Mapping the Commonwealth Countries' Participation in Global Value Chains

Escaith, Hubert and Khorana, Sangeeta

Bournemouth University

January 2020

Mapping the Commonwealth Countries' Participation in Global Value Chains

Final draft, January 2020

H. Escaith
S. Khorana

This draft is an unedited and unabridged background paper. Its results were used as inputs for preparing a report commissioned by the Commonwealth Secretariat:

> Khorana, S and H Escaith (2020) 'Harnessing the Commonwealth Advantage in Global Value Chains', International Trade Working Paper 2020/05, Commonwealth Secretariat, London

The final report can be freely downloaded at:

https://www.thecommonwealth-ilibrary.org/commonwealth/trade/harnessing-the-commonwealth-advantage-in-global-value-chains_45f0ea46-en

Abstract: This background paper provides a general picture of the characteristics and dynamics of Global Value Chains (GVC) in the Commonwealth countries. The main building blocks of the empirical analysis are based on a measure of inter-industrial linkages between and across between 43 of the 53 Commonwealth countries and sectors for which data were available. Using a trade network perspective, it measures the international flows of value-added and assesses countries' position within GVCs. After calculating a series of in-depth GVC indicators, the paper assesses the potential for trade creation within the Commonwealth community. This review is complemented by several suggestions of policy and enabling measures aimed at facilitating the participation of those countries that are at the lower end of the value chain.

Key words: Trade, Commonwealth, input-output, global value chains, inter-industry linkages, trade complementarity, regional trade agreements

JEL codes: C67, F13, F15, F60, O19, O24

Hubert Escaith is a former Chief Statistician at the World Trade Organization and a former Director at the United Nations ECLAC.

Sangeeta Khorana is Professor of Economics at Bournemouth University in the United Kingdom.

Corresponding author for this draft: hubert.escaith@outlook.com

Acknowledgments and disclaimer: This work was prepared as a contribution to a Report commissioned by the Commonwealth Secretariat. This draft, which represents work in progress, has not been submitted to substantive and formal editing. The opinions expressed are personal.

Contents

1. Introduction 3
2. Supply chains: definition, literature and conceptual underpinnings 4
3. Estimating 'Trade in Value-Added' for the Commonwealth countries 7
4. Measuring the strength of pure Commonwealth value-chains 27
5. Building on existing Trade Complementarity 30
6. Main findings and policy recommendations 37
Bibliography 41
7. Annex I Data and Methodology 44

List of Figures

Figure 1 : GVC participation index: Top 20 Commonwealth countries, 2015 10
Figure 2 Participation index of Commonwealth countries in GVCs, 1995-2018 11
Figure 3: Backward (imports of inputs) and Forward (exports of inputs) linkages with other CW countries, 1995-2018 (percent of exports) 12
Figure 4 GVC Linkages within the Commonwealth community, 1995-2018 15
Figure 5 Intra-Industrial trade flows inputs produced by the primary sector, 2015 16
Figure 6 Intra-Industrial trade flows inputs produced by the secondary sector, 2015 17
Figure 7 GVC length and upstreamness of primary and secondary sectors, 2015 20
Figure 8 Domestic and Foreign segments of industry sectors in the value-chain, 2015 21
Figure 9 Domestic and foreign linkages for selected industries and countries, 2015 23
Figure 10 Principal Component Analysis of CW Manufacture exports, 2015 27
Figure 11 Top-10 Average Complementarity Indices with other CW countries, 2015 31
Figure 12 WWZ Decomposition of Domestic Value-Added embodied in Gross Exports 47

List of Tables

Table 1 Country clusters based on the evolution of origin of value-added exports1995-2018 13
Table 2 Country clusters based on the evolution of domestic value-added for intermediate goods exports: 1995-2018 14
Table 3 Upstreamness: Top 10 and bottom countries for primary and secondary sectors 24
Table 4 Secondary sector: Top 20 CW bilateral trade flows of domestic value added, 2015 ... 25
Table 5 Secondary sector: Top 20 Commonwealth to Commonwealth and G20 trade flows of domestic value added, 2015 26
Table 6 Trade in Value-Added between Commonwealth secondary sectors transiting through Non-Commonwealth countries, 2015 (top 20) 28
Table 7 Trade in Value-Added sourced from the Commonwealth (primary and used by Commonwealth secondary sectors) transiting through non-Commonwealth countries, 2015 (top 20 countries) 29
Table 8 Import Complementarity in Final Products with the seven GVC hubs, 2015 33
Table 9 Import Complementarity in Intermediate Inputs with the seven GVC hubs, 2015 .. 34
Table 10 Top and Bottom 10 Relative Comparative Advantages, selected industries, 2015 .. 35
Table 11 Simplified International Input-Output Table 45
Table 12 Simplified Technical Coefficients 45
Table 14 Embodied Value-Added for 100$ of final products in the simplified model 46

Mapping the Commonwealth Countries' Participation in Global Value Chains

1. Introduction

More than two-thirds of world trade in manufacture occurs within global value chains (GVC). 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 (IDE-JETRO et al. 2019) before being consumed as a final product. The growing interdependence and integration of national economies has led GVCs to be internationally fragmentated; this changed the organisation of production and placed the specialisation of countries within GVCs at the centre stage of industrialisation strategies (Antras and Gortari, 2019).

The Commonwealth countries are increasingly important in world trade. The share of Commonwealth countries' goods and services exports represents 15% of total world trade, according to 2018 figures. Intra-Commonwealth trade represents 17% of Commonwealth exports of goods and 15% of their imports. Export growth has not been similar in all countries, some Asian Commonwealth members export more than the others. For instance, Commonwealth Trade Review (2016) reports that countries like Bangladesh, Brunei Darussalam, India, Malaysia, Pakistan, Singapore and Sri Lanka accounted for 41.1% 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 apply anymore within GVCs since significant shares of the value traded may come from other countries than from 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 a burgeoning research program on GVCs, the measurement of value of domestic vs. imported content embodied and the backward and forward linkages between and across between the 53 Commonwealth countries is incomplete. Mapping Commonwealth countries GVCs, i.e. identifying where value-added is initially created and ultimately consumed, how much and by whom, is a challenge given that most trade consists of parts and components, with semi-finished products going back and forth along the production chain between countries.

For this purpose, the report analyses Commonwealth value chains from an inter-industrial network perspective. The analysis examines 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 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. The data for analysis is based on the Commonwealth countries' input-output (IO) tables which are drawn from EORA data reported for 2015 and the UNCTAD-EORA simulation ("nowcasting") based on the IMF World Economic Outlook for 2016-2018. *Section 4* presents an overview on the evolution of Commonwealth countries in GVC trade and maps the dynamics of trade linkages between countries. This section discusses a series of GVC indicators, i.e. backward and forward linkages, length of GVC by country and sector, etc. Using network analysis, we comment on the Commonwealth countries' GVC participation. *Section 5* looks at estimating the potential for intra-Commonwealth trade creation. The discussion is based on the calculation of a series of Trade Complementarity indices. The previous sections set the scene for a discussion on the policy recommendations, outlined in *Section 6, which* suggests how policies could be refined to enhance GVC participation and support Commonwealth countries' efforts to benefit from GVC linkages. The *Technical Annexes* provide an insight into the methodology and explains the computation of GVC indicators, backward and forward linkages as well as the length of the value chain.

2. Supply chains: definition, literature and conceptual underpinnings

Gereffi and Fernandez-Stark (2011) 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 from trade links between countries and the increasingly dense international trade network of intermediate inputs that include parts and components, natural resources and services (Gereffi et al., 2005; UNCTAD/OECD/WTO, 2013; OECD, 2013; 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 globalized system of production. This presents the argument of comparative advantage given growth of trade in intermediate inputs (Deardorff, 2005; Grossman and Rossi-Hansberg, 2006; Baldwin, 2012; Ali and Durash,

2011). Blanchard, Bown and Johnson (2016) find that countries integrated in GVCs have lower tariff protection.

The second strand looks at firms and 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 analysis. Escaith (2014) developed the GVC decomposition and network analysis and 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 (WION) as a directed and weighted network of country-sector pairs and compute several local and global network metrics over a period of time (Cerina et al., 2015). Zhu et al. (2015) use this technique and produce a 'topological view of industry-level GVCs' as global value trees for a large set of pairs country-sector and compute a measure of industry importance based on them. Ferrarini (2013) and Amador and Cabral (2013) 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 GTAP 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 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 growing role of Southern actors and Southern end markets.

Escaith and Inomata (2013) focus on trade in East Asia, they use Input-Output 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 comes from the unequal distribution of primary production factors such as land, labour and capital. In GVCs, what the lead-firm (the firm which is the main driver of upstream supply chain and the down-stream sales to the final users) looks for is 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 bundled into single offerings (also referred to as "tasks").

Several studies examine countries' trade specialisation and revealed comparative by identifying low and high specialisation patterns. For instance, Hidalgo et al. (2007) and Hausmann and Klinger (2007) argue that countries' export specialisation reflects the domestic capabilities and determines the development perspective. However, this (pessimistic) view does not account for the 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 (Bondani, 2091; Koopman et al., 2010; Baldwin, 2012).

Early efforts to explain and measure production fragmentation include work by Feenstra (1998) and Hummels et al., (1999) that focuses 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.

Studies capture the upstream effects by adopting a macro approach based on inter-country or world IO tables (see OECD-WTO, 2012 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, Ishii and Yi, 2001; Daudin et al., 2006, 2009; Johnson and Noguera, 2011; Koopman et al., 2011).

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; Shingai and Razzaque, 2015; Khorana and Inmaculade-Zarsoso, 2018; 2019) and find evidence of intra-CW 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 interregional partnerships.

3.1 Data

Various databases, such as OECD TiVA and WIOD, provide the required data required to assess trade in value-added. This project draws on Eora Multi-Regional Input-Output (MRIO) table (see Lenzen et al. (2013) for a review of Eora construction) and creates Commonwealth member specific database of countries for which data is available.[1] Note that data on the following Commonwealth countries is absent in Eora database: Dominica; Grenada; Kiribati; Nauru; Saint Lucia; Solomon Islands; St Kitts and Nevis; St Vincent and The Grenadines; Tonga; Tuvalu, hence these are not included. Several of these missing countries are classified as Least Developed Countries whose integration into GVC presents specific opportunities, due to preferential market access granted to all developed economies and most emerging ones, but also specific challenges when these preferences are eroded, see Keane (2018) for a review. [2]

This paper analyses GVC indicators for 43 Commonwealth countries. The indicators examine trade within and across the Commonwealth members as well as trade patterns with the main G20 trade partners; 'other countries' are aggregated into Rest of the World (ROW) region. See the list of countries in Annex Table I. The analysis is reported for 2015, which is the data included in Eora and for 2016-2018 with the UNCTAD-EORA simulation ("nowcasting").[3]

UNCTAD-Eora database has a broad geographic coverage but it suffers from several limitations. First, input-output (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 occulted. Third most national statistics focus on trade flows in merchandise only. 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

[1] Eora was initially developed with the objective of assessing the environmental footprint of international trade, and trade in merchandise.
[2] Commonwealth LDCs include Bangladesh, Kiribati, Lesotho, Malawi, Mozambique, Rwanda, Sierra Leone, Solomon Islands, Tuvalu, Uganda, Tanzania, Vanuatu and Zambia. Vanuatu is likely to graduate by 2020.
[3] The UNCTAD-Eora Global Value Chain (GVC) database offers global coverage (189 countries and a "Rest of 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 2016-2019 are nowcasted based on the IMF World Economic Outlook. See https://worldmrio.com/unctadgvc/

national IO tables.[4] For instance, 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.

Eora includes data on 26 sectors that have been aggregated as follows:

- Primary sectors (agriculture, fisheries and mining),
- Secondary sectors (Manufacture),
- Tertiary sectors (commercial and administrative services),
- "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.

The database employed for this analysis includes 58 countries (43 Commonwealth, G20, ROW) and three sectors (primary, secondary and tertiary), which results in a 174 by 174 matrix.

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 the 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 or investment goods, or exported as final good. In GVC trade, the concepts of country of origin or country of destination as traditionally understood in trade statistics do not fully apply: when the national origin of the value-added incorporated in the final product is carefully examined, one realizes that significant shares of the value may come from other countries than from 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 IO relationship between any two countries, and takes 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 service.

The empirical analysis focuses 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 third countries' exports. Annex I present the technical details and elaborates how to estimate trade

[4] The homogeneity and proportionality assumptions are imposed to resolve the issue that 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).

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 exports to third countries (forward linkages) or returned home. Based on this decomposition, the two measures of GVC participation used in this report are: backward linkage, being the share of foreign value-added in total exports of a country, and forward linkage, the domestic value-added embodied in intermediate exports that are re-exported to third countries, expressed as a ratio of gross exports. See Jones, Demirkaya and Bethmann (2019) for a comprehensive review of the analytical tools for GVC analysis and Wang, Wei and Zhu, 2013 and Koopman et. al., 2014 for a more technical examination to the calculation of GVC indicators).

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 at least twice the international borders.

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) and 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 more the length of GVC the more are the stages involved in production unlike larger distance suggesting 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 the share of the manufacturing sector in a country's gross domestic product (GDP), the lower is the share of DVA in its exports. Another important structural factor is the market size. Countries with larger markets are expected to have 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 "hyper-globalization" took place between 1995 and 2005 (Escaith and Miroudot, 2015). The process slowed down during the 2008-2009 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 still ongoing.

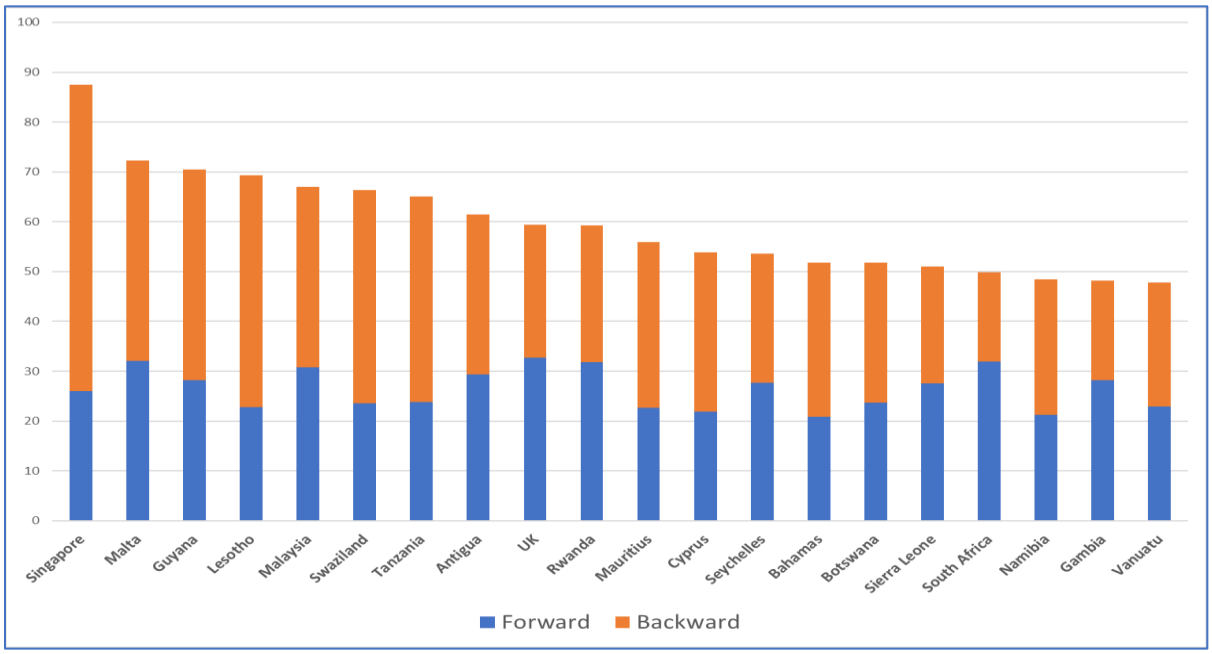
This section examines the evolution of Commonwealth countries trade in value-added from 1995 to 2018. This considers the use of FVAiX on the one hand, and the exports of DVA to other trading partners for further reprocessing and exports on the other.

3.3.1 GVC participation index: 1995-2018

The index, based on UNCTAD-EORA data, is calculated over the entire economy, including primary, secondary and tertiary sectors. The index, based on UNCTAD-EORA data, is calculated over the entire economy, including primary, secondary and tertiary sectors.

Figure 1 presents the GVC participation index for top 20 Commonwealth countries that present evidence of participation in 2015, the last year with detailed EORA data. The index is traditionally measured as the foreign value added embodied in production (usually only exports) plus DVA used by other industries in foreign countries to produce exports.[5] The index, based on UNCTAD-EORA data, is calculated over the entire economy, including primary, secondary and tertiary sectors.

Figure 1 : GVC participation index: Top 20 Commonwealth countries, 2015 (as % of exports)



Source: Authors calculations based on EORA

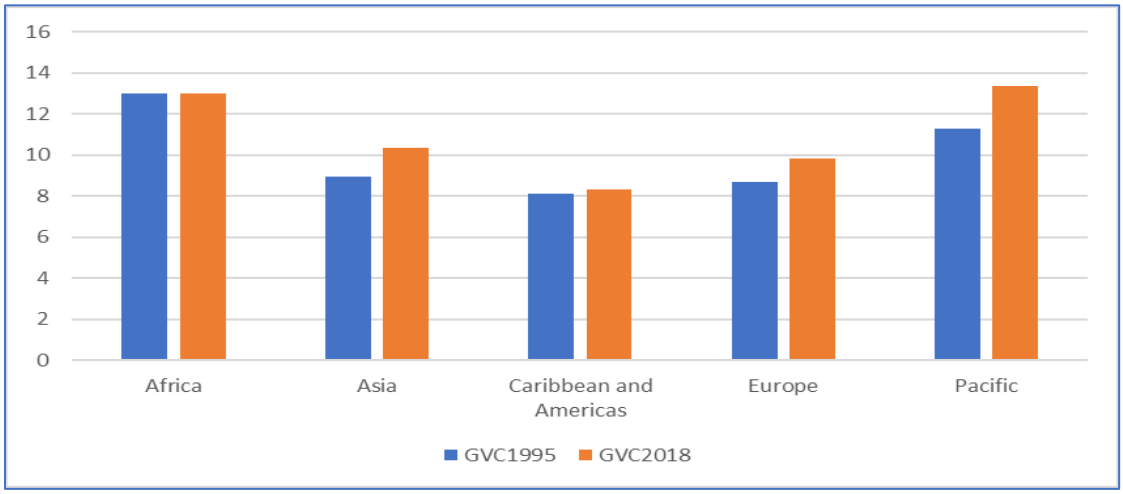
An examination of countries' participation in GVCs, in terms of domestic and foreign value-added content of gross exports by the exporting country, shows that open economies, such as Singapore, Cyprus and Malaysia present evidence of high backward participation. The UK, Malta and South Africa show high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

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

financial services that are used as intermediate inputs in GVCs. South Africa exhibits high value of forward linkage, reflecting the fact that South African exports are used as inputs by other countries.

Figure 2 disaggregates the long-term evolution of Commonwealth member countries' participation in the GVCs. An important finding is that majority of Commonwealth countries increased their reliance on inputs from other Commonwealth trade partners during 1995-2018. The median value, for all Commonwealth countries, increased by more than 1 percentage point, from 4.4% to 5.7%. The average, however, increased by half a percentage point, from 6.4% to 6.9%.

Figure 2 Participation index of Commonwealth countries in GVCs, 1995-2018 (Percent 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

The Asian, Pacific and European regions present evidence of growing participation in GVCs. Asia stands out with the highest growth in GVC integration between Commonwealth members. This, however, does not apply to Africa and the Caribbean regions that did not show much changes in their GVC integration. Nevertheless, while Africa shows high insertion, the Caribbean countries are at the lowest part of the spectrum.

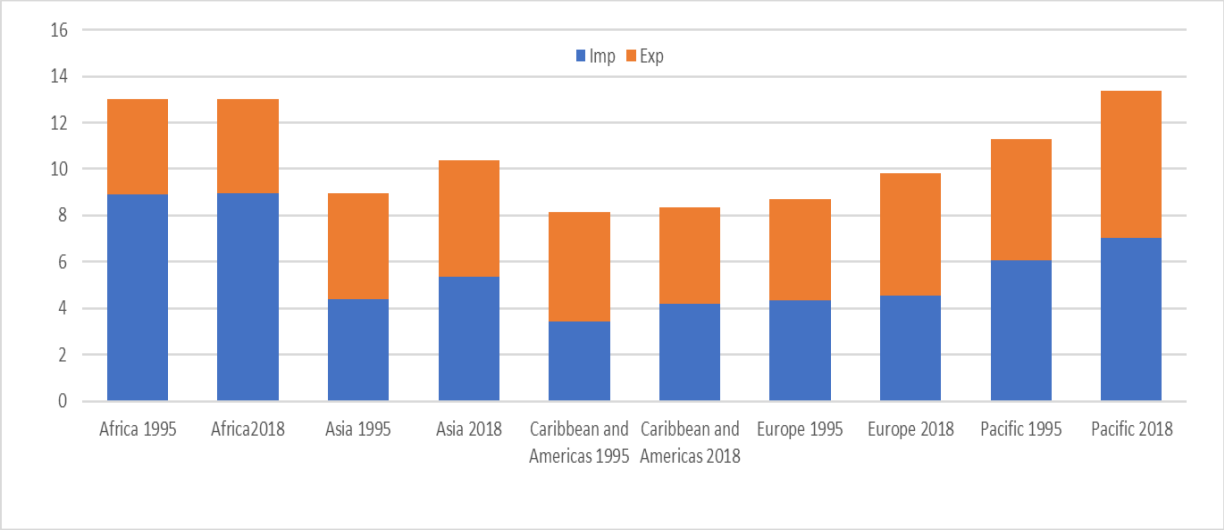
3.3.2 Backward and Forward linkages: 1995-2018

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

The countries in Europe that belong to the Commonwealth –UK, Malta and Cyprus– are highly integrated in the GVCs due to these countries being a part of the EU single market. Actually, it appears that membership into the same deep integration agreement potentialize the positive impact of Commonwealth membership. This explains why Malta and Cyprus registered a higher forward linkage increase (20%) then the backward linkage (5%).

The Caribbean and Americas present a mixed picture – increasing backward linkage (22%) but falling forward linkage (12%). Countries in Africa exhibit a relatively constant participation in both the forward and backward linkage (1% increase in backward and 2% drop in the forward linkage). When the whole economy is considered, Africa shows 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, is particularly affected by the high values found for Botswana and Namibia (over 23 in 1995 and about 20 in 2018) and Mauritius (11 and 12, respectively). Actually, the Africa region is the most heterogeneous with regard to this indicator, with a standard variation of the backward index almost as high than the mean value (8.0 against 8.9 in 1995). For comparison, the standard deviation is 3.1 in Asia, 2.2 in the Pacific and only 0.5 in Europe.

Figure 3: Backward (imports of inputs) and Forward (exports of inputs) linkages with other CW countries, 1995-2018 (percent of exports)



Source: Authors calculations based on UNCTAD-EORA

When it comes to sourcing domestic and imported inputs, the Commonwealth countries present different patterns, even when they are located in the same geographical regions. To examine the evolution of Commonwealth countries' GVCs, we apply the exploratory data analysis to a set of GVC variables.[6] The results obtained with Agglomerative hierarchical clustering (AHC)[7] show the similarities and dissimilarities between countries in both the depth of their GVC integration in 2015 and its evolution from 1995 to 2018.

[6] The variables used include the source of value-added used in producing exports in 2015: Domestic value-added; imported from other Commonwealth countries; imported from other G20 members and imported from Rest of the World. The imports from other G20 countries are aimed at capturing the impact of deep free trade agreements in North America and Europe as well as the emergence of large developing countries (such as China, in particular). The value for 2015 is complemented by the extent of variation every 5 years from 1995 to 2018 (this is 3 years for 2015-2018).

[7] 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.

3.3.2.1 Similarities in Backward Linkages

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

Table 1 Country clusters based on the evolution of origin of value-added exports:1995-2018

Clusters	1	2	3	4	5	6	7	8
Within-cluster variance	272.8	41.9	411.7	246.3	294.2	231.0	742.9	0.0
DVA_2015	69.3	88.4	74.0	78.7	73.4	58.3	63.0	87.2
CWS_2015	7.8	4.2	4.3	15.6	12.5	13.1	7.7	8.0
G20_2015	15.5	5.0	15.8	3.2	6.7	18.5	13.0	2.4
Var. DVA_95_18	9.9	-0.3	2.7	5.7	-0.4	-25.3	-8.3	6.6
Var. CW_95_18	-0.5	0.6	0.6	-4.2	0.5	8.9	1.7	-4.3
Var. G20_95_18	-6.6	-0.1	-3.2	-0.7	-0.3	10.1	3.2	-1.0
Countries	Antigua Malaysia Mauritius Samoa	Australia Bangladesh Cameroon Ghana India Kenya Malawi New Zealand Pakistan Papua New Guinea Sri Lanka Uganda	Bahamas Barbados Belize Brunei Canada Cyprus Jamaica Malta Nigeria Singapore South Africa Trinidad and Tobago UK	Botswana Mozambique Namibia	Fiji Gambia Seychelles Sierra Leone Swaziland Vanuatu	Guyana Tanzania	Lesotho Rwanda	Zambia

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;
G20_2015: share of value-added imported from non- Commonwealth G20 countries.
Imports from the Rest of World are calculated from 100%.
Source: Authors elaboration, based on UNCTAD-EORA data

Some interesting observations emerge:

- Large economies do not rely on the Commonwealth member countries for their inputs. Countries, such as Australia, India, Kenya, New Zealand exhibit a high domestic value added in exports. An explanation is the domestic market size of these countries that provides a large pool of local input suppliers which lowers their backward GVC participation but increases forward GVC participation.
- Open economies import value-added inputs from G-20 countries, and the reliance of countries such as Singapore and UK on the Commonwealth countries is lower (4.2%) than the group average.
- Small economies show some evidence of more inward orientation. Countries, such as Guyana, Tanzania, Mozambique, Swaziland, rely on imported inputs from the Commonwealth countries with value of inputs ranging from 13% to 16%.

3.3.2.2 Similarities in Forward Linkages

Forward linkages show the destination of DVA embodied in the Commonwealth countries intermediate inputs used by other countries to produce exports. Thus, the concept of forward

linkage includes the DVA embodied in intermediate exports further re-exported to third countries, expressed as a ratio of gross exports.

Table 2 Country clusters based on the evolution of domestic value-added for intermediate goods exports: 1995-2018

Country clusters	1	2	3	4	5
Within cluster variance	88.2	38.7	92.2	0	0
Domestic_2015	72.8	76.6	75.5	77.1	72
CW exports_2015	4.3	5.3	3.9	3.8	6.6
G20 exports_2015	14.1	8.5	7.8	7.1	13.1
d_Dom_95_18	-5.9	-2.8	2.1	-0.7	1.2
d_CWS_95_18	0.6	0.4	-0.9	1.4	0.3
d_G20_95_18	4.3	1.6	0.5	-1.3	0
Countries	Antigua Bahamas Brunei Cameroon Canada Malaysia Malta Nigeria Pakistan Papua New Guinea South Africa Trinidad and Tobago UK	Australia Bangladesh Belize Cyprus Fiji Guyana India Kenya Malawi Mauritius Mozambique New Zealand Samoa Seychelles Singapore Sri Lanka Tanzania	Barbados Botswana Gambia Ghana Jamaica Lesotho Namibia Rwanda Sierra Leone Swaziland Uganda	Vanuatu	Zambia

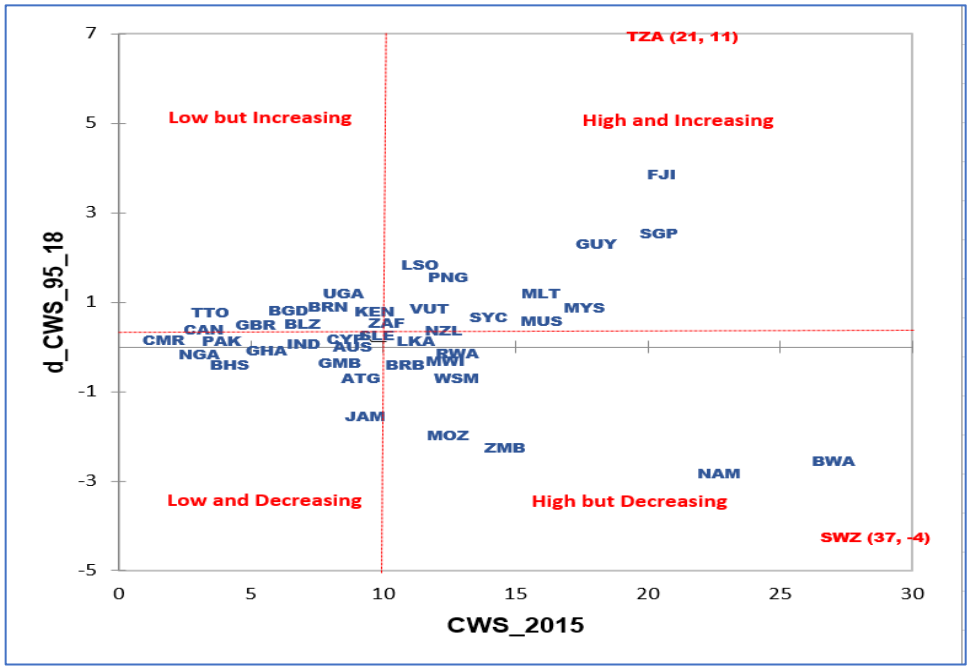
Notes: Domestic_2015: share of domestic value added sold locally and embodied in exports in 2015; CWS_2015: share of value-added exported to other Commonwealth countries for re-exports; G20 exports: G20_2015: share of value-added imported from non- Commonwealth G20 countries. Imports from the Rest of World are calculated from 100%.
Source: Authors elaboration, based on UNCTAD-EORA data

From GVC perspective, the reliance of Commonwealth countries on domestic inputs increased between 1995-2018. Findings worth highlighting are as below:

- Commonwealth countries, such as Canada, UK, Malaysia, South Africa, are more upstream in GVCs with higher forward linkages. These countries source intermediate inputs from the G20 countries; this was 14% more in 2015 compared to 1995 representing an increase of 4 percentage points over the period.
- Countries in Asia and the Pacific, such Bangladesh, India, Sri Lanka, Mauritius, Australia and New Zealand rely on domestic rely more on domestic value-added and exports from the Commonwealth members. These present limited evidence of forward linkages with the Commonwealth and G-20 countries.
- Ghana, Jamaica, Namibia and Swaziland are inward-looking and inwardly-oriented countries, in terms of their reliance on Commonwealth and G20 exports.

Figure 4 presents GVC linkages for the Commonwealth countries, constructed as the sum of backward and forward linkages for 1995-2018.

Figure 4 GVC Linkages within the Commonwealth community, 1995-2018



Note: CWS_2015: sum of the backward and forward linkages, in percent 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.
Source: Authors' elaboration, based on UNCTAD-EORA data

Most countries in the top right quadrant (high and increasing) 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 substitute part of their imports from the Commonwealth for domestic inputs unlike Jamaica with low and declining GVC participation whereas Namibia and Swaziland with an inward orientation.

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

We use 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 is for year 2015; this is the latest data available in Eora.

In the network analysis, each country is represented by a node (a circle or a square), with arrows pointing from supplier to receiver of inputs used by the using industry to produce exports. The methodology used to draw the network analysis (the Fruchterman-Reingold algorithm[8]) 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

[8] The Fruchterman-Reingold Algorithm is a force-directed layout algorithm. The idea of a force directed layout algorithm is to consider a force between any two nodes. In this algorithm, the nodes are represented by steel rings and the edges are springs between them.

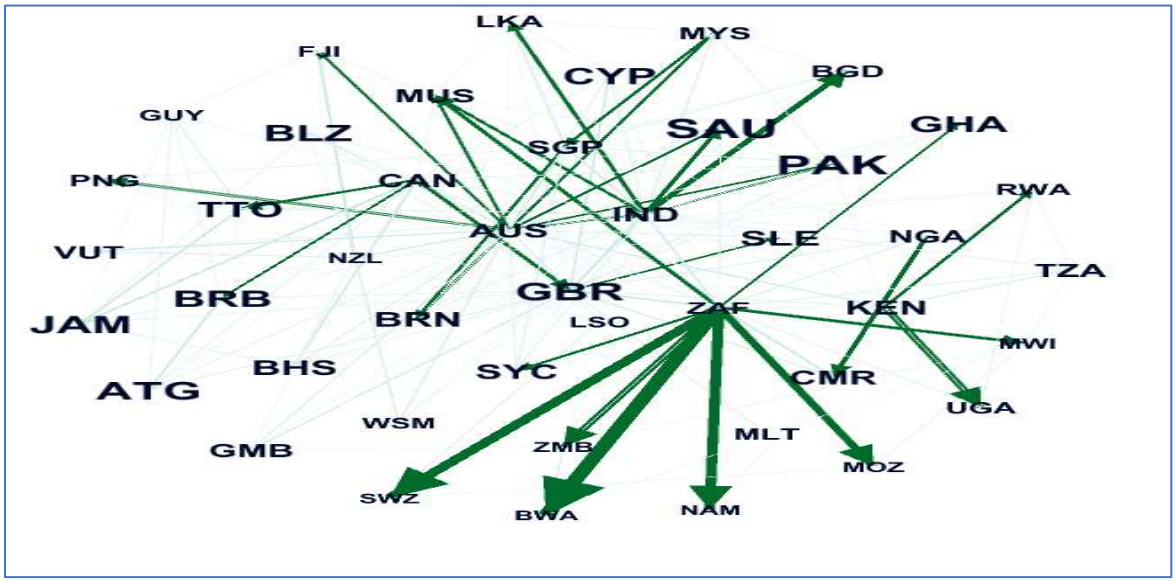
location of the nodes in the network visualisation. The position of the nodes takes into consideration the relative importance of countries in the network. The size of each node is proportional to its total degree (sum of indegree and outdegree) and the colour of the node is mapped to its indegree, with 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 (e.g. 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 uses trade flows expressed in terms of percentage of each country's direct requirements exports, and only the most significant bilateral trade flows have been used.

3.4.1 Trade in primary goods

Figure 5 Intra-Industrial trade flows in intermediate inputs produced by the primary sector, 2015



Note: Intra-regional trade only. Nodes are labelled according to the ISO3 country code; 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.

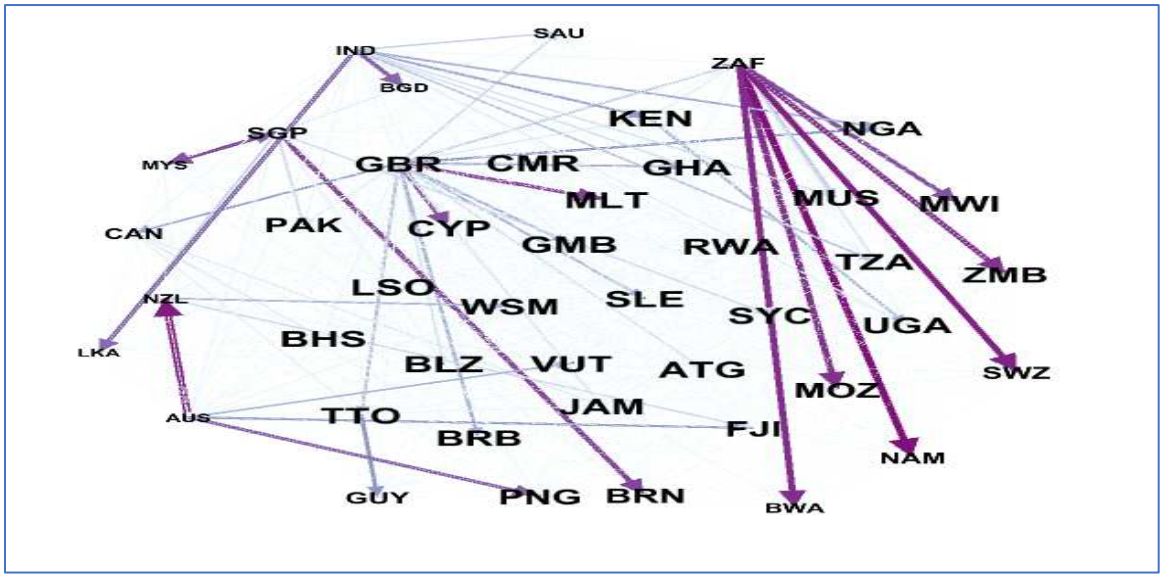
In 2015, the countries placed in the main core are the large Commonwealth countries, like UK, Australia and South Africa, at the centre of the network. The increase in the density of the network places UK in a central position given its economic size and trade in primary goods with the geographically diverse Commonwealth community. South Africa is a key trade partner for African countries, as India is for Asia (e.g. Sri Lanka, Pakistan). On the periphery are

countries in the Caribbean and Africa, given countries like Botswana, Swaziland, Jamaica and Guyana are raw materials suppliers providing inputs at the beginning of the GVC to other countries in the region.

3.4.2 Trade in intermediates or manufactured inputs

Trade in intermediates or manufactured inputs (Figure 6) reflects the economic size of exporting country and its role in the intermediate stages of the GVC.

Figure 6 Intra-Industrial trade flows in manufactured inputs produced by the secondary sector, 2015



Note: Intra-regional trade only. Nodes are labelled according to the ISO3 country code. 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.

South Africa dominates the regional network given it enjoys strong links with the African countries, like Botswana, Zambia, Malawi, located in the outer layers of the network. South Africa is an important source of processed inputs for Commonwealth countries members in the region, but its location at the periphery of the network shows that it is not a major global supplier.

UK's trade of value-added with the Commonwealth countries like Malta, Cyprus and Canada makes it important in the network. The Asian economies are located on the secondary edge. For instance, India, Australia and Singapore supply value added inputs to Bangladesh, New Zealand and Malaysia, respectively.

The analysis highlights the regional dimension of Commonwealth GVCs in sourcing inputs. Main findings are as below:

- Large economies play a vital role as hubs but countries, such as the UK and Canada, source less than 7% of manufacturing inputs from other Commonwealth members. Considering large industrialised Commonwealth economies produce complex

intermediate inputs the lack of linkage with smaller Commonwealth countries is not surprising.

- Membership of preferential trade agreements and the depth of such agreements increase backward GVC participation. Canada's backward linkage is explained by its economic integration with the USA and Mexico under NAFTA.
- Commonwealth countries in the African region show evidence of regional interlinkages. There are two prominent regional clusters - Botswana, Malawi, Mozambique, Namibia, Swaziland and Zambia; Ghana, Kenya, Mauritius, Nigeria and Tanzania. In addition, African countries source over 70% of foreign input requirements from a regional Commonwealth partner. South Africa that holds a prominent position, both as a major supplier of primary and secondary inputs in African GVCs. The Pacific countries are also grouped by geographical characteristics in a cluster comprising Fiji, New Zealand, and Papua New Guinea.
- Regional characteristics are, however, not the sole determinants of GVC trade in manufactured inputs. Countries from different geographical location, such as Cyprus, Gambia, Lesotho, Malta, Rwanda, Saudi Arabia, Sierra Leone, South Africa, UK share similar sourcing patterns.

3.5 Length of GVCs in 2015

The measurement of GVC production length calculating two metrics: "distance to final demand," or "upstreamness" i.e., the average number of stages between production and final consumption, and "the average number of production stages embodied in each product" or the "downstreamness". The calculation provides a measure of the total length of production chains and a sector's position in the chain simultaneously. There are several methodological approaches; this report uses the Average Propagation Length (Inomata, 2008; Escaith and Inomata, 2013). [9] The calculation of APL considers direct and indirect trade flows required for the production of final goods and consider where countries are located in the value chain. Calculation is based on total requirements, including the various steps and 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 GVC.

This is in contrast to the network analysis, that measures bilateral trade flows with traditional trade and national accounts statistics. The more inserted an industry into GVCs, the higher will be the difference between the value of exports from direct connection with the producing industry, and exports it is able to realise through inter-industrial network.

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

[9] 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 I presents the methodology used to estimate APL. There are other approaches, see for example, Fally (2012), Antras et al. (2012) and Antras and Chor (2013).

(mainly agricultural and fishery products). Hence, upstreamness is often associated with specialisation in primary exports, with some exceptions.[10]

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.

With these caveats in mind, Figure 7 presents the length and relative upstreamness of the Commonwealth countries' primary and secondary sector. The measure of "upstreamness" refers to the "distance to final demand". The index measures how many stages of production remain before goods produced reach final consumers. This is a calculation based on the inter-country IO framework used to derive the GVC indicators.

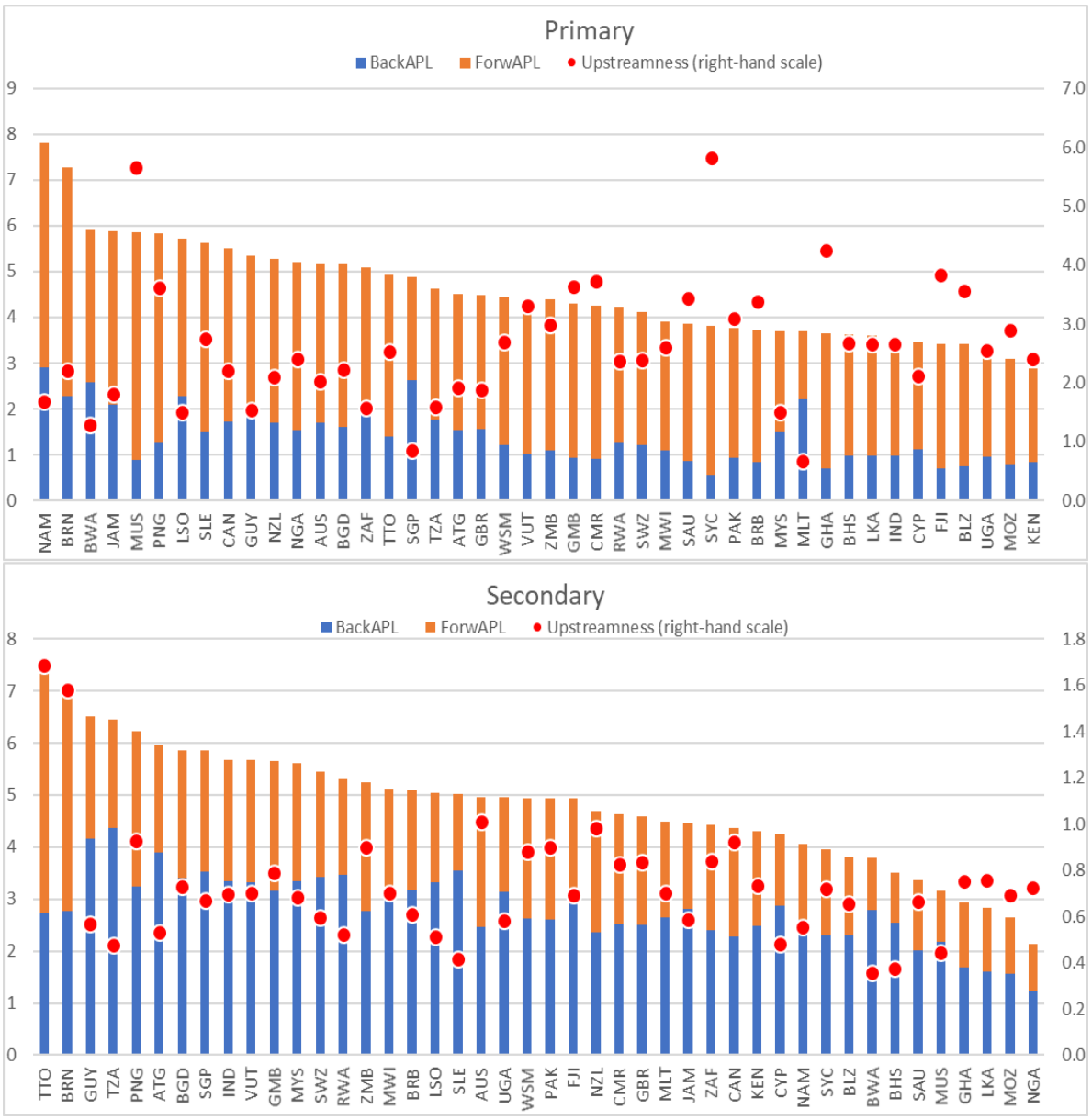
The average value by country (for all industries) is presented below in Figure 7 for selected countries. A high value of upstreamness is associated with the finding that countries are more specialised in the production of inputs at the beginning of the value chain, such as Namibia and Brunei as these are exporters of primary goods. On the contrary, Trinidad and Tobago and Brunei lead in the secondary sector as main exporters of secondary products, for products like refined fuels.

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 it is the case here.

Figure 8 (below) presents the results for a selection of primary and secondary sectors, calculated for the Commonwealth community. The GVC profile of countries across different industry sectors are heterogeneous. The total length of the value chain, both domestic and foreign components, varies from 3 (for Metal products) to 1.6 (for Food and beverage). Textile industry sector is twice as much international than agriculture, when looking at the relative importance of the foreign backward and forward linkages relative to the domestic linkages.

[10] 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.

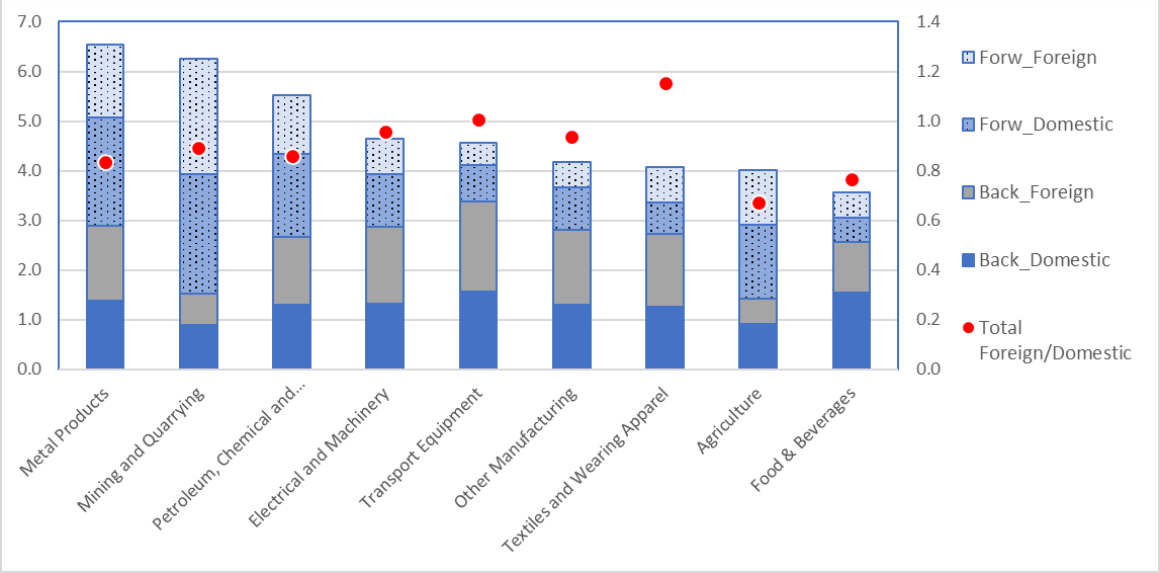
Figure 7 GVC length and relative upstreamness of CW countries' primary and secondary sectors, 2015



Note: Average propagation length are calculated for each individual industry as weighted average of the successive value-chain steps, covering both domestic and foreign linkages. The sectoral aggregates are simple average 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

The longest value chain (Figure 8 below), by Commonwealth countries average, is observed for Metal Products industry. Both domestic (3.6) and foreign (3.0) segments are very long. Mining and quarrying industry has a similar profile, with longer foreign linkages and a shorter domestic linkage (3.3). The Petroleum and Chemical sector has 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 are relatively similar.

Figure 8 Domestic and Foreign segments of industry sectors in the Commonwealth value-chain, 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 second group of industries, i.e. processed products are closer to the final demand, with smaller overall linkages, in particular for domestic part (about 2.2). Within this group, transport equipment and electrical and electronics are the most integrated with partners outside the Commonwealth, with foreign linkages measured at 2.4 and 2.3, respectively as an average for all CW countries. Other manufactures are 2.8 and 2.0 for forward and backward linkages, respectively.

The domestic length of the Textile industry is the shortest among all reported industry sectors, at 1.9. This presents short domestic linkages compared to the foreign linkages.

Agriculture and Food and beverage industry sector is characterised by larger domestic linkages (about 2.0) than the foreign (about 1.7). With few exceptions (especially Canada or New Zealand for agriculture), these two sectors remain inward oriented.

However, upstreamness tells only a part of the story in GVC analysis: 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 is concerned, we find a contrast between countries. We would expect smaller countries to be more reliant on foreign markets, as it is the case with Mauritius and Singapore which are foreign-oriented. But this is not the case with Jamaica and New Zealand that show less outward orientation when compared to the UK, South Africa and Canada. However, large economies such as Australia and India, are highly reliant on domestic value-added and are inward-oriented in the sub-sample.

The upstreamness ratio is affected by the length of backward linkages when it is very small, and can be misleading. Hence, when interpreting sectoral GVC indices, it is important to differentiate 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 includes all inputs (i.e. primary, secondary and tertiary sectors). For example, Singapore's agricultural sector shows 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 secondary and tertiary sectors (for example, wholesale distribution of imported inputs).[11] The strong backward linkage (and weak domestic forward linkages to domestic final demand) is attributed to Singapore's re-exports of agricultural products.

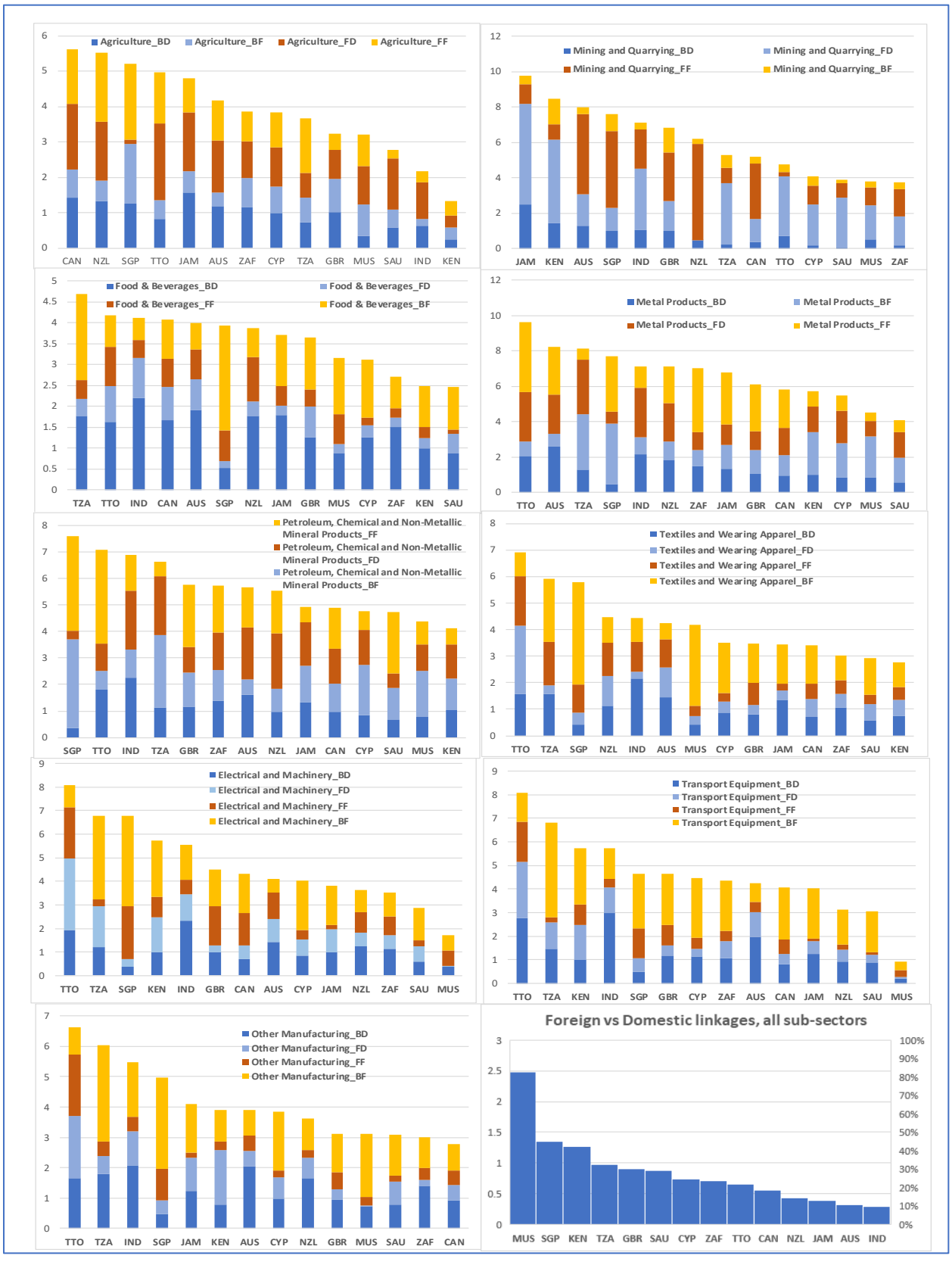
Further examination of agricultural sector linkages for Canada and New Zealand presents evidence of significant comparative advantages, extending to strong backward linkages for their food and beverage industry. It contrasts with Singapore that does not rely on domestic inputs for its food industry sector. Indian agriculture APL is small (i.e. low rank of agricultural linkage) due to inward orientation, both in the use of inputs and lack of export orientation. Kenya agricultural sector, however, shows strong export orientation (e.g. tea, flowers).

For Mining and Quarrying sector, Jamaica and Kenya show long APL mainly due to large domestic forward linkages. But strong comparative advantages is not always correlated with long APL and GVC linkages. For example, Saudi Arabia and South Africa exhibit short backward domestic linkages, while Singapore ranks 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 is by its domestic Petro-Chemical industry rather than being exported for processing.

Again, the length of GVCs do not always correlate with a country's competitive advantage in processing raw inputs. Singapore, as a regional hub, ranks first with long APL in Petroleum, chemicals and non-metallic mineral products. But Saudi Arabia is at the bottom end. Metal products sector is another similar example - Trinidad and Tobago, is rich in oil but not in other mineral endowments, and yet ranks high in terms of APL linkages.

[11] The strength of backward linkages in agriculture is often linked to modern agriculture, reliant on improved seeds and intensive in fertilizers and other chemical inputs.

Figure 9 Domestic and foreign linkages for selected industries and countries, 2015



Note: The suffix "_BD" refers to the length of Backward Domestic linkages, as simple average of selected countries' indicator; "_FD": forward domestic linkages; "_FF": forward foreign linkages; "_BF": backward foreign linkages
Source: Authors, based on EORA data

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 domestic and foreign outsourcing. Most end-products are commercialised by lead firms which have sophisticated supply-chain arrangements. Trinidad and Tobago has the longest value-chain for all sectors, followed by Tanzania. While Trinidad and Tobago has a strong domestic sector reliance, Tanzania shows strong foreign sector reliance in light of its reliance on imported inputs.

Despite the UK being a leader with strong presence in Transport equipment sector (in particular the aeronautical and land transport equipment industry) it does 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 relationship.

Despite the popularity of upstreamness and downstreamness concepts in GVC analysis, the upstreamness index results can be misleading. It is based on ratio between the length of forward and backward linkages, such that a small backward linkage value can induce high upstream indicators even when the actual forward linkages are not large. With these caveats in mind, Table 3 presents an overview on the top and bottom ten Commonwealth countries for primary and secondary sectors.

Table 3 Upstreamness: Top 10 and bottom countries for primary and secondary sectors. 2015

Top 10 Primary sector				Bottom 10 Secondary sector			
Country	BackAPL	ForwAPL	Upstreamness	Country	BackAPL	ForwAPL	Upstreamness
Seychelles	0.6	3.2	5.8	Botswana	2.8	1.0	0.4
Mauritius	0.9	5.0	5.7	Bahamas	2.6	1.0	0.4
Ghana	0.7	3.0	4.2	Sierra Leone	3.5	1.5	0.4
Fiji	0.7	2.7	3.8	Mauritius	2.2	1.0	0.4
Cameroon	0.9	3.4	3.7	Tanzania	4.4	2.1	0.5
Gambia	0.9	3.4	3.6	Cyprus	2.9	1.4	0.5
Papua New Guinea	1.3	4.6	3.6	Lesotho	3.3	1.7	0.5
Belize	0.7	2.7	3.6	Rwanda	3.5	1.8	0.5
Saudi Arabia	0.9	3.0	3.4	Antigua	3.9	2.1	0.5
Barbados	0.8	2.9	3.4	Namibia	2.6	1.4	0.6
Vanuatu	1.0	3.4	3.3	Guyana	4.2	2.4	0.6
Pakistan	0.9	2.9	3.1	Uganda	3.1	1.8	0.6
Zambia	1.1	3.3	3.0	Jamaica	2.8	1.6	0.6
Mozambique	0.8	2.3	2.9	Swaziland	3.4	2.0	0.6
Sierra Leone	1.5	4.1	2.8	Barbados	3.2	1.9	0.6
Samoa	1.2	3.2	2.7	Belize	2.3	1.5	0.7
Bahamas	1.0	2.6	2.7	Saudi Arabia	2.0	1.3	0.7
India	1.0	2.6	2.7	Singapore	3.5	2.3	0.7
Sri Lanka	1.0	2.6	2.7	Malaysia	3.3	2.3	0.7
Malawi	1.1	2.8	2.6	Fiji	2.9	2.0	0.7

Source: Source: Authors, based on Eora data

Bilateral GVC trade decomposition

Bilateral GVC decomposition, a work-horse 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 are based on exports by the 43 CW countries included in EORA and, considering 3 aggregated sectors, i.e. primary, secondary and tertiary by type of activity. The first table covers only intra-CW trade relationship. Table 4 shows the importance of the GVC link from the source industry perspective.

Table 4 Secondary sector: Top 20 CW bilateral trade flows of domestic value added, 2015

Source_Country	Using_Country [a]	FVAX(USD)	FVAX(pct) [b]
Malaysia	Singapore	11618537	8.61
Singapore	Malaysia	4418026	4.89
Malta	Singapore	72699	3.31
Zambia	South Africa	37657	1.28
Australia	Singapore	2475776	1.07
Malta	Malaysia	22722	1.03
Barbados	UK	4398	0.97
Trinidad and Tobago	Canada	56811	0.94
South Africa	UK	853840	0.87
Malta	UK	18674	0.85
Jamaica	UK	15794	0.81
New Zealand	Australia	421955	0.80
Papua New Guinea	Australia	14312	0.79
Brunei	Singapore	20045	0.75
Malaysia	Singapore	943895	0.70
UK	Singapore	3074410	0.68
Australia	Malaysia	1513618	0.66
India	Singapore	1492423	0.66
Cyprus	UK	20319	0.65
New Zealand	Malaysia	326282	0.62

Note: a/ All using sectors are also Secondary sectors, except for the last row (Malaysia-Singapore), where the uses are made by Singapore's tertiary sector.
b/ FVAX(pct): Embodied foreign value-added in exports, percentage of the source industry total value-added.
Source: Based on Eora data and the "Decompr" R package (Quast and Kummrit, 2015).

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

- Malaysia and Singapore are at top of the list of countries, both as a source and exporting countries, with significant foreign value-added contribution.
- Malta ranks high, as explained by European G20 countries: France, Germany, Italy or UK, supplying Singapore manufacturing sector with inputs.
- Foreign value-added export value is high for Australia, UK, Singapore. Singapore leads possibly due to the position as a maritime hub for re-exports (also called the "Rotterdam effect" in trade statistics).

The CW community is relatively small in terms of market for Commonwealth manufactured value added. If we reconstruct Table 4 with countries other than Commonwealth, i.e. other G20 members, the picture is very different (See Table 5). 17 of the 20 main countries are not Commonwealth members. Among Commonwealth countries, only Singapore and Malaysia are in the top20 list of export

markets. The results suggest that intra-industry trade is dominant when it comes to trade in secondary goods, i.e. manufactures.

Table 5 Secondary sector: Top 20 Commonwealth to Commonwealth and G20 trade flows of domestic value added, 2015

Source_Country	Using_Country [a]	FVAX(USD)	FVAX(pct) [b]
Malaysia	Singapore	11618537	8.606911
Brunei	South Korea	148093.3	5.51361
Singapore	Malaysia	4418026	4.886674
Swaziland	South Korea	17604.67	3.844927
Brunei	Japan	98278.64	3.658979
Malta	Singapore	72699.12	3.308675
Canada	USA	14256739	3.08605
Singapore	China	2716324	3.004462
Malaysia	China	3767390	2.79085
Trinidad and Tobago	USA	166606.5	2.762159
Antigua	Germany	1083.294	2.515906
UK	Germany	10327347	2.297049
Malta	Germany	48517.99	2.208146
Zambia	China	54505.07	1.854392
Jamaica	Germany	34325.75	1.766023
Pakistan	China	636632.4	1.753482
Malta	USA	36043.94	1.640428
Malta	Italy	35966.12	1.636886
Malta	China	33310.13	1.516007
Malaysia	Japan	1976076	1.46386

Note: a/ All using sectors are also Secondary sectors.
b/ FVAX(pct): Embodied foreign value-added in exports, percentage of the source industry total value-added.
Source: Based on Eora data and the "Decompr" R package (Quast and Kummrit, 2015).

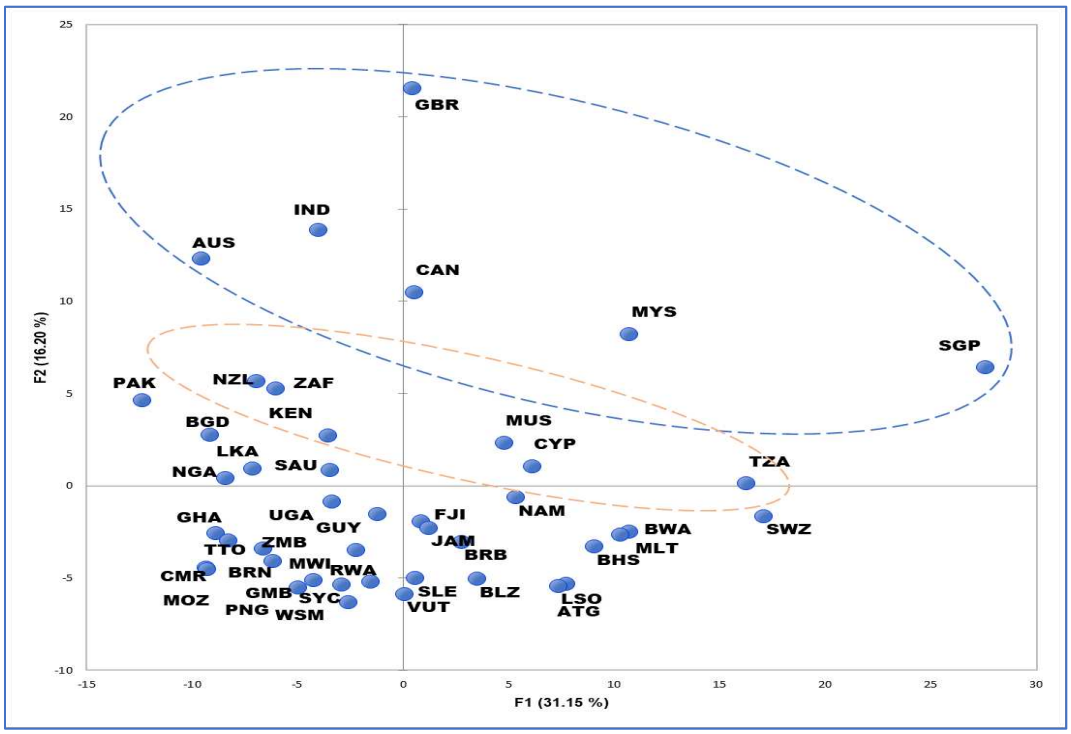
The GVC export profile of the Commonwealth group of countries' shows:

- Firstly, two regional clusters —in Asia (Bangladesh and Pakistan) and Africa (Ghana, Kenya, Nigeria, South Africa, Trinidad and Tobago, Uganda).
- Secondly, GVC exports are linked with the level of development —for example, the cluster consisting of Australia, Canada, India, New Zealand, Sri Lanka and UK, consists of relatively advanced industrial exporters, with the exception of Sri Lanka.

Some CW countries have strong geographical specificities, while others are more geographically diversified. Evaluating each bilateral trade flow is a cumbersome task and we applied instead an exploratory statistical approach.

Figure 10 uses Principal Component Analysis to provide a full picture with the decomposition algorithm. Results shows that Singapore, Malaysia, Canada and the UK are better inserted in GVCs. Australia and India are also important players, but more of an upstream type. A second ring of countries (yellow dotted line, figure 8) are also relatively well inserted in an upstream or downstream position.

Figure 10 Principal Component Analysis of CWS Manufacture exports, 2015



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 include all direct and indirect trade flows and include the segments of the value-chains that are located in non-Commonwealth countries. The role of the non-Commonwealth countries as intermediate between two CW countries can be important especially if they are 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 is through GVC firms in a non-Commonwealth country, for example Italy. It is in this context that it becomes imperative to identify direct GVC linkages from a regional perspective.

To measure 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 was set to 0 in the EORA tables and a Leontief decomposition is recalculated. [12]

Table 6 lists the top-20 country secondary to secondary trade flows, in terms of absolute value, and in percentage of previous value-added flows.

[12] This technique is known as hypothetical extraction in input-output analysis.

Table 6 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

Source: Authors estimates based on Eora data

As expected, values are low when the source country is a large economy and closely inserted into a regional trade agreement with large non-Commonwealth countries. This applies to the UK (member of the EU) and Canada (member of NAFTA, as the Canada-Mexico-USA trade agreement as called in 2015). The bilateral exchange of value-added between Canada and the UK declined by $806 billion showing that nearly 25% of GVC transactions between Canada and UK manufacturing sectors transit through a non-Commonwealth country – USA - main single destination of exports for both countries. Singapore reimports 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% of its UK market.

However, when the economies are geographically close, the decline is usually smaller in percentage terms (e.g., Australia-Singapore; Singapore-Malaysia). As seen in the left panel, some bilateral flows almost dry-up. Several Commonwealth countries (namely, Trinidad and Tobago, Brunei, Namibia and Nigeria) export 90% or more of manufacture value-added to Saudi Arabia through non-Commonwealth intermediaries. The highest decline is 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 manufacture activities. Value-added transactions between 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 7 may have been used by another Canadian firm before being exported to another manufacturer (possibly USA) to produce processed inputs purchased by a Singaporean firm. The percentage decline is larger. As seen in the left panel, Singapore imports a large share of the Commonwealth primary value-added inputs that transit through non-Commonwealth countries. However, after considering the size of both source and use economy as well as the historical and economic ties, results show that more than 40% of UK's use of Australian and Canadian primary value-added is 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 is on average 25% lower for all bilateral transactions analysed (1892).

Table 7 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

A final comment on the tables is the absence of CW LDCs as source of primary or secondary value-added. 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). Yet, these preferences have not materialised into a stronger GVC role into the CW community. It is true that most manufacture 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 small islands).

5. Building on existing Trade Complementarity

Up to now, the report has analysed the existing trade linkages between the CW members. This section will look at the potential for expanding these connexions, in particular from a value-chain perspective. To this aim, we rely on two complementary sets of trade indicators: Trade Complementarity Indices (TCI) and Revealed Comparative Advantages (RCA). TCIs try to match the export structure of a country and the import requirements on another in order to find good correlation between bilateral supply and demand. RCA assesses the competitiveness of a given country by comparing its export structure against World trade. Both sets of indicators indicate the potential for developing bilateral trade between two countries if the demand for imported products of one country matches an efficient export structure from another one.

More formally, the indicators are defined as follows: [13]

- Trade Complementarity Indices (TCI)

TCI measures the degree of fit between the exports structure of one country and the import requirements of another one. A high degree of complementarity indicates that the two countries are "natural trading partners".

$TCI^{i,j} = 100[1- (\Sigma_k \left| (M_k^i/ M^i) - (X_k^j/ X^j) \right| /2)]$

Where

> M_k^i is country i 's imports of product k; M^i stands for total imports of country i for all goods and services; X_k^j is country j 's exports of product k; X^j stands for total exports of country j for all goods and services. The end result is a n by n matrix, with n is the number of countries. Sub setting the EORA database to include only Commonwealth countries produces a 44 x 44 matrix.

Intuitively, TCIs can be compared to correlation coefficients: With perfect correlation between sectoral shares, the index is one hundred; with perfect negative correlation, it is zero. At the difference of correlation coefficient, nevertheless, TCIs are not symmetric and a good fit between exports of country i and imports of country j may not coincide with a good fit between imports of country i and exports of country j.

- Revealed Comparative Advantage (RCA).

This index is traditionally calculated as the ratio of product k's share in country i 's exports to its share in world trade. [14]

[13] For more details, please refer to UNCTAD-WTO (2012).
[14] There are many alternative ways of calculating comparative advantages indices, see Escaith (forthcoming 2020) for a review.

Formally, it reads as:

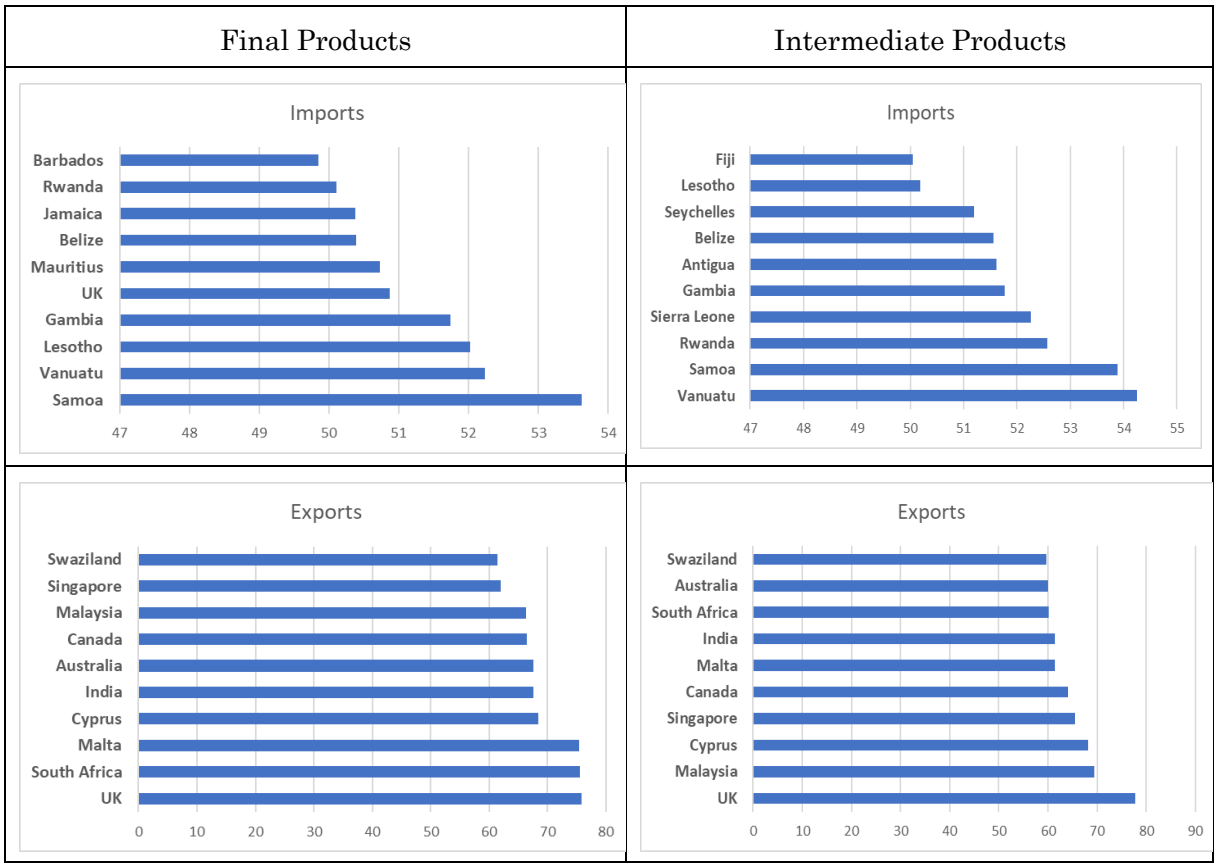
$$RCA_k^i = (X_k^i / X^i) / (X_k^w / X^w)$$

Where:

> X_k^i is country I 's exports of product k; X^i stands for total exports of country I for all goods and services; X_k^w represents the world exports of good k and X^w is the value of total world exports. The calculation creates a list of n*k indicators (44 x 26, when including only the Commonwealth countries covered by the EORA database).[15]

Intuitively, the index compares country i export structure with the World trade situation. A value of the RCA above one in sector) k for country i means that i has a revealed comparative advantage in that sector. Figure 11 shows the Top 10 countries for their average TCI in, respectively, the imports and exports of final and intermediate products (goods and services).

Figure 11 Top 10 Average Complementarity Indices with other Commonwealth countries, 2015



Source: Authors, based on EORA data

There are two ways of interpreting TCIs: identifying, for each exporter, the trade partners that have a demand for imports matching its export baskets, or, conversely, starting from the

[15] As mentioned previously, the results concerning services sectors are not considered significant, considering the weakness of domestic and international trade in services data for most countries included in the database.

demand side and identifying the countries best able to satisfy the demand for imports. Both approaches are valid and should converge to the same conclusions. In addition, the analysis can be done for trade in intermediate inputs or for trade in final products. For example, the best fit in trade in intermediate products (goods and services) is found between the UK's exports and the import demand of Nigeria and Pakistan, with a TCI of 87.6. The best fit for final products is between South African exports and Belize's imports, with a TCI of 88.0.

Both categories of products share similar characteristics: the distribution of trade complementarity is much more asymmetric for exports than for imports and best export fits with the rest of the CW community are generally the advantage of large economies. In other words, import patterns are relatively similar across countries –with small economies are more dependents on imports due to their reduced domestic supply– while exports are more specialised, with only the largest economies being able to supply the large varieties of products able to satisfy their trade partners' demand.

Because our interest is in strengthening GVC linkages, we will focus on the demand from the seven GVC hubs that were identified for the CW community: Australia, Canada, India, Malaysia, Singapore, South Africa and the UK.

Table 8 below presents the TCI results corresponding to these seven hubs considered as importers of final products. The first observation is that these relatively large economies have a good fit between themselves, as seen from the average high values of their export fit with the other Commonwealth GVC hubs. With an average TCI of 68.5, UK has the highest average TCI, followed by Malaysia (67.0).

Among the smaller CW countries, the highest average TCI is found in Europe (Cyprus and Malta): despite their small size, their exports are sufficiently diversified to satisfy a significant proportion of the demand emanating from the seven GVC hubs. Swaziland is also within the top-10 group, thanks to its good fit with South Africa and UK demand; it shows also a significant fit with India (59.8). This fit indicates the existence of an export potential for Swaziland, its realization depending on the series of usual trade constraints (tariff and non-tariff trade costs; export promotion). Other promising cases are only bilateral: Samoa's exports fitting Australia's imports with a TCI of 66.9, Sierra Leone and the UK (64.6) and Kenya with Malaysia (59.6).

More important from a GVC perspective is trade complementarity in intermediate products (Table 9). While trade in final products involve only two countries (the exporter and the importer), trade in intermediate inputs are part of a production chain that may involve several countries at different stages of the production. Evidently, both aspects of trade are closely linked, because the objective of trade in intermediate inputs is the production and sale of final goods.

Table 8 Import Complementarity in Final Products with the seven GVC hubs, 2015

	Australia	Canada	India	Malaysia	Singa-pore	South Africa	UK	Average
Antigua	54.9	39.0	39.6	51.1	37.7	54.6	52.9	47.1
Australia	NA	59.9	57.7	63.4	59.2	68.4	76.6	64.2
Bahamas	40.4	21.6	30.8	40.5	24.5	39.9	44.9	34.7
Bangladesh	19.4	15.6	18.4	22.7	21.4	21.7	27.9	21.0
Barbados	45.6	24.3	35.1	43	26.8	41.9	45.8	37.5
Belize	42.0	24.4	33.1	44.4	24.1	37.7	41.7	35.3
Botswana	44.3	33.5	36.2	49.8	37.6	48.5	56.8	43.8
Brunei	44.3	13.5	26.4	25	16.7	28.9	35.1	27.1
Cameroon	46.7	30.1	41.2	47.8	31.5	42.2	48.9	41.2
Canada	29.1	NA	57.1	49.8	67.8	68.4	71.4	57.3
Cyprus	37.8	61.0	52.8	61.8	65.8	67.6	78.5	60.8
Fiji	58.0	24.1	29.6	44.5	27.6	37.4	47.3	38.4
Gambia	48.9	32.3	39.1	53.8	30.8	46.1	51.6	43.2
Ghana	35.o	24.2	30.4	44.5	26.7	35.7	42.7	34.2
Guyana	39.5	28.8	32.2	48.4	28.9	39.3	45.7	37.5
India	32.3	58.7	NA	56.8	62.0	63.0	72.1	57.5
Jamaica	32.5	22.9	27.0	43.7	26.7	35.1	47.9	33.7
Kenya	36.1	42.3	46.3	59.6	43.8	51.8	63.4	49.0
Lesotho	27.0	15.8	20.5	24.0	17.9	25.5	29.6	22.9
Malawi	38.1	26.2	30.3	44.4	27.5	39.0	48.0	36.2
Malaysia	39.5	68.6	77.2	NA	80.7	70.8	65.1	67.0
Malta	44.8	68.5	65.6	53.1	71.8	79.7	81.5	66.4
Mauritius	31.4	28.0	27.4	38.9	29.8	35.6	46.5	33.9
Mozambique	41.5	30.8	39.1	51.6	30.5	43.1	47.0	40.5
Namibia	34.2	42.6	38.1	54.4	48.6	50.6	60.1	46.9
New Zealand	48.0	37.6	34.7	53.1	33.2	42.3	44.7	41.9
Nigeria	38.5	22.7	37.6	51.9	23.7	39.4	39.0	36.1
Pakistan	26.8	27.0	25.2	32.5	33.4	29.8	39.4	30.6
Papua New Guinea	59.5	14.5	23.4	34.2	16.7	29.4	33.1	30.1
Rwanda	49.2	22.7	34.4	40.2	21.7	36.2	39.2	34.8
Samoa	66.9	18.3	28.0	30.8	18.1	34.8	34.3	33.0
Saudi Arabia	39.7	16.5	35.4	42.3	18.9	35.9	35.4	32.0
Seychelles	41.9	21.3	28.5	38.8	22.7	37.5	41.2	33.1
Sierra Leone	54.5	43.4	45.3	57.0	43.9	52.5	64.6	51.6
Singapore	42.8	62.5	78.6	50.5	NA	70.1	58.1	60.4
South Africa	45.1	68.9	62.7	71.1	69.1	NA	80.3	66.2
Sri Lanka	26.3	31.3	30.7	40.4	39.5	34.8	45.7	35.5
Swaziland	42.3	52.0	59.8	49.7	54.8	65.1	72.7	56.6
Trinidad & Tobago	46.9	20.3	34.3	42.4	23.5	40.5	39.7	35.4
Uganda	39.0	27.5	30.0	45.3	28.7	37.2	41.9	35.7
UK	38.4	79.4	71.7	57.4	76.7	87.1	NA	68.5
Tanzania	35.2	40.8	33.8	52.3	41.5	40.2	50.2	42.0
Vanuatu	47.1	23.3	33.2	42.2	23.1	37.9	41.8	35.5
Zambia	47.9	39.7	46.9	53.5	41.6	53.3	57.4	48.6

Source: Authors, based on EORA data

The results presented in Table 9 below show a situation rather similar to what was observed when analysing the trade complementarity in final products: the average TCI of Common-wealth countries with the seven CW GVC hubs is rather mediocre (a fit of 40%, compared to about 43% in the case of final products), with the best fits found between the seven hubs themselves. Again, within the small economies, it is the exports from Cyprus and Malta that best match the GVC hubs requirements, followed by Swaziland. Other highlightable cases are purely bilateral: Mauritius with Australia and New Zealand with Canada.

Table 9 Import Complementarity in Intermediate Inputs with the seven GVC hubs, 2015

	Australia	Canada	India	Malaysia	Singapore	South Africa	UK	*Average*
Antigua	43.6	44.0	29.7	38.9	32.4	54.9	41.2	40.7
Australia	NA	58.6	55.5	62.6	48.9	50.4	56.9	55.5
Bahamas	33.4	37.7	33.9	38.7	33.5	42.9	38.9	37.0
Bangladesh	29.1	24.4	19.4	27.8	23.4	34.2	28.0	26.6
Barbados	38.4	46.4	43.6	51.6	45.2	56.8	50.6	47.5
Belize	38.2	30.9	26.9	36.0	28.1	40.5	34.7	33.6
Botswana	36.4	35.9	31.9	35.2	30.2	42.2	36.0	35.4
Brunei	15.2	15.4	16.4	12.8	11.7	15.3	13.3	14.3
Cameroon	28.0	26.3	25.2	26.6	19.6	27.8	28.2	26.0
Canada	31.2	NA	60.5	63.9	52.5	66.9	71.7	57.8
Cyprus	37.0	66.7	53.7	66.8	55.0	72.9	69.4	60.2
Fiji	37.5	26.4	22.0	29.7	22.3	29.5	31.4	28.4
Gambia	41.1	35.1	34.2	37.8	31.1	41.3	41.5	37.4
Ghana	27.7	28.3	26.4	28.6	20.8	27.6	31.1	27.2
Guyana	35.3	36.1	34.1	36.4	27.7	34.2	37.9	34.5
India	32.1	60.0	NA	65.7	59.5	62.0	62.2	56.9
Jamaica	37.9	36.2	46.5	46.5	32.2	43.1	37.8	40.0
Kenya	32.1	47.1	44.3	48.2	39.2	48.5	49.4	44.1
Lesotho	39.3	31.0	32.3	29.0	26.8	42.9	34.3	33.7
Malawi	29.9	25.2	21.4	28.5	22.1	31.3	28.6	26.7
Malaysia	38.2	71.4	52.8	NA	79.1	58.0	71.0	61.8
Malta	37.1	58.8	36.9	62.4	75.1	55.3	59.0	54.9
Mauritius	56.1	50.1	30.8	45.1	37.3	40.2	45.5	43.6
Mozambique	37.5	41.3	38.3	42.5	33.3	46.7	43.1	40.4
Namibia	35.2	48.6	45.9	51.2	42.9	51.4	51.3	46.6
New Zealand	48.5	55.0	38.6	51.6	41.8	43.5	54.8	47.7
Nigeria	19.7	21.2	22.3	20.1	17.5	21.6	19.9	20.3
Pakistan	23.7	26.1	22.4	27.3	20.9	26.4	28.0	25.0
Papua New Guinea	36.5	22.8	20.5	23.7	16.9	23.3	24.9	24.1
Rwanda	37.2	32.0	32.0	31.1	28.7	34.6	33.0	32.7
Samoa	48.4	29.1	28.6	33.2	28.7	35.4	34.4	34.0
Saudi Arabia	22.1	29.9	44.6	33.8	36.9	41.8	32.5	34.5
Seychelles	36.8	30.4	27.1	34.6	30.8	36.0	33.6	32.8
Sierra Leone	42.0	42.5	38.8	44.7	36.4	51.8	46.4	43.2
Singapore	40.4	66.0	56.0	71.5	NA	60.2	65.7	60.0
South Africa	40.0	60.7	66.9	67.6	50.7	NA	58.3	57.4
Sri Lanka	26.8	40.8	45.0	47.5	43.4	48.8	46.6	42.7
Swaziland	40.8	49.9	45.8	55.1	47.4	57.7	54.4	50.2
Trinidad and Tobago	26.2	31.3	30.8	31.1	29.0	36.9	29.9	30.7
Uganda	37.3	33.0	29.6	37.3	31.0	39.2	36.0	34.8
UK	46.2	82.6	68.3	82.4	75.0	77.4	NA	72.0
Tanzania	36.3	42.9	34.5	38.8	31.5	34.5	42.5	37.3
Vanuatu	39.8	29.6	24.5	34.2	25.9	40.6	34.5	32.7
Zambia	32.5	37.4	49.8	43.2	29.7	37.4	34.2	37.7

Source: Authors, based on EORA data

In synthesis, the TCI analysis shows fairly good GVC trade creation potential between the seven Commonwealth hubs, but limited potential for most smaller economies. The indicators, nevertheless, are based on existing trade flows while untapped opportunities probably exist at micro-level. But exploring business potentialities at firm level would require another type of approach.

a. Specific Supply Chain Complementarities

All in all, the conclusion from the previous section is not very promising for most of the smaller CW economies, due to their limited and undiversified exportable supply basis. TCI being calculated on all traded goods and services (exports from the supply side, and imports from the demand side), the small size of the domestic economy limits the possibility for a small country to supply a significant amount of the full set of imports required by its trade

partners. Another way of looking at the trade potential is to focus on specific supply chains, and identify as trade potential a situation where the strength of some Commonwealth countries on some specific products would complement the weaknesses of others.

Table 10 Top and Bottom 10 Relative Comparative Advantages, selected industries (2015)

Agriculture	*Final*	*Intermediate*	**Textile**	*Final*	*Intermediate*	**Metals**	*Final*	*Intermediate*
Top 10			***Top 10***			***Top 10***		
Uganda	24.7	14.5	Pakistan	5.8	19.3	Zambia	2.5	4.3
Malawi	12.9	20.5	Bangladesh	7.6	13.0	South Africa	1.4	2.1
Ghana	13.5	13.5	Sri Lanka	4.6	5.0	Kenya	2.9	0.2
Kenya	10.9	13.9	Mauritius	5.5	3.5	India	1.6	1.1
Mozambique	12.9	10.7	Lesotho	6.3	1.7	Antigua	2.1	0.3
Tanzania	9.9	11.7	India	2.0	2.9	Jamaica	0.2	2.2
Papua New Guinea	3.4	18.0	Tanzania	0.9	2.7	Australia	0.7	1.3
Sri Lanka	5.9	11.6	Malawi	1.9	0.9	UK	1.0	0.8
Cameroon	10.1	6.8	Brunei	1.8	0.2	Sierra Leone	1.1	0.3
Belize	6.3	5.7	Fiji	1.2	0.7	Cyprus	0.8	0.6
Bottom 10			***Bottom 10***			***Bottom 10***		
Seychelles	0.3	0.6	Cameroon	0.3	0.1	Mauritius	0.1	0.1
UK	0.3	0.3	Samoa	0.0	0.3	Saudi Arabia	0.1	0.1
Botswana	0.2	0.3	Ghana	0.2	0.1	Lesotho	0.1	0.1
Barbados	0.2	0.3	Seychelles	0.0	0.2	Vanuatu	0.1	0.1
Lesotho	0.1	0.4	Singapore	0.2	0.1	Bahamas	0.1	0.1
Malta	0.2	0.2	Saudi Arabia	0.2	0.1	Papua New Guinea	0.1	0.1
Singapore	0.2	0.2	Vanuatu	0.0	0.2	Malawi	0.1	0.0
Trinidad and Tobago	0.1	0.1	Bahamas	0.0	0.2	Brunei	0.1	0.0
Saudi Arabia	0.1	0.0	Trinidad and Tobago	0.1	0.0	Nigeria	0.1	0.0
Brunei	0.0	0.0	Papua New Guinea	0.0	0.0	Bangladesh	0.1	0.0
Machinery	*Final*	*Inter-mediate*	**Vehicles**	*Final*	*Inter-mediate*	**Other Manufactures**	*Final*	*Inter-mediate*
Top 10			***Top 10***			***Top 10***		
Malaysia	1.6	2.0	Canada	2.3	1.3	Botswana	0.1	18.5
Singapore	1.5	1.8	Antigua	0.9	2.6	Tanzania	4.0	3.2
Malta	1.0	2.3	Cyprus	0.8	1.7	Sri Lanka	1.9	2.8
UK	1.1	1.0	UK	1.0	1.0	Sierra Leone	1.0	3.0
Canada	0.8	0.7	South Africa	0.8	0.5	Pakistan	1.8	2.2
Cyprus	0.6	0.7	Vanuatu	0.2	0.9	India	1.7	1.7
Swaziland	0.8	0.5	Malta	0.6	0.4	Malta	1.8	1.1
India	0.7	0.6	Australia	0.5	0.4	Mauritius	0.9	1.8
Australia	0.7	0.4	Namibia	0.6	0.3	Malaysia	1.4	1.2
South Africa	0.7	0.3	Botswana	0.6	0.3	Canada	1.1	1.2
Bottom 10			***Bottom* 10**			***Bottom 10***		
Bahamas	0.0	0.1	Mauritius	0.0	0.1	Brunei	0.4	0.1
Lesotho	0.0	0.1	Guyana	0.0	0.1	Singapore	0.1	0.3
Malawi	0.0	0.1	Jamaica	0.0	0.1	New Zealand	0.2	0.2
Trinidad and Tobago	0.1	0.0	Papua New Guinea	0.0	0.0	Jamaica	0.1	0.3
Fiji	0.0	0.1	Nigeria	0.0	0.0	Malawi	0.0	0.3
Vanuatu	0.0	0.1	Brunei	0.0	0.0	Bangladesh	0.1	0.2
Guyana	0.0	0.0	Bangladesh	0.0	0.0	Papua New Guinea	0.0	0.2
Nigeria	0.0	0.0	Saudi Arabia	0.0	0.0	Trinidad and Tobago	0.1	0.1
Brunei	0.0	0.0	Trinidad and Tobago	0.0	0.0	Saudi Arabia	0.1	0.0
Papua New Guinea	0.0	0.0	Pakistan	0.0	0.0	Nigeria	0.1	0.0

Note: Countries' RCAs are calculated in relation to World trade. The ranking is based on the RCA average for Final and Intermediate products. The seven GVC hubs are identified in bold.
Source: Authors, based on EORA data

Table 10 above shows the top and bottom 10 exporters ranked for their relative comparative advantages in exporting a selection of primary and manufactured goods. Note that RCAs are based on a comparison of individual exporters' profiles with World trade: the table provides information on actual comparative advantages, and goes beyond a mere comparison within the CW countries.

Countries are ranked according to their RCA average for Final and Intermediate products, which may greatly differ in some cases. Indeed, the more complex the production of a final good is, the harder it will be for a small country to have a relative comparative advantage in this final good. At the contrary, specializing on a smaller set of intermediate products may offer an opportunity to diversify exports. This may explain the surprising ranking of Antigua who, besides primary export goods such as petroleum products, exports also components for the maritime transport equipment industry.

There are two ways of looking at RCA matches in order to identify trade opportunities. The usual one is to pair high and low RCAs to match comparative advantages with comparative disadvantages as an indicator of win-win gains-from-trade potential. The second approach, proper to GVC trade, is to compare RCAs in exporting final goods and RCAs in exporting intermediate goods. Competitive exporters of final products may find profitable to outsource and import parts and components from more competitive exporters of intermediate goods.

From a trade and development point of view, the best situation is when a small developing country shows comparative advantages in a sector where a more advanced country has limitations. The industries from the large country will take the role of GVC lead-firms, marketing the final product and driving demand for intermediate exports from the smaller country's industries. Unfortunately, most of the existing GVC hubs (the potential GVC leaders are also in the top-10 subsets when it comes to competitiveness, with little potential complementarity between large and small Commonwealth countries according to this indicator. The exception are Singapore and the UK for agriculture and Singapore for textile. These two sectors are relatively low-tech and labour intensive; from a lesser developed country, they are the low-hanging fruits for trade creation and export diversification, provided the resources are adequate and the production is internationally competitive (high RCA).

Within the top-10 textile sector panel, there are also interesting differences in final and intermediate goods. Lesotho, with the second highest RCA in final goods (6.3), has an RCA of only 1.7 in intermediate products. It might, for example, benefit from increasing trade with Pakistan or Bangladesh where the RCA in intermediate is much higher than the RCA for final products. Malawi, Brunei and Fiji, which shows comparative advantages in the exports of final goods, would also benefit from importing intermediate tile products from the most competitive CW countries.

The other manufacture sectors in Table 10 show more limited opportunities of similar nature. The main GVC hubs are also within the group of high RCAs for both final and intermediate products. There are a few exceptions. In metal, for example, Kenya has the highest RCA for final goods and the lowest for intermediate inputs. It indicates some GVC trade

potential with Zambia and South Africa, two exporters with higher RCA in intermediate products. In the Other manufacture group, Botswana is specialising in the exports of intermediate products and could become a supplier of parts and components for other countries.

In synthesis, the analysis of sectoral trade data shows a limited series of opportunities to enhance GVC trade within the Commonwealth secretariat. Materializing this potential requires looking more into the detail at individual product level (something outside the scope of this report), but also implementing adequate trade and development policies. Indeed, the Commonwealth is not an inward-oriented trading block and strengthening CW inter-industry complementarities faces the competition of other countries. For example, Canada shows a higher RCA for its exports of final transportation products (e.g., cars) than for related parts and components. The Canadian market for such parts and components may, nevertheless, be difficult to enter considering that most trade flows in intermediate goods for transport equipment takes place with Mexico and the USA within the USMCA free trade agreement.

6. Main findings and policy recommendations

What matters in GVC analysis, i.e. 'trade in tasks', is an industry's competitive advantage from an international trade specialisation perspective.[16] The competitive advantage is based not only on relative competitiveness of a firm, but depends also on monetary (transport costs and custom duties) and non-monetary (logistic delays, 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 tiers suppliers, some of them being located in the same country or in a neighbouring one. Thus, the recommendations must go beyond individual countries' perspective to look at a global inter-industry network perspective.

The main findings from the study on the integration of Commonwealth countries in the GVC show the following:

- Commonwealth member countries participation in GVCs increased over 1995-2015 but this is mainly through non-Commonwealth countries. Most Commonwealth countries are net importers of inputs, except Singapore and Malaysia that are net exporters.
- Three main regional clusters connect GVCs in Asia and Africa, Europe and Australia. Regional linkages between the Commonwealth countries especially in Africa is suggestive of the interconnectedness between countries in the region and that the Commonwealth membership facilitates trade between countries in the African region.

[16] 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. They are not to be understood as comparative advantages from a Ricardian perspective, which are valid only for countries in the long term and do not apply to brick-and-mortar firms.

- Deep regional trade agreement membership, such as the European Union or the NAFTA impact on GVC participation. Membership of preferential trade agreements and the depth of such agreements increase partner countries' backward GVC participation.
- In terms of sectors, Textiles, Transport equipment and Chemicals are important for the Commonwealth countries, in particular for the United Kingdom, Canada and India. The developed Commonwealth countries dominate the Heavy machinery and Metals sector.
- Large economies, such India, Australia and New Zealand, show limited evidence of forward linkages with the Commonwealth and G-20 countries. These do not rely on the Commonwealth member countries for their inputs but open economies tend to import value-added inputs from the G-20 countries. on the contrary, smaller countries tend to be more inward oriented with a high level of reliance on domestic inputs.
- In general, developing countries are dominant in the lower end of the GVC, implying that upgrading to more advanced GVCs is required to support Commonwealth countries' integration into the GVCs.
- UK in a central position given its economic size and trade in primary and secondary sector trade with the Commonwealth community. For the primary sector, the Caribbean and Africa, countries are on the periphery given these are raw materials suppliers providing inputs at the beginning of the GVC to other countries in the region.
- For trade in manufactured inputs produced by the secondary, large economies act as hubs though developed Commonwealth countries, such as the UK and Canada, source less than 7% of manufacturing inputs from other members.

There are some empirical shortcomings worth highlighting. First, the lack of data for all the Commonwealth countries is 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 in a sector that offers significant potential.

The report proposes as set of measures to facilitate the participation of Commonwealth countries in GVCs with the aim to enable the countries reap benefits from GVC participation. From a policy perspective, such an analysis is important given GVC integration implies 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.

- **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.

Studies show that GVC participation needs requisites, some of which depend on policy options under control of national authorities (see World Bank, 2020 for a detailed review).

Supply constraints, however, have a much lower impact on GVCs unlike traditional export-oriented production activities.

The analysis of Commonwealth countries presents evidence of dependence between countries and industry sectors. The findings also confirm that the Commonwealth members are linked to GVCs through non-Commonwealth countries suggesting that there is a case to foster strong intra-Commonwealth linkages and promote intra-GVC linkages. GVC participation can also open up new opportunities that may not have existed in traditional trade-in-final-goods.

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, 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 (e.g. 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.

- **Initiate proactive government policies to develop competitive 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 strengthening linkages with GVCs are important. Government policies should complement the business environment with proactive policies to attract foreign investment. National governments could consider initiating targeted policies to attract foreign investment through special incentives to firms can support country's entry into GVCs. A proactive governmental approach is required to support countries' participation in the GVCs. Policy measures to develop the Commonwealth countries' competitiveness include:

- Measures must support export diversification in developing Commonwealth countries, especially African countries that are primary products exporters of agricultural or extractive (mining) products. Export diversification 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 is recommended. 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, i.e. support education and vocational training, develop ICT and infrastructure, ensure labour market mobility. Such measures will reduce overall uncertainty and promote transparency of the business climate.
- Providing a favourable FDI regime is essential to create an attractive business climate. This can be complemented with simple procedures for registering foreign investors to attract foreign firms to set up production facility in the target country.
- National governments must initiate policies to address 'behind the border' measures to facilitate GVC participation. Low tariffs complemented with other low border costs, such as less time to clear customs, 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 the 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.
- The international community and international institutions could also provide support in the form of logistics and trade facilitation, facilitate legislation on the regulation of business services, investment, business taxation, innovation, industrial development, support convergence with conformity to international standards, and the wider business environment to foster entrepreneurship.

- **Ensure quality institutions and support preferential liberalisation**

Institutional quality matters, and improving global and regional trade governance through the relevant multilateral and regional forums is key for 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). Institutional quality can also be enhanced through memberships of new FTA, which cover legal and regulatory frameworks, harmonize 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 Continental Free Trade Agreement in Africa, 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 way limit the possibility of negotiating separate preferential agreements with third countries – 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 it follows the path of mutual recognition.

Bibliography

Ahmad, N. (2019), 'Improving the accounting frameworks for analyses of global value chains', in Global Value Chain Development Report, Chapter 8, 155–174, WTO, Geneva.

Ali, S. and U. Durash (2011), 'The rise of trade in intermediates: policy implications' International Economic Bulletin (Carnegie Endowment for International Peace).

Amador, J. and S. Cabral (2016) 'Networks of value-added trade' ECB Working Paper Series No 1931.

Baldwin, R. (2012) 'Global supply chains: Why they emerged, why they matter, and where they are going' CEPR Discussion Papers 9103, C.E.P.R. Discussion Papers.

Baldwin, R. (2012) 'Trade and industrialization after globalization's 2nd unbundling : How building and joining a supply chain are different and why it matters', Graduate Institute Geneva, mimeo.

Baldwin, R. and JL. Gonzalez (2013) 'Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses', NBER Working Paper 18957, National Bureau of Economic Research, Cambridge, MA.

Bennett, J., D. Sriskandarajah and Z. Ware (2010) 'An Uncommon Association, A Wealth of Potential' Royal Commonwealth Society, London

Bigsten, A., P. Collier, S. Dercon, M. Fafchamps, B. Gauthier, JW. Gunning, A. Oduro, R. Oostendorp, C. Patillo, M. Soderbom, F. Teal and A. Zeufack (2000) 'Contract Flexibility and Dispute Resolution in African Manufacturing', Journal of Development Studies 36 (4), 1–17.

Blanchard, E., C. Bown and R. Johnson (2016) 'Global supply chains and trade policy', (No. w21883), National Bureau of Economic Research, Cambridge, MA.

Bontadini, F (2019) 'Trade Specialisation and Performance in Global Value Chains', SPRU Working Paper Series, Sussex University.

Cerina, F., Zhu, Z., Chessa, A. and Riccaboni, M. (2015) 'World Input-Output Network', PLoS ONE 10(7), 1–21.

Coe, N. M. and M. Hess (2007) 'Global production networks: debates and challenges', paper prepared for the GPERG workshop, University of Manchester.

Coe, NM. and HWC. Yeung (2015) 'Global Production Networks: Theorizing Economic Development in an Interconnected World', Oxford: Oxford University Press.

Commonwealth Secretariat (2018) 'Commonwealth Trade Review: Strengthening the Commonwealth Advantage', London

Cusumano, M., S. Kahl and F. Suarez (2015) 'Services, industry evolution, and the competitive strategies of product firms' Strategic Management Journal, Vol. 36, pp. 559-575

de Gortari, A. (2018) 'Disentangling Global Value Chains' Meeting Papers 139, Society for Economic Dynamics.

Deardorff, A. (2005) 'How Robust is Comparative Advantage?' Working Papers 537, Research Seminar in International Economics, University of Michigan.

Dietzenbacher, E., I. Romero and N.S. Bosma (2005) 'Using Average Propagation Lengths to Identify Production Chains in the Andalusian Economy'. Estudios de Economia Aplicada 23: 405–422.

Dollar, D. (2019) 'Technological innovation, supply chain trade, and workers in a globalized world', in Global Value Chain Development Report, 1, WTO, IDEJETRO, OECD, RCGVC-UIBE, World Bank and CDFR, Geneva

Escaith, H. (2014) 'Mapping Global Value Chains and Measuring Trade in Tasks' In Asia and Global Production Networks: Implications for Trade, Incomes and Economic

Vulnerability, edited by B. Ferrarini and D. Hummels. Asian Development Bank (Manila) and Edward Elgar Publishing (Cheltenham and Northampton).
Escaith, H. (2019) 'Extraction-cum-substitution: A KISS approach to mapping the impacts of bilateral trade conflicts', 27th International Input-Output Association Conference (Glasgow, UK), MPRA Paper No. 95162
Escaith, H. (2020) 'Contrasting Revealed Comparative Advantages When Trade is (also) in Intermediate Products' forthcoming MPRA paper.
Escaith, H. and S. Inomata (2013) 'Geometry of global value chains in East Asia: The role of industrial networks and trade policies' In D. Elms & P. Low (Eds.), Global value chains in a changing world. Geneva, Switzerland: Fung Global Institute, Nanyang Technological University and World Trade Organization.
Escaith, H. and S. Miroudot (2015) 'World Trade and Income Remain Exposed to Gravity' in "The Global Trade Slowdown: A New Normal?" edited by B. Hoekman; Chapter 7 (pp. 127-160)
Feenstra, R.C (1998) 'Integration of Trade and Disintegration of Production in the Global Economy', Journal of Economic Perspectives, American Economic Association, 12(4), 31–50.
Ferrarini, B. (2013) 'Vertical trade maps' Asian Economic Journal 27(2), 105–123
Gaulier, G., A. Sztulman and D. Ünal (2019) 'Are global value chains receding? The jury is still out. Key findings from the analysis of deflated world trade in parts and components', Banque de France, WP#715
Gereffi, G. (1994) 'The Organization of Buyer-Driven Global Commodity Chains: How US Retailers Shape Overseas Production Networks', in Gereffi, G and M Korzeniewicz (eds.), Commodity Chains and Global Capitalism, Praeger, Westport, CT.
Gereffi, G. and K. Fernadez-Stark (2010) 'The Offshore Services Global Value Chain', Mimeo, Center on Globalization, Governance and Competitiveness, Duke University.
Gereffi, G., J. Humphrey and T. Sturgeon (2005) 'The Governance of Global Value Chains', Review of International Political Economy, 12, 78–104.
Grossman, GM. and E. Rossi-Hansberg (2008) 'Trading Tasks: A Simple Theory of Offshoring' in American Economic Review, American Economic Association,December, 98(5), 1978–97.
Hausmann, R. and Klinger, B. (2007) 'The Structure of the Product Space and the Evolution of Comparative Advantage. CID Working Paper, Harvard University.
Hidalgo, C.A, B. Klinger, A.L Barabasi and R. Hausmann (2007) 'The Product Space Conditions the Development of Nations', Papers 0708.2090
Hirschman, A. (1958) 'Interdependence and Industrialization', in "The Strategy of Economic Development", New Haven, Yale University Press.
Hudson, R. (2004) 'Conceptualizing economies and their geographies: spaces, flows and circuits' Progress in Human Geography, No. 28, pages 447-71.
Hummels, D, J Ishii and KM Yi (2001), 'The Nature and Growth of Vertical Specialization in World Trade,' Journal of International Economics, 54 (1), 75–96
Ignatenko, A, F Raei and B Mircheva (2019) 'Global Value Chains: What are the Benefits and Why Do Countries Participate?', IMF Working Paper No: WP/19/18
Inomata, S (2008) 'Average Propagation Lengths: A New Concept of the 'Distance' between Industries, with an Application to the Asia-Pacific Region,' Sangyo-Renkan 16 (1): 46–55
Johnson, R. and G. Noguera (2012) 'Accounting for intermediates: production sharing and trade in value added,' Journal of International Economics, 86, 224–236
Jones, L., M. Demirkaya, and E. Bethmann (2019) 'Global Value Chain Analysis: Concepts and Approaches' Journal of International Commerce and Economics, April
Keane, J. (2018) 'A Guide for Graduating from Least Developing Country Status: The Trade in Global Value Chain Perspective', Commonwealth Secretariat, London
Khorana, S. and I. Martínez-Zarzoso (2018) 'Trade Governance and Intra-Commonwealth Trade', International Trade Working Paper, Commonwealth Secretariat, London.

Khorana, S. and I. Martínez-Zarzoso (2020), 'Twentyfirst-century trade governance: findings from the Commonwealth countries', Contemporary Economic Policy, 38 (2), 380–396
Koopman, R., W. Powers, Zhi Wang and Shang-Jin Wei (2010) 'Give Credit Where Credit Is Due: Tracing Value-added in Global Production Chains' NBER Working Paper No. 16426, National Bureau of Economic Research
Koopman, R., Z. Wang and SJ. Wei (2014) 'Tracing Value-Added and Double Counting in Gross Exports', American Economic Review, 104, 459–494.
Lenzen, M., D. Moran , K. Kanemoto and A. Geschke (2013) 'Building Eora: A Global Multi-Region Input–Output Database at High Country and Sector Resolution' Economic Systems Research, 25:1, 20-49
Lenzen, M., D. Moran, K. Kanemoto and A. Geschke (2013) 'Building Eora: A Global Multi-Region Input–Output Database at High Country and Sector Resolution' Economic Systems Research, 25:1, 20-49
Low, P. and J. Tijapa (2013) 'Increasing value from global value chain participation: What role for industrial policy?' in Baldwin, Kawai and Wignaraja (ed.) "The Future of the World Trading System: Asian Perspective", CEPR, London.
Milberg, W. and D. Winkler (2013) 'Outsourcing Economics: Global Value Chains in Capitalist Development' Cambridge University Press, New York.
Miroudot, S. and C. Cadestin (2017) "Services in Global Value Chains: From Inputs to Value-Creating Activities", OECD Trade Policy Papers, No. 197, OECD.
Miroudot, S., J. Sauvage and B. Shepherd (2013) 'Measuring the cost of international trade in services', World Trade Review 12(4), pp. 719-735
Muradov, K. (2016) 'Counting Borders in Global Value Chains' paper presented at the 24th International Input-Output Conference, Seoul
Nadvi, K. and R. Horner (2018) 'Global value chains and the rise of the Global South: unpacking twenty-first century polycentric trade', Global Networks, 18, 2:207–237.
Neilson, J., B. Pritchard and H. Wai-Chung Yeung (2014) 'Global value chains and global production networks in the changing international political economy: An introduction', Review of International Political Economy,21:1, 1–8
Nolan, P. and J. Zhang (2010) 'Global Competition After the Financial Crisis', New Left Review, 64, 97–108
OECD (2015) 'Developing Countries Participation in Global Value Chains and its Implications for Trade and Trade Related Policies', OECD Trade Policy Paper No. 179
Quast, B. and V. Kummrit (2015) 'Decompr: Global Value Chain Decomposition in R', CTEI PAPERS CTEI-2015-01, Graduate Institute Geneva
Rodrick, D. (2015) "Premature Deindustrialization", NBER Working Paper Series No 20935.
Shingal, A. and M. Razzaque (2015) 'Exploring Intra-Commonwealth Goods and Services Trade', International Tarde Working Papers Series, Commonwealth Secretariat, London
Ukkusuri, S., R. Mesa-Arango, B. Narayanan, A. Sadri and X. Qian (2010) 'Evolution of the Commonwealth Trade Network: Hubs, Criticality and Global Value Chains', International Trade Working Paper 2016/07, Commonwealth Secretariat.
UNCTAD/OECD/WTO (2013) 'Implications of Global Value Chains for Trade, Investment, Development, and Jobs' UNCTAD/OECD/WTO/2013/1, Geneva.
UNCTAD-WTO (2012) 'A Practical Guide to Trade Policy Analysis', Geneva.
Walsh, K. (2006) 'Approach to Estimating Barriers to Services Trade' Working Paper No 183, The Institute for International Integration Studies, Trinity College Dublin
Wang, Z., S. Wei and K. Zhu (2013) 'Quantifying International Production Sharing at the Bilateral and Sector Level' NBER Working Paper Series No. 19677 revised in 2018
WTO (2011) 'World Trade Report 2011: The WTO and preferential trade agreements, from co-existence to coherence', WTO, Geneva.
WTO (2017), 'World Trade Report, 2017: Trade, technology and jobs', WTO, Geneva.
Zhu, Z., Puliga, M., Cerina, F., Chessa, A. and Riccaboni, M. (2015), 'Global Value Trees', PLoS ONE 10(5), 1–17.

7. Annex on Data and Methodology

A.1 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, in order to include only the Commonwealth (CW) countries and other main trade partners that belong to the G20. All other countries were aggregated into the Rest of the World (ROW) region. The resulting MRIO counts with 58 countries or regions and 26 sectors, resulting in a matrix of 1508 lines and 1508 columns. This Multi-Regional IO table served as the basis for the calculation of all TiVA indicators.

Nevertheless, the huge amount of information generated cannot be easily analysed from a global perspective; moreover (and more importantly from a statistical perspective) the quality of the sectoral data is mediocre. In order to have more robust a basis for empirical 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 a group of "Other sectors" where the quality of data was deemed particularly weak (e.g., recycling, household services, re-exports and re-imports). The resulting inter-sectoral trade flows between the 58 countries and region defines a much smaller table of 174 by 174.

A.2 Measuring Trade in Value Added.

In a global value chain, 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 the trade in value-analysis (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 first difference with traditional trade analysis is that TiVA analysis includes both the supply and the demand side, including final demand (the products required to satisfy consumption and investment). Another difference is that 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. It 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 11. Two countries A and B produce primary and processed goods. In column, we see the requirements in inputs plus the value-added (labour, capital) required by the production. In line, we see the allocation of the output (or sales) for use as intermediate or final demand consumption.

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).

Table 11 Simplified International Input-Output Table

	Country A		Country A		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
A.Secconday	40	5	40	30	115	170	285
A.Secondary	2	10	30	100	142	200	342
Value Added	198	220	205	197			
Output	350	365	285	342			

Note: For illustration purpose only.

The result, often called the "**A**" matrix in input-output analysis, is a 4x4 matrix as in Table 12. It provides the value and origin of the requirements needed to produce one unit of output.

Table 12 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

Note: For illustration purpose only.

Indeed, 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. This is a secondary requirement that is indirectly created by the initial production plan. In turn, satisfying with additional production this second wave will induce a third round of indirect requirements, and so on and so forth. The series of round can be expressed as a power expansion of the A matrix, starting with **I**, an identity matrix of 1 on the diagonal and 0 elsewhere: $I + A + A^2 + A^3 + \ldots + A^n$

I matrix 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 **Error! Reference source not found.**. As shown, we obtain a satisfactory approximation of **L** with only 5 rounds.

A2.1 From direct to total requirements

The total (direct and indirect) requirements are obtained by subtracting the initial demand **I** from the Leontief inverse. 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 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, despite the fact that 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 easy, thanks to IO algebra, to compute the flow of income representing the remuneration of the tasks each industry along the global value chain contributed to the final output. 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 below. Note an important outcome: 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=demand and provide the conditions for a general equilibrium situation (actually, the actual input-output matrices observed in the reality are expressions of an equilibrium situation, as long as the observation period corresponds to a "normal" situation). Obviously, this identity holds at the global level but may not apply at national one, engendering balance of payments surplus or deficits if demand is lower or larger than income generation.

Table 13 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

A2.2 GVC indicators

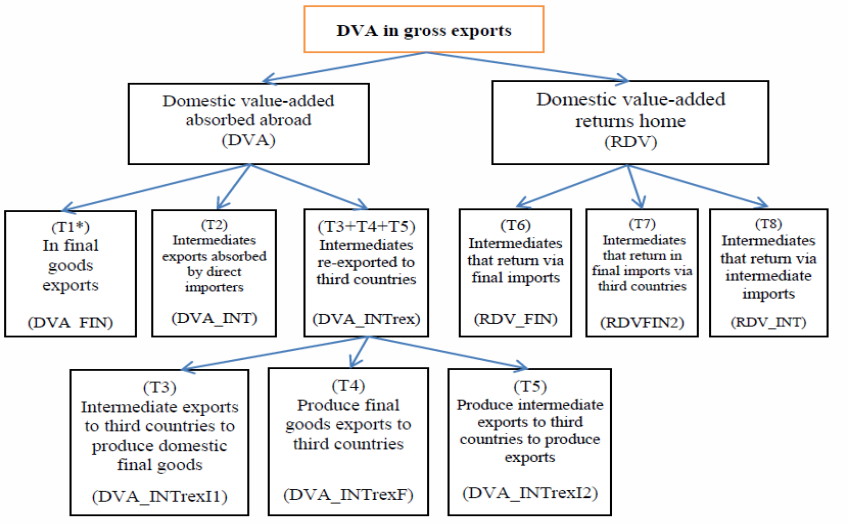
There are many options for analysing global value chains. The first step is always to decompose the flows of value-added according to their source and uses. A first set of measures decompose value chains to identify "Who Produces for Whom"; a second type of indicators tries to measure the length of the GVCs.

- GVC decomposition

The paper applies 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 13 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) further decomposes the value added into several sub-components. WWZ decomposition is rather complex (see Figure 12) and it is not the place here to go much into details; we refer the readers to Wang, Wei and Zhu (2013) and Quast and Kummritz (2015). For example, DVA_FIN represents the domestic VA embodied in exports of 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 correspond 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.

Figure 12 WWZ Decomposition of Domestic Value-Added embodied in Gross Exports



Source: Wang, Wei and Zhu (2013)

RDV concerns the domestic value added that returns to the exporter, embodied in imports of final or in intermediate goods. Other terms —not included in Figure 4 which deals 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, 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 happening 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, Wei and Zhu, 2013).

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

Another widely used set of indicators is the length of a value-chain and the position (upstream or downstream) in this chain. These indicators are also calculated on the input-output matrix and derive from the concept of "backward and forward linkages" introduced by Hirschman (1958). The linkage concept is generalised to the observation that an increase in ongoing activities induce 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. 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 used by other industries in foreign countries to produce their own exports. 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. At the contrary, if its 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 will also present it based on the simpler direct requirements. Actually, this direct approach, based on input and output actually purchased by the industry, is more meaningful from a business perspective and 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, Wei and Zhu, 2013 for a review). Most of the measures are based on the concept of Average Propagation Length (see below).

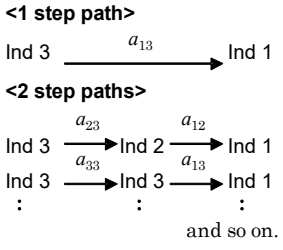
It is worth mentioning that these indicators are the subject of some debate in the community of TiVA analysts. In some cases, it is difficult to characterize the particular role of an industry: a particular bank will provide credit to farmers (upstream activity) and to final consumers (downstream). The ratio will give some idea of what is the main business of this particular bank, but the industry average over all particular banks may not be much 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 Upward and Downward length

There are many different ways of measuring the length of a GVC. Most derive from the application of the Average Propagation Length, as defined in Dietzenbacher, Romero, and Bosma (2005). We use Escaith and Inomata (2013) presentation here:

Input Coefficient Matrix **Impact Delivery Paths**

$$\mathbf{A} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \cdots & a_{nn} \end{bmatrix}$$



Suppose we have an economic system of n industrial sectors with a production structure defined by the input coefficient matrix **A** as shown in Figure A.1. 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. Alternatively, there is 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, whatever the sequence of industries, 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 $\mathbf{A} \times \mathbf{A}^2\,\Delta\mathbf{d} = \mathbf{A}^3\,\Delta\mathbf{d}$, and so on. 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 *k*th round steps or stages of the production process.

The Leontief inverse matrix $\mathbf{L}$, which shows the total amount of goods and services required for the production of one unit of output, can be expanded as an arithmetic series, that is, $\mathbf{L} = (\mathbf{I} - \mathbf{A})^{-1} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + \mathbf{A}^4 + ...$, where $\mathbf{I}$ is an identity matrix (with 1 in diagonal elements and 0 elsewhere). It is immediately clear that the equation 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 *k*th stage of the production process.

With this preliminary understanding, average propagation lengths are specified as:

$$\mathrm{APL}_{(ji)} = 1*a_{ij}/\,(l_{ij} - \delta_{ij}) + 2*[\mathbf{A}^2]_{ij}/\,(l_{ij} - \delta_{ij}) + 3*[\mathbf{A}^3]_{ij}/\,(l_{ij} - \delta_{ij}) + \ldots = \sum_{k=1}^{\infty} k \left([\mathbf{A}^k]_{ij} / \sum_{k=1}^{\infty} [\mathbf{A}^k]_{ij} \right),$$

where $\mathbf{A}$ is an input coefficient matrix, a_{ij} are its elements, l_{ij} are the Leontief inverse coefficients, δ_{ij} is a Kronecker delta which is 1 if i = j and 0 otherwise, and *k* is the number of production stages along the path. We also define $\mathrm{APL}_{(ji)} = 0$ when $(l_{ij} - \delta_{ij}) = 0$.

The first term on the right side of the equation above shows that the impact delivered through one-step paths (k = 1), i.e. direct impact, amounts to a $a_{ij}\,/\,(l_{ij} - \delta_{ij})$ share of the total impact given by the Leontief inverse coefficients (less unity for diagonal elements). Similarly, two-step paths (k = 2) contribute a $[\mathbf{A^2}]_{ij}\,/\,(l_{ij} - \delta_{ij})$ share, and three-step paths (k = 3) give a $[\mathbf{A^3}]_{ij}/\,(l_{ij} - \delta_{ij})$ share of the total impact. This is evident from $\mathbf{L} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + ...$ which is rearranged as $\mathbf{L} - \mathbf{I} = \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + ...$, and hence $(\mathbf{L} - \mathbf{I})_{ij} = (l_{ij} - \delta_{ij}) = \mathbf{A}_{ij} + [\mathbf{A^2}]_{ij} + [\mathbf{A^3}]_{ij} + ...$