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ARE LEAST DEVELOPED COUNTRIES SIDELINED IN ADVANCED MANUFACTURING PRODUCTION NETWORKS?

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Are Least Developed Countries Sidelined in Advanced Manufacturing Production Networks?

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Abstract

The fragmentation of production has expanded the geographic reach of even the most high-technology value chains into non-traditional suppliers. It has been suggested that the production of parts for high-technology final products can play an important role in advancing economic development. This is a particularly attractive outcome for poor countries. But due to data constraints, existing analysis is based largely on middle-income economies. In this paper, we seek to address this oversight by using proxy data to explore the position of the Least Developed Countries (LDCs) located in Asia's vibrant regional production hub for electronics and automotive production. Have they also been able to benefit from the fragmentation of the production process? Our examination shows that there has been a surprising amount of LDC trade activity in these sectors over the past decade. In addition, a selected group of LDCs has succeeded in what appears to be successful engagement with these production networks. We discuss the forms of participation we observe and ask whether they might enable countries to attain development outcomes that might otherwise be out of their reach.

Keywords: Asia, LDCs, value chains, electronics, automobiles

JEL: F14, F15, F23, O24

1. Introduction

Even as the world economy has been moving forward, many poor countries are stuck. This is despite increasing liberalization of the world economy, increases in aid flows and innovations in technical assistance over recent decades. At the macro level, Pritchett (1997) has shown that the divergence in relative incomes between the richest and poorest countries has been growing since 1870. Acemoglu & Ventura (2002) suggest that this income dispersion is shaped by terms of trade effects, which implies that trade liberalization should help. Yet as Collier (2007) reminds us, even in regions where trade has grown sharply, many of the poorest countries remain in a low growth trap.

Does the fragmentation of advanced technology production offer a way out of this trap? Fragmentation opens new opportunities to exploit economies of scale (Arndt & Kierzkowski, 2001), and can increase the level of sophistication of an economy's export basket beyond that which is suggested by their mix of factors of production (Baldwin, 2012). For some countries, the rise of global value chains (GVCs) has clearly pushed industrialization forward. The People's Republic of China's (PRC) world market share of office and telecom equipment grew from 1 per cent in 1990 to 28 per cent in 2010 (Tung & Wan, 2013). Between 2000 and 2007, Thailand's production of passenger cars and commercial vehicles expanded 285 per cent (Wad, 2009). Evidence suggests that GVCs can improve development outcomes in general. Further to this, we explore whether these same channels operate in the poorest countries.

In Asia, the electronics and automotive sectors in particular have driven engagement in GVCs. The literature also suggests that these two sectors have the greatest development potential for those countries which successfully plug in. They are considered to be "propulsive" due to the nature of the technological spillovers and opportunities for ramping up value added (Mann & Kirkegaard, 2006; Sturgeon & Kawakami, 2010). They are also the two most important growth sectors in manufactured intermediate goods trade (Sturgeon & Memedovic, 2010). Given the benefits of producing in these sectors, and the growth possibilities of production fragmentation, we might expect that LDCs, particularly those located in Asia, have a great deal to gain.[1] To explore this, we use a sample of Asia's LDCs – Bangladesh, Cambodia, Lao PDR and Nepal to see whether they have in fact been sidelined or engaged in advanced GVC networks.[2]

LDC status is based on three criteria – income, economic vulnerability, and human assets (Economic and Social Council, 2015).[3] Using these criteria as a guide, we can see directly how participation in advanced technology GVCs might propel an LDC towards graduation. Specifically, integration into value chain production in Asia's core areas of automotive and electronics goods could result in export diversification, export stability, and an increased share of merchandise exports in total exports.[4] To the extent that GVC integration would be expected to improve logistics this might also address instability of agricultural production where the volatility is the result of challenges

[1] Our focus on LDCs in Asia is an acknowledgment that, often, value chains are regional in nature. Thus by looking at those LDCs that are in the best position to gain via their proximity to dynamic high technology GVCs, we seek to understand the best case scenario.

[2] Our choice of countries is based on data availability. These five countries had the most consistent data over the 10 year period we examine in this paper.

[3] Gross National Income is a single indicator, while Economic Vulnerability and Human Assets are both indexes with several sub criteria.

[4] Criteria 3c, 3d and 3f.

of moving goods to markets. These outcomes could directly contribute to higher scores in the economic vulnerability and income indicators.

In this paper, we seek to contribute to the existing literature on the development effects of GVC engagement by extending the framework to the case of high technology chains' impact on the poorest countries in two ways. First, much of the section of the GVC literature which seeks to understand development impacts tend to focus on issues like contribution to innovation (Giuliani, Pietrobelli, & Rabellotti, 2005), competitiveness of suppliers (Bamber, Fernandez-Stark, Gereffi, & Guinn, 2013), trade volumes and GDP growth (UNCTAD, 2013, pp. 148-152). In contrast, our paper incorporates impacts that are specific to LDC development goals including sustainability of production and export diversification.

Second, we expand the LDC-specific analysis to high-technology GVCs. The current application of the existing GVC literature to LDCs focuses almost exclusively on trends in upgrading in low-technology industries (see e.g., Morris & Staritz, 2014; Roberts, 2013).[5] This reflects an artefact of the early study of GVCs. While the literature has now accepted that revealed comparative advantage (RCA) is not an appropriate measure for sectoral analysis (see e.g., Baldwin & Lopez-Gonzalez, 2014) the paucity of alternative data for LDCs has meant that RCA continues to be used, and it reflects their "advantage" in low-technology sectors. While data for LDCs is improving, this group of countries still lacks the necessary indicators to take full advantage of innovations in the study of GVCs.[6]

We attempt to overcome this constraint by using proxy measures for value chain engagement. What we produce is a rough estimate, but enables us to uncover some trends in LDC engagement in higher technology value chains. This first look at these dynamics provides some useful indications about whether the pursuit of high technology value chains by poor countries is a reasonable development strategy. The data appears to suggest that it is, but only for some LDCs in our sample. For others, alternative focus on lower technology sectors is likely to yield greater results.

The article is organized as follows: section 2 introduces the conceptual framework for the analysis of high-technology GVCs. It first discusses the development impact of production fragmentation in general, and then differentiates these impacts in terms of GVC type. Section 3 looks at the position of LDCs in high-technology growth sectors in terms of GVC participation rates, network trade proportion and resilience of GVC participation against shocks. Section 4 assesses the impact of LDC experience with high-technology GVCs that might have on LDC indicators. Finally, section 5 concludes with reference to observed forms of LDC participation in GVCs and their potential impacts on LDC indicators.

2. Conceptual Framework for High-technology GVCs Analysis

When Samoa began producing wire harnesses for an Australian Mitsubishi assembly plant in 1991, it was heralded as a great step forward for the small, resource-based economy. The linkage to an automotive value chain created jobs, foreign exchange, and a new product in the export mix. But as the global financial crisis (GFC) catalyzed high-technology GVCs worldwide to contract to their core suppliers, production in Samoa shut down. This example is illustrative of many LDCs' experience

[5] Kowalski, Gonzalez, Ragoussis, & Ugarte (2015) include LDCs in their country groupings.

[6] The release of the World Input-Output Database (WIOD) tables in 2013 was a great step forward in the study of GVCs generally as it included input-output tables for a much larger set of countries than was before available. Time series data is available for 40 countries. None, however, are LDCs. The Eora global multi-region input-output (MRIO) tables, also released in 2013, covers 187 countries. This dataset focuses largely on environmental indicators.

during the GFC. And yet, many continue to pursue engagement into GVCs as an element of their trade strategy. Does the literature offer any evidence that this makes sense? In fact it does.

The core of GVC analysis is comprised of two streams that focus on value chain organization - economic upgrading and governance. While neither is directly aimed at revealing the links between GVCs and development outcomes, both offer suggestive insights about where these links might be. Economic upgrading is defined as moving to higher-value activities in GVCs in order to increase the benefits[7] from participating in global production (Bair & Gereffi, 2003; Bair, 2005). While it is recognized that upgrading typically seen in developing economies consists of only marginal value increases (Humphrey & Schmitz, 2002), there are several channels through which upgrading can promote development outcomes. GVCs can increase export diversification by allowing countries develop capacities in limited segments of the value chain (O. Cattaneo, Gereffi, Miroudot, & Taglioni, 2013),[8] and improves endogenous technical capability development (Morrison, Pietrobelli, & Rabellotti, 2008).

The governance stream analyzes the relationships between actors in value chains, highlighting the power relations within value chains (Gereffi, Humphrey, & Sturgeon, 2005; Kaplinsky & Morris, 2001). The type of governance structure has been used to explain different degrees of knowledge transmission (Pietrobelli & Rabellotti, 2011), how wages are impacted by globalization (Costinot, Vogel, & Wang, 2012), how spatial unbundling occurs (Baldwin & Venables, 2013), and the way that firms upgrade (Giuliani et al., 2005). From this we draw insight about the sustainability of existing LDC linkages into GVCs.

In this section, we discuss how production fragmentation promotes economic development through employment generation and industrialization, and why LDC participation in high-technology GVCs tends to be more beneficial than in low-technology GVCs.

2.1 Production fragmentation and economic development

The fragmentation of production is defined as the separation of a production process into two or more steps that can be undertaken in different locations without changing product quality (Deardorff, 2001). It can take the forms of snakes and spiders (Baldwin & Venables, 2013). Snakes involve a sequence in which intermediate goods are sent from one country and incorporated into intermediate goods in other countries until they reach the final stage of production. Spiders involve multiple parts coming together from a number of destinations to a single location for assembly. Most production processes are complex mixtures of the two (Timmer, Erumban, Los, Stehrer, & de Vries, 2014). In this paper, we refer to all fragmented production processes as GVCs.

GVCs can contribute to development through employment gains and by providing opportunities for industrial upgrading. Employment gains occur in low-wage countries where large supply of low-skilled workers is available. In developed countries where firms face a higher relative wage for low-skilled workers than that found abroad, the outsourcing activities are those that use a large amount of low-skilled workers, such as assembly of components and other repetitive tasks. Moving these activities overseas will reduce the relative demand for low-skilled workers in the developed country, while it will generate employment for low-skilled workers in developing countries (Feenstra, 1998).

The relocation of unskilled-labor-intensive production activities from developed countries to lower-wage countries results in the declining share of high-income countries in manufacturing GVCs,

[7] such as security, profits, skill, technology, or knowledge transfer

[8] Though Bamber et al. (2013) remind us that without supportive policies, it may not translate into development gains.

falling from 74 per cent in 1995 to 56 per cent in 2008 (Timmer et al., 2014). This is even more pronounced in East Asia, where the share of high-income countries declined from 21 to 11 per cent. In contrast, emerging countries where large supply of low-skilled labor is available have experienced rapid increase in the shares by 18 percentage points. PRC accounted for half of this increase, from 4 to 13 per cent.

Asia is one of the main hubs for GVCs (Baldwin, 2012). This suggests that GVCs are more sensitive to distance than final-good trade which is in line with that found in Gamberoni, Lanz, & Piermartini (2010). The intensity of GVCs in Asia can present LDCs with longer-term development opportunities through industrial upgrading. In particular, it can offer the potential for technology dissemination and skill building, which can help firms improve their productivity in GVCs and enter or expand into higher value added activities in GVCs (UNCTAD, 2013).

The development impact of GVCs depends on how local firms manage to increase productivity and upgrade to activities with higher value added in GVCs. Linking local firms to transnational corporations is essential to acquire new capabilities capturing a higher share of the value added in a GVC. The development experiences of several Asian countries show that linkages and innovations arising from knowledge spillovers play a crucial role in industrialization. For example, PRC plugged into GVCs by specializing in the activities of final product assembly and then moved to a higher value-added activities by building a competitive supply base of intermediate goods (developing linkages) and by enhancing the quality of its exports (Whittaker, Zhu, Sturgeon, Tsai, & Okita, 2010).

However, some forms of GVC participation can lock LDCs in narrow technology base and in low value added activities. According to UNCTAD (2013), the capacity of local firms to avoid such dependency and the potential for them to upgrade depends on the value chain in which they are engaged, the nature of inter-firm relationships, absorptive capacities and framework conditions in the local business environment. Even in the same sector, gains from value chain participation are unevenly distributed. For example, in electronics industry, lead firms and suppliers of key components capture greater value than contract manufacturers (Shin, Kraemer, & Dedrick, 2013). In garment industry, garment producers in Viet Nam are unable to access the higher quality and higher value chains (Nadvi et al., 2004). In the next section, we differentiate governance structure and upgrading trajectory of low- and high-technology GVCs, exemplified by garments and electronics.

The differences in low and high technology value chains have been lightly examined in the literature. Costinot et al. (2012) for example, show that the impact on wages differ in primary versus manufacturing sectors and show that the wage effects differ depending on whether the worker is at the bottom or the top of a chain.

2.2 LDCS and garment GVCs: what this tells us about development

GVCs in low-tech industries such as garments play a crucial role in economic development for developing countries. At the global level, developing countries supply much of the semi-finished inputs to exporters in developed countries. In 2010, foreign value added share in export for the textile industry was about 32 per cent for developed countries, which is much larger than that for developing countries (18%) (UNCTAD, 2013). At the country level, the link to a trans-national garment manufacturer can increase employment and output in the country's garment sector. Crystal Group, one of the largest Hong Kong, China-based apparel manufacturers, employed around 45,000 workers, and recorded a turnover of US$ 1.3 billion in 2012. The company operates in Malaysia, PRC, Cambodia, Viet Nam, Bangladesh, Mauritius, Sri Lanka, in addition to Hong Kong, China. It is a

supplier to a number of global clothing retail brands such as Victoria's Secret, Levi's, Uniqlo, H&M, Marks & Spencer, Gap, JC Penney and Abercrombie & Fitch (Azmeh & Nadvi, 2014).

The garment industry is the archetype of a buyer-driven value chain reflecting the power of large retailers, branded marketers, and branded manufacturers in setting up the chain in different exporting countries (Gereffi, 1999). Lead firms, including retailers and brand owners, in most cases, outsource manufacturing to a global network of contract manufacturers in developing countries that offer the most competitive rates. These lead firms are typically headquartered in the leading markets—Europe, Japan, and the United States (US). These firms tend to perform the most valuable activities in the garment value chain—design, branding, and marketing of products— and in most cases, they outsource the manufacturing process to a global network of suppliers (Gereffi & Memedovic, 2003).

The outsourcing of garment production results in the splitting up of production processes into five segments: (1) raw material supply, such as natural and synthetic fibers; (2) provision of components, such as the yarns and fabrics manufactured by textile companies; (3) production networks made up of garment factories, including their domestic and overseas subcontractors; (4) export channels established by trade intermediaries; and (5) marketing networks at the retail level (Gereffi & Memedovic, 2003). The fragmentation of the garment GVCs is characterized by relational value chains (Gereffi et al., 2005). This type of GVCs governance has been driven by low complexity, easy codifiability, and growing capabilities of global supply-base mainly through full package production. For example, some East Asian countries–Japan, Republic of Korea, Taipei,China, and Hong Kong, China–were able to move from the mere assembly of imported inputs to a more domestically integrated and higher value-added form of exporting.

Low complexity, easy codifiability and the use of low-skilled labor in garment GVCs made relocation of East Asian firms into LDCs straightforward and rapid. For example, the number of garment factories in Cambodia rose from 67 in 1997 to 285 in 2008 (Natsuda, Goto, & Thoburn, 2009). The key motivation for these firms are Multi-Fibre Arrangement (MFA) and preferential market access to the US and European Union (EU) (Record et al., 2014; Staritz, 2011). Given quota restrictions and rising labor costs, East Asian firms coordinated triangular manufacturing networks by first sourcing inputs from their own textile mills or established networks based in Asia, then concentrating cut-make-trim (CMT) production in Cambodia, Lao PDR, and Bangladesh, and finally selling to the US and EU markets (Keola, 2010; Morris & Staritz, 2014; Staritz, 2011). That is, East Asian firms maintain their core competency such as product design and marketing at headquarters, while fragmenting low-skill activities in LDCs such as CMT production.

Despite the success in plugging into the global garment value chains, only Bangladesh has been successful in building locally owned firms to embed in garment industry. The levels of local embeddedness have important implications of garment exporting operations and economic upgrading trajectories (Morris, Staritz, & Barnes, 2011). In Bangladesh, the ownership structure in garment industry has changed from the domination of foreign own firms in 1980s to the domination of locally owned firms in the present (Staritz, 2011). For instance, in 2006 there were 4,303 firms, only 83 were wholly or partially foreign-owned. Most export-oriented firms have moved up the garment value chains as they are able to source part of inputs instead of sourcing all inputs from buyers for CMT production. The export-oriented local entrepreneurs make the sector more embedded and increases the potential for local linkages and spillovers.

The development of locally-embedded garment export industries in Cambodia and Lao PDR, however, has not materialized. Most firms in these countries are local affiliates of transnational

producers, and are integrated into their manufacturing networks. For instance, due to language similarity about half of foreign-owned firms in Lao PDR are Thai investors whose factories do the cutting, sewing, trimming, labeling and packaging for shipment direct to retail outlets and warehouses (Keola, 2010; Record et al., 2014). While this type of integration has promoted access to global sourcing and merchandising networks, it has limited the prospects for upgrading as higher value functions are confined to the headquarters. Therefore, the integration via triangular manufacturing networks has locked Cambodia and Lao PDR's suppliers into second-tier positions and has resulted in limited local linkages and spillovers. The following section briefly sets out why drawing attention to high-technology GVCs can address challenges for economic upgrading faced by firms in the low-technology GVCs.

2.3 Five facts about high-tech GVCs that make them an attractive target

GVCs in high-tech industries such as electronics and automobiles are largely benefited industrialized countries. At the global level, foreign inputs for the production of exports in developing countries tend to be higher than those in developed countries. Data by UNCTAD (2013) show that foreign value added share in export for the automotive industry was about 31 per cent for developed countries, which is much lower than that for developing countries (55%) in 2010. At the regional level, Asia has benefited most from the rise of cross-border production networks, especially electronics GVCs; the share of Asia's GVC trade in worldwide manufacturing exports rose from 8.6 per cent in 1995 to 16.2 per cent in 2008, reflecting the region's reputation as "Factory Asia". But most GVC trade was concentrated in the People's Republic of China (PRC); Hong Kong, China; Japan; the Republic of Korea; and Taipei,China, which together accounted for 12.1 per cent of worldwide manufacturing exports in 2008 and three quarters of Asian GVC trade (ADB, 2014).

The electronics GVC is an archetype of a producer-driven value chain reflecting the power of lead firms that control product and technology development that are crucial for competing in the final-product market (Sturgeon & Kawakami, 2011). Unlike buyer-driven value chain in which profits come from marketing, branding, and retailing activities, profits of producer-driven value chain come from scale, volume, and technological advances, resulting from economic rents that are derived from proprietary knowledge or technology.

Given the complexity of electronics, its value chain is longer than other sectors of GVCs. It consists of five main segments: (1) raw materials and inputs to electronic components, such as semiconductor wafers and metals; (2) electronic components, such as active discrete and printed circuits; (3) electronic subassemblies, such as displays and printed circuit board; (4) final product assembly, such as computers and phones; and (5) marketing (Frederick & Gereffi, 2013). The long value chain of electronics contributes to the generation of employment and value-added activities. Sturgeon & Kawakami (2011) show that the share of total manufactured intermediate goods trade accounted for by the electronics industry was 20.3 per cent in 2006, while that of apparel and footwear accounted for only 2.5 per cent of manufactured intermediates in the same year.

The various segments within electronics GVCs are characterized by modular value chains, which have important implication for LDC participation. Modular production enables diversification of production sites as a result of the relative ease of relocation. Narrowing profit margins have led to an ongoing search for more efficient production sites (van Liemt, 2007). The decision about where to locate production sites in a modular GVC, and by extension whether to involve an LDC production site, takes into consideration three variables (Gereffi et al., 2005). These include (1) the complexity of transactions, (2) the ability to codify transactions, and (3) the capabilities in the supply-base.

The coordination process within modular value chains in LDCs has not been quite so straightforward. As will be explained later in the following sections, the products in which we have identified GVC participation in LDCs are low on the sophistication scale. Thus the biggest challenge faced by LDCs is capabilities in the supply base. In one of the few surveys of LDC suppliers, authors find that even in low-technology GVCs, there are zero cases of lead firms and only some first-tier suppliers (Gibbon & Ponte, 2005). Even in Viet Nam, where electronics exports are relatively well established, the Viet Nam Electronics Enterprises' Association has attributed more than 90 per cent of the sector's export turnover to foreign-owned firms. All of the LDCs in this study remain highly dependent on foreign firms in their GVC production, which facilitates codification and eases the complexity of transactions.[9]

The producer-driven governance structure of the electronics industry can enhance export diversification in LDCs through three channels: (1) functional upgrading, (2) facilitating access to global market, and (3) export stability. First, given the near product space of electronics, an increase in the number of firms in adjacent value chain segments and higher technology segments can result in functional upgrading along the electronics GVCs. Functional upgrading is the movement into new value-adding activities in the chain, and typically represents a shift from production-related activities to 'intangible activities' such as distribution, sourcing, R&D, marketing and sales (Humphrey & Schmitz, 2002). The producer-driven value chain allows suppliers to focus on their core competency. For example, in the PC sector contract manufacturers have moved from merely assembling final products on behalf of lead firms, to distributing the final products to the ultimate buyers, handling sourcing and financing of components (Frederick & Gereffi, 2013).

Second, gain from electronics GVCs is non-zero sum. Though not an LDC, Viet Nam's experience in production chain trade offers some lessons about gaining access to advanced GVCs. Its electronics sector has continued to expand into lower income countries which are not major consumer markets despite the fact that electronics GVC trade is concentrated in high and upper-middle income countries. In particular, Viet Nam's trade expansion occurred in tandem with rather than at the expense of its higher income neighbors (OECD, WTO, & UNCTAD, 2013).[10] This suggests that electronics GVCs can facilitate access to global markets and integration in the global economy for LDCs.

Third, electronics GVCs can serve as a better insulator against economic shocks compared with the "buyer-led" GVCs such as garments. The reason is that technology, capital, and skill-intensive value chain activities are harder to relocate and scale up in specific country locations than is labor-intensive work (Milberg & Winkler, 2010). This is confirmed by Ando & Kimura (2012) who found that Japanese exports of machinery parts and components tend to be stable and robust against the 2008 global financial crisis and the 2011 East Japan earthquake. The stability and resilience of suppliers against shocks suggest that the participation of LDCs in electronics GVCs can function as a development tool to reduce export uncertainty and thereby economic vulnerability.

Even where the institutional environment remains weak, LDCs can offer low-cost production sites that are located near key assembly points in the electronics and automotive trade in Asia. As will be shown in the following section, the reality of GVC linkages with LDCs is that production is of

[9] This is not unusual. Even in PRC, nearly two-thirds of manufactured exports come from foreign invested firms (Sturgeon & Kawakami, 2010).

[10] For Viet Nam for example, in 2010 and 2011 the government issued a number of policies designed to encourage the high-tech manufacturing sectors. Policies include: prioritization for land allocation, support from government-run technical assistance programs, human resource training opportunities and duty incentives.

peripheral goods by foreign firms located in restricted geographic zones. However for LDCs where opportunities for technological learning and even business process experience have largely been limited to low-technology sectors, government interventions can have important impacts on their development trajectory.

3. Snapshot of LDC Position in High-tech GVCs

Among the low-income countries that produce in the periphery of high-technology GVCs, there is a clear dichotomy. The product space literature points out that some have reached a path to transformation while others have not (Hidalgo, Klinger, Barabási, & Hausmann, 2007). A closer look at the experience of Asia's LDCs supports this observation. We examine the position of high-technology GVCs using three indicators, namely GVC participation rate, network trade proportion, and resilience of GVC participation against shock. All these indicators have their shortcomings (as discussed below), but together they enable us to infer with reasonable confidence whether an LDC has consistently engaged in high-technology GVCs.

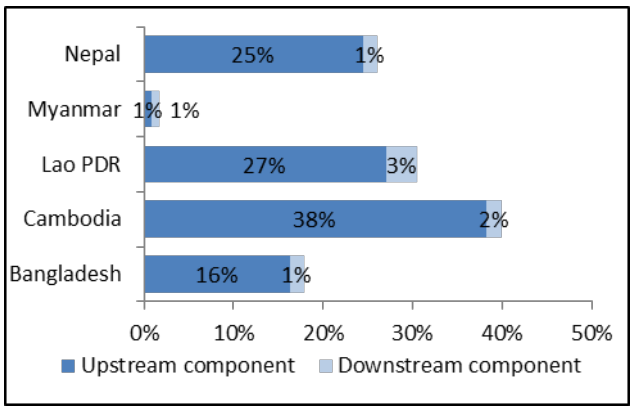
Using the indicators of GVC position, the analyses show that the engagement of Asia's LDCs in high-technology GVCs can be classified into two groups. The first group of LDCs is referred to as "active group" because the private sector appears to be more active in both diversifying their products and cementing their position in high-technology GVCs. The active group is represented by Bangladesh and Cambodia. The second group of LDCs is referred to as "passive group" because the private sector appears to be more passive in that it is mainly foreign direct investment (FDI) that has been experimenting and therefore there may be less incentive to aggressively pursue ways to link in. The passive group is represented by Lao PDR, Myanmar, and Nepal, which also have positive exports of automotive and electronics goods.

3.1 High-tech GVC participation

GVC participation indicates the share of a country's exports that is part of a multi-stage trade process, by adding to the foreign value added used in a country's own exports also the value added supplied to other countries' exports (UNCTAD, 2013). We calculate the GVC participation rates using data from Eora MRIO, which contains input-output tables and international trade blocks with a common 26-sector classification for 187 countries. Given the high level of aggregation, however, we were unable to identify accurate product classification for electronics and automobiles. Therefore, 'electrical and machinery' available in the input-output table is used as a rough proxy for electronics and 'transport equipment' for automobiles. Despite this shortcoming, the participation rates serve as a useful indicator to gauge the extent to which a country's exports are integrated in international production networks.

The GVC participation rates for five LDCs are illustrated in Figure 1. It shows that the level of GVC participation for the active group is higher than that of the passive group. Cambodia has the highest level of GVC participation among LDCs sample, recorded about 40 per cent for both electrical and machinery and transport equipment in 2011. This reflects its export-oriented manufacturing and processing activities. In contrast, the level of GVC participation for Lao PDR and Nepal are recorded lower than 32 per cent in both sectors; Myanmar is found to have the lowest level of GVC participation in these sectors.

a. Electrical and machinery



b. Transport equipment

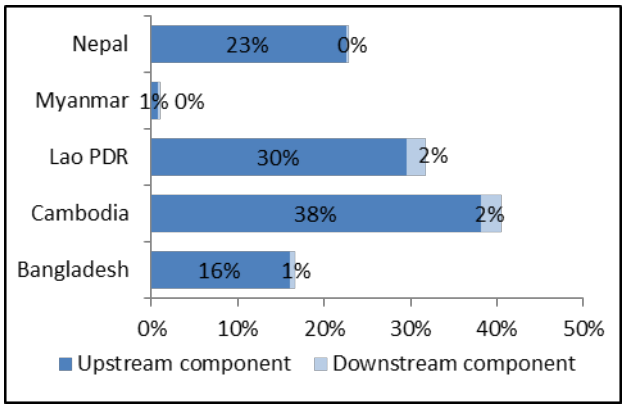


Figure 1. High-tech GVC participation rates, 2011
Source: Authors' calculation using data from Eora MRIO database.
Note: GVC participation is the foreign value added used in a country's exports (upstream component) plus the value added supplied to other countries' exports (downstream component), divided by total exports.

In addition, while both active and passive groups' high-technology exports are dominated by upstream component, domestic value added in other countries' export (downstream component) is higher for the active group than the passive group in transport equipment. The downstream component of transport equipment for Cambodia is about 2 per cent, while that for Myanmar and Nepal is only 0.2 per cent and 0.3 per cent, respectively (Figure 1).

To gain further insights about why firms expanded international production network into LDCs, we showcase investors' motivations for automotive GVC in Cambodia and electronics GVC in Lao PDR. The case studies have been selected because of the relatively high level of GVC participation in the respective countries. Our preliminary analysis shows that low wage rate and special economic zones are important determinants for the expansion of production fragmentation in LDCs.

The automotive firms in Cambodia are dominated by affiliates of Japanese multinational enterprises. As of November 2013, there are 35 Japanese manufacturers which include firms such as small motor maker, Minebea Corporation, and car-use wire harness producer, Sumitomo Wiring Systems Ltd (Ito, 2013). There are two main motivations for these firms to manufacture in Cambodia: (i) the special economic zones combined with low labor costs; and (ii) proximity to key production network such as PRC and other emerging economies in Southeast Asia. The monthly salary rate in Cambodia is $101 which is lower than its neighboring countries, PRC ($375), Thailand ($366), and Viet Nam ($162) (Chomchuen & Obe, 2014). With wages in countries such as Thailand and PRC on the rise, Cambodia is likely to become even more attractive for foreign investors.

The electronics firms in Lao PDR have been dominated by Japanese affiliate factories to support the same Japanese affiliate factories in Thailand (Keola, 2010). The first major electronics investment was in 1999 when an affiliate of a Japanese electronics component manufacturer established a factory in Lao PDR to support its Thai factory. As of 2014, there are five export-oriented electronics firms, four owned by Japanese and one owned by Laotian. There are two main motivations for these firms to manufacture in Lao PDR: (i) the special economic zones combined with low labor costs; and (ii) cultural and language similarity between Lao and Thai. The monthly salary rate in Lao PDR is $137 which is lower than its neighboring countries, PRC ($375), Thailand ($366), and Viet Nam ($162) (Chomchuen & Obe, 2014). Furthermore, Lao workers constantly received trainings in Thai by Thai trainers which were dispatched from the Japanese affiliate factories in Thailand (Keola, 2010).

3.2 Network trade proportion

Another indicator for understanding trade patterns of high-technology GVCs is the network trade proportion, measured by a Grubel-Lloyd Index (GLI). This instrument is more commonly used to test for intra-industry trade; however it has also been used as a proxy for the presence of network trade where more granular data is not available, such as in the case of LDCs.

Following practice in the literature, a cut-off value of 0.65 of the GLI is used. Based on the GLI formula, the score of 0.65 means either the imports of the respective industry are about twice as big as its exports or vice versa. Therefore, a GLI score greater than 0.65 indicates a decent amount of intra-industry trade of the industry. We can reasonably assume it is tied to network trade.

Table 1. Automotive and electronics exports by network trade proportion (2011) (value in million $)

country	total exports (by value)	electronics exports (value)	% electronics exports with GLI>0.65 (GLI>0.5)	automotive exports (value)	% automotive exports with GLI>0.65 (GLI>0.5)
Cambodia	13500	294	0 (0.067)	295	0.375 (0.375)
Bangladesh	26666	121	0 (0.125)	123	0 (0.133)
Lao PDR	2900	3	0 (0)	11	0 (0)
Myanmar	8210	7	0 (0)	2	0 (0)
Nepal	817	7	0 (0)	6	0 (0)

Source: authors' calculations using data from United Nations (2014).
Note: electronics exports are classified by SITC 3-digit.

Our analyses show that the active group has achieved consistent engagement, while the passive group remains in the exploration phase. Bangladesh and Cambodia (the active group) each export more than $100 million in electronics and automotive goods, which is a significant amount given the export concentration of most LDCs (Table 1). The proxy indicator shows high scores in network trade presence for their automotive exports at the 0.65 level. The network trade indicator in the electronics sector is relatively less indicative compared to the automobile sector. However, if we loosen the measurement a little bit to allow a GLI score of 0.5, which implies the imports of electronics sector are three times as big as its exports or vice versa, we observe promising results of network trade for both countries.

By contrast, the passive group has positive exports of automotive and electronics goods, but these exports are most likely not part of regional networks.[11] In addition, as we will detail in section 4, the survival rate of their exports in electronics and automobiles are low, which suggests that many of the exports are explorations of the domestic cost structure (or data artefacts, see e.g., Stirbat, Record, & Nghardsaysone, 2011).

[11] The coarseness of the data precludes us from concluding with certainty about the presence or absence of network trade.

Table 2. Cambodia's exports of SITC 821 (furniture, cushions etc) and SITC 785 (Cycles, motorcycles, etc)

Year	SITC 821 exports			SITC 785 exports		
	GLI >0.65	Top 3 export destinations	Export value (million US$)	GLI >0.65	Top 3 export destinations	Export value (million US$)
2005	0.7025	PRC, Republic of Korea, Malaysia	5.4	0.0390	Viet Nam, Thailand, Japan	0.2
2006	0.8012	Myanmar, Japan, Republic of Korea	3.8	0.4320	Viet Nam, Thailand, Japan	39
2007	0.7377	PRC, Indonesia, Singapore	3.9	0.4607	Viet Nam, Singapore, Thailand	38
2008	0.8508	Lao PDR, Viet Nam	5.3	0.4844	Hong Kong, China; Japan, Viet Nam	49
2009	0.8080	Republic of Korea, Singapore, Viet Nam	10	0.7946	Japan, Thailand, Viet Nam	42
2010	0.8158	Viet Nam, Malaysia, PRC	12	0.9327	Japan, Thailand, Viet Nam	71
2011	0.7347	Thailand, Singapore	15	0.9001	Thailand, Singapore, Japan	110

PRC = People's Republic of China

Source: Authors' calculation using data from United Nations (2014).

The uneven success we see between active and passive countries is likely a function of threshold effects in exporting (Collier & Venables, 2007). That is, it may be difficult to establish new export sectors, but once they are locked in, costs fall quickly. A closer look at two of Cambodia's most successful automotive exports (Table 2) reveals that they had been exported internationally and involved in network trade for some time before a significant increase in export value in 2010 (50% and 41% respectively).

3.3. Resilience of GVC participation against shock

Another distinction between active and passive groups is the resilience of GVC participation after the global financial crisis of 2008. Table 3 tracks all advanced sector exports that show evidence of GVC participation for both sets of countries. Only Cambodia has managed to maintain, and even expand the proportion of their advanced sector exports that are traded within GVCs. The proportion of automotive exports with GLI greater than 0.65 for Cambodia rose from 25 per cent in 2009 to 38 per cent in 2011, while the proportion of electronics exports remains constant over the period 2008-2010. This suggests that the crisis resulted in concentration of GVCs particularly in these two sectors. Only the most productive suppliers were retained.

Table 3. Proportion of electronics and automotive exports for which GL>0.65 (all sample countries)[12]

Year	Bangladesh		Cambodia		Lao PDR		Myanmar		Nepal	
	elec	auto	elec	auto	elec	auto	elec	auto	elec	auto
2000	5%						5%		5%	17%
2001						17%			5%	17%
2002						8%			5%	8%
2003	5%					8%	5%			25%
2004		25%	13%							17%
2005		25%			5%	8%	5%			17%
2006		25%			9%	8%	5%	8%		8%
2007		13%				8%	5%		5%	
2008			7%			8%	5%	8%	5%	8%
2009			7%	25%						
2010			7%	13%						
2011				38%						

Source: Authors' calculation using data from United Nations (2014) and ITC (2014).
Note: Bangladesh data is from ITC (2014) based on HS 1996 data. Converted to SITC3 by the authors.

This snapshot of GVC engagement among LDCs confirms the expectation that LDCs are not important nodes in high-technology GVCs. However, it also highlights that certain LDCs have succeeded in plugging into network trade in electronics and automobiles. This division among LDCs implies that different policies will be needed to achieve development via these channels. In the next section, we show how high-technology GVCs can enhance the development for these LDCs.

4. Evidence for Within-network Transmission of Development for LDCs

The fundamental question that underlies this research is – does the LDC participation that we observe in advanced GVCs enable countries to attain development outcomes that would otherwise be out of their reach? In this section we take three indicators of LDC status to evaluate whether advanced technology GVC participation can and has improved these indicators in our sample LDCs. The indicators we look at are export concentration, product exploration, and trade finance gaps.

4.1 Export concentration

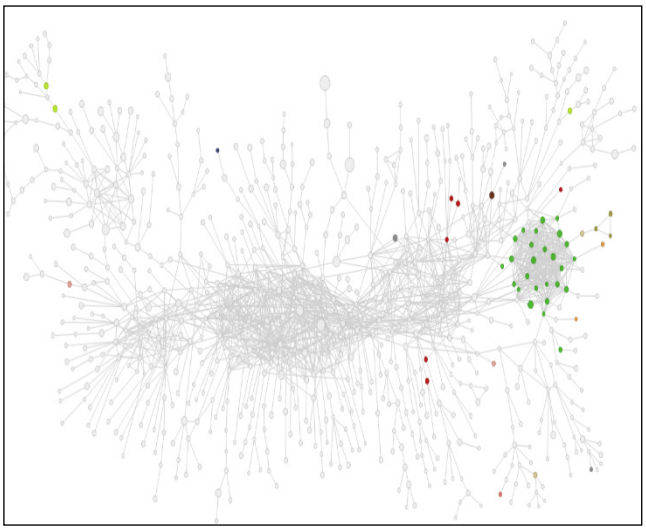
We know that the mix of goods a country produces has implications for economic growth (Hausmann, Hwang, & Rodrik, 2006). And it is well established that low-income countries produce a narrow range of goods (Imbs and Wacziarg, 2003). In line with this, many LDCs have prioritized export diversification in their strategic development plans.

In this section, we consider the development potential, as measured by export diversification, of both active and passive LDC's experience with high-technology GVCs. Diversification is an important feature of economic development as evidence by the fact that there are no developed countries that feature the high levels of export concentration found in many of today's developing countries (Agosin, Alvarez, & Bravo-Ortega, 2012). In addition, successful diversification of manufactured

[12] The calculations of the Lafay index yielded consistent negative values for all 3-digit codes in the two sectors examined. This is not unexpected given that in low income countries the manufacturing sector in general is often less than 25 per cent of GDP and the two sectors explored here constitute only a small proportion of our sample countries' exports in manufacturing.

exports will positively impact 3 out of 8 of the criteria in the Economic Vulnerability Index which is used to identify LDC status.[13]

a. Cambodia



b. Lao PDR

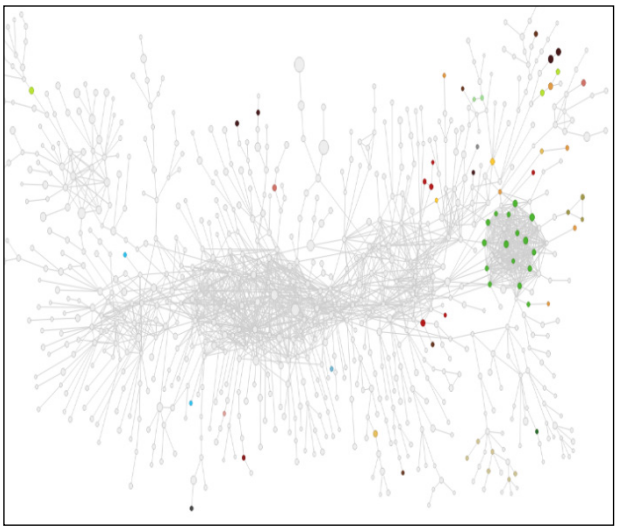


Figure 2. The product space for Cambodia and Lao PDR, 2011
Source: Observatory of Economic Complexity, available at https://atlas.media.mit.edu/en/explore/. Accessed September 2015.

We examine export diversification based on two approaches, namely product space analysis and trade diagnostic approach. The product space is a graphical interpretation of the relationships and spatial linkages between products, according to income level and scope of diversification (Hidalgo et al., 2007). The product space is the same for all countries, but each country produces only a limited proportion of the total number of products on the map. The location of any given product is

[13] The Economic Vulnerability Index (EVI) used by the UN constitutes one of three criteria by which LDC status is conferred. The EVI consists of 8 criteria which include: (a) population size, (b) remoteness, (c) merchandise export concentration, (d) share of agriculture in GDP, (e) share of population in low lying coastal areas, (f) instability of exports of goods and services, (g) victims of natural disasters, (h) instability of agricultural production.

determined by the number of linkages between that product and others. The size of the nodes reflects the share of a product within world trade flows.

Figure 2 illustrates the overall product space for Cambodia and Lao PDR in 2011, where most products are located on the periphery, with limited linkages to other products and limited opportunities for diversification. Cambodia is less diversified than the Lao PDR with a thinly populated product space map. But, the garments grouping marked as green spots on the right hand side of the map is more densely populated, reflecting the country's relatively developed export capacity in this sector. Similarly, the Lao PDR's product space is sparsely distributed, indicating the limited number of export products. A cluster of spots on the right hand side of the map indicates export activity in garments and wood products sectors. The product space maps for both countries do not show electronics and automotive exports as they do not have comparative advantage in these sectors.

Another perspective for examining export diversification is to use the trade diagnostic approach with particular reference to the extensive margin. We examine evidence that diversification has occurred in either electronics or automotive sectors. Sturgeon & Kawakami (2010) note that once a country has entered the electronics GVC, the short product cycle ensures that opportunities to evolve will continue. Following Cadot, Carrère, & Strauss-Kahn (2011) we look at the extensive margin of the two sectors as measured by the number of active export lines. Table 4 shows that for almost all LDCs there has been an expansion of the extensive margin in these products. An increase in the number of products suggests that there has been diversification around existing exports.

Table 4. Active export lines for active and passive groups (2000 and 2011)
(Percentage share in world's active export lines)

	Bangladesh		Cambodia		Lao PDR		Myanmar		Nepal	
	2000	2011	2000	2011	2000	2011	2000	2011	2000	2011
Electronics Products (%)										
Intermediate	40.82	44.9	8.16	16.33	14.29	22.45	40.82	40.82	28.57	36.73
Final	31.15	47.54	18.03	22.95	9.02	26.23	34.43	32.79	23.77	33.61
Automotive Products (%)										
Intermediate	27.59	62.07	41.38	24.14	20.69	34.48	37.93	62.07	27.59	27.59
Final	28.57	42.86	57.14	100.0	28.57	28.57	57.14	42.86	42.86	28.57

Source: Authors' calculation using data from United Nations (2014).
Note: Number of export lines is based on SITC 5-digit level. There are 49 active lines for world's exports of electronics intermediate products, 122 for electronics final products, 29 for automotive intermediate products, and 7 for automotive final products. Mirror data were used to calculate the number of active export lines for Bangladesh, Lao PDR, Myanmar, and Nepal.

In addition, Table 4 shows that there remains a great deal of room for countries to expand their production in these two sectors. The number of positive export lines for electronics intermediate products is less than half of the total world's active export lines in the same category, with a minimum of 16 per cent for Cambodia and a maximum of 45 per cent for Bangladesh. The same pattern of export diversification is also true for electronics final products. The number of positive export lines of automotive intermediate products is lower than 35 per cent for Cambodia, Nepal, and Lao PDR, while it is about 62 per cent for Bangladesh and Myanmar. Except Cambodia, extensive

margins for automotive final products in many LDCs are still less than half of the total world's export lines in the same category.[14]

Given this expansion of the extensive margin for most LDCs in advanced sector products, we highlight two channels by which LDC experience in high-technology GVCs will decrease economic vulnerability via export diversification. While these channels are also available for low-technology GVC trade, the trade data suggests that they operate more effectively under high-technology exports.

4.2 Product exploration

One impact of high-technology GVCs on diversification occurs through its promotion of exploratory exports in non-traditional sectors. For LDCs which share the characteristic of highly specialized exports, experimentation is an important vehicle to promote manufacturing diversification. Even when exports do not survive, their production contributes to the ongoing process of discovery about the underlying cost structure of the economy (Hausmann et al., 2006) and national production capabilities. The stuttering movement shown in within the product space is consistent with the search model of international trade.

Because the exact mix of goods produced for any given endowment will vary over time and among countries we can expect to see exploration. If a good is exported in year one but not subsequently, this suggests that the experiment revealed that the capability to export this product or related products does not exist. However, if a good is produced in both year one and subsequently into the future, we can assume that this signals the presence of capability and that diversification into nearby products is possible given domestic conditions. Future success is thus related to the current export situation.

a. Cambodia b. Lao PDR

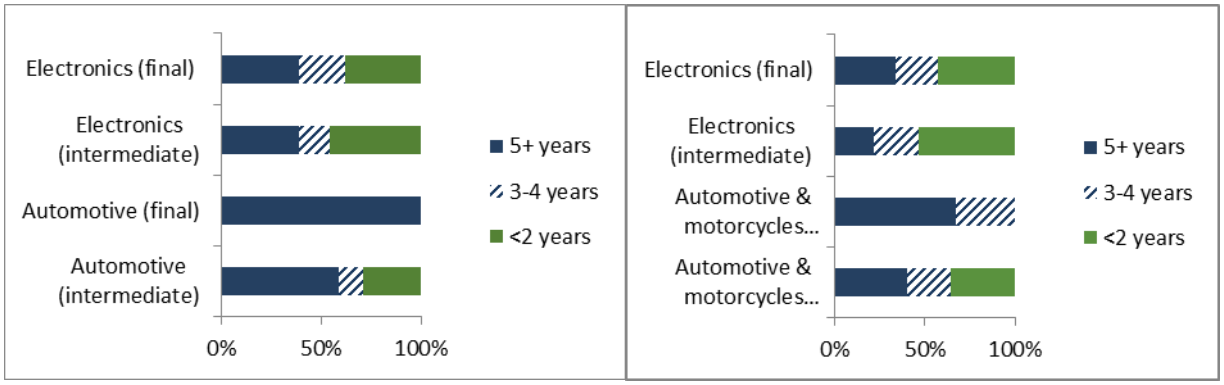


Figure 3. Sustainability of exports index (Cambodia and Lao PDR, 2000-2011)
Source: Authors' calculations using data from United Nations (2014).

We observe a considerable amount of exploration around LDCs' experience with high-technology GVCs, where exploration is defined as a situation where advanced sector products are exported for 3

[14] The fact that the percentage share in world's active export lines is 100 per cent for Cambodia's automotive final products should be interpreted with a caveat. SITC 5-digit level is a broad measure compared to various kinds and brands of automobile.

years or less. This is expected given that for any country, the survival rate of new exports is often low (Álvarez & Fuentes, 2011; Besedeš & Prusa, 2006).

Figure 3 illuminates the different dynamics behind the expansion of the extensive margin shown in Table 4. For active countries, GVC trade has directly led to diversification by enabling countries to become established producers of new non-traditional exports. For Cambodia, automotive exports show strong sustainability from 2000-2011. While production is possible under many conditions, surviving homogenous exports are those which rapidly converge in price to incumbent goods prices (Álvarez & Fuentes, 2011). GVCs facilitate links between buyers and suppliers and can offer domestic firms links that otherwise might not be known to them.

For passive countries, the expansion in the extensive margin represents an ongoing process of exploration of potentially productive exports. Though passive group's exports are most likely not linked to GVC trade, the drive to find products which might become sustainable has led to important steps forward in the knowledge gathering process needed for diversification. In Figure 3, Lao PDR GVC exports in both sectors are positive but only a limited number of goods have become sustained exports. The degree of exploration reflects Baldwin's (2011) prediction that the cross-border lending of technology in slices of the production process result in industry appearing (and disappearing) very quickly.

The distinctiveness of exploration in high-technology GVCs is in its market-driven nature. For low-technology GVCs, there exists a great deal of external interventions designed to improve LDC participation. These include Aid for Trade, tariff preferences and even (formerly) global initiatives such as the MFA. Given the exclusive focus on low-technology trade in LDCs, these resources are likely to continue. However, resources to explore high-technology potential are less forthcoming. Yet, as we see in this section, the search for cost efficiency in GVCs has resulted in foreign enterprises functioning as a vehicle to explore potential sectors for diversification that otherwise would not be supported.

4.3 Trade finance gaps

A second way in which GVC trade can transmit development to LDCs is via their impact on trade finance constraints. Financial sector underdevelopment is one of the reasons that LDCs struggle with export diversification and survival. Higher levels of financial development are linked to higher shares of manufactured exports in GDP (Beck, 2002) and a wider range of exports (Manova, 2013). Evidence has shown that in liquidity constrained markets, the presence of GVCs enable firms that otherwise might not export at all, to gain from trade (Manova & Yu, 2012).

More than 90 per cent of global trade transactions involve some form of credit, insurance or guarantee (Auboin, 2009). Exporters rely on trade finance to cover both upfront operational costs such as R&D and variable expenses such as inputs. Yet, a 2013 survey of banks found a $1.9 trillion dollar global shortfall in the supply of trade finance (DiCaprio, Beck, & Daquis, 2014). Of this unmet demand, $1.1 trillion is in developing Asia (excluding PRC and India). Though data is scarce, it is highly likely that this shortfall is even more severe in LDCs.

There have been efforts to extend coverage to address finance gaps in Asia. Asian Development Bank's Trade Finance Program for example, offers guarantees and loans to banks to cover the risk of operating in relatively risky environments. But even this program has not fully addressed the problem

for LDCs. According to the issuing banks covered by ADB's trade finance program as of January 2014, less than 40 per cent of LDCs in Asia and the Pacific are included.[15]

GVC participation can ease the trade finance constraint for participating LDCs in two ways. First, domestic firms involved in GVCs have access to greater resources through their production relationship with buyers. Manova & Yu (2012) have shown that ordinary trade imposes a heavier financial burden on the resources available to a developing country firm than does GVC trade. This implies that liquidity constrained manufacturers will gain most from participating in GVC trade.

Second, for the case of high-technology GVCs that buy from LDC production sites, the heavy presence of foreign enterprises which are not tied to domestic capital constraints bypasses that bottleneck to diversification in these sectors. The importance of FDI in growing production networks has been documented (Hanson, Mataloni, & Slaughter, 2005). Foreign firms - because of their access to parent company finance and deeper internal reserves – can more easily overcome domestic capital constraints than domestically owned firms (Desai, Foley, & Hines, 2004; Manova, Wei, & Zhang, 2011).

Table 5. Presence of Fortune Global 500 firms in LDCs (2001 and 2010)

Country	Fortune Global 500 firms in 2001		Fortune Global 500 firms in 2010	
	Name of firm	No.	Name of firm	No.
Bangladesh	Akzo Nobel, BASF, GlaxoSmithKline, Nestlé, Nippon Express, Pfizer, Unilever Roche Group	7	Unilever, Merck, GlaxoSmithKline, American Express, BASF, Siemens, Ricoh, Bank of Nova Scotia, Marubeni Corporation, Mitsubishi, Mitsui, Nippon Express, Novartis, State Bank of India	14
Cambodia	Sumitomo, Toyota Tsusho	2	British American Tobacco, Suzuki Motors, Alcatel-Lucent, Mitsui, Deutsche Post, Toyota Tsusho	6
Lao PDR	None	0	Allianz, Deutsche Post, Hochtief, Royal Dutch Shell, Sodexo	5
Myanmar	Sumitomo, Mitsui, Toyota Tsusho, Suzuki, Tomen	5	Bayer, Lufthansa, Marubeni-Itochu, Mitsubishi, Posco, Siemens, Suzuki Motors, Toyota Tsusho, Wilmar	9
Nepal	Aventis, Mitsui Fudosan	2	Sanofi-Aventis, Unilever, A.P. Moller-Marsk, American Express, Mitsui	5

Source: UNCTAD (2011) (table I.1).

Table 5 illustrates the increasing role of foreign enterprises in these countries. In all of the sample LDCs, there has been at least a 45 per cent increase in Fortune 500 firms operating domestically. While some are low-technology fields such as agrifood, most other new foreign enterprises are in services, pharmaceuticals and automotive or electronics production. To the extent that foreign enterprises are able to better bridge trade finance gaps than domestic enterprises, this implies that trade finance gaps may be narrowing as a result of GVC trade in LDCs.

For the LDCs in this study, GVC participation would have the most important impact on those the passive countries which have had the most difficulty plugging in. The reason is that these countries are the most severely liquidity constrained. In addition to not being covered by stop-gap guarantee programs as detailed in Table 5, they are not even included in sovereign risk ratings (according to S&P and Moody's local currency risk ratings as of January 2014).

[15] ADB's program is in the process of extending coverage to include Myanmar.

When a country is unrated, it becomes difficult for an exporting firm to gain access to working capital for an order or even to access letters of credit at a reasonable price. This is because foreign banks where the buyers are located are unable to establish country limits where there is no risk rating. And in the absence of country limits, there is no way to price the risk of an unknown local bank.[16]

It is clear that both active and passive countries have much to gain from high-technology GVCs' impact on their trade finance constraints. Active countries are currently in the best position to access these gains given that they have attained country ratings,[17] and have some domestic firms that are producing for GVCs in addition to foreign enterprises. However, passive countries have considerably more to gain given their lack of sovereign risk ratings.

5. Conclusions

The objective of this paper was to illuminate the LDC experience with high-technology GVCs. We confirmed that even in the dynamic hub of Asia, LDCs remain peripheral. However, the expansion of GVC participation suggests that this does not mean they have been marginalized. In fact, for some LDCs, the promotion of high-technology GVC participation may facilitate catch up to the extent that diversification is pursued. In addition, our analysis confirmed that the observed form of LDC participation in high-technology GVCs can enable them to attain development outcomes that would otherwise be out of their reach. High-technology GVC participation has improved three indicators: (1) export diversification, (2) product exploration, and (3) trade finance gap.

Our research also differentiated two distinct groups of LDC participation in high-technology GVCs, namely active and passive groups. This implies different policy recommendations to support export diversification and export platform investment for each group. For active countries, policies aimed at ramping up participation in these two production networks can be a reasonable way to close the income distribution gap. Continued support for special economic zones can attract foreign enterprises, while programs linking domestic suppliers into existing GVC trade can further expand participation. For passive countries, low survival rates suggest that policy efforts might be more efficiently targeted at helping firms stay in new markets rather than discovering new exports. These policy recommendations should be complemented with a functioning legal system (Antras & Helpman, 2008); adequate trade finance (Stiebale, 2011); low trade costs (Anderson & van Wincoop, 2004); low exchange rate volatility (Agosin et al., 2012); and skilled labor (Agosin et al., 2012).

By including LDCs in the conversation about high-technology GVCs, our research unpacks two areas of potential research. First, it has been shown that the dynamics of GVCs are different from our classical understanding of the drivers of trade, which raises the question of whether the operational dynamics of high-technology GVCs are substantially different from those of low-technology GVCs. Related to this, is there evidence that participation in these sectors has enabled technological catch-up as suggested by Gershenkron (1952) or is technology transfer ephemeral as suggested by Baldwin (2011)? Second, this research opens the question of whether there are trends in GVC participation that are common among LDCs**.** This issue is particularly important given the presence of a global

[16] While shadow ratings exist, for example via EIU or Euler-Hermes, most large international banks will only follow the big three ratings agencies. This does not mean that unrated countries are particularly risky. As Ratha, De, & Mohapatra (2011) show, unrated countries may in fact be less risky than rated countries. However, given the volume of activity, in practice unrated countries are treated as poorly rated by the banking industry.

[17] Bangladesh was first rated by both S&P and Moody's in April 2010 Cambodia was first ranked in May 2007.

regime for LDC assistance. If we can identify horizontal policies that can promote development impacts of GVC participation for LDCs, this can directly impact the framework of international assistance. Yet, most work on LDCs and GVCs are country case studies. This offers limited transferability and therefore has limited impact on the global regime.

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