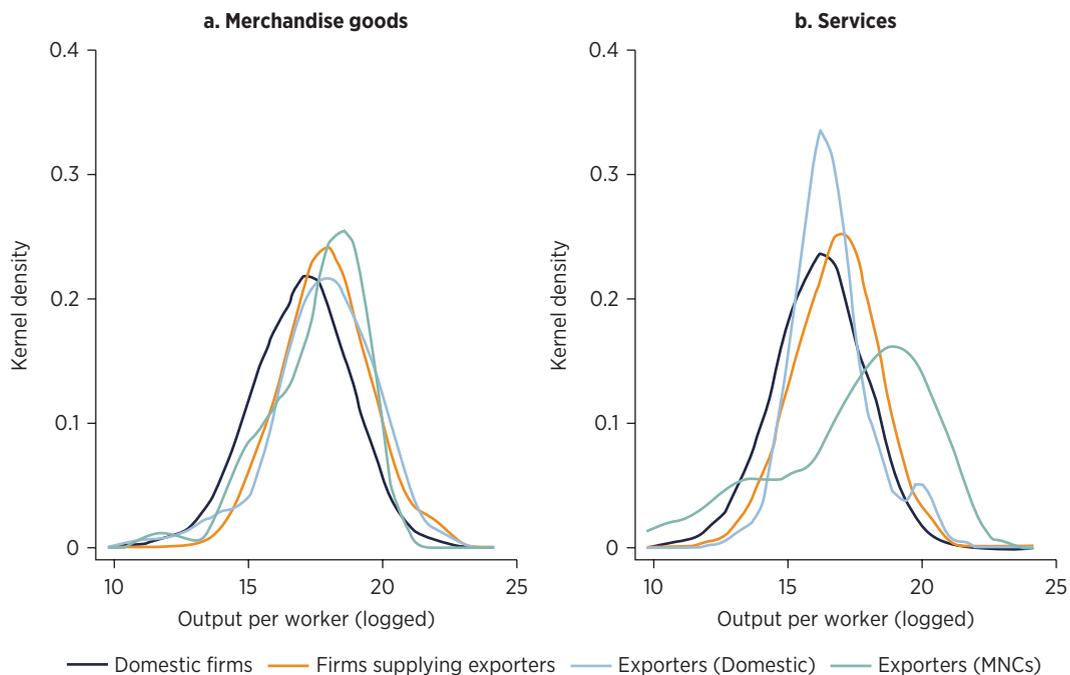
b. Suppliers to exporting firms are restricted to nonexporters.

c. MNCs include foreign-owned firms, joint ventures, and domestic firms with foreign affiliates (outward foreign direct investment).

Table 11.8 provides a breakdown of West Bengal's firm participation in GVCs, again showing a relatively low share of GVC participation across firms. Overall, the largest number of exporting firms is in textiles, apparel, and leather. The chemical products industry has the largest number of suppliers to exporting firms. In contrast, food products and agricultural goods have a relatively small number of exporters or suppliers.

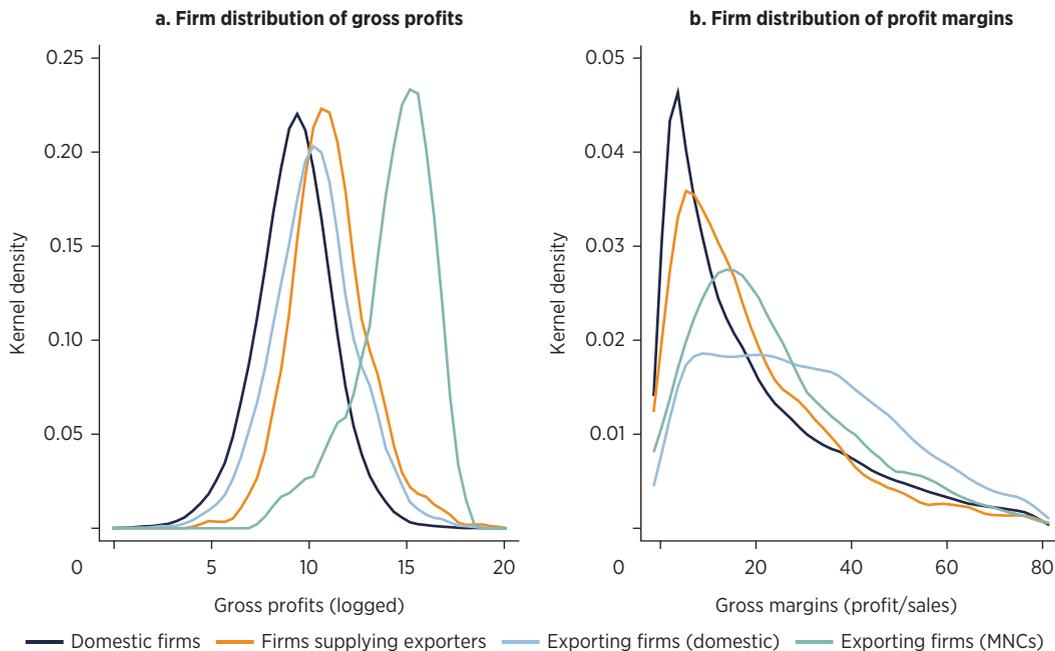
In both Rwanda and West Bengal, GVC participants tend to be the most productive firms. Rwanda's distribution of output per worker by firm type is presented in figure 11.5, which shows that for merchandise goods domestic firms are the least productive, followed by GVC suppliers and GVC exporters (domestic), whereas GVC exporters (MNCs) are the most productive on average. For services, the difference between domestic firms and domestic GVC exporters is not as pronounced.¹⁵ However, we still see that GVC suppliers and GVC exporters run by MNCs are much more productive than domestic firms (their overall distribution lies to the right). In West Bengal, two productivity metrics were considered: gross profits and profit margins (figure 11.6).¹⁶ Both panels show that domestic firms tend to be less profitable, both in absolute terms and as a share of their overall sales. The next most profitable are suppliers to domestic exporters and domestic exporters, whose gross profits closely overlap. However, suppliers have lower average profit margins. Exporting MNCs are

FIGURE 11.5 Productivity distribution of Rwanda's firms in goods and services, domestic firms, suppliers, and exporters, 2008–17



Source: World Bank calculations.

Note: Merchandise goods includes coffee and tea; agriprocessing; textiles, apparel, and leather; and chemicals. Services includes tourism and professional services. GVC = global value chain; MNC = multinational corporation.

FIGURE 11.6 Productivity distribution of West Bengal's firms in goods, 2011–15

Source: World Bank calculations.

Note: Suppliers to exporting firms are restricted to nonexporters; MNCs include foreign-owned firms, joint ventures, and domestic firms with outward foreign investment. Sectors include agricultural goods; food products; textiles, apparel, and leather; and chemicals. GVC = global value chain; MNC = multinational corporation.

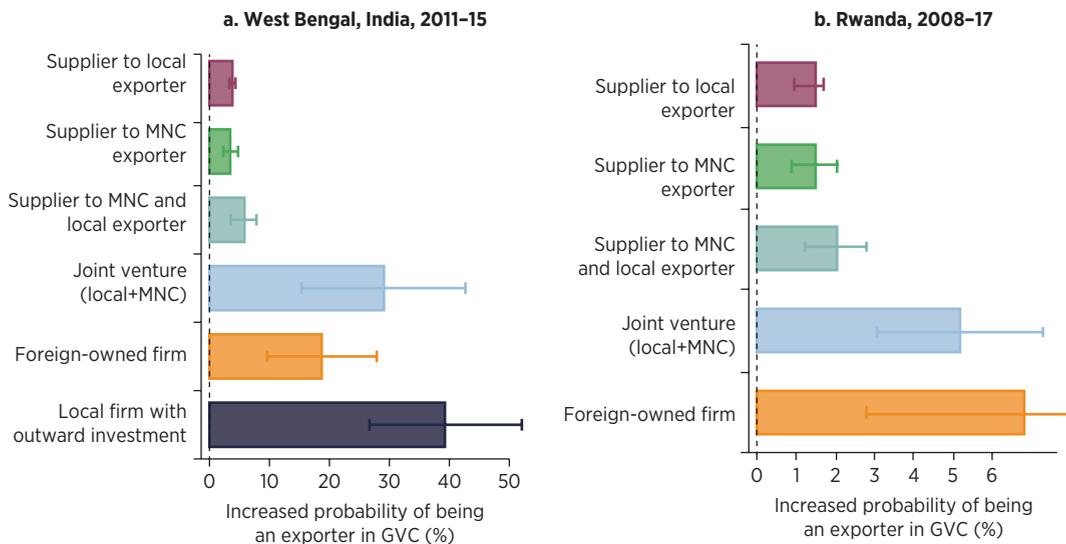
both considerably more profitable and most likely to have high profit margins. Hence, the most productive firms tend to become exporting firms.¹⁷

Pathways for internationalization

As shown in chapter 3, firms have three different pathways for internationalization: MNC-supplier linkages, JVs between MNCs and domestic firms, and outward investment by domestic firms. Results from both areas (figure 11.7) suggest that all pathways of entry into GVCs raise the probability that a firm will become a direct exporter. The more closely domestic firms interact with international firms, the more likely they will start exporting. As such, investment-based GVC participation (JVs and outward FDI) is a stronger predictor than supplier links of becoming an exporter. In many cases, domestic firms were also found to engage in more than one pathway to GVC entry (for example, supplying some MNCs while engaged in a joint JV with another MNC).

In both Rwanda and West Bengal, the importance of supply linkages differs across GVC types. In Rwanda, supply linkages are most conducive to internationalization in more-complex GVCs. The importance of supply linkages is largest in more-complex GVCs that may embody some relational ties, including in textiles, apparel, and leather; chemicals; and professional services, providing firms with an opportunity to produce to higher product standards. In contrast, there is less opportunity to move into GVCs for relatively simple inputs such as coffee and tea

FIGURE 11.7 The comparative impact of different types of global value chain participation on the probability of a firm becoming a direct exporter in select value chains



Source: World Bank calculations.

Note: West Bengal's foreign firms were identified using Orbis data only, and therefore represent only a small number of large, publicly listed firms in the region. The ownership of Rwandan firms was determined using data from the national investment promotion agency (the Rwanda Development Board). All regressions include sector and year fixed effects and robust standard errors. Joint ventures are defined as any firms in which a foreign partner has an equity stake of between 10 and 50 percent. Foreign-owned firms are firms in which a foreign partner has an equity stake of 51 percent or more. Local with outward investment firms are defined as firms that are headquartered in the country and have one or more foreign subsidiaries. GVC = global value chain; MNC = multinational corporation.

and agriprocessing. For West Bengal, being a supplier for food product exporters is associated with the greatest likelihood that the firm itself will become an exporter. The effect of supply linkages is smallest in the textiles, apparel, and leather and chemical products sectors. This difference could possibly be explained by the total number of export suppliers in each sector. There are relatively few firms supplying food products, so each supplier may provide a broader range of inputs for a specific exporter (relational sourcing). In contrast, there are many more firms supplying exporters in textiles, apparel, and leather and chemical products, indicating a situation in which many small firms sell individual inputs (spot sourcing) rather than a few firms supplying a range of inputs for a specific exporter (relational sourcing). Another possibility is that firms in food products and agriculture source more goods locally, whereas the other sectors are more import dependent.¹⁸

Foreign ownership tends to predict being an exporter across most GVC archetypes. In both Rwanda and West Bengal, foreign-owned firms were considerably more likely to be exporters across GVC archetypes. In West Bengal, domestic firms with outward investment were even more likely to be exporters. JVs, however, were more varied. JVs were most likely to occur in sectors in which foreign and domestic firms complement each other. In Rwanda, for example, JVs are significant predictors for becoming GVCs in only two sectors—agriprocessing and professional services. Both may be examples of sectors in which Rwandan firms offer key complementarities to foreign firms either by engaging with suppliers who

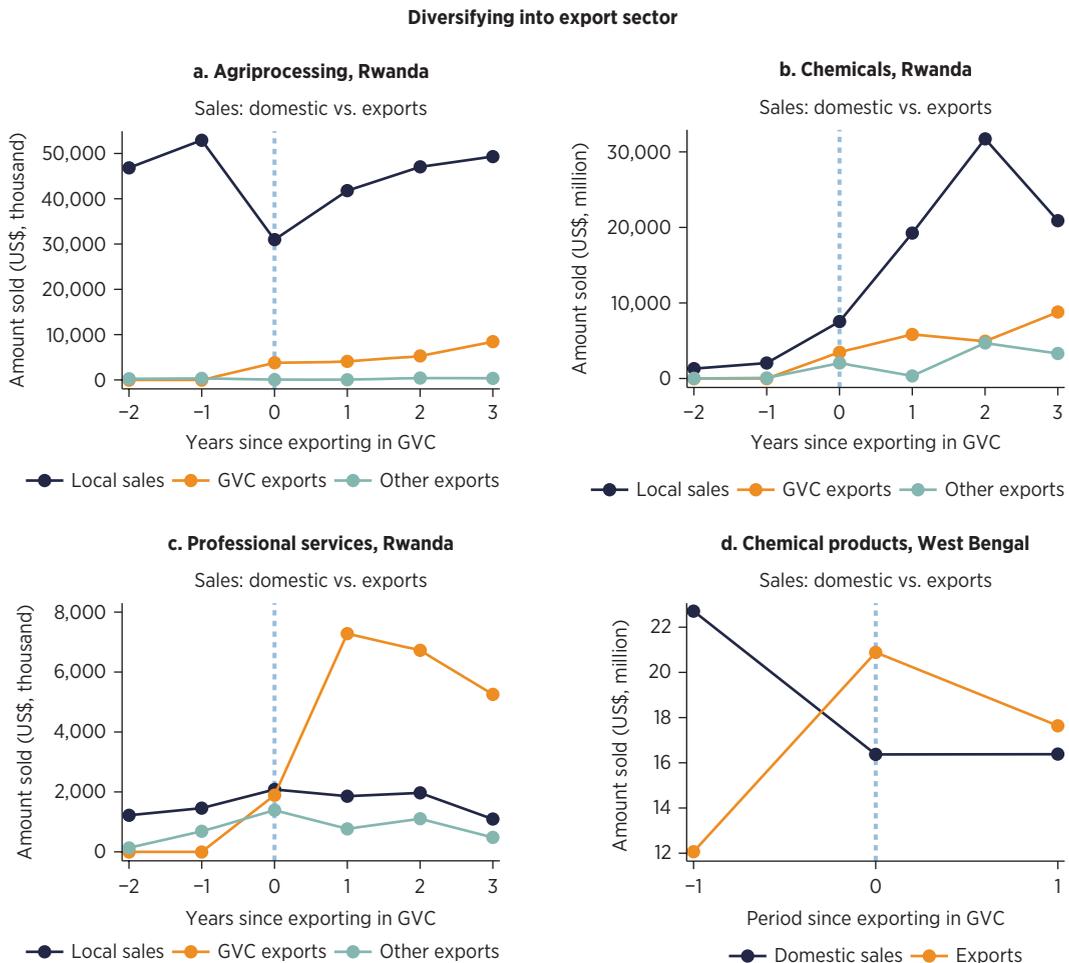
... speak only the local language (agriprocessing) or by being able to manage a complex regulatory environment (professional services).

The effect of global value chain participation on firm behavior

Finally, this chapter considers how GVC participation affects firm behavior by making use of a simple event study that compares firms in the years preceding and following their initial participation in GVCs (see chapter 3 for details).

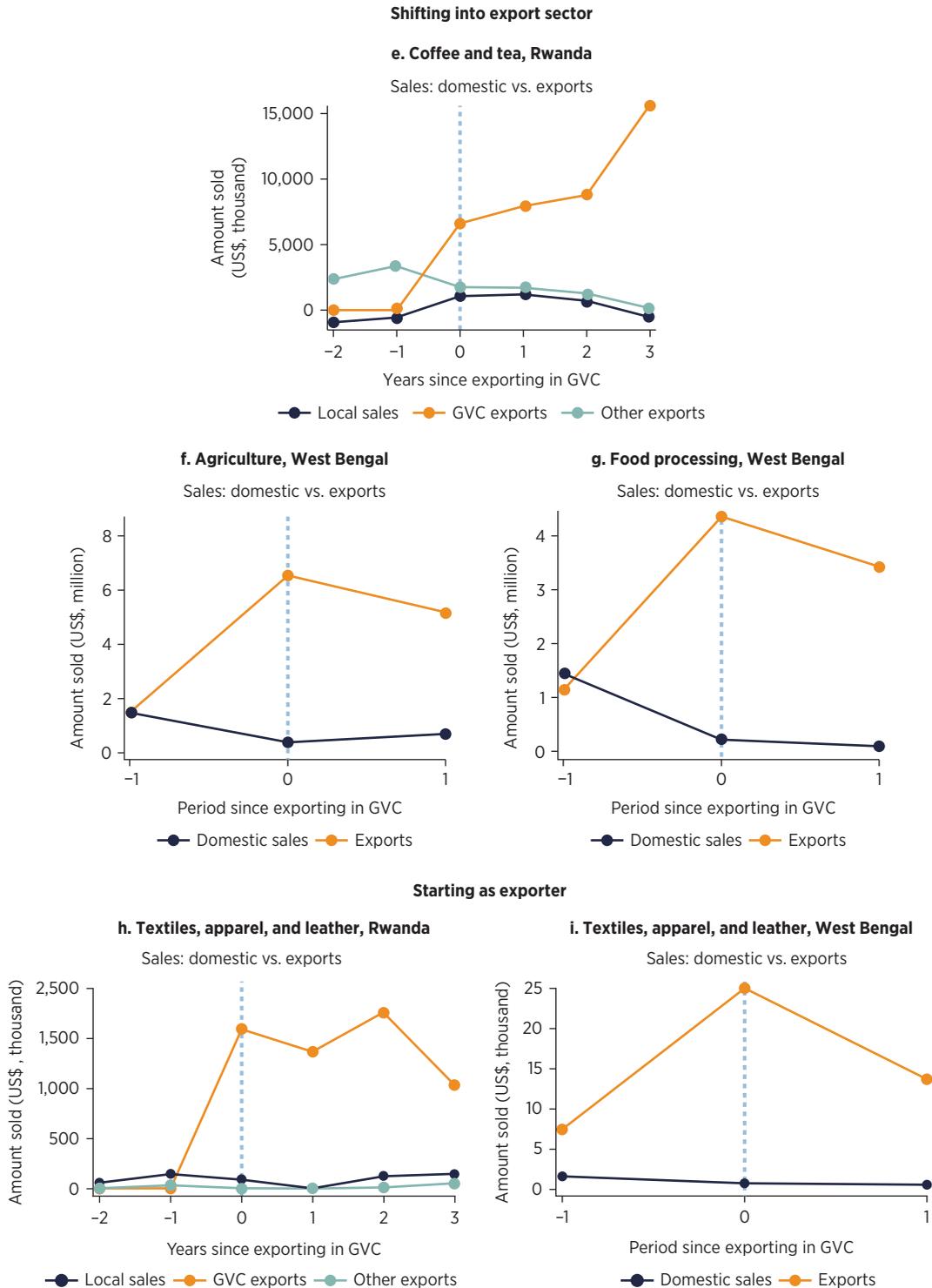
The analysis first considers the ways in which firms become direct exporters (figure 11.8). Three distinct dynamics are identified: diversifying into exports, shifting into different export sectors, and starting as exporters.

FIGURE 11.8 The three main ways in which firms become direct exporters in Rwanda and West Bengal, India



Continued on next page >

FIGURE 11.8 The three main ways in which firms become direct exporters in Rwanda and West Bengal (continued)



Source: World Bank calculations.

Note: For West Bengal's "Period since exporting," -1 = 2011/12, 0 = 2013/14, 1 = 2015/16. GVC = global value chain.

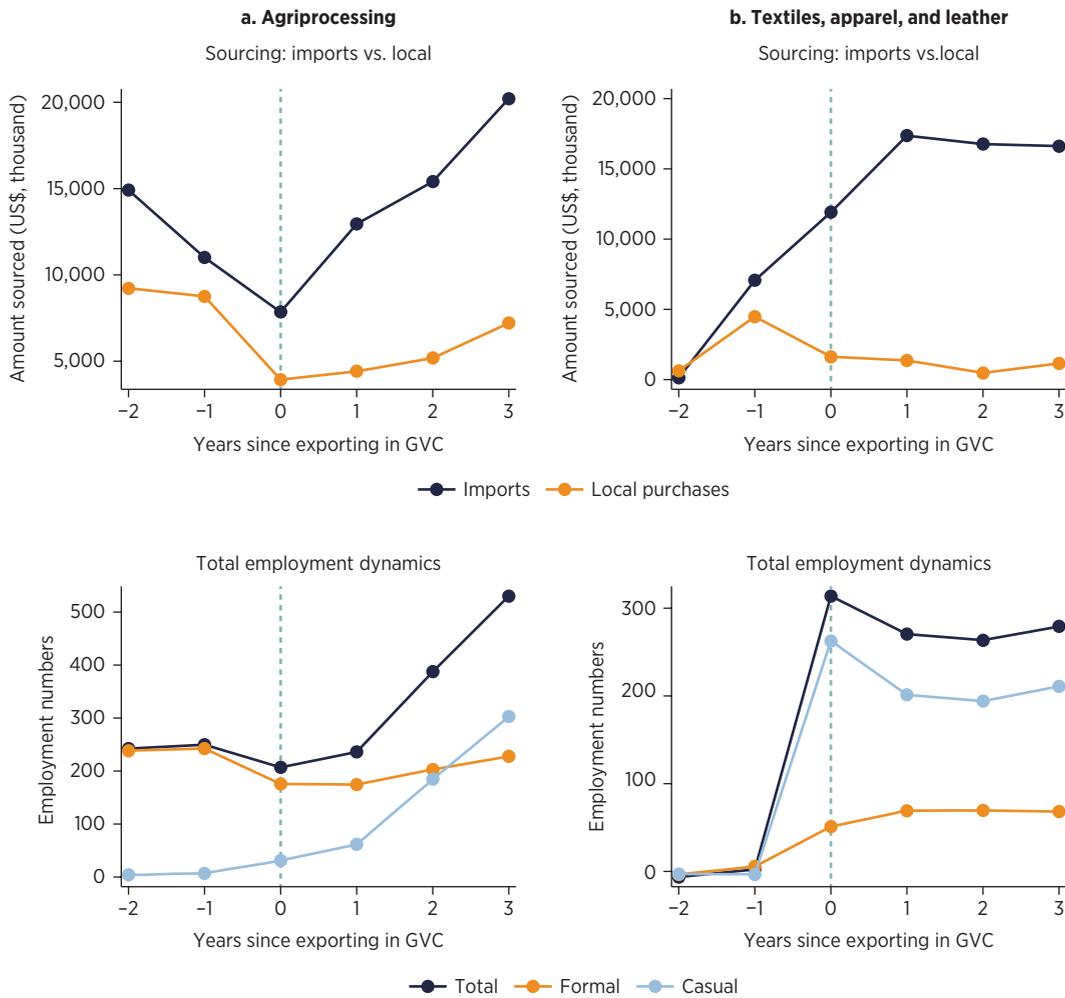
1. *Diversifying into exports.* The most common way in which domestic firms enter into GVCs appears to be for large, domestic firms to gradually expand into exports alongside their domestic operation. This is the case in Rwanda for exporters in agriprocessing, chemicals, and professional services, and for chemical products in West Bengal. These firms were able to both grow exports and maintain sizable domestic sales. In this case, sourcing dynamics appear relatively unaffected.
2. *Shifting into the export sector.* Another option is for a firm to move from one market into another (either by pivoting production or operating as a trader of a specific commodity). This option seems to be the dominant modality for exporters in coffee and tea in Rwanda and for agricultural goods and food processing in West Bengal. For such firms, domestic sales were initially significant, but then the increase in exports was accompanied by a decline in domestic production. Interestingly, these firms all tended to have strong domestic sourcing before becoming exporters; their sourcing amounts subsequently increased, but most of their sourcing continued to come from domestic purchases.
3. *Starting as an export-only company.* For textiles, apparel, and leather, much of the industry is fully oriented toward the export market, and for that reason many exporting firms in this sector focus entirely on exporting. These firms have specialized in exports since their establishment. For these firms, overall sales were close to zero before entering GVCs, and production is mostly geared toward exports. Almost all the inputs for this sector appear to be imported, with limited local sourcing (further supporting the evidence in the previous section for why supply linkages appear less conducive to internationalization in this sector).

Evidence for firms' improvements in competitiveness after beginning to participate in GVCs was also found. In both the Rwanda study and the West Bengal study, firms that started exporting for international markets often grew and became more productive (figures 11.4 and 11.5). They also became more dependent on more-complex imports either directly preceding or following their internationalization, suggesting that they were sourcing capital equipment rather than raw inputs (figure 11.9, top row). GVC participation also has a significant effect on firms' employment dynamics, often leading to a steep rise in employment (figure 11.9, bottom row). Similar findings were identified in West Bengal. Overall, these dynamics suggest that recently internationalized firms tend to upgrade their essential production capabilities (for example, their capital, skill, and research and development intensity) to meet more demanding global product requirements.

Conclusion

This case study uses novel data sets and methodologies to provide new insights into firm-level dynamics across GVCs. The analysis finds that, in both Rwanda and West Bengal, FDI plays an important role in GVC participation. Foreign firms are more

FIGURE 11.9 The effect of global value chain participation (direct exporting) on firm imports and employment in Rwanda, 2008–17



Source: World Bank calculations.
Note: GVC = global value chain.

likely to export and contribute a disproportionately high share of exports, and regression analysis suggests FDI is positively correlated with a sector’s export share.

Using firm- and transaction-level data, network analysis helps illustrate interfirm relationships in selected value chains. The network analysis shows that foreign firms tend to be positioned at the end of domestic value chains, given that they are more likely to export. Network analysis further suggests that GVC participation across multiple sectors is dominated by a small number of foreign-owned firms. This approach can show which types of firms are engaging in GVCs as exporters and as suppliers

(according to their ownership, size, and location). As such, it provides insights into the wide network of GVC actors that may be less easily observable with traditional stakeholder analysis (such as tier 2 suppliers). This technique may assist in developing a GVC strategy, and it can also be used to monitor the strategy's overall progress. One downside of this approach, however, is that no data are available for firms not based within the country, so only the part of the GVC taking place within the country is observable.

The analysis indicates that participation in GVCs tends to be restricted to the most productive firms. Three types of pathways are dominant in raising the probability that domestic firms will become direct exporters: MNC-supplier linkages, JVs between MNCs and domestic firms, and outward foreign investment. However, some important differences across GVCs are found, depending on the sector, that any GVC strategy should accommodate. For example, whereas supply linkages appear most important in GVCs with higher product standards that require firm-level skills upgrading to accommodate (for example, in textiles, apparel, and leather; chemicals; and professional services), JVs are most important for sectors in which domestic firms offer complementarities to foreign firms, either by engaging with suppliers who speak only the local language (agriprocessing) or by being able to manage a complex regulatory environment (professional services). The overall difference in *type* of firms that choose to export (direct GVC exporters, large firms diversifying into exports alongside domestic sales, or firms shifting from one export product to another) may further help shape approaches to stimulating GVC participation.

This chapter demonstrates how researchers can make use of novel firm- and transaction-level data sets to provide greater insights into a country's GVC participation. Although this approach is not without limitations, consistent use of such analysis may provide important new findings that can help policy makers better understand the dynamics of firms within GVCs and help design better sector-industrial strategies to stimulate their GVC participation.

Notes

1. West Bengal has a population of about 100 million and ranks as the sixth-highest contributor to India's GDP. Its GDP per capita stands at US\$1,500 in 2018/19 (Reserve Bank of India 2020, <https://m.rbi.org.in/Scripts/PublicationsView.aspx?id=20004>). The state shares international borders with Bangladesh to the east and Nepal and Bhutan to the north, and it is the gateway to the northeastern part of India.
2. Agricultural goods exports are particularly concentrated in two products, rice and tea, which make up 4.4 percent and 3.3 percent of all exports, respectively.
3. Part of the export of basic commodities may include products that are produced elsewhere in India and exported via West Bengal, or that are imported into the state and reexported to neighboring countries. The Directorate General of Commercial Intelligence and Statistics data do not separate out such products.
4. For example, to identify Rwandan firms that are part of the commodities (coffee and tea) global value chain, those firms that export goods listed under HS headings 0901 and 0902 are included. If a firm exports multiple products, the firm is assigned to the GVC in which it is most engaged. A table presenting all criteria used to identify firms active in the six GVC archetypes considered is available in Steenbergen et al. (2021).

5. The simplifying assumption that all of hotel and tour operator services are exported is applied.
6. The business types are Manufacturer, Distributor, Agency, Wholesaler, Retailer, Auctioneer, Works Contractor, Transferor of Right to Use Goods, Hire Purchaser, Hotelier, Club, Importer, Exporter, and Others.
7. West Bengal has four rates across commodities: 0, 1.0, 5.0, and 14.5 percent.
8. When calculating the dependent variable (the share of a sector's output that is exported), the exercise also includes the contribution of foreign-owned firms themselves, which is important because MNCs are known to be large, positive outliers with regard to exporting.
9. In line with Reyes (2018) only sectors in manufacturing and services are included in the sample.
10. Two-way trading firms in this study are defined as firms that both import and export in the same year.
11. Although the use of price markups was initially planned, it was ultimately dropped given challenges in the available data and difficulty in estimating markups accurately.
12. The coffee and tea value chain might be the only representative value chain because the numbers of firms in other value chains are too small to draw any meaningful conclusions on market power.
13. This group includes only firms that are registered to pay VATs (so only medium and large firms), which likely excludes key informal providers such as coffee-washing stations for coffee GVCs or food suppliers for hotels.
14. The limited number of suppliers in tourism is partly a result of the limited data that classify any larger hotel or tour operator as a direct exporter.
15. This is partly because tourism sales to foreigners (exports) and sales to Rwandans (domestic sales) cannot be differentiated and thus all income is treated as exports. For professional services, GVC firms are found to be considerably more productive than domestic firms.
16. Ideally, total factor productivity or output per worker would have been examined, but this was not possible with the available data.
17. Reverse causality is also a possibility, whereby firms that supply GVCs or start exporting become more productive, so that their productivity is improved (Alfaro-Ureña, Manelici, and Vasquez 2019).
18. For more details, see Steenbergen et al. (2021).

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