The Commonwealth

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Harnessing the Commonwealth Advantage in Global Value Chains

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Abstract

This paper examines the participation of 43 of the 54 Commonwealth countries in global value chains (GVCs).
Findings show that Commonwealth member countries' participation in GVCs increased between 1995–2015,
but that the increase was primarily with non-Commonwealth countries, especially large developed and develop-
ing economies belonging to the G20 group. Three main regional clusters connect Commonwealth value chains
in Africa, Asia-Pacific and Europe, and deep regional trade agreement membership impacts on GVC participa-
tion. While open economies, such as Singapore, tend to import value-added inputs from the G20 countries,
smaller Commonwealth countries were relatively more reliant on other Commonwealth members for inputs for
domestic industries. In terms of industrial linkages, Textiles, Transport Equipment and Chemicals were impor-
tant for the Commonwealth countries. The developed Commonwealth countries dominated the Automotive
and Metals sectors. Developing countries were, in general, dominant in the upstream basic commodity parts
and in the light-industry downstream parts of the GVC. Targeted measures and an enabling business environ-
ment are required. Additional support to developing countries and least developed countries will facilitate par-
ticipation of particularly those countries that are at the lower end of the value chain.

Contents

Acronyms

AfCFTA	African Continental Free Trade Area
AHC	agglomerative hierarchical clustering
APL	average propagation length
DVA	domestic value-added
Eora	Global Multi-Region Input–Output Database
EU	European Union
FTA	free trade agreement
FVA	foreign value-added
FVAiX	foreign value-added content of exports
GVCs	global value chains
IMF	International Monetary Fund
IO	Input–output
LDCs	least developed countries
MRIO	Eora Multi-Regional Input–Output (table)
NAFTA	North American Free Trade Agreement
OECD	Organisation for Economic Co-operation and Development
R&D	research and development
ROW	Rest of the World (region)
TiVA	Trade in Value-Added
UNCTAD	United Nations Conference on Trade and Development

Executive summary

The main aim of this commissioned report is to provide a general picture of the characteristics and dynamics of global value chains (GVCs) from a complex network perspective. First, using a network perspective, we examined international flows of trade in value-added and countries' position within GVCs. Second, we measured the value of domestic versus imported content embodied in exports and the backward and forward inter-industrial linkages between and across 43 of the 54 Commonwealth countries and sectors for which data were available. Third, we estimated the length of backward and forward connections for a selection of primary and secondary sectors. This was done by segregating the influence of the foreign component from the domestic component of the value chain.

We used the Commonwealth countries' input–output (IO) tables extracted from the Global Multi-Region Input–Output Database (Eora) for 2015 (the latest reported period) and the UN Conference on Trade and Development (UNCTAD)-Eora ('nowcasting') extension based on International Monetary Fund (IMF) data for 2016–18.

The main findings on the participation and level of Commonwealth countries' integration in GVCs are as below:

- Commonwealth member countries' participation in GVCs increased over 1995–2015, but the increase was primarily with non-Commonwealth countries, especially large developed and developing economies belonging to the G-20 group.
- Three main regional clusters connect Commonwealth value chains in Africa, Asia-Pacific and Europe. Regional linkages between the Commonwealth countries in Africa were closely knitted around South Africa, with some inter-industrial interactions outside the region.
- Deep regional trade agreement membership, such as the European Union (EU) or the North American Free Trade Agreement (NAFTA), impacted on GVC participation. The membership and the depth of such agreements increased Commonwealth countries' GVC participation with other

members of the trading agreement, especially with other Commonwealth countries when they belong to the same preferential scheme. This was the case for Cyprus, Malta and the UK. Based on the same analogy, the African Continental Free Trade Area (AfCFTA) agreement was likely to benefit African countries. However, multilateral preferential schemes allowed to the least developed countries (LDCs) did not appear to have the same effect for Commonwealth LDCs.

- Large economies, such as India, Australia and New Zealand, showed limited evidence of forward linkages with the Commonwealth and did not rely on the Commonwealth member countries for inputs. Open economies, such as Singapore, tended to import value-added inputs from the G-20 countries. Smaller Commonwealth countries were relatively more reliant on other Commonwealth members for inputs for domestic industries. Some showed a high level of reliance on domestic inputs and were more inward -oriented.
- The UK enjoyed a central position in the GVC network, given its economic size and its participation in primary and secondary sector trade with the Commonwealth community.
  o For the primary sector, the Caribbean and African countries were on the periphery of the GVC network, given these are raw materials suppliers and provide inputs to other countries for activities at the beginning of the GVC. The tertiary sector, where some Caribbean countries have comparative advantages, was not analysed in detail due to the weakness of bilateral trade in services statistics for most countries.
  o For inter-industry trade in manufactured inputs produced by the secondary sector, large economies acted as hubs for Commonwealth trade in intermediate products. But this role remained limited and developed Commonwealth countries, such as the UK and Canada, sourced less than 7 per cent of their manufacturing inputs from other members.

- In terms of industrial linkages, Textiles, Transport Equipment and Chemicals were important for the Commonwealth countries, in particular for the UK, Canada and India. The developed Commonwealth countries dominated the Automotive and Metals sectors. Developing countries were, in general, dominant in the upstream basic commodity parts and in the light-industry downstream parts of the GVC, implying that upgrading to more advanced GVCs was required to support Commonwealth countries' integration into GVCs.

The report proposes a set of measures to facilitate the participation of Commonwealth countries in GVCs. It is important to provide an enabling business environment to support the countries to reap the benefits of participating in GVCs. In addition, targeted measures are required to support developing countries and LDCs to upgrade their position in the value chain. This will enable some of the Commonwealth countries to harness the GVC potential and will lead to the effective participation of those countries that are integrated at the lower end of the value chain.

Specific suggestions to enhance Commonwealth countries' participation in GVCs include: first, developing the sectoral competitiveness of the less developed and less competitive Commonwealth countries; second, initiating proactive government policies to upgrade and develop competitive domestic value chains, which requires targeted sectoral policies to maximise the absorption potential of the domestic economy and strengthen linkages between countries; and third, ensuring good governance to ensure that countries have higher institutional quality complemented by preferential liberalisation, and improving global and regional trade governance through the relevant multilateral and regional forums.

1. Introduction

More than two-thirds of world trade occurs within global value chains (GVCs). GVCs involve production where the output of one firm in a country is used by another firm in another country to produce a more complex product which, in turn, may be used by another firm for further processing (World Bank et al. 2019) before being consumed as final products. The growing interdependence and integration of national economies has led GVCs to be internationally fragmented; this has changed the organisation of production and placed the specialisation of countries within GVCs at the centre stage of industrialisation strategies (Antràs and Gortari 2018).

The 54 Commonwealth members enjoy a significant (19%) trade advantage (i.e. 'Commonwealth Advantage') without any formal collaboration.[1] The share of Commonwealth countries' goods and services exports was 14.9 per cent of total world trade in 2016, and intra-Commonwealth trade as a proportion of global trade has been estimated at 20 per cent of Commonwealth countries' total trade with the world (Commonwealth Secretariat 2018). The export growth has, however, not been uniform in all countries and some Asian Commonwealth members export more than the others. For instance, the Commonwealth Trade Review (ibid.) reports that Bangladesh, Brunei Darussalam, India, Malaysia, Pakistan, Singapore and Sri Lanka accounted for 41.1 per cent of the combined total Commonwealth exports of goods and services in 2016.

From a developmental perspective, the surge in developing countries' participation in international trade, and in particular in GVCs, has changed the understanding of how countries trade. The concept of the country of origin or destination does not fully apply anymore within GVCs, since significant shares of the value traded may come from countries other than the country of origin ascribed by customs records (Escaith 2014). As Dollar (2019) says, 'net imports are no longer a proper measure of the impact of an international trade shock on the domestic economy in the age of GVCs'.

Despite the growing participation of Commonwealth member countries in trade and burgeoning research on GVCs, the measurement of value of domestic versus imported content embodied and the backward and forward linkages between and across the 54 Commonwealth countries is incomplete. Mapping Commonwealth countries' GVCs, i.e. identifying where value-added is created, how much and by whom, is a challenge given most trade consists of parts and components, with semi-finished products going back and forth along the production chain between countries' international transactions.

The Commonwealth Secretariat commissioned a paper entitled 'Harnessing the Commonwealth Advantage in Global Value Chains' which recognises the growing discussion on global and regional value chains and trade in primary and intermediate inputs, i.e. 'who produces for whom' within the Commonwealth context. The broad objectives of the commissioned paper were to:

1. Identify trade connectedness and examine the economic interdependency among the Commonwealth countries.
2. Provide insights into GVC linkages by examining GVC indicators:
    a. 'who produces for whom', i.e. estimate domestic and foreign value-added content of gross exports by exporting industry;
    b. the participation of countries in value chains, either via intermediate imports embodied in exports (backward linkages) or in partners' exports, and the final demand (forward linkages);
    c. length of value chain and the backward and forward linkages by industry; and
    d. level of Commonwealth integration with the Rest of the World (ROW), in particular with large developed and emerging countries.
3. Present policy recommendations on what steps countries must undertake to upgrade and foster insertion in GVCs.

This report analyses Commonwealth value chains from a network perspective. The analysis examined international flows of trade in value-added and countries' position within GVCs to highlight the level of interconnectedness

between the Commonwealth members and how countries' export competitiveness is dependent on the sourcing of inputs and on access to final producers and consumers in third countries. The information is organised as follows.

Section 2 reviews the definition and related literature on the growing importance of GVCs in international trade. This section provides a framework within which to contextualise GVCs and examines relevant literature on GVCs.

Section 3 provides a brief description of the data and methodology employed for empirical analysis, as well as examining the GVC linkages between Commonwealth countries. The data for analysis were based on the Commonwealth countries' input–output (IO) tables, which were drawn from Eora data reported for 2015, and the UNCTAD-Eora simulation ('nowcasting'), based on the IMF World Economic Outlook for 2016–18. The analysis part presents an overview of the evolution of Commonwealth countries in GVC trade and maps the dynamics of trade linkages between countries. This

discusses GVC indicators, i.e. backward and forward linkages, and length of GVC by country and sector. Using network analysis, we comment on the Commonwealth countries' GVC participation, and set the scene for a discussion on the policy recommendations.

Section 4 discusses the importance of measuring inter-Commonwealth GVC trade transiting through a non-Commonwealth country at any stage in the value chain. This estimates trade in value-added in both the primary and secondary sectors for products transiting between the Commonwealth and non-Commonwealth countries.

Section 5 outlines policy recommendations and suggests how policies could be refined to enhance GVC participation and support Commonwealth countries' efforts to benefit from GVC linkages.

The technical annex provides an insight into the methodology and explains the computation of GVC indicators, backward and forward linkages, and the length of the value chain.

2. Supply chains: Definition, literature and conceptual underpinnings

Gereffi and Fernandez-Stark (2010) define a value chain as the 'full range of activities that firms and workers do to bring a product from its conception to its end use and beyond'. The concept of GVC was introduced in early 2000 following increasing fragmentation of production across countries and the specialisation of countries in 'tasks' and business functions rather than 'specific products' (Gereffi 1994).

Recent literature debates the evolution of supply chains, and the impact on production of trade links between countries leading to an increasingly dense international trade network of intermediate inputs that include parts and components, natural resources and business services (Gereffi et al. 2005; UNCTAD 2013; OECD 2012; Neilson et al. 2014; Coe and Yeung 2015; WTO 2017). Studies find evidence that the current GVC network is both global and regional, and the latter comprises three regional blocs commonly called Factory Asia, Factory North America and Factory Europe (Baldwin and Lopez-Gonzalez 2013).

The existing GVC literature is categorised into three strands; the first two are based on theoretical issues around supply chains, and the third is mainly empirical. The first strand views that supply chains are a sign of increased efficiency in the globalised system of production. This presents the argument of comparative advantage, given growth of trade in intermediate inputs (Grossman and Rossi-Hansberg 2008; Baldwin 2012; Ali and Durash 2011). Blanchard et al. (2016) find that countries integrated in GVCs have lower tariff protection.

Looking at firms and market power, the second strand acknowledges the growing importance of networked multinational firms in global trade (Keane 2014). Studies show that lead firms (from China and India, in particular) have monopolistic market and command negotiation power over third-tier suppliers from developing countries (Bigsten et al. 2000; Gereffi et al. 2005; Nolan and Zhang 2010; Milberg and Winkler 2013; Nielson 2014; Nadvi and Horner 2018).

The third strand of literature empirically disentangles the domestic and foreign content of countries' trade. Koopman et al. (2014) and Wang et al. (2013) developed methodologies to break down gross trade flows to origin of value-added in Trade in Value-Added (TiVA) analysis. Escaith (2014) relates GVC decomposition with network analysis. Recent works by Ignatenko et al. (2019) and Ahmad (2019) use the GVC lens to examine the complex network structure of flows of goods, services, capital and technology across national borders. Increasingly, GVC analysis highlights the complexity of interactions between global producers and emphasises the concept of 'network' rather than the 'chain' (Coe and Hess 2007). As Hudson (2004) mentions, 'economic processes must be conceptualised in terms of a complex circuitry with a multiplicity of linkages and feedback loops rather than just "simple" circuits or, even worse, linear flows'.

Recent work drawing on the network perspective examines the total world input–output network as a directed and weighted network of country–sector pairs, and computes several local and global network metrics over a period of time (Cerina et al. 2015). Zhu et al. (2015) use this technique. They produce a 'topological view of industry-level GVCs' as global value trees for a large set of country–sector pairs and compute a measure of industry importance based on them. Ferrarini (2013) and Amador and Cabral (2016) use international trade data on products, classified as parts and components to quantify vertical trade among countries and map the resulting global network.

Ukkusuri et al. (2016) employ the computable general equilibrium (CGE) model to examine the GVC network structure of intra-Commonwealth trade. The results report the presence of regional clusters influenced by India and South Africa (as Commonwealth countries) and the ability of regional agreements (such as the EU and NAFTA) to influence the strength and distribution of intra-Commonwealth trade. Johnson and Noguera (2012) analyse supply chains' regionalisation and find that geographical distance impacts value-added trade flows across countries. Nadvi and Horner (2018) explore the changing geography of global trade and, in highlighting the emergence of more polycentric trade, present evidence of the growing role of Southern actors and Southern end markets.

Escaith and Inomata (2013) focus on trade in East Asia. They use IO data to measure value-added to examine the contribution of production networks to industrial development and highlight the centrality of policy in shaping industrial development. The work highlights the role of policy in fostering regional integration and shows how reductions in variance among tariffs dilute a bias against exports that typically accompanies inwardly focused industrialisation strategies based on domestic markets.

The increasing international fragmentation of production, together with large shares of intermediate goods in total trade and intensified reliance on services in production and trade – all prominent features of GVC-based production – can be explained by traditional theory, but one needs to get a complete picture for effective policy-making. In the Ricardian and Heckscher-Ohlin models (the workhorses of international trade), comparative advantage is assumed to be 'natural' and to come from the unequal distribution of primary production factors such as land, labour and capital. In GVCs, the lead firm (the firm which is the main driver of the upstream supply chain and the downstream sales to the final users) looks for creating value by selecting, domestically or internationally, the best suppliers of the required tasks – research and development, design, production, business services, logistics and distribution. In this process, comparative advantages from the lead firm perspective are 'created' instead of 'natural', because they may not correspond to the factor endowment of the lead-firm country. As a result, it is impossible to ignore the close nexus between trade and investment in supply chain production, or the fact that products are frequently unbundled into a series of single offerings (also referred to as 'tasks').

Studies examined countries' trade specialisation and revealed comparative advantage by identifying low and high specialisation patterns. For example, Hidalgo et al. (2007) and Hausmann and Klinger (2007) argue that countries' export specialisation reflects their existing domestic capabilities and determines the development perspective. However, this pessimistic view does not account for the dynamic characteristics of GVC trade. The increasing fragmentation of production across countries that accompanies the emergence of

GVCs blurs the causal relationship between (gross) export and the domestic economic structure (Bontadini 2019; Koopman et al. 2010; Baldwin 2012).

Early efforts to explain and measure production fragmentation include work by Feenstra (1998) and Hummels et al. (1998) that focus on factor content and/or vertical specialisation measures. Koopman et al. (2014), Wang et al. (2013) and Johnson and Noguera (2012) propose methodologies to examine gross trade flows by the origin of value-added. These focus on the value-added content in trade to explain and measure the links between standard trade data (measured in gross terms) and trade measured in value-added terms.

Empirical studies capture the upstream effects by adopting a macro approach based on inter-country or world input-output (IO) tables (see OECD-WTO-UNCTAD 2013 for details). In fact, the use of IO tables to devise alternative measures to document how various countries and sectors participate in GVCs has become standard practice (see Hummels et al. 2001; Daudin et al. 2006, 2009; Johnson and Noguera 2012; Koopman et al. 2010).

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3. Estimating 'trade in value-added' for the Commonwealth countries

The 2013 meeting of the Commonwealth Heads of Government identified intra-Commonwealth trade (and investment) as an area for potential growth. Several studies examine the 'Commonwealth Effect' (Bennet et al. 2010; Shingal and Razzaque 2015; Khorana and Martinez-Zarsoso 2018, 2020) and find evidence of intra-Commonwealth trade in goods. Ukkusuri et al. (2016) examine the insertion of Commonwealth countries in the GVC network and report that clusters are distributed across different countries, which allows trade growth in those regions and offers the potential for inter-regional partnerships.

3.1 Data

Several databases, such as OECD Trade in Value-Added (TiVA) and World Input–Output Database (WIOD), provided the data required to assess trade in value-added. This project drew on the Eora Multi-Regional Input–Output (MRIO) table (see Lenzen et al. 2013) for a review of Eora construction and creates a Commonwealth member-specific database of countries for which data are available.[2] Note that data on the following Commonwealth countries were absent from the Eora database: Dominica; Grenada; Kiribati; Nauru; Saint Lucia; Solomon Islands; Saint Kitts and Nevis; Saint Vincent and The Grenadines; Tonga; and Tuvalu. Hence these were not included. Several of these missing countries are classified as least developed countries (LDCs) for which no IO data is available in any official domain.[3]

This report analysed GVC indicators for the 43 Commonwealth countries for which data were available. The indicators examine trade within and across the Commonwealth members, as well as trade patterns with the main G-20 trade partners; 'other countries' were aggregated into the Rest of the World (ROW) region. See the list of countries in Annex Table I. The analysis is reported for 2015, which was the data included in Eora, and for 2016–18 with the UNCTAD-Eora simulation ('nowcasting').[4]

The UNCTAD-Eora database has a broad geographic coverage, but it suffers from several limitations. First, IO data at the national level for many countries are not accurate. Second, the database relies on aggregated IO data and the sectoral disaggregation of GVC flows is coarse, so a lot of GVC activity occurring within the broadly defined sectors goes missing. Third, most national statistics in developing countries focus on bilateral trade flows in merchandise only, so most data on the services sectors are rough estimates. Finally, researchers impose strong assumptions in constructing the IO tables to estimate bilateral intermediate input trade flows, given that these cannot be readily read from either customs data or national IO tables.[5] For example, an assumption used in creating import matrices is the 'proportionality' assumption, which assumes that the share of imports in any product consumed directly

as intermediate consumption or final demand (except exports) is the same for all users.

The database for this analysis included 43 Commonwealth, 14 non-Commonwealth G-20 members and Rest of the World, and 26 sectors (see Annex 2); it was disaggregated as a 1508 by 1508 matrix of inter-industrial linkages. For reporting, the 26 sectors have been aggregated as follows:

- primary sectors (Agriculture, Fisheries and Mining);
- secondary sectors (Manufacture);
- tertiary sectors (Commercial and Administrative Services); and
- 'other sectors' (e.g. recycling, household services, re-exports and re-imports), but the quality of data was particularly weak, so this has been excluded from analysis.

3.2 Methodology

Several production activities are carried out across different countries within GVCs, with semi-finished products going back and forth along the production chain between countries. Every time a product crosses national borders, international transactions are recorded at the full or gross value of the product, and this leads to multiple counting.

At the end of the supply chain, the parts are assembled for final use and then either absorbed domestically as consumption and/or investment goods, or exported as final goods. In this latter case, the concept of country of origin or country of destination does not fully apply – if the national origin of the value-added incorporated in the final product is examined, one realises that significant shares of the value may come from countries other than the country of origin as ascribed by customs records (Escaith 2014).

Network analysis provides an insightful analysis of GVCs and examines international flows of value-added and countries' position within GVCs by examining the input–output (IO) relationship between any two countries, taking into account the effect on all other countries. The flows of value-added in a GVC tend to occur in a sequential way, with firms incorporating foreign value-added as they embody intermediate goods in production subsequently exported for final consumption or integrated into other products or services.

The empirical analysis focused on the computation of GVC indicators that break down gross trade flows by source and destination of value-added using global IO matrices.

The GVC participation index is expressed as a percentage of gross exports and indicates the share of foreign inputs in exports of a country and domestically produced inputs used in a third countries' exports. Annex I presents the technical details and elaborates how to estimate trade in value-added, i.e. how to compute direct and total requirements, components of domestic and foreign value-added, and the length of the GVC.

Domestic value-added (DVA) is decomposed into exports absorbed in the destination country and those that are used as intermediate inputs for export to third countries (forward linkages) or returned home. Based on this decomposition, the two measures of GVC participation used in this report were: backward linkage, being the share of foreign value-added in total exports of a country, and forward linkage, being the domestic value-added embodied in intermediate exports that are re-exported to third countries, expressed as a ratio of gross exports.[6]

The foreign value-added content of exports (FVAiX) measures the use of imported inputs to produce goods that are exported (see Koopman et al. 2014). This IO-based measure of GVC focuses on the (direct and indirect) import content of exports by capturing cases where the production is carried out in at least two countries and the products cross the international borders at least twice.

The length of GVC indicates the number of stages involved in a value chain. The average propagation length (APL) examines how much domestic and foreign value-added is embodied in a country's exports. This measures the relative distance from the most upstream (primary commodities) to the downstream (final goods) part of the value chain (see Inomata 2008). A country can be upstream or downstream, depending on its specialisation. In other words, the longer the length of GVC, the more stages are involved in production, rather than longer distance suggesting a country's position in the GVC stream, i.e. relatively upstream.

3.3 Trade in value-added: evolution and linkages

Importing for exports is a key feature of GVC trade. This is particularly true in the case of manufactures. In other words, the higher is the share of the manufacturing sector in a country's

gross domestic product (GDP), the lower the share of DVA in its exports. Another important structural factor is the market size. Countries with larger markets are expected to have a higher share of DVA in exports, since they rely on a wider array of domestic intermediates, both in terms of purchases and sales (OECD 2015). Time is another factor: the rise of GVC trade, sometimes called 'hyperglobalisation', took place between 1995 and 2005 (Escaith and Miroudot 2015). The process slowed down during the 2008–09 global crisis, with post-2008 showing some stagnation and even a shortening of the value chain, albeit there is a debate on the source and extent of this trend. The IDE-JETRO report (2017) finds that complex GVCs have continued to expand, and recent research by Gaulier, Sztulman and Ünal (2019) confirms that the process is ongoing.

Figure 1 examines domestic and foreign value-added embodied in Commonwealth countries' exports. The DVA estimated for 2018 shows 87 per cent for Belize and 66 per cent for Ghana. An examination of the Commonwealth countries shows that the countries do not vary

from the non-Commonwealth G-20 countries, though the group average shows less reliance on foreign value-added (20.5% versus 21.8%).

Figure 2 presents the evolution of DVA and foreign value-added (FVA) for Commonwealth countries. The analysis showed high use of domestic inputs and when the participation was examined from an international perspective, it became clear that there was a higher level of sourcing inputs by Commonwealth countries from non-Commonwealth G-20 countries and ROW.

The next section examines the evolution of Commonwealth countries' trade in value-added from 1995 to 2018. This considers the use of FVAiX on the one hand and the exports of DVA to other trading partners for further reprocessing and exports on the other.

3.3.1 GVC Participation Index: 1995–2018

The index, based on UNCTAD-Eora data, was calculated for the entire economy, and included the primary, secondary and tertiary sectors.

Figure 3 presents the GVC participation index for the top-20 Commonwealth countries

Figure 1. Commonwealth countries: domestic and foreign origin of value-added in exports, 2018
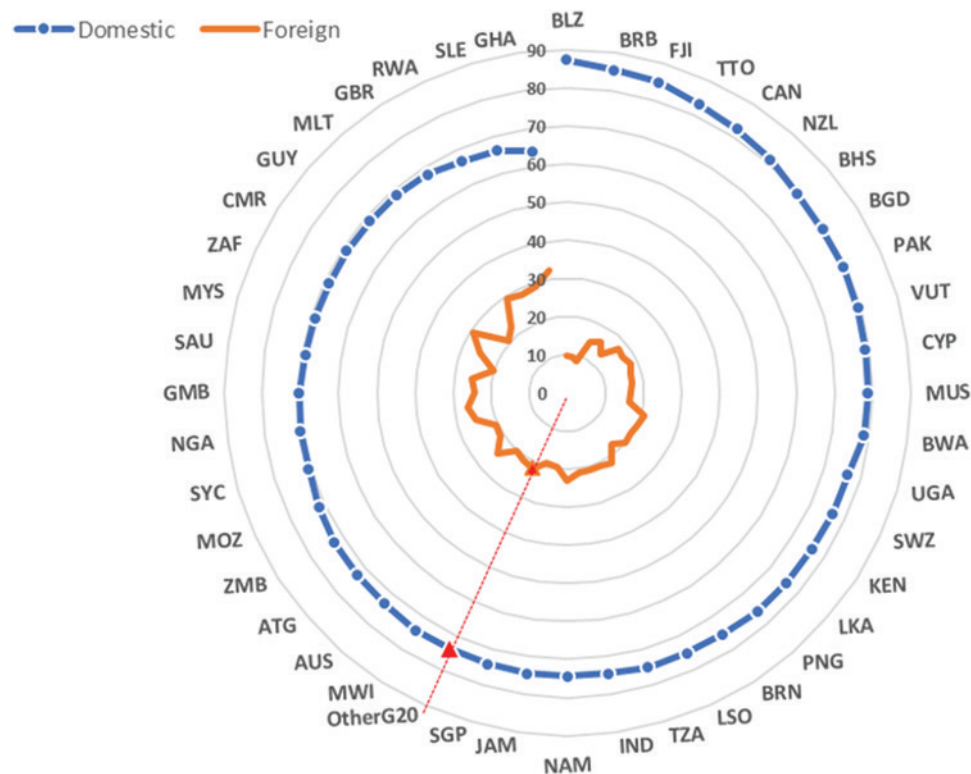
Note: See Annex 1 for a correspondence between country names and ISO codes. Other G20: simple average of non-Commonwealth G20 members.
Source: Authors' calculations based on UNCTAD-Eora

Figure 2. Evolution of domestic and foreign value-added embodied in exports, 1995-2018
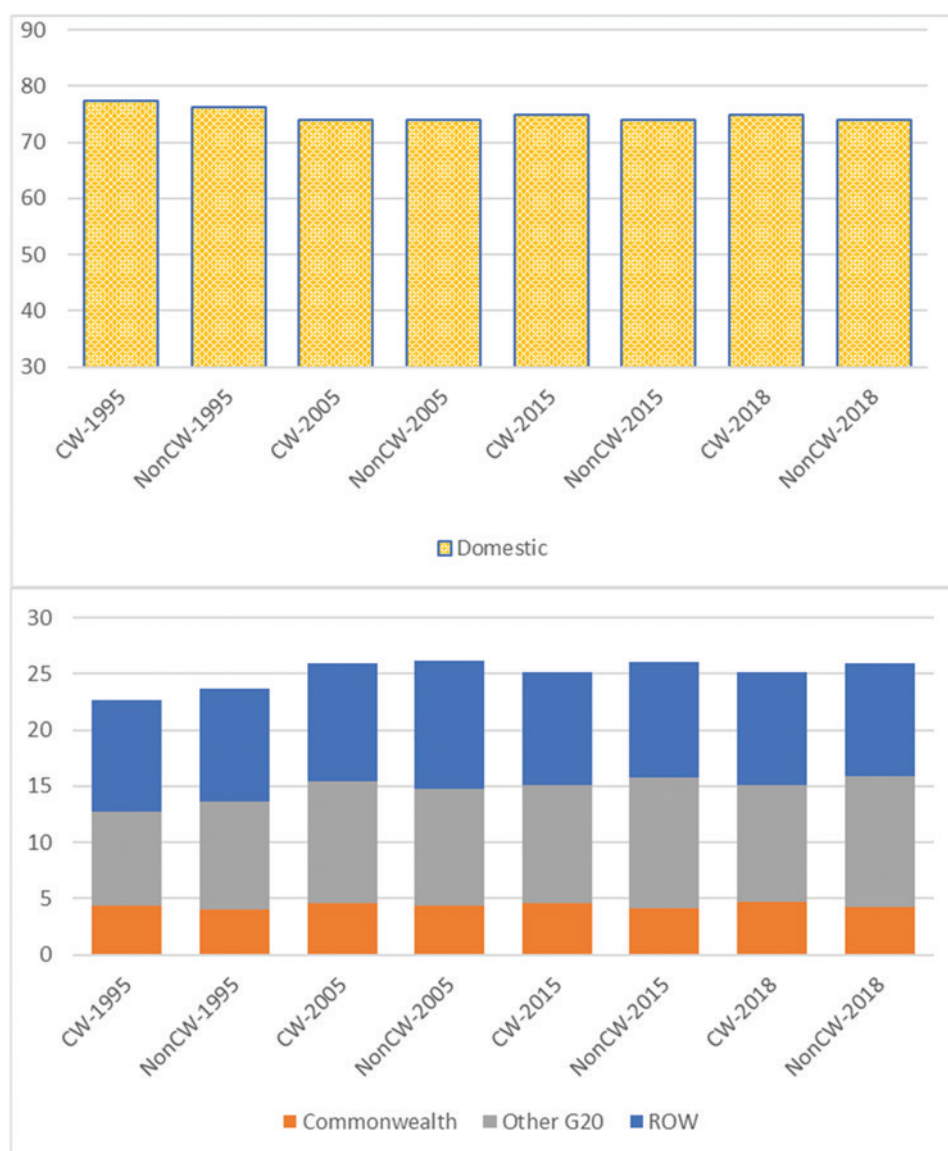
Source: Authors' calculations based on UNCTAD-Eora
Notes: Simple average for countries; 1995, 2005 and 2015 are actuals but 2018 are estimates.
NonCW: G-20 countries that are not in the Commonwealth.
ROW: Rest of the World (all non-Commonwealth trade partners).

in 2015, which was the last year for which detailed data were available in Eora. The index is traditionally measured as the foreign value-added embodied in production plus the domestic value-added used by other industries in foreign countries to produce goods.[7]

An examination of countries' participation in GVCs, in terms of domestic and foreign value-added content of gross exports by the exporting country, showed that open economies, such as Singapore, Cyprus and Malaysia, present evidence of high backward participation. The UK, Malta and South Africa showed high forward

linkage. The UK is a large exporter of business and financial services that are used as intermediate inputs in GVCs. South Africa exhibited a high value of forward linkage, reflecting the fact that South African exports are used as inputs by other countries.

Figure 4 disaggregates the long-term evolution of Commonwealth member countries' GVC participation. An important finding was that the majority of Commonwealth countries increased their reliance on inputs from other Commonwealth countries during 1995–2018. The median value, for all Commonwealth

Figure 3. GVC participation index: top-20 Commonwealth countries, 2015 (as % of exports)
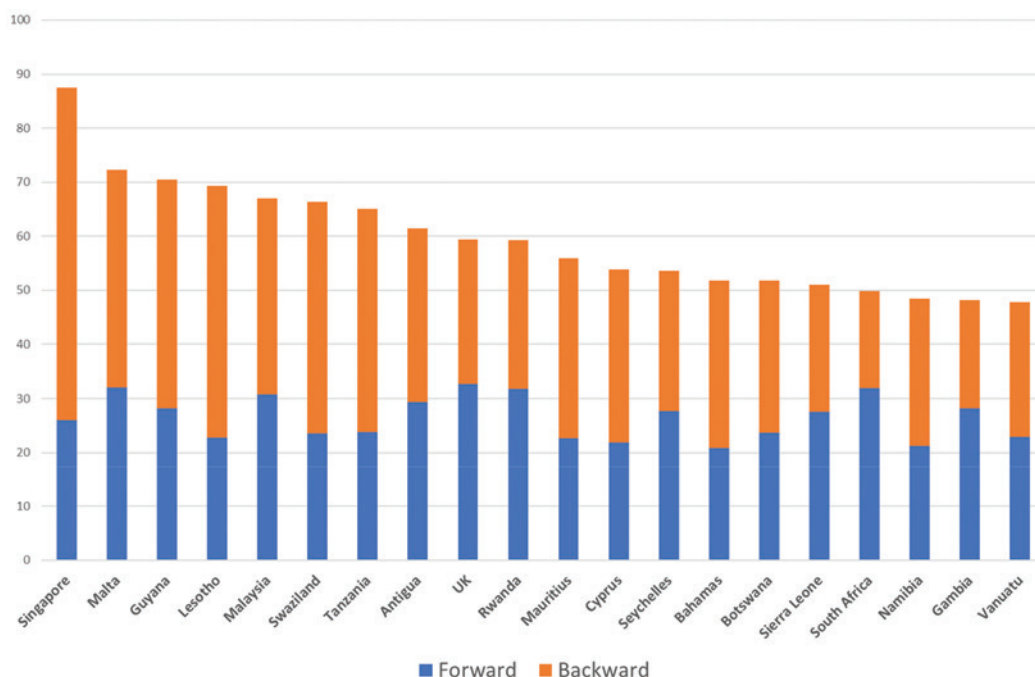
Source: Authors' calculations based on Eora

countries, increased by more than 1 percentage point, from 4.4 per cent to 5.7 per cent. The average, however, increased by half a percentage point, from 6.4 per cent to 6.9 per cent.

The Asian, Pacific and European regions presented evidence of growing participation in GVCs. Asia stood out, with the highest growth in GVC integration between Commonwealth members. This, however, did not apply to Africa and the Caribbean regions, which did not present evidence of much change in the level of

GVC integration. Africa exhibited a high level of insertion into GVCs, while the Caribbean countries were at the lowest end of the GVC spectrum.

3.3.2 Backward and forward linkages: 1995–2018

The two measures of intra-Commonwealth GVC participation are defined as: backward linkages – the share of foreign value-added in total exports of a country; forward linkages – the

Figure 4. Participation index of Commonwealth countries in GVCs, 1995–2018 (% of exports, sum of forward and backward linkages)
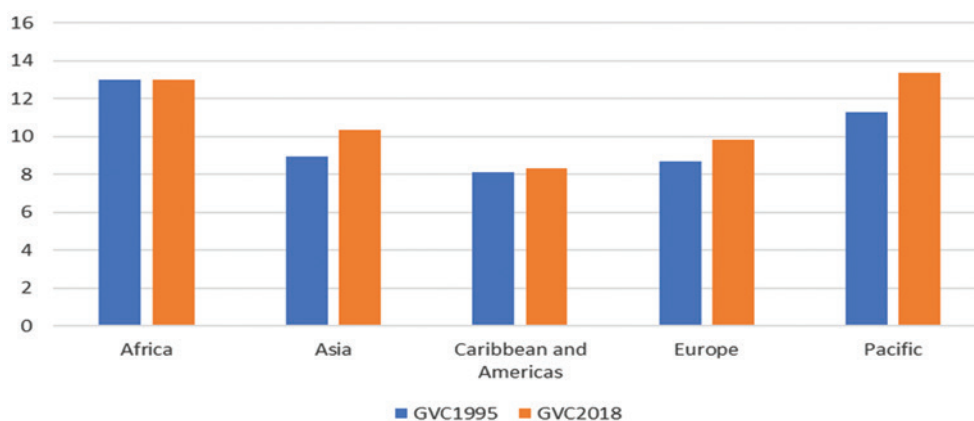
Note: Regional indicators based on a simple average of individual countries' indices.
Source: Authors' calculations based on UNCTAD-Eora

domestic value-added embodied in intermediate exports that are further re-exported to third countries, expressed as a ratio of gross exports.

Figure 5 disaggregates the linkages by backward (imports of inputs) and forward (export of intermediate goods) linkages. This reveals that the Asian and Pacific countries increased their reliance on imported inputs (i.e. backward linkage) by 22 per cent and 16 per cent, respectively, and that exports of intermediate goods (i.e. forward linkage) increased by 10 per cent and 22 per cent, respectively, between 1995 and 2018.

While most developed and developing countries engage in both types of GVC activity, countries with relatively strong backward linkages (buying) tend to have weaker forward linkages (selling), and vice versa. For example, a country that primarily assembles products into final goods and then exports them will tend to have a high backward, but a low forward, measure of participation. Conversely, a country that primarily supplies intermediate goods to an assembler will typically show a highly developed forward participation, but a low backward participation measure. The countries in Europe that belong to the Commonwealth – UK, Malta and Cyprus – were highly integrated in GVCs due to them being a part of the EU single market. It appeared that their membership and deep integration agreement in the EU market leveraged the positive impact of Commonwealth membership with the UK. This explains why Malta and Cyprus registered a higher forward linkage increase (20%) than backward linkage (5%).

The Caribbean and Americas presented a mixed picture – increasing backward linkage (22%) but falling forward linkage (12%). Countries in Africa exhibited a relatively constant participation in both the forward and backward linkage (1% increase in backward and 2% drop in forward linkage). When the whole economy was considered, Africa showed a high incidence of backward linkages, despite its comparative advantages in forward-type exports of commodities. The backward index, calculated as a simple average of countries' indices, was particularly affected by the high values found for Botswana and Namibia (over 23 in 1995 and about 20 in 2018) and for Mauritius (11 and 12 respectively). In fact, the Africa region was the most heterogeneous with regards to the backward linkage indicator, with a standard deviation of the backward index almost as high as the mean value (8.0 against 8.9 in 1995). For comparison, the standard deviation was 3.1 in Asia, 2.2 in the Pacific and only 0.5 in Europe.

When it comes to sourcing domestic and imported inputs, all the Commonwealth countries presented different patterns, even when they were located in the same geographical regions. To examine the evolution of Commonwealth countries' GVCs, we applied the exploratory data analysis to a set of GVC variables.[8] The results obtained with agglomerative hierarchical clustering (AHC)[9] presented similarities and dissimilarities between countries in terms of the evolution of trade connections from 1995 to 2018 and depth of GVC integration in 2015.

Figure 5. Backward (imports of inputs) and forward (exports of inputs) linkages with other Commonwealth countries, 1995–2018 (% of exports)
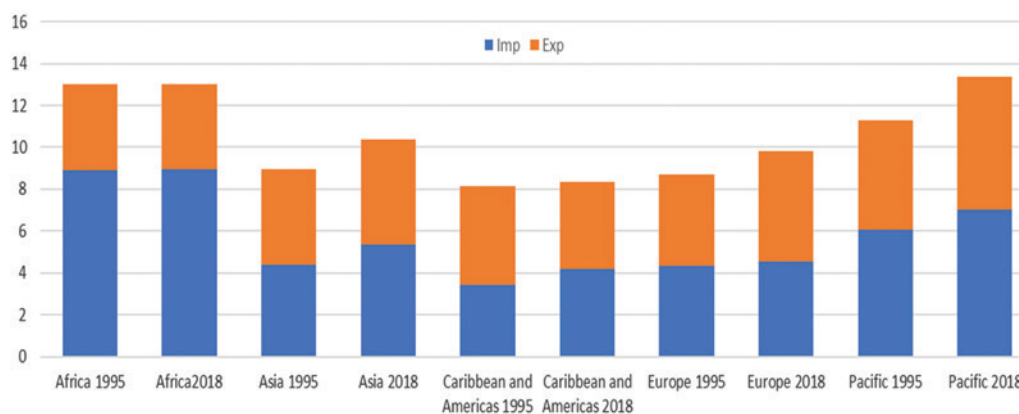
Note: Regional groupings include both developing and developed Commonwealth countries. Regional indicators are based on a simple average of individual countries' indices. GVC indices include both intra- and extra-Commonwealth linkages.
Source: Authors' calculations based on UNCTAD-Eora

3.3.2.1 Similarities in backward linkages

Table 1 provides an overview of the level of Commonwealth countries' backward linkage in the GVCs.

Some interesting observations emerged:

- Large economies did not rely on the Commonwealth member countries for their inputs. In countries such as Australia, India, Kenya and New Zealand, a high domestic value-added in exports was strikingly evident. An explanation is the domestic market size of these countries. This provides a large pool of local input suppliers, which lowers their backward GVC participation but increases forward GVC participation.

- Open economies imported value-added inputs from other G-20 countries, and the reliance of countries such as Singapore and the UK on the Commonwealth countries was lower (4.2%) than the group average.

Table 1. Country clusters based on the evolution of the origin of value-added in production, 1995–2018

Class	1	2	3	4	5	6	7	8
Within-class variance	215.6	71.9	246.3	406.2	231.0	742.9	0.0	0.0
DVA_2015	71.1	87.8	78.7	68.7	58.3	63.0	57.2	87.2
CWS_2015	5.5	3.6	15.6	8.3	13.1	7.7	33.8	8.0
G20_2015	17.8	5.7	3.2	13.4	18.5	13.0	5.1	2.4
d_DVA_95_18	6.4	0.3	5.7	0.2	−25.3	−8.3	4.5	6.6
d_CWS_95_18	0.0	0.5	−4.2	1.5	8.9	1.7	−4.8	−4.3
d_G20_95_18	−5.3	−0.5	−0.7	−2.0	10.1	3.2	−0.1	−1.0
Countries	Antigua	Australia	Botswana	Cyprus	Guyana	Lesotho	Swaziland	Zambia
	The Bahamas	Bangladesh	Mozambique	Fiji	Tanzania	Rwanda		
	Barbados	Brunei	Namibia	Gambia				
	Belize	Cameroon		Malta				
	Canada	Ghana		Seychelles				
	Jamaica	India		Sierra Leone				
	Malaysia	Kenya		Singapore				
	Mauritius	Malawi		Vanuatu				
	Samoa	New Zealand						
		Nigeria						
		Pakistan						
		Papua New Guinea						
		Saudi Arabia						
		South Africa						
		Sri Lanka						
		Trinidad & Tobago						
		Uganda						
		UK						

Notes: Based on agglomerative hierarchical clustering (AHC).
DVA_2015: share of domestic value-added in exports in 2015; CWS_2015: share of value-added imported from other Commonwealth countries; G-20_2015: share of value-added imported from non-Commonwealth G-20 countries. Imports from the Rest of the World are calculated from 100 per cent.
Source: Authors' elaboration, based on UNCTAD-Eora data
See E:\EORA\Eora-UNCTAD\VAXpctIMP_1995-2018.xlsx

- Small economies provided evidence of more inward orientation. Countries such as Guyana, Tanzania, Mozambique and Swaziland relied on imported inputs from the Commonwealth countries, with value of inputs ranging from 13 per cent to 16 per cent.

3.3.2.2 Similarities in forward linkages

Forward linkages show the destination of DVA embodied in intermediate inputs used by other countries to produce exports. These are measured as the DVA embodied in intermediate exports further re-exported to third countries, expressed as a ratio of gross exports.

From a GVC perspective, the reliance of Commonwealth countries on domestic inputs increased between 1995 and 2018 (Table 2). Findings worth highlighting were as below:

- Commonwealth countries, such as Canada, UK, Malaysia and South Africa, were more upstream in GVCs, with higher forward linkages. These countries sent intermediate inputs to the G-20 countries; this was 14 per cent more in 2015 compared to 1995,

Table 2. Country clusters based on the destination of domestic value-added for intermediate use, 1995–2018

Class	1	2	3	4	5	6	7	8
Within-class variance	57.0	38.7	151.3	76.8	48.0	0.0	0.0	0.0
DVA_2015	71.2	76.6	81.5	77.4	75.0	68.2	77.1	72.0
CWS_2015	4.9	5.3	5.0	2.4	3.6	4.5	3.8	6.6
G20_2015	14.5	8.5	4.1	14.9	8.4	10.4	7.1	13.3
d_DVA_95_18	−5.9	−2.8	3.4	−5.2	2.1	−0.5	−0.7	1.2
d_CWS_95_18	0.7	0.4	−0.3	0.7	−1.0	−1.5	1.4	0.3
d_G20_95_18	4.4	1.6	−0.2	3.7	0.4	2.8	−1.3	0.0
Countries	Antigua	Australia	Barbados	Canada	The Gambia	Rwanda	Vanuatu	Zambia
	The Bahamas	Bangladesh	Botswana	Nigeria	Ghana			
	Brunei	Belize		Trinidad & Tobago	Jamaica			
	Cameroon	Cyprus			Lesotho			
	Malaysia	Fiji			Namibia			
	Malta	Guyana			Sierra Leone			
	Pakistan	India			Swaziland			
	Papua New Guinea	Kenya			Uganda			
	Saudi Arabia	Malawi						
	South Africa	Mauritius						
	UK	Mozambique						
		New Zealand						
		Samoa						
		Seychelles						
		Singapore						
		Sri Lanka						
		Tanzania						

Notes: Domestic_2015: share of domestic value-added sold locally and embodied in exports in 2015; CWS_2015: share of value-added exported to other Commonwealth countries for re-exports;

G-20 exports: G-20_2015: share of value-added imported from non-Commonwealth G-20 countries.

Imports from the Rest of the World add up to 100 per cent.

Source: Authors' elaboration, based on UNCTAD-Eora data

representing an increase of 4 percentage points over the period.

- Countries in Asia and the Pacific, such as Bangladesh, India, Sri Lanka, Mauritius, Australia and New Zealand, relied more on domestic value-added and exports from the Commonwealth members. These countries presented limited evidence of forward linkages with the Commonwealth and G-20 countries.
- Ghana, Jamaica, Namibia and Swaziland were inward-looking and inwardly oriented countries in terms of their reliance on Commonwealth and G-20 exports.

Figure 6 presents GVC linkages for the Commonwealth countries, constructed as the sum of backward and forward linkages for 1995–2018.

Most countries in the top right quadrant (high and increasing) of Figure 6 are small and open countries, unlike the larger Commonwealth

countries that have a stagnant rate of GVC integration with other Commonwealth partners. Botswana, Mozambique and Zambia substituted part of their imports from the Commonwealth for domestic inputs, unlike Jamaica, which had low and declining GVC participation; Swaziland on the other hand, was characterised by declining linkages.

3.4 A closer look at the intra-industry trade networks: 2015

We used the tools of Social Network Analysis to visualise the strength of bilateral inter-industrial linkages, of primary and intermediate inputs, for the Commonwealth countries in relation to non-Commonwealth countries. The analysis was for 2015; this was the latest detailed data available in Eora.

In the network analysis, each country is represented by a node with arrows pointing from supplier to receiver of inputs used by the using industry to produce exports. The

Figure 6. GVC linkages within the Commonwealth community, 1995–2018
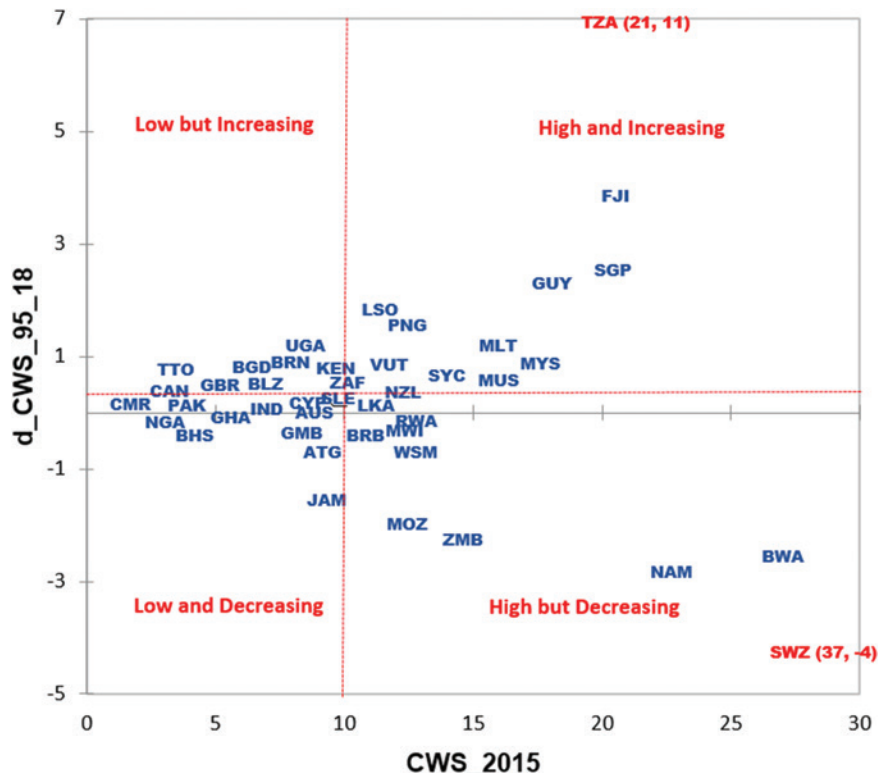
Note: CWS_2015: sum of the backward and forward linkages with the Commonwealth countries, in percentage of respective imports and exports of intermediate products; d_CWS_95_18: weighted sum of respective variations of imports and exports between 1995 and 2018.
Dotted lines indicate the median value for both concepts. Countries are identified by ISO3 code, see Annex I for the table of correspondence.
Source: Authors' elaboration, based on UNCTAD-Eora data
See: E:\EORA\Eora-UNCTAD\GVC VAXpctIMPandExp_1995-2018.xlsx

methodology used to draw the network analysis – the Fruchterman-Reingold (1991) algorithm – places the most important nodes (i.e. countries) in the centre. The size of an economy interacts with its level of integration in the GVCs to establish its importance within the network. In this analysis, a force-directed layout algorithm is typically used to determine the location of the nodes in the network visualisation. The position of the nodes takes into consideration the relative importance of countries in the network. The size of each node is proportional to its total degree (sum of indegree and outdegree) and the colour of the node is mapped to its indegree, with darker shades indicating higher values.

The larger countries are generally located in the centre of the network, primarily due to the fact that they are important suppliers of intermediate goods. Smaller economies are mainly on the periphery of the network, suggesting that these economies are placed in intermediate stages of the GVC and act as intermediaries, either at the beginning of the chain (for example, focused on R&D and engineering or raw materials) or in the final stages (as assembling facilities). Note that some small countries have darker nodes in the graph as they use inputs from several sources, signalling a strong integration in the network.

The Commonwealth countries are of varying sizes, and it would be misleading to use actual trade flows for the analysis because smaller countries would be overshadowed by the large ones. To address this bias, the analysis used trade flows expressed in terms of percentage of each country's direct requirements of imported inputs, and only the most significant bilateral trade flows were used.

3.4.1 Trade in primary goods

Figure 7 examines the network representations of trade in primary goods between the Commonwealth countries. In 2015, the countries placed in the main core at the centre of the network were the large Commonwealth countries, for example the UK, Australia and South Africa. The increase in the density of the network places the UK in a central position, given its economic size and trade in primary goods with the geographically diverse Commonwealth community. South Africa was a key trade partner for African countries, as India was for Asia (for example, Sri Lanka and Pakistan). On the periphery, were countries in the Caribbean and Africa, given that countries like Botswana, Swaziland, Jamaica and Guyana were raw materials suppliers providing inputs at the beginning of the GVC to other countries in the region.

3.4.2 Trade in intermediates manufactured inputs

Trade in intermediates manufactured processed inputs produced by the secondary sector (Figure 8) reflects the economic size of the

Figure 7. Intra-industrial Commonwealth countries trade flows in intermediate inputs produced by the primary sector, 2015
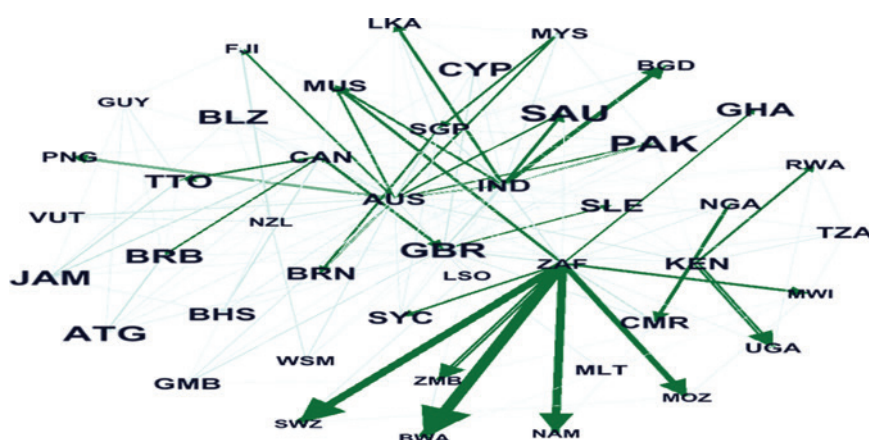
Note: Nodes are labelled according to the ISO3 country code (see Annex I); the size of the fonts indicates the centrality role of the country in the network. Arrows (edges) are sized according to their weight in the importers' foreign direct requirements.
Source: Authors, based on processed Eora data and the Gephi package

Figure 8. Intra-industrial Commonwealth countries trade flows in manufactured inputs produced by the secondary sector, 2015

Note: Nodes are labelled according to the ISO3 country code (see Annex I). The size of the fonts indicates the centrality role of the country in the network. Arrows (edges) are sized according to their weight (from importer's perspective).
Source: Authors, based on processed Eora data and the Gephi package
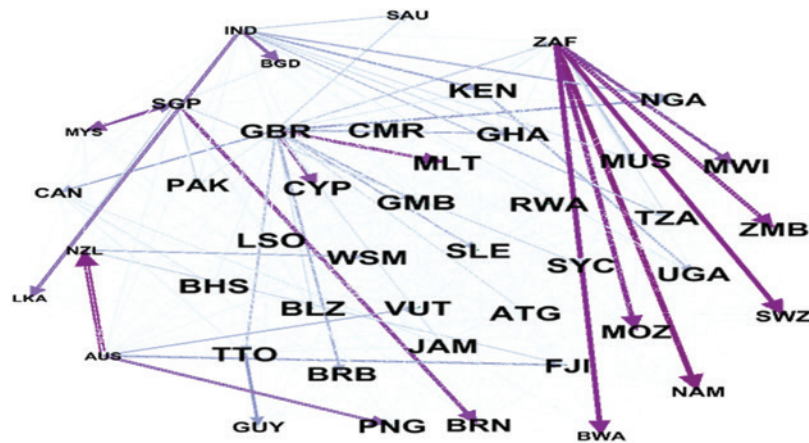
exporting country and its role in the intermediate stages of the GVC.

South Africa dominated the African regional network, given it enjoyed strong trade links with the African countries, such as Botswana, Zambia and Malawi, located in the outer layers of the network. Though South Africa was an important source of processed inputs for Commonwealth member countries in the African region, its location by the Fruchterman-Reingold (1991) algorithm on the network periphery suggests that it was not a major global supplier when all GVC linkages are considered.

The Asian economies are located on the secondary edge. For instance, India, Australia and Singapore supplied value-added inputs to Bangladesh, New Zealand and Malaysia respectively. The UK's trade in value-added with many Commonwealth countries, especially with Malta, Cyprus and Canada, made it an important player in the Commonwealth value chain network.

The analysis highlighted the regional dimension of Commonwealth GVCs in sourcing inputs. The main findings were as below:

- Large economies played a vital role as hubs, but countries such as the UK and Canada sourced less than 7 per cent of manufacturing inputs from other Commonwealth members. Considering that large industrialised Commonwealth economies produce

complex intermediate inputs, the lack of linkage with smaller Commonwealth countries was not surprising.
- Membership of preferential trade agreements and the depth of such agreements increased backward GVC participation. Canada's backward linkage was explained by its economic integration with the USA and Mexico under NAFTA.
- Commonwealth countries in the African region showed evidence of regional interlinkages. There were two prominent regional clusters: i) Botswana, Malawi, Mozambique, Namibia, Swaziland and Zambia; and ii) Ghana, Kenya, Mauritius, Nigeria and Tanzania. In addition, African countries sourced over 70 per cent of their manufactured foreign input requirements from regional Commonwealth partners. South Africa held a prominent position, both as a major supplier of primary and secondary inputs in African GVCs. The Pacific countries were also grouped by geographical characteristics in a cluster comprising Fiji, New Zealand and Papua New Guinea.
- Regional characteristics were, however, not the sole determinant of GVC trade in manufactured inputs. Countries from different geographical locations, such as Cyprus, Gambia, Lesotho, Malta, Rwanda, Sierra Leone, South Africa and the UK, shared similar sourcing patterns. Tables 2

Table 3. Secondary sector: intra-Commonwealth bilateral trade flows
in domestic value-added (top-20 countries), 2015

Source_country	Using_country [a]	FVAX (USD)	FVAX (pct) [b]
Malaysia	Singapore	11,618,537	8.61
Singapore	Malaysia	4,418,026	4.89
Malta	Singapore	72,699	3.31
Zambia	South Africa	37,657	1.28
Australia	Singapore	2,475,776	1.07
Malta	Malaysia	22,722	1.03
Barbados	UK	4,398	0.97
Trinidad and Tobago	Canada	56,811	0.94
South Africa	UK	853,840	0.87
Malta	UK	18,674	0.85
Jamaica	UK	15,794	0.81
New Zealand	Australia	421,955	0.80
Papua New Guinea	Australia	14,312	0.79
Brunei	Singapore	20,045	0.75
Malaysia	Singapore[a*]	943,895	0.70
UK	Singapore	3,074,410	0.68
Australia	Malaysia	1,513,618	0.66
India	Singapore	1,492,423	0.66
Cyprus	UK	20,319	0.65
New Zealand	Malaysia	326,282	0.62

Note: a) All using sectors are also secondary sectors, except for the second (Malaysia–
Singapore[a*]) row, where the inputs are used the Singapore's tertiary sector.
   b) FVAX (pct): Embodied imported value-added in using countries' exports,
   percentage of the source industry total value-added.
Source: Based on Eora data and the 'Decompr' R package (Quast and Kummrit 2015).

and 3 show that countries from different geographical locations may share similar sourcing (i.e. export) patterns. This implied that due to the Commonwealth relationship, although we tend to classify countries as a community, this did not exclude the same group of countries having large import flows from other countries. Further, even with the Commonwealth Advantage characterising trade between countries, the revealed structures across different goods were different and this suggested that we distinguish between countries, as done in Tables 2 and 3.

3.5 Length of value chains: 2015

The measurement of GVC production length calculates two metrics: 'distance to final demand', or the 'upstreamness', i.e. the average number of stages between actual production and final consumption, and 'the average number of previous production stages embodied in each product', measuring the 'downstreamness': downstream firms located close to final demand will exhibit a larger number of previous processing steps. The calculations provide a measure of the total length of production chains and a sector's position in the chain simultaneously.

There are several methodological approaches to estimate the length of value chains; this report used the average propagation length (APL) (see Inomata 2008; Escaith and Inomata 2013).[10] The calculation of APL is based on the total requirements, including the various steps, as well as the back and forth linkages required for producing a final product. Intuitively, the more strategically an industry is inserted into a value chain, the more often it will be required to supply inputs to other GVCs.

This is in contrast to the network analysis, which measures bilateral trade flows with traditional trade and national accounts statistics. The better inserted an industry into GVCs, the higher the difference between the value of exports from direct connection with the producing industry.

The nature of intermediate goods influences APL: commodities tend to travel longer in the value chain, as the value-added is embodied in processed goods used further down the supply chain. However, only a small proportion of primary goods are produced for final demand (mainly some agricultural and fishery products). Hence, upstreamness is often associated with specialisation in primary exports, with some exceptions.[11]

The nature of a business model also affects the location of the firm in the GVC: in a less integrated country, there is little outsourcing and most tasks are done internally. As a result, the corresponding backward linkages are reduced. Modern business models, on the contrary, exploit the value chain opportunities and present higher inter-industry interactions and longer domestic and foreign value chains.

3.5.1 Length and relative upstreamness of primary and secondary sectors

With these caveats in mind, Figure 9 presents the length and relative upstreamness of the Commonwealth countries' primary and secondary sectors. The measure of upstreamness refers to the 'distance to final demand'. The

Figure 9. GVC length and relative upstreamness of Commonwealth countries' primary and secondary sectors, 2015
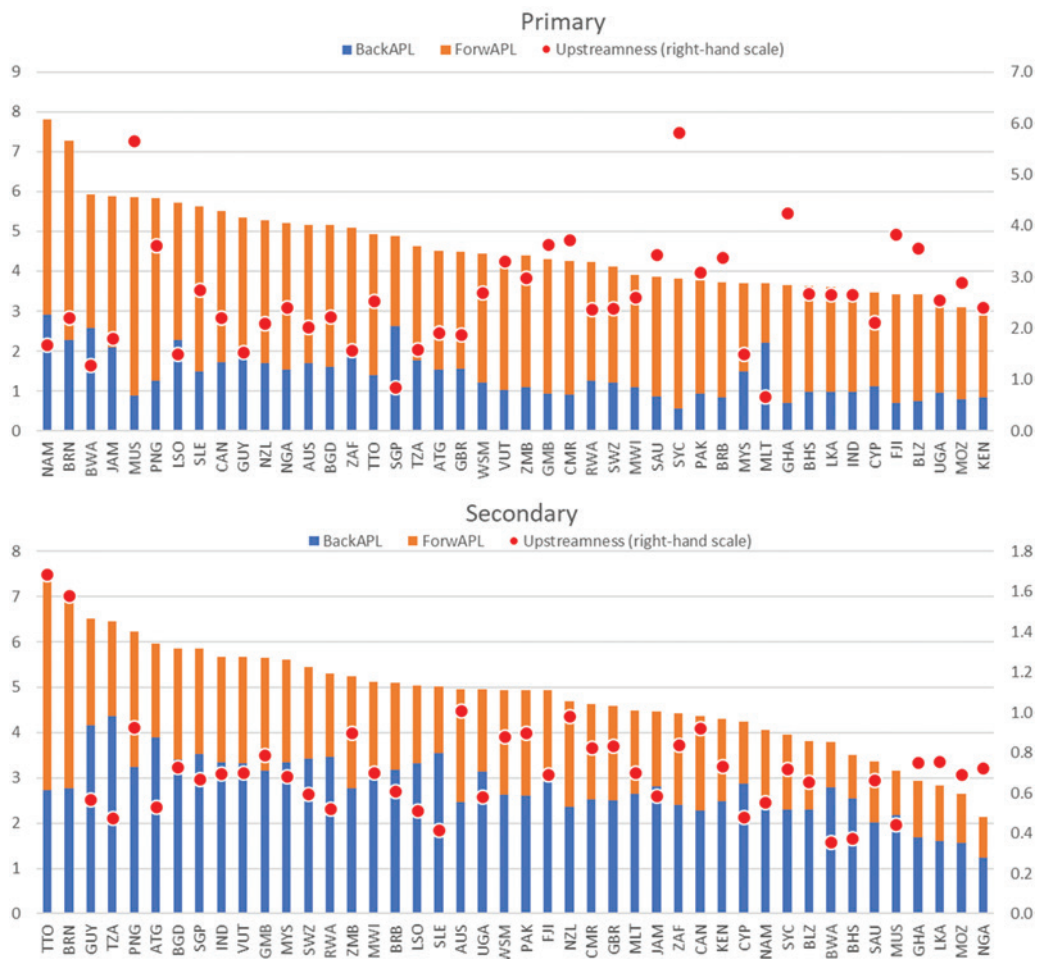
Note: Countries are identified by ISO3 code, see Annex I for the table of correspondence. Average propagation length is calculated for each individual industry as a weighted average of the successive value chain steps, covering both domestic and foreign linkages. The sectoral aggregates are simple averages of the industries belonging to the primary and the secondary sectors. Forward APL is based on the Ghosh matrix and backward linkages are calculated from the Leontief table.

Source: Authors' estimates based on Eora data

index indicates how many stages of production remain before goods produced reach final consumers. This is a calculation based on the intercountry IO framework used to derive the GVC indicators.

The average value by country (for all industries) is presented in Figure 9 for selected countries. A high value of upstreamness is associated with the finding that countries such as Namibia and Brunei are more specialised in the production of inputs at the beginning of the value chain, as these are exporters of primary goods. On the contrary, Trinidad and Tobago and Brunei lead in the secondary sector, as main exporters of secondary products such as refined fuels.

3.5.2 Length of value chains for select industries

When calculating the length of backward and forward indices, it is possible to separate the influence of the foreign value chain from the domestic interactions. This calculation is particularly interesting when the objective is to look at the strength of international linkages as an indicator of the outward orientation of an industry, as was the case here.

Figure 10 presents the results for a selection of primary and secondary sectors, calculated for the Commonwealth community.

The GVC profiles of countries across different industry sectors were heterogeneous. The total length of the value chain, for both domestic and foreign components, varied from 3 (for Metal products) to 1.6 (for Food and Beverages). The Textile industry sector was twice as internationalised as Agriculture, when looking at the relative importance of the foreign backward and forward linkages relative to the domestic linkages.

The longest value chain, by Commonwealth countries' average, was observed for the Metal Products industry. Both domestic (3.6) and foreign (3.0) segments were very long. The Mining and Quarrying industry had a similar profile. The Petroleum and Chemical sector had more compact value chains with domestic (3.0) and foreign (2.6) linkage components. All in all, the GVC profiles of relatively unprocessed products that are used as intermediate inputs by other industries were relatively similar.

The second group of industries, i.e. processed products, were closer to the final demand, with smaller overall linkages, in particular for the domestic part (about 2.2). Within this group, Transport Equipment, and Electrical and Electronics were the most integrated, from an international perspective, with foreign linkages measured at 2.3 as an average. Other manufactures, a more heterogeneous group, had shorter foreign linkages (2.0).

The domestic length of the Textile industry was the shortest among all reported industry sectors, at 1.9, compared to foreign linkages with an APL of 2.2.

Figure 10. Domestic and foreign segments of industry sectors in Commonwealth value chains, 2015
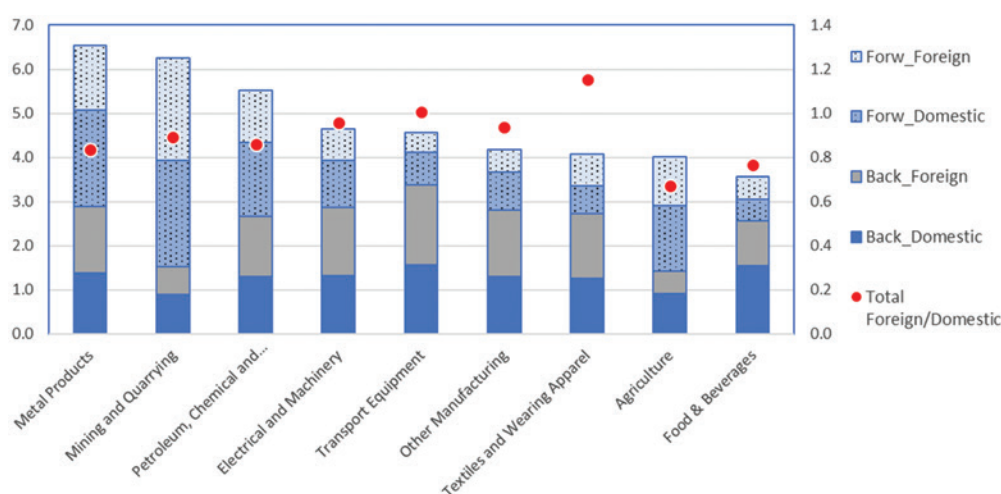
Note: The lengths of the forward and backward linkages are simple averages of Commonwealth countries calculated using the APL method.
Source: Authors, based on Eora data

The Agriculture and the Food and Beverages industry sectors were characterised by larger domestic linkages (about 2.0) than foreign linkages (about 1.6). With few exceptions (notably Canada or New Zealand for Agriculture), these two sectors remained mainly inward-oriented.

However, upstreamness is a ratio between two measures, and tells only a part of the story in GVC analysis. The actual length of the respective linkages must be considered: primary sectors such as Agriculture, and Mining and Quarrying are both upstream with forward linkages to downstream industries largely dominating the GVC length. Yet mineral products are much more internationally tradable than agricultural products, with long forward linkages.

As far as the inward and outward orientation was concerned, we found a contrast between countries. We would expect smaller countries to be more reliant on foreign markets, as was the case with Mauritius and Singapore, which were foreign-oriented. But this was not the case with Jamaica and New Zealand, which showed less outward orientation when compared to the UK, South Africa and Canada. However, large economies such as Australia and India were highly reliant on domestic value-added and were inward-oriented in the sub-sample.

The upstreamness ratio is affected by the length of backward linkages when it is very small, and this can be misleading. Hence, when interpreting sectoral GVC indices, it is important to differentiate between the nature of backward and forward indicators.

Forward linkages deal with the sales of a single output, produced by the industry of interest. This output, nevertheless, is used by different industries from primary to tertiary sectors, either directly or embodied into other intermediate goods.

Backward linkages include all purchases of inputs required for production, whether direct or indirect, and include all inputs (i.e. from primary, secondary and tertiary sectors). For example, Singapore's agricultural sector showed relatively strong domestic backward linkages. But this should not be interpreted as an indicator of strong reliance on domestic agricultural inputs, but as the contribution of the secondary and tertiary sectors (for example, wholesale distribution of imported inputs).[12] The strong backward linkage (and weak domestic forward linkages to domestic final demand) can be attributed to Singapore's re-exports of agricultural products.

Further examination of agricultural sector linkages for Canada and New Zealand presented evidence of significant comparative advantages, extending to strong backward linkages for their Food and Beverages industry (see Figure 9). This contrasts with Singapore, which does not rely on domestic inputs for its Food industry sector. Indian agriculture APL was small (i.e. low rank of agricultural linkage) due to inward orientation, both in the use of inputs and the lack of export orientation. Kenya's agricultural sector, however, showed strong export orientation (for example, tea and flowers).

For the Mining and Quarrying sector, Jamaica and Kenya showed long APL, mainly due to large domestic forward linkages (see Figure 9). But strong comparative advantages are not always correlated with long APL and GVC linkages. For example, Saudi Arabia and South Africa exhibited short backward domestic linkages, while Singapore ranked fourth. Developing an industry from huge domestic resources leads to short backward domestic linkages, because firms undertake the tasks for extraction and initial processing of raw materials internally. The Saudi case is illustrative and most output was by its domestic Petro-Chemical industry rather than being exported for processing.

Again, the length of GVCs does not always correlate with a country's competitive advantage in processing raw inputs. Singapore, as a regional hub, ranked first with a long APL in Petroleum, Chemicals and non-metallic mineral products, despite no natural resources (Figure 11). But Saudi Arabia was at the bottom end. The Metal Products sector is another similar example – Trinidad and Tobago is rich in oil but not in other mineral endowments, and yet ranked high in terms of APL linkages.

Textiles, Electric and Electronic products, Transport Equipment and Other Manufacture sectors are closely associated with the GVC business model. The degree and diversity of processing offers large potential for both domestic and foreign outsourcing and most end-products are commercialised by lead firms which have sophisticated supply-chain arrangements. Trinidad and Tobago had the longest value chain for all sectors, followed by Tanzania. While Trinidad and Tobago had a strong domestic sector reliance, Tanzania

Figure 11. Domestic and foreign linkages for selected industries and countries, 2015
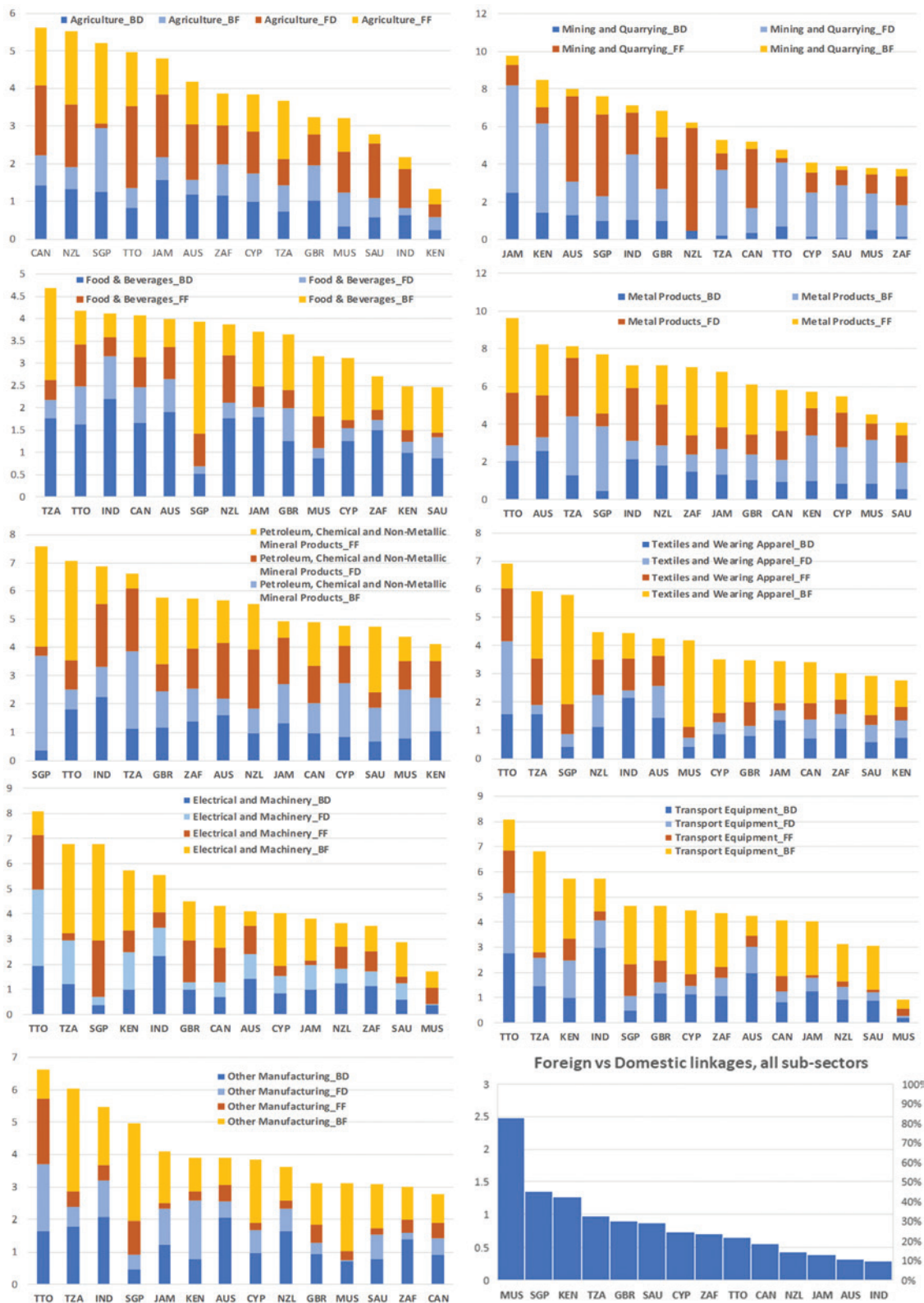
Note: Countries are identified by ISO3 code, see Annex I for a table of correspondence. The suffix '_BD' refers to the length of backward domestic linkages, as a simple average of selected countries' indicators; '_FD': forward domestic linkages; '_FF': forward foreign linkages; '_BF': backward foreign linkages.
Source: Authors, based on Eora data

showed strong foreign sector reliance in light of its reliance on imported inputs.

Despite the UK being a leader with a strong presence in the Transport Equipment sector (in particular, the aeronautical and land transport equipment industry), it did not dominate the sector. This is indicative of the fact that GVC indices have little to do with the comparative advantage of a country. When trading under GVCs, developing a domestic industry does not necessarily depend on existing 'natural' advantages that can be attributed to natural resources, technology or labour endowments. In fact, an industry that relies on geographically diversified markets for inputs and outputs is likely to insert itself into deep inter-industry relationships.

3.5.3 Bilateral GVC trade decomposition

Bilateral GVC decomposition, a workhorse of trade in value-added analysis, examines the origin of value-added embodied into the production or the exports of a given industry. The calculations were based on exports for the 43 Commonwealth countries included in Eora. The results by industry were combined for presentation purposes into three aggregated sectors, i.e. primary, secondary and tertiary, by type of activity.

Table 3 shows the importance of the GVC linkage for intra-Commonwealth trade from the source industry perspective.

The main observations on a country's position in the GVC were as below:

- Malaysia and Singapore were at the top of the list of countries, both as source and exporting countries, with significant foreign value-added contribution.
- Malta ranked high, as explained by European G-20 countries (France, Germany, Italy or the UK) supplying Singapore's manufacturing sector with inputs.
- Foreign value-added export value was high for Australia, the UK and Singapore. Singapore led, possibly due to its position as a maritime hub for re-exports (also called the 'Rotterdam effect' in trade statistics).

The Commonwealth community was relatively small in terms of market for Commonwealth manufactured value-added. If we reconstruct Table 3 with countries other than Commonwealth members, i.e. other G-20 members, the picture is very different (see Table 4). Seventeen (17) of the 20 main countries were not Commonwealth members. Among Commonwealth countries, only Singapore and Malaysia were in the top-20 list of export markets.

The main findings are summarised as below:

- First, two regional clusters – in Asia (Bangladesh and Pakistan) and in Africa (Ghana, Kenya, Nigeria, South Africa, and Uganda).
- Second, GVC exports were linked with the level of development – for example, the cluster consisting of Australia, Canada, India, New Zealand, Sri Lanka and the UK consisted of relatively advanced industrial exporters, with the exception of Sri Lanka.

Evaluating each bilateral trade flow is cumbersome given that Eora has more than two million observations for total intra-industrial flows. We applied an exploratory statistical approach to the results of the GVC decomposition to identify the main patterns in trade in value-added. Figure 12 uses Principal Component Analysis to provide a full picture with the Leontief decomposition algorithm. Results can be interpreted along the South-West/North-East diagonal. A circle in the upper part shows that Singapore, Malaysia, Canada and the UK were the best inserted in GVCs. Australia and India were also important players but were more of an upstream type. A second ring of countries (yellow dotted line) were also relatively well inserted in an upstream or downstream position.

To sum up, the results of the GVC export profile for the Commonwealth group of countries presented the following:

- There were two regional clusters, in Asia (Bangladesh and Pakistan) and Africa (Ghana, Kenya, Nigeria, South Africa and Uganda).
- Singapore, Malaysia, Canada and the UK were better inserted in GVCs. Malaysia and Singapore were at the top of the list of Asian countries, both as source and exporting countries, and made a significant foreign value-added contribution.
- The foreign value-added in exports was high for Australia, the UK and Singapore. Singapore led, possibly due to its position as a maritime hub for re-exports.
- With a few exceptions, intra-Commonwealth GVC trade was overshadowed by Commonwealth value-added exports to larger non-Commonwealth countries.

Table 4. Secondary sector: top-20 Commonwealth to
Commonwealth and G-20 trade flows of domestic value-added, 2015

Source_Country	Using_Country [a]	FVAX (USD)	FVAX (pct) [b]
Malaysia	Singapore	11,618,537.00	8.606911
Brunei	South Korea	148,093.30	5.51361
Singapore	Malaysia	4,418,026.00	4.886674
Swaziland	South Korea	17,604.67	3.844927
Brunei	Japan	98,278.64	3.658979
Malta	Singapore	72,699.12	3.308675
Canada	USA	14,256,739.00	3.08605
Singapore	China	2,716,324.00	3.004462
Malaysia	China	3,767,390.00	2.79085
Trinidad and Tobago	USA	166,606.50	2.762159
Antigua	Germany	1,083.294	2.515906
UK	Germany	10,327,347.00	2.297049
Malta	Germany	48,517.99	2.208146
Zambia	China	54,505.07	1.854392
Jamaica	Germany	34,325.75	1.766023
Pakistan	China	636,632.40	1.753482
Malta	USA	36,043.94	1.640428
Malta	Italy	35,966.12	1.636886
Malta	China	33,310.13	1.516007
Malaysia	Japan	1,976,076.00	1.46386

Note: a) All using sectors are also secondary sectors.
b) FVAX (pct): Embodied imported value-added in exports, by percentage of the source
   industry total value-added.
Source: Based on Eora data and the 'Decompr' R package (Quast and Kummrit, 2015).
See: E:\Eora\R_area\CS_LeonAgg.csv

Figure 12. Principal Component Analysis of Commonwealth manufactures exports, 2015
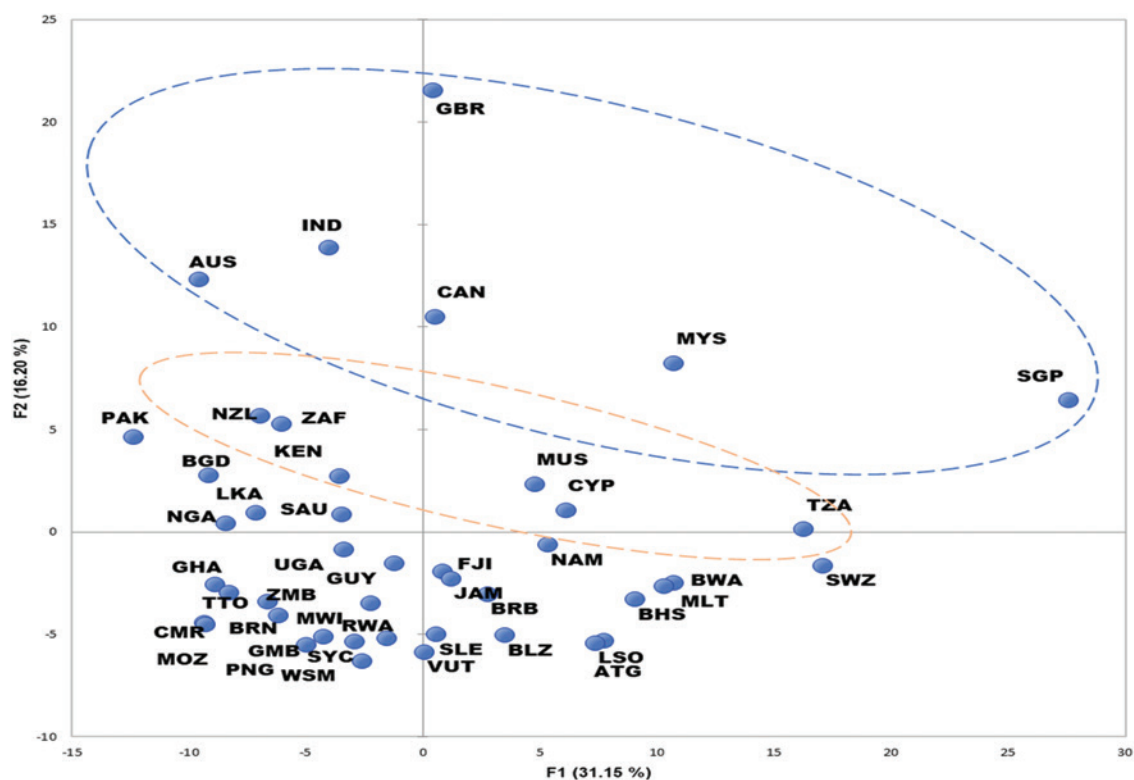
Note: Countries are identified by their ISO3 code, see Annex I for a table of correspondence.
Source: Based on processed Eora data and the 'Decompr' R package (Quast and Kummrit 2015)

4. Measuring the strength of pure Commonwealth value chains

All GVC trade in value-added indicators for the Commonwealth countries based on the Eora input–output matrix included all direct and indirect trade flows and also the segments of the value chains that were located in or transit through non-Commonwealth countries.

The role of the non-Commonwealth countries as intermediates between two Commonwealth countries could be important, especially if they were regional hubs – an issue that has not been considered so far. For example, it is possible that significant value-added exchange between Cyprus and Malta was through GVC firms in a non-Commonwealth country, such as Italy. It is in this context that it becomes imperative to identify direct intra-Commonwealth GVC linkages from a regional perspective.

To measure and set aside inter-Commonwealth GVC trade transiting through a non-Commonwealth country at some stage of the value chain, the exports of intermediate inputs to non-Commonwealth countries were set to 0 in the Eora tables and a Leontief decomposition was recalculated.[13]

Table 5 lists the top-20 countries' secondary-to-secondary sectors trade in value-added flows, in terms of both absolute value and in percentage of exporting industry value-added. As expected, values were low when the source country was a large economy and closely inserted into a regional trade agreement with large non-Commonwealth countries. This applied to the UK (a member of the EU in 2015) and Canada (a member of NAFTA, as the Canada-Mexico-USA trade agreement was called in 2015). The bilateral exchange of value-added between Canada and the UK declined by US$806 billion, showing that nearly 25 per cent of GVC transactions between Canada and UK manufacturing sectors transited through a non-Commonwealth country – especially the USA, the main single destination of exports for both countries. Singapore re-imports large Commonwealth value-added through non-Commonwealth third countries. So, severing GVC ties with non-Commonwealth value chains would deprive Singapore's

manufacturing sector of 37 per cent of its UK market.

However, when the economies are geographically close, the decline was usually smaller in percentage terms (for example, Australia–Singapore; Singapore–Malaysia). As seen in the left panel, some bilateral flows almost dried up. Several Commonwealth countries (namely, Trinidad and Tobago, Brunei, Namibia and Nigeria) exported 90 per cent or more of manufactured value-added to Saudi Arabia through non-Commonwealth intermediaries. The highest decline was recorded for duplets of geographically distant Commonwealth countries, suggesting that complex GVCs involve several steps, in particular when goods transit through large non-Commonwealth countries.

The previous table dealt with inter-industrial exchange between industries belonging to the same secondary sector, which includes manufacturing activities. Value-added transactions between the primary (commodities) and secondary (manufactures) sectors depict the complementary nature of upstream and downstream industry. The primary value-added sector goods that transit through a third country may have been transformed into a secondary (or even tertiary) sector product, even before being imported by the using industry. Thus, what is measured is the commodity sector value-added embodied into intermediate inputs imported by secondary sectors, and not the nature of the intermediate input itself. For example, the Canadian primary value-added imported by Singaporean manufactures in Table 6 may have been used by another Canadian firm before being exported to another manufacturer (possibly the USA) to produce processed inputs purchased by a Singaporean firm.

As seen in the left panel (ranking of monetary losses), Singapore imported a large share of the Commonwealth primary value-added inputs that transited through non-Commonwealth countries. However, after considering the size of source and use economy, as well as the historical and economic ties, results showed that more than 40 per cent of the UK's use of

Table 5. Trade in value-added between Commonwealth secondary sectors transiting through non-Commonwealth countries, 2015 (top 20)

Top 20 by value				Top 20 by percentage			
Source	Using	Drop in VAX	Drop (%)	Source	Using	Drop in VAX	Drop (%)
UK	Singapore	−764,185	−24.9	Trinidad and Tobago	Saudi Arabia	−288	−93.5
UK	Canada	−468,513	−26.4	Brunei	Saudi Arabia	−256	−91.8
Canada	Singapore	−401,403	−41.5	Brunei	Canada	−2,192	−91.7
UK	Malaysia	−368,811	−28.4	Namibia	Saudi Arabia	−56	−91.2
Malaysia	Singapore	−360,689	−3.1	Nigeria	Bahamas	−49	−90.3
Canada	UK	−337,405	−27.4	Nigeria	Saudi Arabia	−1,113	−89.8
Australia	Singapore	−277,326	−11.2	Brunei	India	−1,883	−88.5
Malaysia	UK	−248,488	−30.3	Nigeria	Trinidad and Tobago	−110	−88.1
UK	India	−234,415	−22.4	Cameroon	Singapore	−1,825	−86.7
India	UK	−217,558	−27.1	Nigeria	Guyana	−11	−86.5
India	Singapore	−193,745	−13.0	Nigeria	Malaysia	−6,957	−85.9
Malaysia	Canada	−185,676	−50.3	Nigeria	Singapore	−19,034	−85.6
Canada	Malaysia	−179,918	−41.5	Nigeria	Cyprus	−60	−85.3
Singapore	UK	−167,261	−36.7	Namibia	Malaysia	−424	−84.5
Australia	UK	−146,376	−24.5	Cameroon	Malaysia	−1,028	−84.4
Australia	Malaysia	−145,680	−9.6	Trinidad and Tobago	Malaysia	−2,166	−84.3
India	Canada	−132,342	−24.9	Malaysia	Bahamas	−133	−84.1
Australia	Canada	−129,245	−27.9	Pakistan	Bangladesh	−229	−84.1
Singapore	Malaysia	−127,021	−2.9	Nigeria	Australia	−899	−83.9
Singapore	Canada	−119,163	−62.8	Namibia	Singapore	−844	−83.1

Note: VAX: embodied imported value-added in the exports of the using country, in million USD and in percentage of the source industry total value-added.

Source: Authors' estimates based on Eora data

Australian and Canadian primary value-added was processed in a non-Commonwealth country. When looking at the right-hand side panel, the picture is strikingly different – all bilateral flows in the top-20 list are practically reduced to 0; the drop was on average 25 per cent lower for all bilateral transactions analysed (a total of 1892).

The absence of Commonwealth LDCs as source of primary or secondary value-added, even in terms of percentage (right-hand side panels of Tables 5 and 6) is striking. LDCs benefit from preferential market access granted under the WTO agreements by developed countries and by an increasing number of large developing countries. Moreover, inputs from LDCs are often excluded from the rules of origin governing deep regional agreements. These trade preferences are expected to foster GVC participation (Keane 2018) between LDCs and developed countries that are also important GVC hubs. Yet, these preferences have not translated into a stronger GVC role, at least within the context of the Commonwealth community. It is true that most manufactures-oriented LDCs are downstream and export mainly finished products (Apparel, in the case of Bangladesh) or rely on services for their exports (especially tourism for many small islands, which is also a downstream activity).

Table 6. Trade in Value-Added sourced from the Commonwealth (primary and used by Commonwealth secondary sectors) transiting through non-Commonwealth countries, 2015 (top-20 countries)

Top 20 by value				Top 20 by percentage			
Primary_industry	Secondary_industry	Drop in VAX	Drop (%)	Primary_industry	Secondary_industry	Drop in VAX	Drop (%)
Canada	Singapore	−544,346	−84.6	Trinidad and Tobago	Singapore	−70,946	−99.9
Australia	Singapore	−294,401	−37.1	Trinidad and Tobago	Saudi Arabia	−2,211	−99.8
Saudi Arabia	Singapore	−279,261	−95.2	Trinidad and Tobago	Malaysia	−16,282	−99.8
Malaysia	Singapore	−254,062	−18.2	Brunei	Saudi Arabia	−378	−99.5
Canada	UK	−232,894	−41.5	Trinidad and Tobago	India	−8,006	−99.5
Australia	Malaysia	−208,215	−28.2	Brunei	Canada	−3,196	−99.5
Saudi Arabia	UK	−203,792	−96.7	Trinidad and Tobago	Nigeria	−106	−99.2
India	UK	−193,572	−35.4	Trinidad and Tobago	Australia	−2,620	−98.9
UK	Singapore	−176,686	−39.6	Saudi Arabia	Bahamas	−234	−98.9
Canada	Malaysia	−175,407	−73.4	Brunei	India	−2,783	−98.8
India	Singapore	−164,123	−22.1	Saudi Arabia	Trinidad and Tobago	−905	−98.7
Australia	UK	−149,939	−44.1	Saudi Arabia	Cyprus	−788	−98.6
Saudi Arabia	Canada	-124,266	−74.6	Brunei	UK	−4,156	−98.6
Australia	Canada	−122,958	−51.0	Nigeria	Bahamas	−193	−98.5
Saudi Arabia	Malaysia	−122,024	−73.8	Saudi Arabia	Malta	−1,194	−98.5
Nigeria	Singapore	−111,090	−98.4	Nigeria	Singapore	−111,090	−98.4
India	Canada	−97,264	−26.1	Saudi Arabia	Jamaica	−297	−98.4
India	Malaysia	−95,115	−15.6	Saudi Arabia	Pakistan	−1,815	−98.4
Nigeria	UK	−87,400	−66.9	Saudi Arabia	Cameroon	−197	−98.1
UK	Canada	−86,204	−19.0	Brunei	Malaysia	−6,510	−98.0

Source: Authors' estimates based on Eora data

5. Main findings and policy recommendations

5.1 Main results

What matters in GVC analysis, i.e. 'trade in tasks', is an industry's competitive advantage from an international trade specialisation perspective.[14] The competitive advantage is based not only on the relative competitiveness of a firm, but depends also on monetary (transport and custom duties) and non-monetary (logistic delays and uncertainties related to the business climate) costs.

Supply and demand are other important factors. For small or medium firms, joining a GVC involves fitting into an existing business logic driven by a lead firm – often located in a large developed or emerging country – and its first-tier suppliers, some of them being located in the same country or in a neighbouring one. Thus, the recommendations must go beyond individual countries' perspectives and look at a global inter-industry network perspective.

The main findings from the study on the integration of Commonwealth countries in GVCs showed the following:

- Commonwealth member countries' participation in GVCs increased over 1995–2015, but this was mainly through non-Commonwealth countries, especially large economies belonging to the G-20 group. Further, most Commonwealth countries were net importers of intermediate inputs, except Singapore and Malaysia, which were net exporters. The increasing importance of large non-Commonwealth trade partners was attributed to two factors: first, the growth of China as 'the factory of the world'; and second the growth of deep trade agreements in North America and in Europe that explained post-1995 trade patterns. Asia led in terms of GVC integration growth between Commonwealth members. GVC trade between developed and developing Pacific countries increased, in particular between the European Commonwealth members. Africa and the Caribbean regions did not present evidence of much change in GVC integration. The regional averages concealed divergences in each individual country's performance. For example, Tanzania, Lesotho, Guyana and Fiji (with Singapore) ranked among the top-5 countries in terms of increasing GVC linkages with Commonwealth countries. At the end of the spectrum countries in Africa (such as Mozambique, Zambia, Botswana, Namibia and Swaziland) were the main countries with lowest GVC linkages with Commonwealth countries.
- Two closely knitted GVC clusters connected Asian and African GVC members. Other GVC clusters found in Europe and the Pacific were more geographically diversified. Regional linkages between the developing Commonwealth countries, especially in Africa, were suggestive of the interconnectedness between countries in the region and that Commonwealth membership facilitated trade between developing countries.
- Deep regional trade agreement membership, such as the EU or NAFTA, impacted on GVC participation. Membership of preferential trade agreements and the depth of such agreements increased partner countries' backward GVC participation. It is likely that the existing linkages within

Africa from the African Continental Free Trade Area (AfCFTA) agreement will benefit countries' tariff reduction protocol from intra-Africa merchandise trade. Multilateral preferential schemes for the least developed countries (LDCs) did not appear to have the same effect for Commonwealth LDCs.

- Large economies, such as India, Australia and New Zealand, showed limited evidence of forward linkages with the Commonwealth and did not rely on the Commonwealth member countries for their inputs. Open economies, such as Singapore, tended to import value-added inputs from the G-20 countries. Smaller Commonwealth countries were relatively more reliant on other Commonwealth members for inputs for domestic industries. Some showed a high level of reliance on domestic inputs and were more inward-oriented. The modest export-orientation of their industries was to be related to the small size of the firms in these countries.
- The UK enjoyed a central position in the GVC network due to its economic size, rather than as a GVC hub for the Commonwealth community. Singapore was increasingly playing the role of GVC hub in the Asia and Pacific regions, as was South Africa in the African region.
  - For the primary sector, the Caribbean and African countries were on the periphery of the GVC network as these were raw materials suppliers providing inputs at the beginning of the GVC to other countries in the region. There was no evidence of change in the level of GVC integration over time, and the countries were at the lowest end of the GVC spectrum.
  - For inter-industry trade in manufactured inputs produced by the secondary sector, large economies acted as hubs for Commonwealth trade in intermediate products. But this role remained limited and developed Commonwealth countries, such as the UK and Canada, sourced less than 7 per cent of manufacturing inputs from other members. This share was lower when all intermediate goods and services were included (this was between 2 and 2.5 per cent, which was less than half the Commonwealth average) and the share increased

marginally by 0.4 percentage points only between 1995 and 2018.

- In terms of industrial linkages, Textiles, Transport Equipment and Chemicals were important for the Commonwealth countries, in particular for the UK, Canada and India. The developed Commonwealth countries dominated the Automotive and Metals sectors. Developing countries were, in general, dominant in the upstream basic commodity and in the light-industry downstream parts of the GVC, implying that upgrading to more advanced GVCs will be required to support Commonwealth countries' integration into the GVCs.

5.2 Policy recommendations

The report proposes a set of measures to facilitate the participation of Commonwealth countries in GVCs, with the aim of enabling the countries to reap benefits from GVC participation. From a policy perspective, such an analysis is important given that GVC integration implies a country's reliance on imported inputs to gain competitiveness (on the import side) and, especially in the case of developing countries, as a means to improve access to export markets. Further, specific policies to support integration of the Commonwealth LDCs in GVC present opportunities.

5.2.1 Develop sectoral competitiveness of the less developed (less competitive) Commonwealth countries

Imports make exports: in a GVC, firms rely on the best inputs to produce competitive exportable output, which often requires importing them. Thus, GVC trade is not limited to the capacity of countries to produce a final good in an inter-industrial network, but depends on the capacity to provide a specific task contributing to the production of final goods.

Because trade in tasks focuses on a segment of the value chain instead of the whole production process, supply constraints have a much lower impact on GVCs, unlike traditional export-oriented production activities. However, studies show that fostering GVC participation needs requisites, some of which depend on policy options under the control of national authorities (see World Bank 2020 for a detailed review).

The analysis of Commonwealth GVCs presented evidence of dependence between countries and industry sectors. The findings also confirmed that the Commonwealth members were linked to GVCs through non-Commonwealth countries, suggesting that there is a case for fostering strong intra-Commonwealth linkages and promoting intra-GVC linkages. GVC participation can also open up new opportunities that may not have existed in traditional trade in final goods.

The report focused on trade in goods, due to statistical shortcomings on the services sector. But services are an important component of GVC trade and a key component of GVC upgrading through the increased 'servicification' of agricultural or manufacture production. Moreover, services trade is not constrained by geographical distance and trade agreement membership presents an opportunity for Commonwealth countries. Studies confirm that trade in services, through its different modes of delivery or through the 'servicification' of GVCs, offers the highest potential to strengthen inter-Commonwealth trade.

Baldwin (2012) states 'building and joining a supply chain are different. For smaller economies, joining a supply chain is almost by definition finding a niche market. But building an industrial basis out of GVCs requires additional effort'. While each strategy would have to be country- and context-specific, the policy should be cross-sectoral, because GVCs involve firms from diverse productive sectors, from agriculture to industry and services. Commonwealth countries, such as India and Nigeria, can play an important role in boosting the Commonwealth Advantage in the trade space.

The centrality of South Africa in the African cluster indicates that, as trade conditions improve for this country, it can indirectly benefit the conditions of its trading partners (for example, Ghana, Zambia, Kenya, Uganda, Tanzania, Mauritius, Mozambique, Namibia, Botswana, Malawi and Rwanda). Targeted policies to address the supply-side constraints are required to be initiated with a specific focus on ensuring sectoral competitiveness.

5.2.2 Initiate proactive government policies to develop and upgrade domestic value chains

A competitive domestic value chain is critical for upgrading value chains in the short and long term. Targeted sectoral policies to maximise the absorption potential of the domestic economy and strengthen linkages with GVCs are important.

Government policies should complement the business environment with proactive policies to attract foreign investment. It is important that national governments consider initiating targeted policies to attract foreign investment through special incentives to firms, which can support a country's entry into GVCs. A proactive governmental approach is required to support countries' participation in GVCs. Policy measures to upgrade the position in GVCs and develop the Commonwealth countries' competitiveness include the following:

- Supporting export diversification in developing Commonwealth countries, especially African countries that are primary products exporters of agricultural or extractive (mining) products. Export diversification through trade in tasks will mitigate risks and help Commonwealth countries in Africa to capture the value-added component of the GVC.
- Developing the ability of less developed Commonwealth countries to absorb new technology. Countries may be considered to have 'forward participation' in GVCs, since their exports are used in other countries' manufacturing, and those manufactures may in turn be exported. But moving into downstream manufacturing from a primary product base generally requires that a country acquire new technological and managerial capabilities.
- Governments could consider promoting skills development policies, for example, supporting education and vocational training, developing ICT and infrastructure, and ensuring labour market mobility. Such measures will reduce overall uncertainty and promote transparency of the business climate.
- Providing a favourable foreign direct investment (FDI) regime is essential to create an attractive business climate. This can be complemented by simple procedures for registering foreign investors to attract foreign firms to set up production facilities in the target country.
- National governments must initiate policies to address border and 'behind the border' measures to facilitate GVC participation. Low tariffs, complemented by other low border costs such as less time to clear customs and less 'red tape', are important from a GVC perspective to ensure participation.

- Most Commonwealth developing countries have limited export production capacity. Smaller economies are constrained to industrialise through export-oriented industrialisation and, therefore, rely on Export Processing Zones (Low and Tijapa 2013). While such zones can play a determining role as incubators, the successful experiences are those that generate upstream and downstream opportunities for other domestic firms. This may require additional, and more horizontal, economic policies.
- Targeted policies to support integration of the Commonwealth LDCs in GVCs are required to support this group of countries.
- The international community and international institutions could also provide support in the form of logistics and trade facilitation, facilitation of legislation on the regulation of business services, investment, business taxation, innovation and industrial development, and support to convergence with international standards. They could also support the wider business environment to foster entrepreneurship.

5.2.3 Ensure quality institutions and support preferential liberalisation

Institutional quality matters; improving global and regional trade governance through the relevant multilateral and regional forums is key to providing an enabling business environment to harness the GVC potential of Commonwealth countries. Countries with better institutional quality exhibit stronger GVC participation and export in more contractually intensive sectors (World Bank 2020). It is important to strengthen global and regional trade governance through the relevant multilateral (WTO) and regional forums.

The institutional quality in Commonwealth countries can be enhanced through membership of new free trade agreements (FTAs) and regional forums. Such trade agreements cover legal and regulatory frameworks, harmonise customs procedures and set the rules on intellectual property rights. The World Bank (2020) finds that membership of preferential trade agreements and the depth of those agreements increase backward GVC participation. The Commonwealth countries that are FTA members could use existing FTAs as a mechanism to increase participation in the GVCs.

Some ongoing trade liberalisation initiatives involve Commonwealth countries, such as the AcFTA, the Pacific Agreement on Closer Economic Relations and, in Asia, the Regional Comprehensive Economic Partnership negotiations (even with India having withdrawn). Because most Commonwealth countries are members of trade agreements, which can in some ways limit the possibility of negotiating separate preferential agreements with third countries – the UK's membership of the EU being probably the best example – the margin for tariff negotiations is somewhat reduced.

But such constraints do not exist for non-tariff measures, especially if they follow the path of mutual recognition.

5.3 Limitations of the study

There are some shortcomings worth highlighting. First, the lack of data for all the Commonwealth countries was an important limitation of this study. Second, the quality of statistical data on services trade for most developing Commonwealth countries is poor, which does not allow a detailed analysis of a sector that offers significant potential.

Annex 1: List of countries

Included in Eora				Not included			
ISO3	Economy	Economic	Geographical	ISO3	Economy	Economic	Geographical
BWA	Botswana	Developing	Africa	DMA	Dominica	Developing	Caribbean and Americas
CMR	Cameroon	Developing	Africa	GRD	Grenada	Developing	Caribbean and Americas
SWZ	Eswatini	Developing	Africa	KNA	Saint Kitts and Nevis	Developing	Caribbean and Americas
GMB	Gambia	Developing	Africa	LCA	Saint Lucia	Developing	Caribbean and Americas
GHA	Ghana	Developing	Africa	VCT	Saint Vincent and the Grenadines	Developing	Caribbean and Americas
KEN	Kenya	Developing	Africa	KIR	Kiribati	Developing	Pacific
LSO	Lesotho	Developing	Africa	NRU	Nauru	Developing	Pacific
MWI	Malawi	Developing	Africa	SLB	Solomon Islands	Developing	Pacific
MUS	Mauritius	Developing	Africa	TON	Tonga	Developing	Pacific
MOZ	Mozambique	Developing	Africa	TUV	Tuvalu	Developing	Pacific
NAM	Namibia	Developing	Africa				
NGA	Nigeria	Developing	Africa				
RWA	Rwanda	Developing	Africa				
SYC	Seychelles	Developing	Africa				
SLE	Sierra Leone	Developing	Africa				
ZAF	South Africa	Developing	Africa				
TZA	Tanzania, United Republic of	Developing	Africa				
UGA	Uganda	Developing	Africa				
ZMB	Zambia	Developing	Africa				
BGD	Bangladesh	Developing	Asia				
BRN	Brunei Darussalam	Developing	Asia				
IND	India	Developing	Asia				
MYS	Malaysia	Developing	Asia				
PAK	Pakistan	Developing	Asia				
SGP	Singapore	Developing	Asia				
LKA	Sri Lanka	Developing	Asia				
ATG	Antigua and Barbuda	Developing	Caribbean and Americas				

Included in Eora				Not included			
ISO3	Economy	Economic	Geographical	ISO3	Economy	Economic	Geographical
BHS	Bahamas	Developing	Caribbean and Americas				
BRB	Barbados	Developing	Caribbean and Americas				
BLZ	Belize	Developing	Caribbean and Americas				
GUY	Guyana	Developing	Caribbean and Americas				
JAM	Jamaica	Developing	Caribbean and Americas				
TTO	Trinidad and Tobago	Developing	Caribbean and Americas				
AUS	Australia	Developed	Developed				
CAN	Canada	Developed	Developed				
CYP	Cyprus	Developed	Developed				
MLT	Malta	Developed	Developed				
NZL	New Zealand	Developed	Developed				
GBR	United Kingdom	Developed	Developed				
FJI	Fiji	Developing	Pacific				
PNG	Papua New Guinea	Developing	Pacific				
WSM	Samoa	Developing	Pacific				
VUT	Vanuatu	Developing	Pacific				

Annex 2: Technical annexes

Input–output tables and preliminary data processing

The initial Eora database covers 190 countries and 26 sectors, from 1990 to 2015. To simplify the data processing, the first task was to reduce the size of the geographical coverage, with the aim to include only the Commonwealth countries and other main trade partners that belong to the G-20. All other countries were aggregated into the Rest of the World (ROW) region.

The resulting MRIO with 58 countries or regions and 26 sectors, generated a matrix of 1508 lines and 1508 columns, with more than two million data points. This Multi Regional IO table served as the basis for the calculation of all Trade in Value-Added (TiVA) indicators.

From a statistical perspective, the quality of the sectoral data is often mediocre. Unless specified, for presentation purpose and for network analysis, the sectoral GVC indicators resulting from the TiVA analysis were aggregated into four categories:

- primary sectors (Agriculture, Fisheries and Mining);
- secondary sectors (Manufacture),
- tertiary sector (Commercial and Administrative Services); and
- 'other sectors' where the quality of data was deemed particularly weak (e.g., recycling, household services, re-exports and re-imports).

Measuring trade in value added

In a GVC, the final value of a product results from the aggregation of the contribution of many industries, some of them being located in different countries. The objective of TiVA is to disentangle the origin and contribution of the different contributions. The final value of a product is the sum of the various contributions, as measured by the value-added contributed by each industry in each country of the chain.

The main differences between traditional trade and TiVA analysis are:

- TiVA analysis includes both the supply and the demand side, and includes the final demand (the products required to satisfy consumption and investment).
- TiVA analysis is not based on directly observable trade flows (direct requirements) but on a more systemic approach: the total requirements and their value-added content. This means that not only bilateral trade flows are taken into consideration, but also all the other transactions that were indirectly activated by the direct requirements.

Let's take an example, based on a two country/two product model such as Table A.1. Two countries A and B produce primary and processed goods. Vertically (in column), we see the requirements in inputs plus the value-added (basically, the remuneration of labour and capital) required by the

Table A.1 Simplified international input–output table

	Country A		Country B		Total product sales		Total
	Primary	Secondary	Primary	Secondary	Intermediate	Final	Output
A. Primary	80	50	10	10	150	200	350
A. Secondary	30	80	0	5	115	250	365
B. Primary	40	5	40	30	115	170	285
B. Secondary	2	10	30	100	142	200	342
Value added	198	220	205	197			
Output	350	365	285	342			

Note: For illustration purposes only.

Table A.2 Simplified technical coefficients

	A. Primary	A. Secondary	B. Primary	B. Secondary
A. Primary	0.23	0.14	0.04	0.03
A. Secondary	0.09	0.22	0.00	0.01
B. Primary	0.11	0.01	0.14	0.09
B. Secondary	0.01	0.03	0.11	0.29

production. In line, we see the allocation of the output (or sales) for use as intermediate or final demand consumption. The input–output table describes a state of equilibrium from an accounting perspective, where supply equals demand in both the production and income dimensions (total output equals total requirements for intermediate and final use, and the sum of the value-added equals the total value of final demand).

The matrix of technical coefficients, also known as direct requirements, is obtained by dividing the material inputs required in each column by the industry' s total output (value-added is not part of this calculation). The result, often called the 'A' matrix in input–output analysis, is a 4x4 matrix, as in Table A.2. It provides the value and origin of inputs needed to produce one unit of output.

In order to produce $100 of output, the primary sector of B will purchase 4 from the A' s primary sector, 14 from other primary sector firms in B and 11 of B's manufactures. In order to produce the $29 of inputs required by the initial round of production ($100), each of these sectors will, in turn, purchase inputs from other

sectors and launch a second round of production. In turn, this second wave will induce a third round of indirect requirements, and so on and so forth. The additional value of intermediate inputs required diminishes at each round and tends rapidly to 0.

The series of rounds can be expressed as a power expansion of the A matrix, starting with $\mathbf{I}$, an identity matrix of 1 on the diagonal and 0 elsewhere: $I + A + A^2 + A^3 + \cdots + A^n$

$\mathbf{I}$ indicates the initial demand of output (normalised to 1). Because the technical coefficients are positive numbers smaller than 0, the suite converges rapidly to its limit, called the Leontief inverse $\mathbf{L} = (\mathbf{I}-\mathbf{A})^{-1}$. The suite of indirect requirements and the resulting Leontief inverse corresponding to our model are in Table A.3. As shown, we obtain a satisfactory approximation of $\mathbf{L}$ with only 5 rounds.

The total (direct and indirect) requirements are obtained by subtracting the initial demand $\mathbf{I}$ from the Leontief inverse. Table A.3 shows that in order to produce 100 of output, the primary sector of B will indirectly generate and additional output of 6.3 from the A' s primary sector (instead of only 4 directly required), 19 from

Table A.3 Indirect requirements and Leontief inverse of the simplified model

A^2	0.068	0.063	0.016	0.020	A^3	0.023	0.024	0.007	0.010
	0.038	0.060	0.005	0.010		0.015	0.019	0.003	0.005
	0.044	0.023	0.033	0.042		0.016	0.013	0.011	0.017
	0.017	0.016	0.046	0.095		0.011	0.009	0.017	0.033
A^4	0.008	0.009	0.003	0.005	L	1.332	0.237	0.063	0.068
	0.005	0.006	0.001	0.003		0.147	1.308	0.010	0.034
	0.006	0.006	0.004	0.006		0.184	0.059	1.190	0.156
	0.005	0.005	0.006	0.011		0.044	0.061	0.178	1.438
A^5	0.003	0.003	0.001	0.002	L exp	1.331	0.235	0.062	0.066
	0.002	0.002	0.001	0.001		0.146	1.307	0.010	0.034
	0.002	0.002	0.001	0.002		0.182	0.057	1.189	0.155
	0.002	0.002	0.002	0.004		0.042	0.060	0.177	1.436

Note: A^2 stands for $\mathbf{A.A}$, in matrix multiplication. $A^3 = A^2.A$, etc. $\mathbf{L}$ is the Leontief inverse and $\mathbf{L}$exp is its approximation using the exponential expansion down to 5 rounds.

Table A.4 Embodied value-added for 100$ of final products in the simplified model

	A. Primary	A. Secondary	B. Primary	B. Secondary
A. Primary	75.4	13.4	3.5	3.8
A. Secondary	8.9	78.8	0.6	2.1
B. Primary	13.2	4.2	85.6	11.2
B. Secondary	2.5	3.5	10.2	82.9
Value Added	100.0	100.0	100.0	100.0

other primary sector firms in B instead of 14 and 17.8 of B's manufactures (compared to 11 of direct requirements). Interestingly, B's primary sector will also induce an additional production of 1 from A's manufacture, although it did not directly require any inputs from it. This is due to the fact that the suppliers of B's primary sector did use A's manufacture to produce the inputs it required.

The matrix of total requirements is based on material flows of products. It is simple, based on IO algebra, to compute the flow of income representing the monetary value of the tasks each industry along the GVC contributed to the final output.

The measurement of trade in value-added is based on the Leontief matrix. This operation, called the 'GVC Leontief Decomposition', is performed by pre-multiplying L by a matrix V where the diagonal elements are the value-added ratios (0.57, 0.60, 0.72 and 0.58 for A and B sectors, respectively) and all other elements are set to 0.

The result for the simplified model is shown in Table A.4. An important outcome is the sum of value-added created is equal to the value of the final output. In other words, the production of products through the GVC generate enough income for supply to be equal to demand and provide the conditions for a general equilibrium situation (actually, the actual input–output matrices observed in reality are expressions of an equilibrium situation, as long as the observation period corresponds to a 'normal' situation). This identity holds at the global level but may not apply at the national one, engendering balance of payments surplus or deficits if demand is lower or larger than income generation.

GVC indicators

The first step to analyse GVC trade is to decompose the flows of value-added according to the source and uses. First, we use a set of measures to decompose value chains to identify 'who produces for whom'; the second type of indicator measures the length of the GVCs.

- **GVC decomposition**

This report applied two approaches. The Leontief decomposition of GVC trade is closely related to the table of total requirements, but instead of indicating the gross value of production, it indicates the origin of the value-added embodied into the production, as in Table A.4 above. Applied to exports flows, it shows the contribution of all trade partners in the value of the products exported by a given industry.

The other decomposition by Wang, Wei and Zhu (2013) {termed WWZ} decomposes the value added into several sub-components (see Figure A.1) (see Wang et al. 2013; and Quast and Kummritz 2015 for detailed explanations).

- DVA_FIN represents the domestic VA embodied in exports of a final product. Those products are consumed (absorbed) in the importing country and do not continue participating in a value chain.
- DVA_INT is the VA embodied in intermediate goods that will be further processed as final goods and absorbed by the importer.
- DVA_INTrex corresponds to the exported domestic value-added that is reprocessed by the importing country and re-exported to third countries as intermediate goods.
- DVA_INTrex is further split into three categories according to its use by the second importer.
- RDV is the domestic value added that returns to the exporter, embodied in imports of final or in intermediate goods.

Other terms — not included in Figure A.1 which deal only with the domestic value-added content of gross exports — correspond to other concepts:

- MVA is the foreign value-added embodied in the exports and sourced from the importing country.

Figure A.1 WWZ decomposition of domestic value-added embodied in gross exports
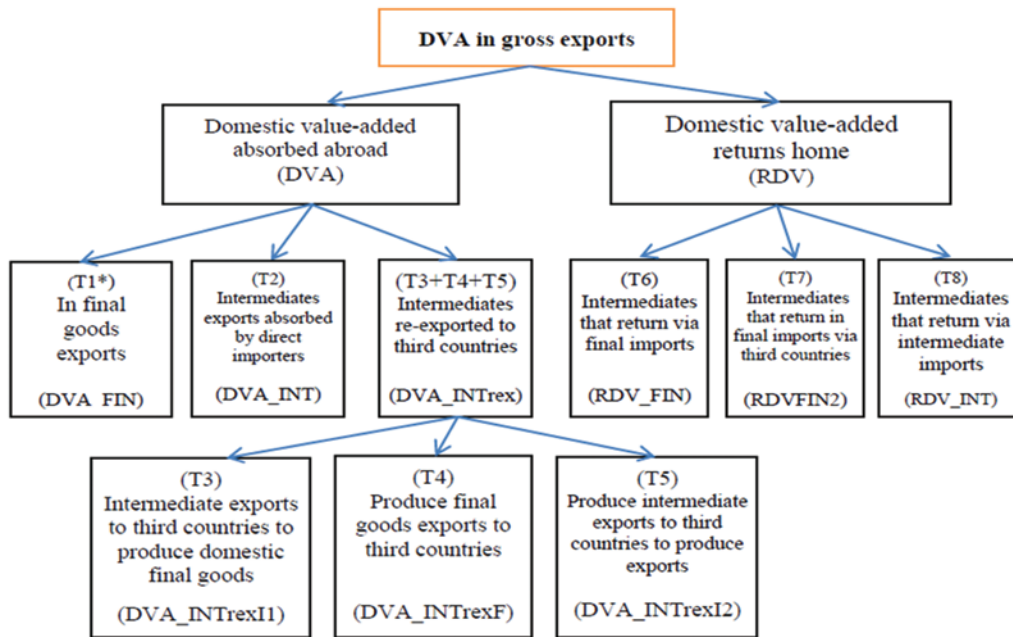
Source: Wang, Wei and Zhu (2013)

- OVA is the foreign value-added embodied sourced from all other countries.
- MVA and OVA are further split according to their use for intermediate of final goods.
- DDC, ODC and MDC capture double counting, a statistical issue that happens when trade takes place within GVCs.

Because pure double counting of foreign value-added in a country's exports can only occur when there is back and forth trade of intermediate goods, it is also an indirect indicator of the deepening of GVC trade (Wang et al. 2013).

- **GVC length, upward and forward linkages**

Another set of indicators widely used is the length of a value chain and the position of an industry (upstream or downstream) in the chain. These indicators are calculated with the input–output matrix and derive from the concept of 'backward and forward linkages' introduced by Hirschman (1958).

The linkage concept is based on the observation that an increase in ongoing activities induces other industries to undertake new activities. Backward linkage effects are related to derived (upstream) demand for intermediate inputs required. Forward linkage effects (downstream) are related to the intermediate output utilisation, i.e. the output from a given activity will allow other industries to use it as inputs in some new activities. The backward linkages, in Hirshman's view, constitute a pull effect (similar to the Leontief model), while the forward linkages create a push effect (called the Ghosh model).

This concept has been adapted to analyse the participation of an industry in the global economy. In trade analysis, the GVC participation of a given industry for a particular country is traditionally measured as the foreign value-added embodied in its production (usually, taking only the exports) plus its domestic value-added that is exported and used by other industries in foreign countries to produce their own output. This production may be consumed locally or further re-exported (the full description of the various alternatives being given by the above-mentioned WWZ decomposition).

The first measure is called 'backward GVC linkage' and the second one 'forward GVC linkage'; the ratio of forward over backward measures provides an indicator of the relative position of this particular industry: if the ratio is greater than 1, the industry is considered to be in an upstream situation.

On the contrary, if forward linkages are smaller than the backwards, it is a downstream

industry, meaning it is relatively close to the end of the GVC (final demand). The indicator is usually constructed on the basis of the Leontief decomposition (total requirements), but we also present it based on the simpler direct requirements. If this direct approach, based on input and output actually purchased by the industry, does not give the full picture of the GVC interactions, it is more meaningful from a micro-economic and business perspective because it relies on what the firm actual buys and sells. It is therefore easier to factor in when promoting evidence-based policy-making.

Similarly, the length of a value chain can be measured in two directions: forward, as the distance to the final consumer; backward, as the distance to the most upstream supplier. The literature offers various options to calculate these two measures, and the length of GVCs has been trending up since the late 1990s (see Wang et al. 2013 for a review).

It is worth mentioning that these indicators are the subject of some debate in the community of TiVA analysts. In some cases, it is difficult to characterise the particular role of an industry: a particular bank will provide credit to farmers (upstream activity) and to final consumers (downstream). The ratio will give some idea of what the main business of this particular bank is, but the industry average over all particular banks may not be very informative. Another more technical point of discussion is that these measures are intuitively based on the false idea that GVCs are linear chains. Actually, the Leontief inverse, which measures total requirements, is based on a series of loops.

• **GVC length**

There are different ways of measuring the length of a GVC. Most derive from the application of the APL, as defined in Dietzenbacher et al.

(2005). For this report we used the methodology developed by Inomata (2008) and Escaith and Inomata (2013); the technical details are as below.

Suppose we have an economic system of n industrial sectors with a production structure defined by the input coefficient matrix $\mathbf{A}$ as shown in Figure A.2. Input coefficients a_{ij} are calculated from an input–output table by dividing input values of goods and services used in each industry by the industry's corresponding total output, i.e., $a_{ij} = z_{ij} / x_j$, where z_{ij} is the value of the good or service i purchased for the production in industry j, and x_j is the total output of industry j. Thus, the coefficients represent the direct requirement of inputs for producing just one unit of output of industry j.

The vertical sequence of demand propagation can be depicted as follows.

Let us consider the impact of demand for 100 units in industry 3 on the output of industry 1. The simplest form of all is given by the direct linkage [3→1], which is calculated as a product of multiplying 100 units by input coefficient a_{13}. This is because a_{13}, by definition of an input coefficient, represents an immediate amount of products of industry 1 required for producing just one unit of products of industry 3.

There is also a two-step path going through another industry, such as [3→2→1]. This is derived by two-stage multiplication, that is, 100 units by a_{23} and then by a_{12}. There can also be a two-step path going through the same industry, such as [3→3→1] or [3→1→1], which would be derived, respectively, as $100 \times a_{33} \times a_{13}$ and $100 \times a_{13} \times a_{11}$ (see Figure A.2).

The exercise reveals that the impact of any two-step path can be given by feeding back a set of direct impacts, $\mathbf{A} \, \Delta \mathbf{d}$, into the input coefficient matrix, that is, $\mathbf{A} \times \mathbf{A} \, \Delta \mathbf{d} = \mathbf{A}^2 \, \Delta \mathbf{d}$, where $\Delta \mathbf{d}$ is an initial demand injection. Similarly, the impact of three-step paths is given by $\mathbf{A} \times \mathbf{A}^2 \, \Delta \mathbf{d} = \mathbf{A}^3 \, \Delta \mathbf{d}$, that of four-step paths by $\mathbf{A} \times \mathbf{A}^3$

Figure A.2 Input coefficient matrix Impact delivery paths
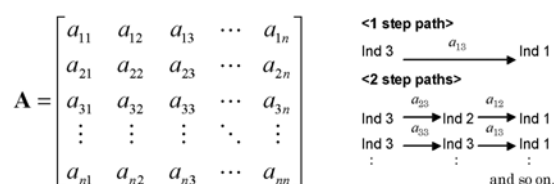
Source: Escaith and Inomata (2013)

$\Delta \mathbf{d} = \mathbf{A}^4 \, \Delta \mathbf{d}$, and so on, which is evident from $[\mathbf{A}^2]_{ij} = \Sigma_k a_{ik} a_{kj}$, $[\mathbf{A}^3]_{ij} = \Sigma_k \Sigma_h a_{ik} a_{kh} a_{hj}$, etc. The amount of impact shown in each layer of $\mathbf{A}^k$s (k = 1, 2, 3, …) is a result of the initial demand injection passing through all k-step paths. It captures the effect of every direct and indirect linkage that undergoes exactly the kth round steps or stages of the production process.

The expansion of the Leontief inverse matrix $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + \mathbf{A}^4 + \cdots$, represents the decomposition of the total impact on output into its constituent layers according to the number of production stages involved. Matrix $\mathbf{I}$ corresponds to an initial (unit) demand injection and the following $\mathbf{A}^k$s are interpreted as progressive impacts of the initial demand when supply chains are sliced at the kth stage of the production process.

Based on the preliminary understanding, APL is specified as the weighted sum of the series $k\mathbf{A}^k$:

$$\mathbf{APL}_{(ji)} = \sum_{k=1}^{\infty} k \left([\mathbf{A}k]_{ij} \Big/ \sum_{k=1}^{\infty} [\mathbf{A}^k]_{ij} \right)$$

Notes

1　The advantage is attributed to the historical ties, familiar administrative and legal systems, the use of English as the means of communicating with foreign partners, and large and dynamic diasporas, which have contributed to strong trade relationships among the members (Commonwealth Trade Review 2018).

2　Eora was initially developed with the objective of assessing the environmental footprint of international trade, and trade in merchandise.

3　Commonwealth LDCs include Bangladesh, Kiribati, Lesotho, Malawi, Mozambique, Rwanda, Sierra Leone, Solomon Islands, Tuvalu, Uganda, Tanzania, Vanuatu and Zambia. Vanuatu was thought likely to graduate by 2020.

4　The UNCTAD-Eora GVC database offers global coverage (189 countries and a 'Rest of the World' region) and a timeseries from 1990 to 2019 of the key GVC indicators: foreign value added (FVA), domestic value added (DVA) and indirect value added (DVX). Results from 1990 to 2015 are generated from Eora Multi-Region Input–Output tables (MRIOs). Results for 2016–19 are nowcasted based on the IMF World Economic Outlook. See: https://worldmrio.com/unctadgvc/

5　The homogeneity and proportionality assumptions are imposed because the available datasets do not have information on which domestic industries buy which imports. However, such assumptions are not necessarily valid. Specifically, under the homogeneity assumption, all firms in the same industry are assumed to have the same production function and use the same bundle of inputs. Yet, at the country-industry level, input use varies with output, since firms exporting to different countries and industries participate in different value chains and face distinct rules of origin (De Gortari 2018).

6　See Jones et al. (2019) for a comprehensive review of the analytical tools for GVC analysis, and Wang et al. (2013) and Koopman et al. (2014) for a more technical examination of the calculation of GVC indicators.

7　The participation indicator is based on nominal trade value and is influenced by variation in international prices, especially for trade in commodities.

8　The variables used included the source of value-added used in producing exports in 2015: domestic value-added; imported from other Commonwealth countries; imported from other G-20 members and imported from Rest of the World. The imports from other G-20 countries were aimed at capturing the impact of deep free trade agreements in North America and Europe, as well as of the emergence of large developing countries (such as China, in particular). The value for 2015 was complemented by the extent of variation every 5 years from 1995 to 2018 (this is 3 years for 2015–2018).

9　Agglomerative clustering is the most common type of hierarchical clustering used to group objects in clusters based on their similarity. The algorithm starts by treating each object as a singleton cluster. Next, pairs of clusters are successively merged until all clusters have been merged into one big cluster containing all objects.

10　The APL approach has the merit of being closely associated with the concepts of backward and forward linkages used in traditional input–output analysis. Annex II presents the methodology used to estimate the APL. There are other approaches; see, for example, Fally (2012) and Antràs and Chor (2013).

11　For example, a manufacture industry in an advanced country may specialise in upstream activities, such as R&D, and outsource the manufacturing operations to low-cost countries. In this particular case, upstreamness is associated with high technological content.

12　The strength of backward linkages in Agriculture is often linked to modern agriculture, reliant on improved seeds and intensive in fertilisers and other chemical inputs.

13　This technique is known as hypothetical extraction in input–output analysis. See Escaith (2019) for a didactic presentation.

14 Competitive advantage in a GVC is a mix of absolute comparative advantage (cost and quality competitiveness) and complementarity with the other firms in the production network. These are not to be understood as comparative advantages from a Ricardian perspective, which is valid only for countries in the long term.

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