ISSN 2413-3175
2016/07

The Commonwealth

INTERNATIONAL TRADE WORKING PAPER

Evolution of the Commonwealth Trade Network: Hubs, Criticality and Global Value Chains

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International Trade Working Paper 2016/07
ISSN 2413-3175

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Please cite this paper as: Ukkusuri, SV, R Mesa-Arango, B Narayanan, AM Sadri and X Qian (2016), 'Exploring Intra-Commonwealth Goods and Services', *International Trade Working Paper* 2016/07, Commonwealth Secretariat, London.

Abstract

This paper studies the evolution of the Commonwealth trade network and considers the interrelationship between Commonwealth member countries and other important players in the global economy, and intra-Commonwealth country trade flows. Rich trade data from multiple economic sectors in the 1995–2011 period are analysed using complex network analysis tools. The paper finds that the Commonwealth is divided into three strongly connected hubs and provides important links for several global value chains, among other findings.

JEL Classification: F15, F20
Keywords: International trade network, global value chains, centrality, cluster, Commonwealth

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1. Summary

This paper studies the evolution of the Commonwealth trade network and considers: (i) the interrelationship between Commonwealth member countries and other important players in the global economy; and (ii) intra-Commonwealth country trade flows. Rich trade data from multiple economic sectors in the 1995–2011 period are analysed using complex network-analysis tools.

A number of important findings and implications have arisen from this interdisciplinary study:

- The Commonwealth is separated into three strongly connected communities.
- South Africa is a very important hub for the African cluster.
- India has increased trade with similar economies in the recent past, whereas Canada has been doing this for many years.
- Australia, Malaysia and Singapore trade with partners that have medium levels of similarity.
- Other Commonwealth member countries tend to trade with very dissimilar partners.
- The United Kingdom has the highest centrality in the intra-Commonwealth trade network.
- The Commonwealth provides important links for several global value chains.
- Associations with countries that have played a prominent part in different clusters could help to promote and strengthen trade.
- Identifying clusters could help to inform countries' trade policies which should aim to promote associations with as many other countries as possible.
- Prioritising trade partners based on mutual trade strength and cluster positioning is necessary for Commonwealth member countries. Specific recommendations for potential clusters are identified for the Asia and Africa sectors.
- For poorer member countries, a focus on more value-added and advanced sectors in trade is required to develop both trade and economies.
- In order for the United Kingdom to have an important role in Commonwealth trade, the trading relationships between the European Union (EU) and the Commonwealth have to evolve.

This paper is organised into three parts. The first part deals with the complete network analysis of Commonwealth member countries and their global partners. The second part focuses on a network analysis undertaken at the regional level by considering only the trade relationships between Commonwealth countries. The findings from this additional network analysis are solely applicable to intra-Commonwealth trade activities and have different implications with respect to the global trade economy. The third part includes several trade network visualisations at different levels of analysis, which are primarily focused on Caribbean and Pacific island countries.

Key terms in network analysis

International Trade Network: a network representing international trade between economic sectors at different regions around the world.

Nodes: these represent regions (when all sectors are aggregated), or regions/sectors (when sectors are disaggregated).

Arcs: these indicate the presence, direction (import/export) and monetary value of trade between nodes.

Network density: the fraction of unilateral arcs (i.e. imports or exports) carrying trade from the total number of possible unilateral connections.

Bilateral density: the fraction of bilateral arcs (trade in both directions between two nodes) from the total number of possible bilateral connections.

Unilateral degree: the total number of trade partnerships (presence of imports + presence of exports) associated with a node.

Unilateral strength: the total monetary value of trade (imports + exports) associated with a node.

Centrality: this indicates the cumulative topological presence of a node/arc in the shortest trade path between each pair of nodes. Measured using Betweenness Centrality (see Appendix 2)

Cluster or community: a subset of nodes (regions or regions-sectors) that are highly interconnected and with high amounts of trade.

Global Value Chains (GVCs): the transformation of value for different economic activities at different places around the world. In this paper, clusters/communities are used to describe GVCs from a network perspective.

2. Background

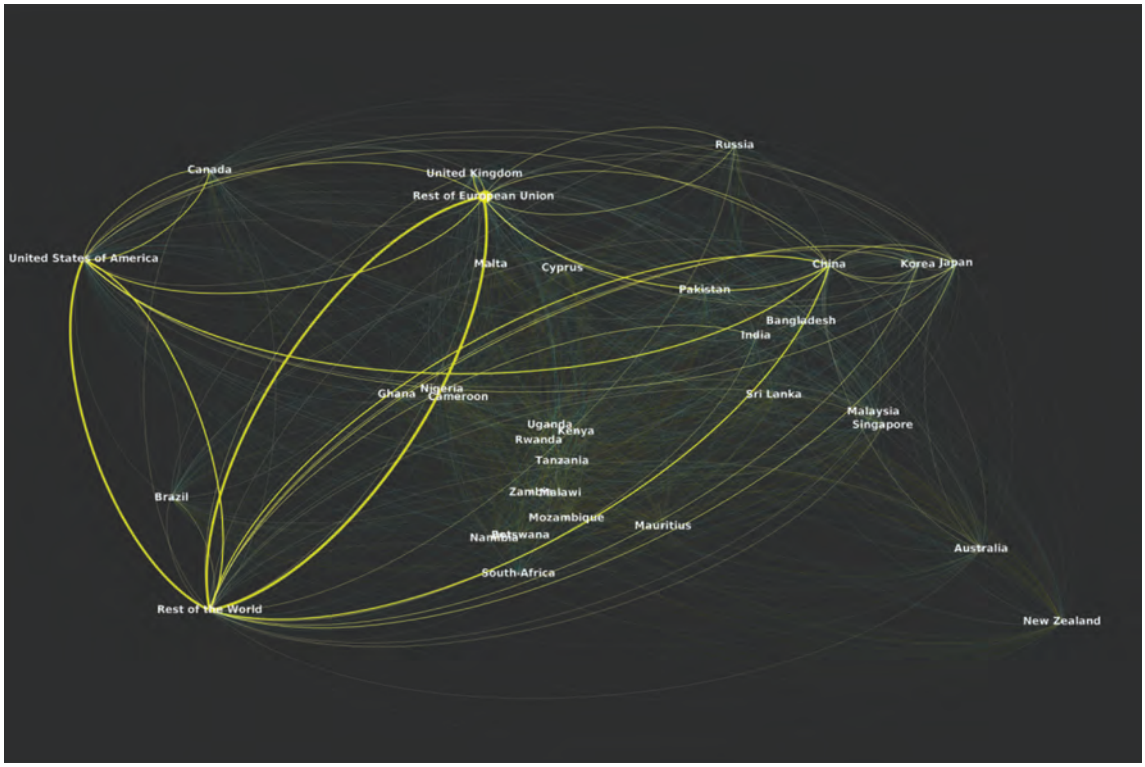
Trade is an important activity for the economy of any nation. The complexity of trade interaction has been studied by economists, policymakers and researchers for many years. International trade arises as a result of production imbalances of certain commodities in different geographic locations. Recently, network science has focused on analyses of world trade given that this can be described as an international trade network in which nodes represents nations and links represent trade relationships (Figure 1). Trade partnerships are important to describe this network but do not provide the complete picture. Other elements in this network are important for a comprehensive analysis, such as directionality of trade (exports/imports), monetary values, history and input/output relationship between multiple economic sectors. This last feature is important to understand the interaction between global value chains (GVCs) or worldwide transformations of commodities. Although several existing studies have analysed the international trade network, few of them consider GVCs. Understanding all these dimensions is important in developing innovative policy studies.

The complex current global trade environment is characterised by bilateral negotiations and negotiations among large groups of countries. These negotiations include important aspects such as import tariff duties, labour and environmental regulation, intellectual property rights and technical barriers. An accurate description of GVCs is important to understand these issues because imposing rules and standards on a sector in a particular country can indirectly affect many other sectors in different countries. Therefore, the Commonwealth is embedded in an international trade network in which member countries interact with each other as well as with other important economies around the world.

The Commonwealth is an intergovernmental organisation that includes 53 states. Although member countries collaborate by sharing values, they have no legal obligation to one another. However, this relationship represents an interesting potential platform for international trade whereby developing countries can fight against poverty and expedite economic growth (The Commonwealth 2015). According to the Commonwealth Network (2015), most of these countries are net importers (averaging 11 per cent of gross domestic product (GDP)), although Singapore and Malaysia are important net exporters (28 per cent and 18 per cent of 2010 GDP, respectively). However, countries such as Namibia and Botswana strongly depend on imports, in particular from other countries in other member countries. Trade between Commonwealth countries is significantly higher (38–50 per cent) than trade between Commonwealth countries and other nations. This complex interconnectedness can be exploited to develop efficient trade policies based on network analysis.

The main objective of this paper is to conduct a comprehensive analysis of global trade and GVCs in the Commonwealth network using state-of-the-art techniques for complex networks. This preliminary analysis can be used to identify clusters and hubs in the network (by countries

Figure 1. The International Trade Network (2010)



Source: authors

and sectors). The evolution of the Commonwealth network analysis reveals the criticality of various nodes and their trade resilience.

Two important implications are derived from this study. First, providing a broad picture of global trade and GVCs in the Commonwealth network shows policy-makers and business communities the extent of dependence of their countries and industries on other countries and industries. Commonwealth member countries can identify key partners with whom to boost trade, so that they can emerge as strong players in the global trade arena. Policy-makers in general can employ some of these results to frame strategies for trade negotiations with specific partners. At present, countries engage in trade negotiations with multiple partners, and prioritisation could be informed by the results of this network analysis. Second, we highlight specific types of analyses, as a result of this study, to pursue pointed policy-oriented research using this host of tools and their extensions. This is an exploratory study, with a focus on many sectors or groups of countries within the Commonwealth. Policy-makers may prefer analyses with a sharper focus on specific issues, which requires even more sophisticated tools, as outlined towards the end of this study.

2.1 The challenge

Commonwealth countries have many commonalities that foster opportunities for intra- and inter-trade. They have a legacy of similar political systems, social values, cultural aspects and a sense of solidarity. Therefore, there is a huge potential for trade among these countries. Despite this, there has not been any collective effort among member countries to promote intra-Commonwealth trade. In the absence of any such collective effort, it is important to study the structure of trade networks in these countries to develop strategies to promote their collective trade.

Most of the Commonwealth countries are net importers, although Singapore and Malaysia, which are both net exporters, are notable exceptions. This is a cause for concern to policy-makers in these countries, because increased dependence on imports can lead to current account deficits, which may reach unsustainable levels in the future; as such, trade promotion as a means by which to enhance exports is an important policy strategy for the majority of Commonwealth countries. One reason for low net exports from Commonwealth member countries is the lack of concerted trade policy efforts across these countries.

Policies that focus on facilitating and promoting trade both among the Commonwealth countries and beyond them are crucial for businesses in these countries. It is, therefore, essential to identify key strategic partners with which to prioritise relationships, among both Commonwealth countries and non-Commonwealth countries, because global trade is a complicated value-chain network. In this model, successful trade policies in one node in the network could affect another node that is not directly connected. In other words, there are secondary and tertiary effects of trade that need to be carefully analysed to understand strategic trade agreements that may enable all Commonwealth countries to be important trade partners in the future. Accounting for such complex relationships would help prioritise trade partners and sectors based on a country's position in a particular network/cluster and its proximity to a hub.

In recent years, global trade has evolved into a network of GVCs in which commodities are produced, combined and transformed in different countries, thereby adding value to their underlying businesses. Pascal Lamy, the former Director-General of the World Trade Organization (WTO) said that 'Any discussion today of international trade and investment policy that fails to acknowledge the centrality of GVCs would be considered outmoded and of questionable relevance' (Elms and Low 2013). GVCs have reshaped the structure of supply chains around the world, which has led to the evolution of new business structures (e.g. outsourcing, offshoring, vertical integration, fragmentation, etc.). These phenomena have significantly involved several Commonwealth member countries. However, their role is not clear from regular bilateral analysis, which is based on the traditional trade analysis conducted in the past.

Understanding the structural components and patterns of this network of GVCs is extremely challenging. This is not a unique characteristic of the international trade network, but is also the case for other complex networks such as the internet, biological systems, social networks, etc. Statistical network analysis has evolved as a new field to address such complexity. A number of analytical tools have been developed over the past few years, but economists and policy-makers have not fully exploited their enormous potential. Although collaboration with network scientists has grown slowly, the lack of good quality data limits the scope of these studies. The current project narrows this knowledge gap by augmenting the work of two important research groups at Purdue University: the Interdisciplinary Transportation Modeling and Analytics Lab (ITMAL) and the Global Trade Analysis Project (GTAP). ITMAL has extensive experience in the development of network-analysis tools for interdisciplinary projects, and GTAP measures and collects international trade data with the support of several international organisations, including US governmental agencies, the World Bank, the United Nations, and WTO (Narayanan *et al.* 2012).

In the next section, the rich data set from GTAP is explored using a set of powerful network-analysis tools.

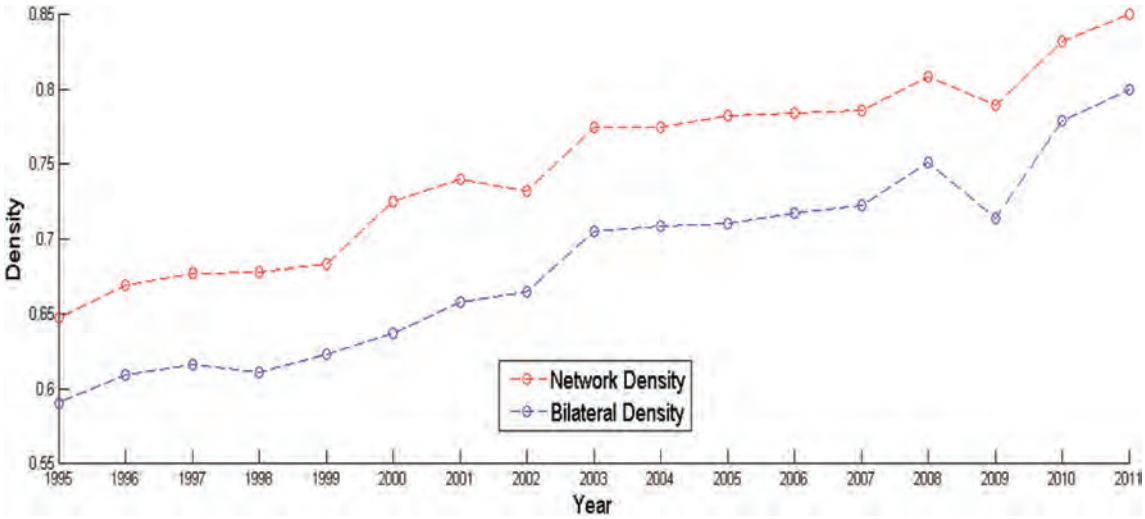
2.2 Key findings

This project uses the rich international trade data set constructed and managed by GTAP. The value of trade between 1995 and 2011 is available for 134 regions/countries around the world and for 43 economic sectors. Appendix 1 (Table A1.1) shows the Commonwealth member countries considered in this analysis. Likewise, it shows other important players required to account for external network effects. Appendix 2 (Table A1.2) presents the corresponding economic sectors. A set of network-analysis tools has been applied to this data set to observe the structural composition of the network and provide the key findings outlined below.

3. Evolution of the trade network encompassing the Commonwealth member countries

A trade network approach is used to represent the international trade environment of the Commonwealth member countries. The countries/regions and sectors considered in this

Figure 2. Density of the international trade network surrounding Commonwealth member countries



Source: authors

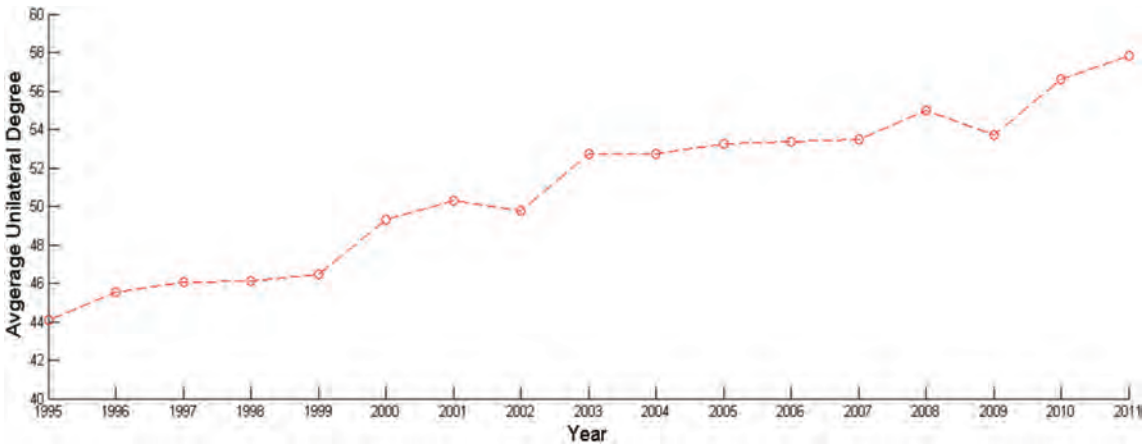
representation are summarised in Appendix 1, which enables the use of descriptive statistical network-analysis metrics (Appendix 2). The density of interconnections in this network has increased from approximately 65 per cent in 1995 to 85 per cent in 2011 (Figure 2). Although the number of partnerships in the trade network is already high, it continues to increase. From the bilateral perspective (i.e. mutual trade), the number of partnerships is slightly lower. This metric has changed from 59 per cent in 1995 to 80 per cent in 2011. Therefore, there is a small fraction of trade that moves in just one direction and this fraction tends to remain constant.

The increased number of trade relationships is also shown in Figure 3 where the average unilateral degree increases from 44 imports-plus-exports partnerships in 1995 to 58 in 2011.

Partnerships, or trade relationships, are useful to understand the topologic evolution of this network. However, they do not account for the value of trade between these countries/regions. Figure 4 shows the historical evolution of average unilateral strength (trade) in the network. Given that values are standardised to 1995, this figure shows a real expansion, which is not masked by inflation.

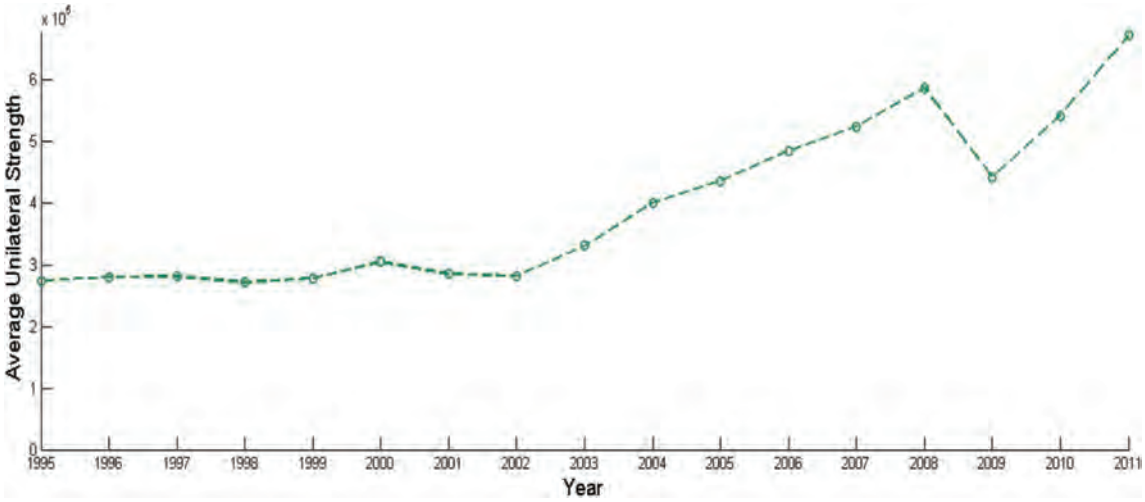
Some countries/regions are at the middle of complex GVCs, that is, they are common to several trade paths in the world. Network science measures the centrality of an element using the concept of 'Betweenness Centrality' (BC). Figure 5 shows that after top average levels of centrality between 2000 and 2002, this metric has reduced. Therefore, at the aggregated level, elements in the trade network encompassing Commonwealth

Figure 3. Average unilateral degree



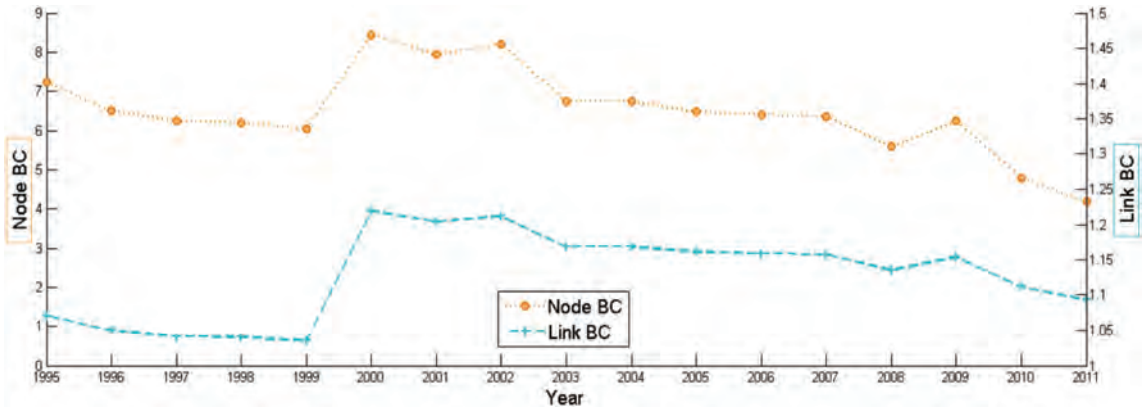
Source: authors

Figure 4. Average unilateral strength (1995, constant millions of US$)



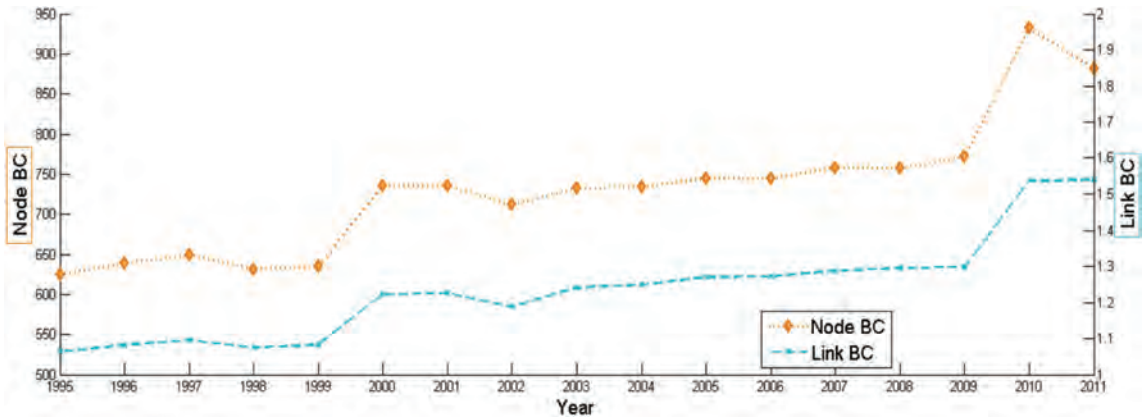
Source: authors

Figure 5. Average node/arc centrality (aggregated sectors)



Source: authors

Figure 6. Average node/arc centrality (disaggregated sectors)



Source: authors

member countries have lost centrality. This feature is important because low levels of centrality are related to gains in resilience, that is, the network recovers and adjusts faster when there is an economic crisis in a specific geography. However, when specific commodities are considered (Figure 6), the average centrality for sectors in different regions is growing over time. This is a

Table 1. Countries/regions in the global cluster

Commonwealth			Other	
Australia	Malaysia	Pakistan	Brazil	Republic of Korea
Bangladesh	New Zealand	Singapore	China	Rest of the World
Canada	Nigeria	Sri Lanka	Japan	USA
India				

Source: authors

Table 2. Countries/regions in the European cluster

Commonwealth	Other
Cameroon	Rest of the European Union
Cyprus	Russian Federation
Malta	
UK	

Source: authors

sign of specialisation taking place at specific locations around the Commonwealth and in other countries in the world economy.

Several key findings have been obtained following a careful analysis of the evolution of the Commonwealth network from 1995 to 2011. These findings are summarised below.

Key finding 1: The Commonwealth is separated into three strongly connected communities

From the aggregate level, the trade network surrounding the Commonwealth is separated into three strongly connected communities or clusters. Countries within a cluster are highly interconnected and/or have high volumes of trade with other members. It should be noted that countries in a cluster also trade with countries in other clusters but at lower levels of volume and with lower interconnectivity (networked partnerships).

Community 1: Global cluster

This community has the largest number of countries/regions (Table 1). A general description of the cluster is provided before focusing on the Commonwealth member countries. Important players such as the Rest of the World, the USA, China, Japan, the Republic of Korea and Brazil interact with countries from the Commonwealth. Interestingly, there is no European country in this cluster. Recognised and emerging economies from the Commonwealth appear in the cluster. The following nations have been part of the cluster for the entire time period: Canada (the only nation from North America); four Pacific nations (Australia, Malaysia, Singapore and New Zealand); four Asian nations (Bangladesh, Pakistan, Sri Lanka and India); and Nigeria (the only African nation). Some African nations sporadically join the global cluster from the African cluster as will be shown below.

Table 3 highlights Canada's position as the most important member of the Commonwealth from the total trade perspective (imports and exports). Likewise, the rise of India is clear. India has gained importance over other nations such as Singapore, Australia and Malaysia, which have had strong trade in the past. Small players in this cluster are emerging economies such as Bangladesh and Sri Lanka. In addition, Table 4 shows the evolution of centrality for these nations with similar rankings. Although Nigeria has been ranked sixth from trade value for several years, its centrality has been small over the years. This indicates how Nigeria has specialised in primary products that are at the downstream of GVCs (e.g. oil, the energy sector, etc.).

Furthermore, Table 5 shows the role of other countries/regions in the global cluster. The rest-of-the-world leads trade, followed by the USA. In recent years, China has displaced Japan. Rankings are similar from the centrality perspective (Table 6).

Community 2: European cluster

The main players in this cluster are the Rest of the European Union, the United Kingdom and Russia (Table 2). There are four countries from the Commonwealth that have remained in this cluster over time (the United Kingdom, Cyprus, Malta and Cameroon). The first two countries are part of the European Union. Cameroon is the only African nation that has remained part of the cluster over the time span (1995–2011).

Table 3. Global cluster and total trade evolution for the Commonwealth

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada	Canada
Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	Singa-pore	India	India	India	India	India
Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	India	Malaysia	Australia	Singa-pore	Australia	Australia
Australia	Australia	Australia	Australia	Australia	Australia	Australia	Australia	Australia	India	India	Malaysia	Singa-pore	Malaysia	Australia	Singa-pore	Malaysia
India	India	India	India	India	India	India	India	India	Australia	Australia	Australia	Australia	Singa-pore	Malaysia	Malaysia	Singa-pore
New Zealand	New Zealand	New Zealand	New Zealand	New Zealand	Nigeria	Nigeria	New Zealand	Nigeria	Nigeria	Nigeria	Nigeria	Nigeria	Nigeria	Nigeria	Nigeria	Nigeria
Pakistan	Nigeria	Nigeria	Nigeria	Nigeria	New Zealand	New Zealand	Nigeria	New Zealand	New Zealand	New Zealand	Pakistan	New Zealand	New Zealand	Pakistan	Pakistan	Pakistan
Nigeria	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan	New Zealand	Pakistan	Pakistan	New Zealand	New Zealand	New Zealand
Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh	Bangla-desh
Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka

Table 4. Global cluster and centrality evolution for the Commonwealth

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Canada	India	Canada	Canada	Malaysia	Singa-pore	India	India	Canada	India	India	India	Malaysia	India	India	Canada	Canada
Pakistan	Canada	India	Malaysia	India	Malaysia	Malaysia	Malaysia	India	Canada	Pakistan	Singa-pore	India	Canada	Canada	India	India
India	Pakistan	Malaysia	India	Singa-pore	India	Canada	Singa-pore	Malaysia	Malaysia	Malaysia	Malaysia	Canada	Malaysia	Malaysia	Malaysia	Australia
Singa-pore	Singa-pore	Australia	Singa-pore	Canada	Canada	Singa-pore	Canada	Pakistan	Australia	Canada	Pakistan	Australia	Australia	Australia	Australia	Malaysia
Malaysia	Australia	Singa-pore	Australia	Pakistan	Australia	Australia	Australia	Australia	Singa-pore	Singa-pore	Canada	Pakistan	Pakistan	Pakistan	Pakistan	Pakistan
Australia	Malaysia	Pakistan	Bangla-desh	Australia	Pakistan	Pakistan	Pakistan	Singa-pore	Pakistan	Australia	Australia	Singa-pore	Nigeria	Singa-pore	Singa-pore	Singa-pore
Bangla-desh	New Zealand	Bangla-desh	Pakistan	New Zealand	New Zealand	Bangla-desh	New Zealand	Bangla-desh	Bangla-desh	New Zealand	New Zealand	Nigeria	Singa-pore	Nigeria	New Zealand	New Zealand
New Zealand	Bangla-desh	New Zealand	New Zealand	Sri Lanka	Sri Lanka	Nigeria	Nigeria	New Zealand	New Zealand	Nigeria	Nigeria	Bangla-desh	New Zealand	New Zealand	Nigeria	Bangla-desh
Nigeria	Sri Lanka	Nigeria	Sri Lanka	Nigeria	Bangla-desh	New Zealand	Bangla-desh	Nigeria	Nigeria	Bangla-desh	Bangla-desh	New Zealand	Sri Lanka	Sri Lanka	Bangla-desh	Sri Lanka
Sri Lanka	Nigeria	Sri Lanka	Nigeria	Bangla-desh	Nigeria	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Sri Lanka	Bangla-desh	Bangla-desh	Sri Lanka	Nigeria

Table 5. Global Cluster and total trade evolution for other countries/regions

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World
USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA
Japan	Japan	Japan	Japan	Japan	Japan	Japan	Japan	Japan	China	China	China	China	China	China	China	China
China	China	China	China	China	China	China	China	China	Japan	Japan	Japan	Japan	Japan	Japan	Japan	Japan
Korea[a]	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea
Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil

[a] 'Korea' refers to the Republic of Korea

Table 6. Global cluster and centrality for other countries/regions

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
USA	USA	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World	Rest of World
Rest of World	Rest of World	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA	USA
Japan	Japan	China	Japan	Japan	Japan	Japan	China	China	China	China	China	Japan	China	China	China	China
Korea[a]	Korea	Japan	China	China	China	China	Japan	Japan	Japan	Japan	Japan	China	Japan	Japan	Japan	Japan
China	China	Korea	Brazil	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea	Korea
Brazil	Brazil	Brazil	Korea	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil	Brazil

[a] 'Korea' refers to the Republic of Korea

Table 7. European cluster and total trade evolution for the Commonwealth

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK
Malta	Cyprus	Cyprus	Cyprus	Malta	Malta	Cyprus	Cyprus	Malta	Malta	Malta	Malta	Malta	Malta	Malta	Malta	Cyprus
Cyprus	Malta	Malta	Malta	Cyprus	Cyprus	Malta	Malta	Cyprus	Cyprus	Cyprus	Cyprus	Cyprus	Cyprus	Cyprus	Cyprus	Malta
Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon	Came-roon

Table 7 and Table 8 show the evolution of total trade and centrality for countries in the Commonwealth. Malta, Cyprus and Cameron are emerging economies that are closely related to the European cluster. Table 9 and Table 10 present the corresponding values for other countries/regions.

Community 3: African cluster

This cluster is exclusively composed of Commonwealth member countries. All the countries in this cluster are from Africa. The country with highest levels of trade is South Africa, which significantly outperforms other countries in the cluster. South Africa seems to have an important influence on the international economy of other countries in the cluster. In 1997, South Africa was closer to the European cluster. Surprisingly, another eight countries from the African cluster migrated to the European one in 2015. Similarly, in 2010, South Africa was part of the Global cluster and was accompanied by another nine nations from the African cluster. Furthermore, several nations move back and forth from the African cluster to the other two clusters. For example, Zambia moved three times to the Global cluster (in 1997, 2006 and 2011). Kenya, Tanzania, Uganda, Rwanda, Mozambique and Malawi were in the European cluster in 1997 and then moved to the Global cluster in 2006, 2007 and 2011 (Mozambique and Malawi in 2011 only). Botswana and Namibia are the only two nations that have not joined the Global cluster. They were closer to the European cluster in 2002 and 2011. Ghana and Mauritius were part of the European cluster for 8 years. They then stayed in the African cluster with sporadic appearances in the European cluster (Mauritius in 2006). In 2010, Ghana joined the Global cluster and continued in it to 2011, when Mauritius also joined it.

Table 11 and Table 12 show the evolution of total trade and centrality for countries in the Commonwealth. South Africa is the most relevant country in this cluster.

Key finding 2: South Africa is an important hub for the African cluster

South Africa is an important hub for the African cluster. Several other countries depend on the economic relationship of this country with its partners.

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).

Interestingly, the single homophily for South Africa has been close to the values for strong economies such as China, the USA, the Rest of the World, and the Rest of European Union (Figure 7). This trait highlights the importance of South Africa not only within the Commonwealth but also within the African cluster. South Africa is a strong hub that connects and processes commodities from different sectors in Africa and connects them to the other clusters.

In recent years, China has gained importance in the global economic environment. Interestingly, Figure 7 shows how this country has evolved from being connected with similar countries in early years to a more diversified economy over recent years.

Key finding 3: India has increased trade with similar economies in the period 2007–11, whereas Canada has been doing this for many years

Canada is a strong economy. Over the years, it has been the most important powerful and central trader from the Commonwealth in the Global cluster. Its single homophily has varied from 0.54 to 1.00. Therefore, Canada tends to trade with countries that have similar trading behaviour, that is, other relatively strong traders.

India has evolved over the years from being a small player in the global economy to a strong player. Before 2006, its single homophily grew from –0.55 to –0.07. From 2006, this value increased from 0.04 to 0.40. This period coincides with the position of India as the second strongest Commonwealth member country in the Global cluster. Therefore, when India had low importance in international trade, it tended to trade with stronger partners. However, as India grew, on average, it continued trading with strong partners.

The evolution of single homophily for these and other regions not in the Commonwealth are summarised in Figure 8.

Key finding 4: Australia, Malaysia and Singapore trade with partners that have medium levels of similarity

The single homophily for Australia has grown from –0.39 to –0.07 from 1995 to 2011. This indicates that it traded with dissimilar partners but has evolved to a medium level of

Table 8. European cluster and centrality evolution for the Commonwealth

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK	UK
Cyprus	Cameroon	Cyprus	Malta	Cyprus	Cameroon	Cyprus	Cameroon	Cameroon	Cameroon	Malta	Malta	Malta	Cyprus	Cyprus	Cyprus	Malta
Malta	Cyprus	Malta	Cyprus	Malta	Cyprus	Cameroon	Cyprus	Cyprus	Malta	Cyprus	Cameroon	Cyprus	Cameroon	Cameroon	Malta	Cyprus
Cameroon	Malta	Cameroon	Cameroon	Cameroon	Malta	Malta	Malta	Malta	Cyprus	Cameroon	Cyprus	Cameroon	Malta	Malta	Cameroon	Cameroon

Table 9. European cluster and total trade evolution for other countries/regions

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU
Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation

Table 10. European cluster and centrality evolution for other countries/regions

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU	Rest of EU
Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation	Russian Federation

Source: authors

Table 11. African cluster and total trade evolution for the Commonwealth

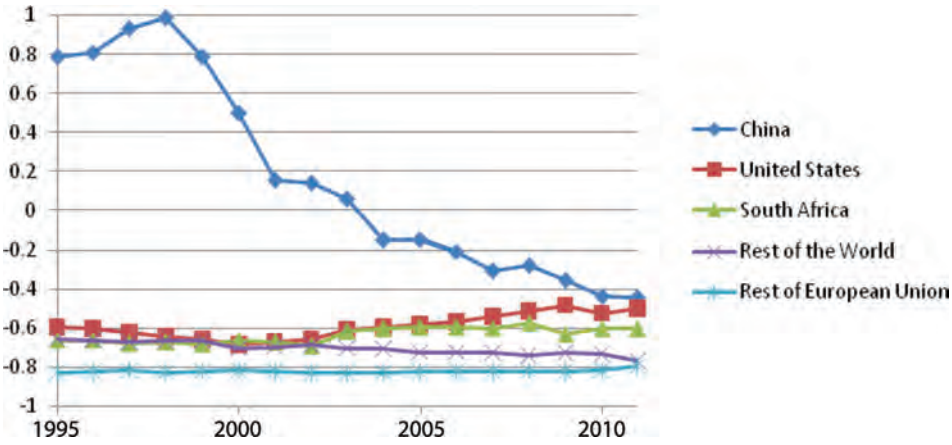
1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa
Kenya	Ghana	Ghana	Kenya	Kenya	Botswana	Botswana	Ghana	Kenya	Ghana	Ghana	Kenya	Kenya	Ghana	Kenya	Kenya	Ghana
Mauritius	Mauritius	Mauritius	Ghana	Ghana	Ghana	Kenya	Mauritius	Botswana	Kenya	Kenya	Ghana	Ghana	Kenya	Ghana	Ghana	Zambia
Ghana	Kenya	Kenya	Mauritius	Mauritius	Mauritius	Ghana	Kenya	Ghana	Botswana	Botswana	Zambia	Botswana	Tanzania	Zambia	Zambia	Kenya
Zambia	Zambia	Zambia	Tanzania	Tanzania	Kenya	Mauritius	Tanzania	Mauritius	Namibia	Tanzania	Botswana	Zambia	Zambia	Tanzania	Tanzania	Uganda
Tanzania	Tanzania	Tanzania	Zambia	Zambia	Namibia	Namibia	Zambia	Tanzania	Mauritius	Namibia	Namibia	Namibia	Botswana	Botswana	Mozambique	Tanzania
Uganda	Uganda	Uganda	Uganda	Mozambique	Tanzania	Tanzania	Mozambique	Namibia	Tanzania	Zambia	Tanzania	Tanzania	Namibia	Mozambique	Botswana	Mauritius
Mozambique	Malawi	Malawi	Mozambique	Uganda	Zambia	Zambia	Botswana	Zambia	Zambia	Mauritius	Mauritius	Mozambique	Mozambique	Mauritius	Mauritius	Mozambique
Malawi	Mozambique	Mozambique	Malawi	Malawi	Mozambique	Mozambique	Uganda	Mozambique	Mozambique	Mozambique	Mozambique	Mauritius	Mauritius	Uganda	Uganda	Namibia
Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Uganda	Uganda	Namibia	Uganda	Uganda	Uganda	Uganda	Uganda	Uganda	Malawi	Namibia	Botswana
Botswana	Botswana	Botswana	Botswana	Botswana	Malawi	Malawi	Malawi	Malawi	Malawi	Malawi	Malawi	Malawi	Malawi	Namibia	Malawi	Malawi
Namibia	Namibia	Namibia	Namibia	Namibia	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda

Table 12. African cluster and centrality evolution for the Commonwealth

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa
Kenya	Kenya	Tanzania	Kenya	Kenya	Tanzania	Tanzania	Kenya	Kenya	Kenya	Kenya	Kenya	Kenya	Kenya	Kenya	Kenya	Kenya
Mauritius	Tanzania	Kenya	Tanzania	Tanzania	Zambia	Zambia	Zambia	Mauritius	Tanzania	Mauritius	Mauritius	Tanzania	Mauritius	Tanzania	Mauritius	Tanzania
Malawi	Malawi	Mauritius	Mauritius	Mauritius	Kenya	Kenya	Mauritius	Tanzania	Mauritius	Tanzania	Tanzania	Mauritius	Tanzania	Mauritius	Tanzania	Mauritius
Tanzania	Mauritius	Malawi	Zambia	Zambia	Mauritius	Malawi	Tanzania	Zambia	Malawi	Zambia	Zambia	Zambia	Zambia	Zambia	Zambia	Malawi
Uganda	Zambia	Uganda	Uganda	Malawi	Ghana	Mauritius	Uganda	Uganda	Uganda	Ghana	Mozambique	Uganda	Mozambique	Malawi	Malawi	Namibia
Zambia	Uganda	Zambia	Malawi	Mozambique	Malawi	Ghana	Ghana	Mozambique	Zambia	Malawi	Namibia	Mozambique	Ghana	Uganda	Ghana	Zambia
Mozambique	Ghana	Ghana	Rwanda	Rwanda	Mozambique	Uganda	Malawi	Malawi	Mozambique	Mozambique	Malawi	Namibia	Uganda	Mozambique	Namibia	Mozambique
Rwanda	Rwanda	Mozambique	Mozambique	Uganda	Namibia	Namibia	Rwanda	Namibia	Namibia	Botswana	Ghana	Ghana	Malawi	Botswana	Mozambique	Ghana
Botswana	Mozambique	Rwanda	Ghana	Ghana	Botswana	Mozambique	Namibia	Ghana	Botswana	Namibia	Botswana	Malawi	Namibia	Ghana	Uganda	Uganda
Namibia	Botswana	Botswana	Botswana	Botswana	Uganda	Botswana	Mozambique	Botswana	Ghana	Uganda	Uganda	Botswana	Botswana	Rwanda	Botswana	Botswana
Ghana	Namibia	Namibia	Namibia	Namibia	Rwanda	Rwanda	Botswana	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Rwanda	Namibia	Rwanda	Rwanda

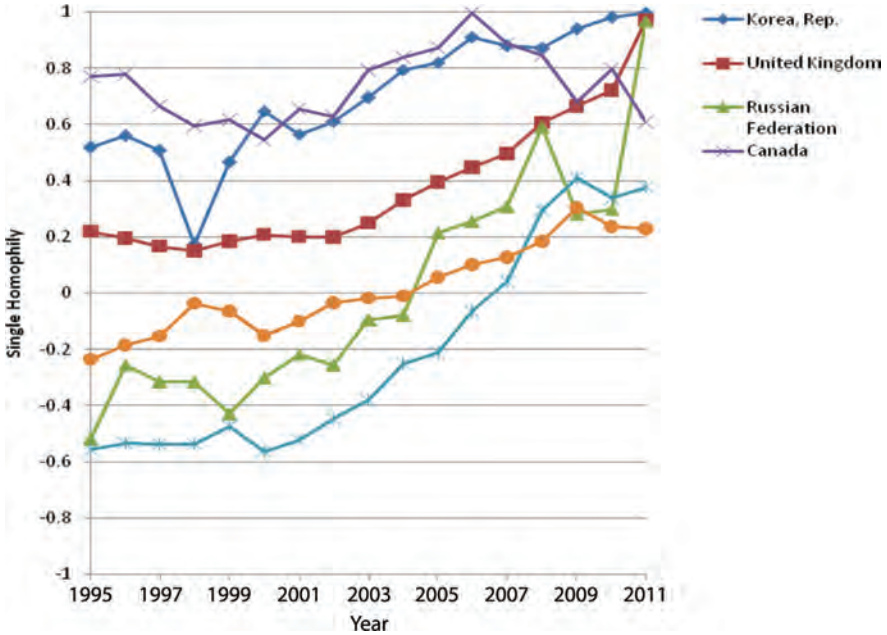
Source: authors

Figure 7. Single homophily evolution for values between –0.3 and –0.8 in 2011



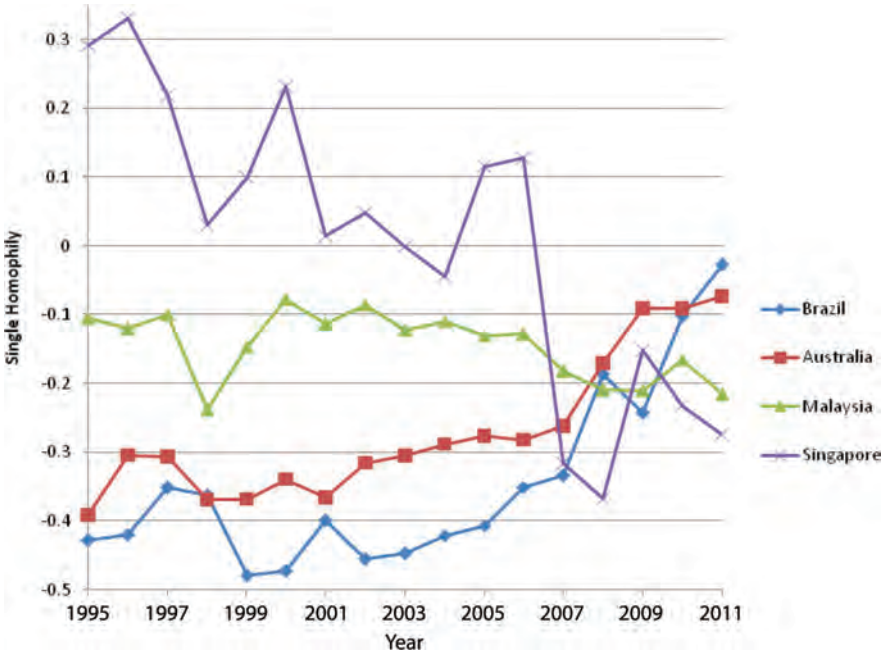
Source: authors

Figure 8. Evolution of single homophily for values greater than 0.2 in 2011



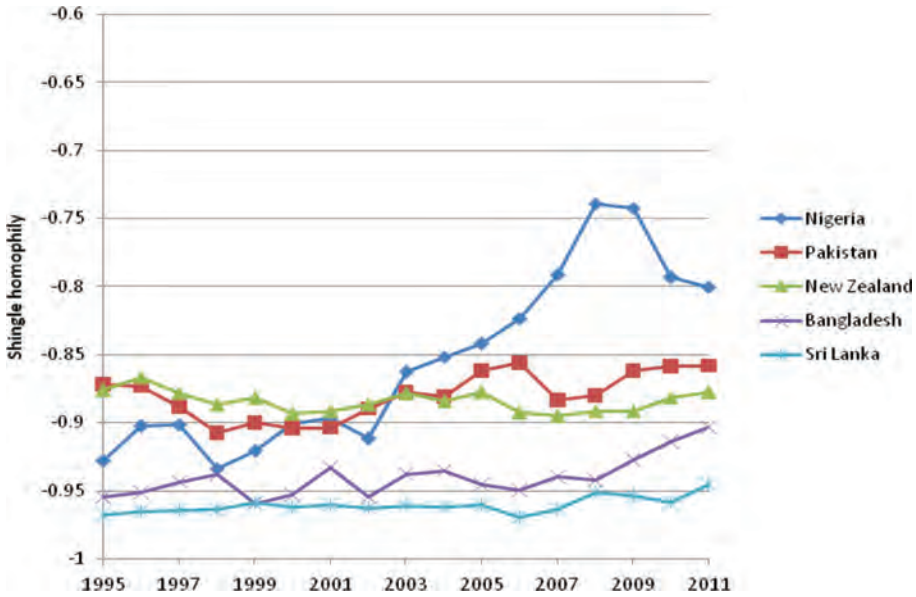
Source: authors

Figure 9. Evolution of single homophily for values between 0.2 and –0.3 in 2011



Source: authors

Figure 10. Evolution of single homophily for values between –0.8 and –0.95 in 2011



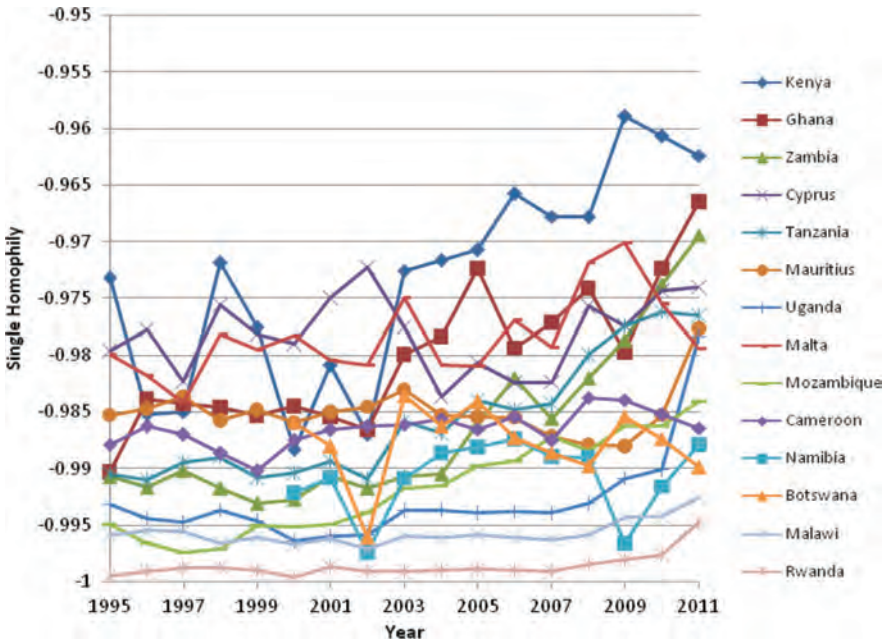
Source: authors

similarity/dissimilarity. This trend mimics the behaviour of Brazil, whose homophily changed from –0.48 to 0.03. Malaysia and Singapore have kept medium levels of similarity/dissimilarity over the time period. However, Malaysia traded with more dissimilar countries in the past, whereas Singapore did the opposite. This shows the potential for trade agreements between the countries in this region with other big players in the Commonwealth.

Key finding 5: other countries in the Commonwealth tend to trade with very dissimilar partners

As shown in Figure 10 and Figure 11, many developing economies have single homophily values close to –1, which indicates high levels of dissimilarity with their trading partners. This might be problematic for nations with low trade volumes and low centrality (e.g., Rwanda,

Figure 11. Evolution of single homophily for values below –0.95 in 2011



Source: authors

Botswana, Uganda, Ghana, etc.) because they are highly dependent on the economic conditions of their trading partners.

From these figures, we observe that small economies are not necessarily trading with similar small economies but, in turn, they tend to trade more to larger economies. These economies can benefit from developing strategic trading partners with larger economies in the African and Global (Asian) clusters.

Key finding 6: The Commonwealth provides important links for several global value chains

This study uses community detection algorithms to identify the GVCs that compose the most recent trade network (i.e. 2011 data). Disaggregated data are used to identify the relationships between economic sectors in different locations (i.e. Commonwealth and other relevant countries/regions). Economic sectors and regions are summarised in Appendix 1.

As a result, it is observed that the trade network encompassing the Commonwealth is composed of seven general GVCs:

- GVC 1: equipment and manufactures to final demand mostly between non-European economies;
- GVC 2: equipment, manufactures and food to final demand mostly in Europe;
- GVC 3: energy in the world;
- GVC 4: chemical/rubber/plastic in the world;
- GVC 5: metals and mineral products in the world;
- GVC 6: food and vegetables mostly between non-European economies;
- GVC 7: textiles and clothing in the world.

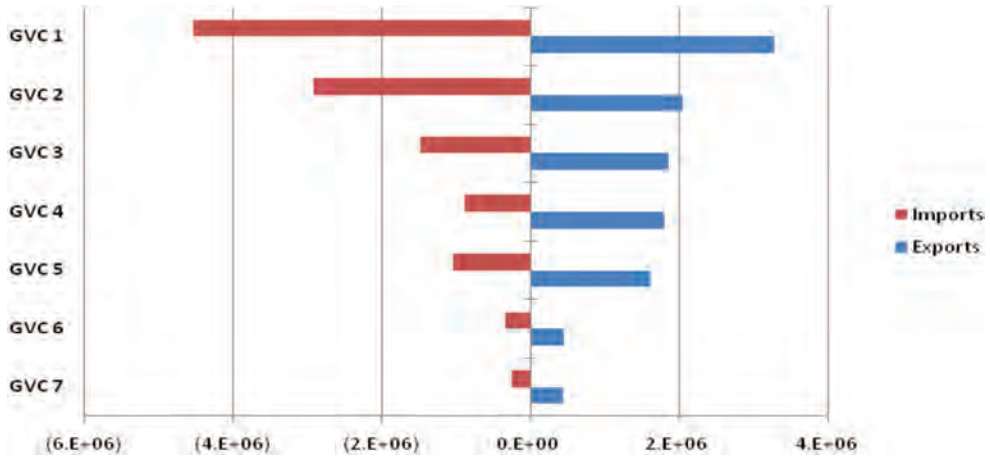
Figure 12 illustrates the total imports and exports for the geo-economic sectors in each GVC. A general description of each GVC and its relationship with the Commonwealth is provided below.

GVC 1: Equipment and manufactures to final demand mostly between non-European economies

This GVC describes the relationship between inputs to elaborate equipment and manufactures, its transformation and distribution to the final demand over the world mostly between non-European economies. Several types of equipment exports contribute to this GVC in these geographies (e.g. machinery, electronics, motor vehicles and parts, transportation, etc.). Manufactures with lower exports are still relevant (e.g. general manufactures, wood products, clothing, leather products, etc.). The final demand plays an important part in importing products from these economic sectors. Likewise, the equipment and manufacturing sectors described above are important importers of supplies (Figure 13).

The economic sectors in this GVC are mainly hosted by non-European countries/regions. The top five hubs from the export perspective are China, the Rest of the World, the USA, Japan and the Republic of Korea. Important exporters from the Commonwealth are Canada, Singapore, Malaysia, India, Australia and South Africa. Looking at the imports, the top five hubs are the Rest of the World, the USA, China and Japan. From the Commonwealth, Canada is an important importing hub (after Japan),

Figure 12. Total imports (in parentheses) and exports for the 2011 GVCs (1995, constant millions of US$)



Source: authors

followed by Australia, India, Malaysia, Singapore and New Zealand (Figure 14).

Figure 15 shows the top five economic sectors by location in GVC 1. Electronics, machinery and equipment are important exports from China and the Rest of the World. Machinery and equipment from the USA is also relevant. Final demand dominates imports, especially to the Rest of the World, the USA, Japan, China and Canada. This highlights the importance of commodities in this GVC commercialised to the final demand in Canada.

Figure 16 shows the top five economic sectors by location in the Commonwealth as part of this GVC. Electronic equipment from Malaysia and Singapore, motor vehicles from Canada,

Figure 13. Important sectors in GVC 1 (1995, constant millions of US$)

Sector	Exports	Cumulative	Sector	Imports	Cumulative
Machinery and equipment nec	1,083,020.09	33.2%	Final Demand	3,033,000.30	66.9%
Electronic equipment	803,268.83	57.7%	Electronic equipment	414,747.22	76.0%
Motor vehicles and parts	432,908.87	71.0%	Machinery and equipment nec	411,056.51	85.1%
Transport equipment nec	323,254.49	80.9%	Motor vehicles and parts	261,118.23	90.9%
Manufactures nec	168,064.48	86.0%	Transport equipment nec	143,848.66	94.0%
Wood products	108,301.11	89.4%	Manufactures nec	83,156.43	95.9%
Wearing apparel	88,160.42	92.1%	Wood products	56,690.73	97.1%
Leather products	82,341.82	94.6%	Beverages and tobacco products	35,352.53	97.9%
Beverages and tobacco products	32,632.81	95.6%	Leather products	27,213.72	98.5%

Source: authors

Figure 14. Important regions/countries in GVC 1 (1995, constant millions of US $)

Region/Country	Exports	Cumulative	Region/Country	Imports	Cumulative
China	857,175.44	26.2%	Rest of the World	1,667,784.30	36.8%
Rest of the World	733,584.60	48.7%	United States of America	1,097,488.26	61.0%
United States of America	497,342.69	63.9%	China	489,325.50	71.8%
Japan	376,141.70	75.4%	Japan	271,342.80	77.8%
Korea	221,345.70	82.2%	Canada	200,016.19	82.2%
Rest of European Union	108,630.00	85.5%	Korea	160,343.22	85.7%
Canada	106,161.44	88.8%	Australia	112,579.40	88.2%
Singapore	82,592.98	91.3%	India	101,812.59	90.4%
Malaysia	81,853.80	93.8%	Malaysia	92,824.04	92.5%
Brazil	52,295.06	95.4%	Brazil	90,225.24	94.5%
India	47,799.33	96.9%	Singapore	87,173.92	96.4%
Australia	24,758.57	97.6%	Rest of European Union	54,157.00	97.6%
South Africa	17,071.39	98.2%	New Zealand	16,793.95	98.0%
United Kingdom	16,325.00	98.7%	Russian Federation	16,630.42	98.3%

Source: authors

Figure 15. Top five geo-economic hubs in GVC 1 (1995, constant millions of US $)

Region/Country and Sector	Exports	Cumulative	Region/Country	Imports	Cumulative
China-Electronic equipment	288,570.00	8.8%	Rest World-Final Demand	1,232,300.00	27.2%
China-Machinery and equipment nec	256,960.00	16.7%	United States of America-Final Demand	839,420.00	45.7%
Rest World-Machinery and equipment nec	254,000.00	24.5%	Japan-Final Demand	199,780.00	50.1%
United States of America-Machinery and equipment nec	213,330.00	31.0%	China-Final Demand	190,310.00	54.3%
Rest World-Electronic equipment	213,160.00	37.5%	Canada-Final Demand	136,900.00	57.3%

Source: authors

Figure 16. Top five geo-economic hubs related to the Commonwealth countries in GVC 1 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cumulative	Region/Country	Imports	Cumulative
Malaysia-Electronic equipment	47,957.00	73.4%	Canada-Final Demand	136,900.00	57.3%
Singapore-Electronic equipment	47,436.00	74.8%	Australia-Final Demand	94,959.00	67.0%
Canada-Motor vehicles and parts	39,939.00	79.9%	India-Final Demand	76,493.00	70.7%
Singapore-Machinery and equipment nec	30,084.00	82.8%	Malaysia-Final Demand	44,041.00	81.2%
India-Manufactures nec	26,303.00	86.3%	Singapore-Final Demand	43,755.00	82.1%

Source: authors

machinery and equipment from Singapore and manufactures from India are important exporters in this GVC. From the imports perspective, final demand still dominates. The most important countries are Canada, Australia, India, Malaysia and Singapore.

GVC 2: equipment, manufactures and food to final demand mostly in Europe

This GVC describes the relationship between inputs for equipment, manufactures and food, its transformation and distribution to the final demand, mostly between European economies. Exports from several economic sectors contribute to the GVC (e.g. machinery and equipment, motor vehicles, electronic equipment, food products, paper products, wood products, etc.). Similarly to the previous GVC, final demand has an important role in importing products from economic sectors in this GVC,; other sectors have lower contributions to the imports (Figure 17).

These economic sectors are mainly hosted by European countries/regions. Clearly, the rest of the European Union, the United Kingdom and Russia have larger imports and exports. Remarkably, exports from India have important contributions in the GVC. Furthermore, imports from South Africa are also important (Figure 18).

Figure 19 shows that the top five economic sectors in this GVC are located in the rest of the European Union, (i.e. machinery and equipment, motor vehicles and parts, electronic equipment, food products and paper products/publishing). Final demand dominates imports, in particular to the rest of the European Union, the United Kingdom and Russia. Machinery and equipment and motor vehicle and parts are also important imports to the rest of the European Union.

Figure 20 shows the top five economic sectors by location related to the Commonwealth in this GVC. Exports of machinery and equipment, motor vehicles and parts, electronic equipment and paper products/publishing from the United Kingdom significantly contribute. India also contributes with exports of clothing. Likewise, the following sectors are important imports in the United Kingdom: final demand, machinery and equipment, motor vehicles and parts and food products. Remarkably, final demand in South Africa is part of this GVC and has significant imports.

Figure 17. Important sectors in GVC 2 (1995 constant millions of US$)

Sector	Exports	Cumulative	Sector	Imports	Cumulative
Machinery and equipment nec	710,583.39	34.8%	Final Demand	1,987,032.70	68.3%
Motor vehicles and parts	460,313.49	57.3%	Machinery and equipment nec	281,374.28	77.9%
Electronic equipment	162,921.09	65.3%	Motor vehicles and parts	230,695.60	85.8%
Food products nec	114,457.25	70.9%	Electronic equipment	80,703.37	88.6%
Paper products/ publishing	103,953.18	76.0%	Food products nec	61,742.97	90.7%
Wood products	71,227.22	79.4%	Paper products/ publishing	49,579.45	92.4%
Beverages and tobacco products	59,718.72	82.4%	Manufactures nec	33,376.03	93.6%
Manufactures nec	54,355.89	85.0%	Beverages and tobacco products	32,955.04	94.7%
Leather products	41,504.39	87.1%	Wood products	31,590.53	95.8%
Dairy products	36,014.97	88.8%	Dairy products	23,298.58	96.6%
Gas	35,010.90	90.5%	Leather products	17,212.66	97.2%
Vegetables/ fruit/ nuts	31,619.82	92.1%	Meat products nec	15,314.82	97.7%

Source: authors

Figure 18. Important regions/countries in GVC 2 (1995 constant millions of US $)

Region/Country	Exports	Cumulative	Region/Country	Imports	Cumulative
Rest of European Union	1,840,770.54		Rest of European Union	2,391,250.10	82.1%
United Kingdom	125,412.48		United Kingdom	332,077.37	93.5%
Russian Federation	30,773.43		Russian Federation	142,688.30	98.5%
India	12,391.20		South Africa	33,040.36	99.6%

Source: authors

Figure 19. Top five geo-economic hubs in GVC 2 (1995, constant millions of US $)

Region/Country and Sector	Exports	Cumulative	Region/Country	Imports	Cumulative
Rest EU-Machinery and equipment nec	660,040.00	32.3%	Rest EU-Final Demand	1,551,700.00	53.3%
Rest EU-Motor vehicles and parts	427,710.00	53.2%	United Kingdom-Final Demand	263,070.00	62.3%
Rest EU-Electronic equipment	149,440.00	60.5%	Rest EU-Machinery and equipment nec	256,940.00	71.2%
Rest EU-Food products nec	106,560.00	65.8%	Rest EU-Motor vehicles and parts	206,590.00	78.3%
Rest EU-Paper products/ publishing	96,815.00	70.5%	Russian Federation-Final Demand	135,390.00	82.9%

Source: authors

Figure 20. Top five geo-economic hubs related to the Commonwealth countries in GVC 2 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cumulative	Region/Country	Imports	Cumulative
United Kingdom-Machinery and equipment nec	49,852.00	73.4%	United Kingdom-Final Demand	263,070.00	62.3%
United Kingdom-Motor vehicles and parts	31,042.00	74.8%	South Africa-Final Demand	32,271.00	91.1%
United Kingdom-Electronic equipment	13,315.00	79.9%	United Kingdom-Machinery and equipment nec	24,119.00	94.0%
India-Wearing apparel	9,114.30	82.8%	United Kingdom-Motor vehicles and parts	18,182.00	95.4%
United Kingdom-Paper products/ publishing	6,958.40	86.3%	United Kingdom-Food products nec	6,607.30	97.4%

Source: authors

GVC 3: energy in the world

This GVC describes the trade relationship between energy sectors, such as oil, petroleum/ coal products, gas, coal and minerals, around the world. Oil is the top export, followed by the other sectors. However, the main importer economic sector is petroleum/coal products. Other sectors contribute to lower degrees. Remarkably, final demand appears to be an important importing hub in this GVC (Figure 21).

The economic sectors in this GVC are located in several places in the world. The Rest of the World and Russia are important global exporting hubs in this GVC. Several countries related to the Commonwealth have significant contributions to these exports. For example, Canada, Nigeria, the United Kingdom, Singapore, India and Australia have important contributions to the exports in the global energetic GVC. Furthermore, importing hubs in this GVC are Rest of the World, the Rest of the European Union, the USA, Japan and India. It should be noted that India has higher energy imports than China in this cluster. Other importing hubs from the Commonwealth are Singapore, Pakistan and Canada (Figure 22).

Figure 23 shows the top five economic sectors by location in this energetic GVC. Exporting hubs are oil, gas, petroleum/coal products from

Figure 21. Important sectors in GVC 3 (1995, constant millions of US$)

Sector	Exports	Cummulative	Sector	Imports	Cummulative
Oil	1,222,888.18	66.4%	Petroleum/ coal products	1,362,518.12	92.4%
Petroleum/ coal products	389,218.02	87.6%	Oil	81,632.48	98.0%
Gas	200,661.64	98.5%	Final Demand	17,046.00	99.1%
Coal	27,631.76	100.0%	Gas	8,469.07	99.7%
Mineral products nec	662.40	100.0%	Coal	2,916.86	99.9%

Source: authors

Figure 22. Important regions/countries in GVC 3 (1995, constant millions of US$)

Region/Country	Exports	Cummulative	Region/Country	Imports	Cummulative
Rest of the World	1,100,767.00	59.8%	Rest of the World	571,768.20	38.8%
Russian Federation	358,234.00	79.2%	Rest of European Union	326,643.70	61.0%
Rest of European Union	91,760.00	84.2%	United States of America	189,639.50	73.8%
Canada	45,072.20	86.7%	Japan	78,043.37	79.1%
Nigeria	44,759.58	89.1%	India	73,670.00	84.1%
United States of America	42,194.99	91.4%	China	64,242.13	88.5%
United Kingdom	26,446.00	92.8%	Korea	57,945.56	92.4%
Singapore	17,406.00	93.8%	Singapore	26,795.00	94.2%
India	17,342.00	94.7%	Pakistan	21,793.36	95.7%
Australia	17,116.70	95.6%	Canada	10,935.38	96.4%

Source: authors

Figure 23. Top five geo-economic hubs in GVC 3 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Rest World-Oil	781,530.00	42.4%	Rest World-Petroleum/ coal products	499,310.00	33.9%
Russian Federation-Oil	322,210.00	59.9%	Rest EU-Petroleum/ coal products	325,620.00	56.0%
Rest World-Gas	181,820.00	69.8%	United States of America-Petroleum/ coal products	186,990.00	68.7%
Rest World-Petroleum/ coal products	123,750.00	76.5%	Japan-Petroleum/ coal products	78,043.00	74.0%
Rest EU-Petroleum/ coal products	81,585.00	81.0%	India-Petroleum/ coal products	73,670.00	79.0%

Source: authors

the Rest of the World, oil from Russia, and petroleum/coal products from the Rest of the European Union. Importing hubs are petroleum/coal products from the Rest of the World, the Rest of the European Union, the USA, Japan and India. Petroleum/coal products in India constitute a top importing economic sector from the Commonwealth in this GVC.

Figure 24 shows the top five economic sectors by location in the Commonwealth as part of this GVC. Oil from Nigeria is an exporting hub for this GVC. Furthermore, gas and oil in Canada and petroleum/coal products in Singapore and India contribute to the exports of this GVC. Following the importing shown before, petroleum/coal products have the higher contributions. Such importing hubs are located in India, Singapore, the United Kingdom and Canada. Interestingly, final demand from Pakistan is a top importing sector in this GVC.

GVC 4: chemical/rubber/plastic in the world

This GVC describes the relationship between the inputs, outputs and transformation of chemicals/rubber/plastic products around the world. There are important economic sectors from the exporting and importing in this GVC. The exporter/importers sectorial hubs are chemicals/rubber/plastic products, and paper products/publishing. Other sectors have lower contributions (e.g. crops, vegetables/fruits/nuts and paddy rice) (Figure 25).

The geographic location of these sectors is widely spread over the world and the Commonwealth. Top exporters are the rest of the European Union, the Rest of the World, the USA, China and Japan. Within the Commonwealth, competitive exporting hubs are the United Kingdom, Canada, India, Singapore and Malaysia. However, top exporters are the Rest of the European Union, the Rest of the World, China, the USA and Japan. Importing hubs at the Commonwealth are India, Canada, the United Kingdom, Malaysia and Australia (Figure 26).

Figure 27 shows the top five economic sectors by location in the chemical/rubber/plastic GVC. Global hubs are related to imports and exports of chemical/rubber/plastic products in the Rest of the European Union, the Rest of the World, the USA, China and Japan.

Figure 28 shows the top five economic sectors in this GVC located within the Commonwealth. Sectorial hubs are imports and exports of chemical/rubber/plastic products in the United Kingdom, Canada, Singapore, India and Malaysia.

GVC 5: metals and mineral products in the world

This GVC describes the relationship between the inputs, outputs and transformation of metals and minerals around the world. The exporter/importer sectorial hubs in this GVC are metals, minerals and ferrous metals. With lower levels of trade, machinery and equipment and manufactures also contribute to this GVC (Figure 29).

The geographic location of these sectors is spread widely over the world and the Commonwealth. Top exporters are the Rest of the European Union, the Rest of the World, China, Australia and the USA. Australia is an important

Figure 24. Top five geo-economic hubs related to the Commonwealth countries in GVC 3 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Nigeria-Oil	44,582.00	83.4%	India-Petroleum/ coal products	73,670.00	79.0%
Canada-Gas	17,838.00	88.6%	Singapore-Petroleum/ coal products	26,795.00	93.0%
Canada-Oil	17,807.00	89.6%	Pakistan-Final Demand	17,046.00	94.2%
Singapore-Petroleum/ coal products	17,406.00	90.5%	United Kingdom-Petroleum/ coal products	9,568.30	94.9%
India-Petroleum/ coal products	17,342.00	91.4%	Canada-Petroleum/ coal products	7,571.00	96.0%

Source: authors

Figure 25. Important sectors in GVC 4 (1995, constant millions of US$)

Sector	Exports	Cummulative	Sector	Imports	Cummulative
Chemical/rubber/plastic prods	1,642,771.92	91.5%	Chemical/rubber/plastic prods	751,760.25	84.6%
Paper products/ publishing	105,690.79	97.4%	Paper products/ publishing	91,009.73	94.9%
Crops nec	34,160.52	99.3%	Vegetables/ fruit/ nuts	10,912.40	96.1%
Vegetables/ fruit/ nuts	7,591.18	99.7%	Paddy rice	6,845.54	96.9%
Paddy rice	1,551.13	99.8%	Crops nec	6,402.24	97.6%

Source: authors

exporting hub for the GVC related to metals and mineral products. Other important exporters related to the Commonwealth are Canada, India, the United Kingdom, South Africa and Malaysia. However, importing hubs in this GVC are the Rest of the European Union, China, the Rest of the World, Japan and India. Thus, India is an importing hub for the metals/minerals GVC. Other importing countries with lower contributions related to the Commonwealth are the United Kingdom and Canada, for example (Figure 30).

Figure 31 shows the top five economic sectors by location in the metals/minerals GVC. Global export hubs are located in the Rest of the World for metals and minerals not elsewhere classified (NEC), and Rest of the European Union for ferrous metals, metals and metals NEC. Importing geo-economic hubs are ferrous metals, metal products and metals NEC in the Rest of the European Union, and ferrous metals and metals NEC in China.

Figure 32 shows the top five geo-economic hubs related to the Commonwealth in the metals/minerals GVC. As mentioned above, Australia is an important exporting hub, specifically for commodities in the minerals NEC

Figure 26. Important regions/countries in GVC 4 (1995, constant millions of US$)

Region/Country	Exports	Cummulative	Region/Country	Imports	Cummulative
Rest of European Union	660,157.55	36.8%	Rest of European Union	234,313.58	26.4%
Rest of the World	351,702.70	56.4%	Rest of the World	179,245.70	46.6%
United States of America	222,188.52	68.7%	China	122,807.90	60.4%
China	145,590.65	76.9%	United States of America	98,393.31	71.5%
Japan	88,909.06	81.8%	Japan	59,527.30	78.2%
Korea	59,802.74	85.1%	Korea	33,609.62	82.0%
United Kingdom	59,604.87	88.5%	India	32,289.65	85.6%
Canada	51,299.43	91.3%	Brazil	26,044.95	88.5%
India	31,834.75	93.1%	Canada	20,918.90	90.9%
Singapore	30,346.60	94.8%	United Kingdom	20,240.14	93.2%
Russian Federation	26,503.93	96.3%	Malaysia	12,223.39	94.5%
Malaysia	23,955.37	97.6%	Australia	8,344.15	95.5%
Brazil	18,149.61	98.6%	Russian Federation	7,879.42	96.4%
Australia	8,077.65	99.1%	Singapore	7,804.32	97.2%
South Africa	6,968.71	99.4%	South Africa	6,541.24	98.0%

Source: authors

Figure 27. Top 5 geo-economic hubs in GVC 4 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Rest EU-Chemical/rubber/plastic prods	660,060.00	36.8%	Rest EU-Chemical/rubber/plastic prods	233,780.00	26.3%
Rest World-Chemical/rubber/plastic prods	300,990.00	53.5%	Rest World-Chemical/rubber/plastic prods	142,240.00	42.3%
United States of America-Chemical/rubber	191,900.00	64.2%	China-Chemical/rubber/plastic prods	97,381.00	53.3%
China-Chemical/rubber/plastic prods	122,250.00	71.0%	United States of America-Chemical/rubber/plastic prods	79,879.00	62.3%
Japan-Chemical/rubber/plastic prods	83,270.00	75.7%	Japan-Chemical/rubber/plastic prods	46,096.00	67.5%

Source: authors

Figure 28. Top five geo-economic hubs related to the Commonwealth countries in GVC 4 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
United Kingdom-Chemical/rubber/plastic p	59,585.00	79.0%	India-Chemical/rubber/plastic prods	26,746.00	77.2%
Canada-Chemical/rubber/plastic prods	36,094.00	84.1%	United Kingdom-Chemical/rubber/plastic prods	20,015.00	82.0%
Singapore-Chemical/rubber/plastic prods	28,768.00	85.8%	Canada-Chemical/rubber/plastic prods	15,661.00	85.8%
India-Chemical/rubber/plastic prods	27,059.00	90.3%	Malaysia-Chemical/rubber/plastic prods	10,042.00	88.5%
Malaysia-Chemical/rubber/plastic prods	22,440.00	94.1%	Singapore-Chemical/rubber/plastic prods	6,815.10	90.9%

Source: authors

Figure 29. Important sectors in GVC 5 (1995, constant millions of US $)

Sector	Exports	Cummulative	Sector	Imports	Cummulative
Metals nec	470,644.01	29.4%	Ferrous metals	306,802.83	29.6%
Minerals nec	362,171.59	52.1%	Metals nec	299,075.04	58.5%
Ferrous metals	348,031.80	73.8%	Metal products	213,990.33	79.1%
Metal products	263,195.18	90.3%	Mineral products nec	129,717.93	91.6%
Mineral products nec	133,569.54	98.6%	Minerals nec	50,551.73	96.5%
Machinery and equipment nec	13,434.30	99.5%	Machinery and equipment nec	26,892.00	99.1%
Manufactures nec	7,815.41	99.9%	Manufactures nec	7,084.52	99.8%

Source: authors

Figure 30. Important regions/countries in GVC 5 (1995, constant millions of US$)

Region/Country	Exports	Cummulative	Region/Country	Imports	Cummulative
Rest of European Union	415,908.00	26.0%	Rest of European Union	282,578.40	27.3%
Rest of the World	413,909.00	51.9%	China	208,469.00	47.4%
China	135,657.60	60.4%	Rest of the World	178,225.00	64.6%
Australia	107,085.85	67.0%	Japan	71,395.36	71.5%
United States of America	98,792.20	73.2%	India	63,788.73	77.6%
Japan	68,504.14	77.5%	United States of America	62,926.40	83.7%
Brazil	66,630.20	81.7%	Korea	53,451.95	88.9%
Canada	55,489.20	85.1%	United Kingdom	32,616.34	92.0%
India	42,724.80	87.8%	Canada	24,916.50	94.4%
Russian Federation	42,431.60	90.5%	Brazil	10,776.60	95.5%
United Kingdom	41,678.20	93.1%	Russian Federation	9,623.39	96.4%
Korea	38,346.34	95.5%	Australia	9,208.54	97.3%
South Africa	37,171.50	97.8%	Malaysia	8,445.17	98.1%
Malaysia	11,219.20	98.5%	South Africa	4,205.33	98.5%
Zambia	7,060.60	98.9%	Singapore	4,096.79	98.9%
Singapore	4,649.87	99.2%	Zambia	2,614.74	99.2%
New Zealand	2,066.46	99.4%	Sri Lanka	1,597.68	99.3%

Source: authors

Figure 31. Top five geo-economic hubs in GVC 5 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Rest World-Metals nec	163,780.00	10.2%	Rest EU-Ferrous metals	85,499.00	8.3%
Rest World-Minerals nec	128,300.00	18.3%	Rest EU-Metal products	82,932.00	16.3%
Rest EU-Ferrous metals	123,960.00	26.0%	China-Ferrous metals	82,830.00	24.2%
Rest EU-Metal products	109,550.00	32.9%	Rest EU-Metals nec	64,295.00	30.5%
Rest EU-Metals nec	105,690.00	39.5%	China-Metals nec	56,455.00	35.9%

Source: authors

Figure 32. Top five geo-economic hubs related to the Commonwealth countries in GVC 5 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Australia-Minerals nec	84,149.00	44.7%	India-Machinery and equipment nec	25,481.00	65.0%
Canada-Metals nec	28,703.00	68.6%	India-Metal products	14,036.00	82.1%
Australia-Metals nec	19,376.00	77.3%	Canada-Metals nec	12,310.00	84.5%
South Africa-Metals nec	16,085.00	83.7%	India-Ferrous metals	11,376.00	85.6%
Canada-Minerals nec	14,544.00	84.6%	India-Metals nec	7,471.00	89.1%

Source: authors

sector. Metals NEC also contribute to the exports from Australia in this GVC. Other important exporters within the Commonwealth are Canada (metals NEC and minerals NEC) and South Africa (metals NEC). India is a relevant importing hub for this cluster for the machinery and equipment NEC, metal products, ferrous metals and metals NEC sectors. In addition, Canada has contributions to the imports related to metals NEC.

GVC 6: food and vegetables mostly between non-European economies

This GVC describes the relationship between the inputs, outputs and transformation of food and vegetables, mostly between non-European economies. The most important sectorial hubs for exports/imports are food products and vegetable oils and fats. There are several sectors that contribute to the exports in this GVC (e.g. oil seeds, vegetables/fruits/nuts, wheat and cereal grains). Likewise, several sectors contribute to the imports. Final demand is a relevant sector as well as meat, animal products, vegetables/fruits/nuts and raw milk, for example (Figure 33).

The geographic location of these sectors is mainly non-European localities. Nonetheless, several sectors in Russia are part of this GVC. Top exporter hubs are the Rest of the World, the USA, China, Brazil and Canada. Therefore, Canada is an important exporter in the food/vegetables GVC. In addition, Malaysia, Australia and India have significant contributions to the exports of this GVC. Importing hubs are the Rest of the World, China, the USA, Japan and Nigeria. Therefore, Nigeria is a relevant importer for this food/vegetables GVC (Figure 34).

Figure 35 shows the top five economic sectors by location in this food/vegetables GVC. Global export hubs are located in the Rest of the World for food products NEC, vegetables/fruit/nuts and vegetable oils and fats. Furthermore, China and the USA are important for food products NEC. Importing hubs in

the GVC are food products NEC located in the Rest of the World, Japan, the USA and China. As stated above, an important importing hub in this GVC is Nigeria, in particular for the final demand.

Figure 36 shows the top five geo-economic hubs related to the Commonwealth in the food/vegetables GVC. For the specific exporting sectors in each nation, vegetable oils and fats are important for Malaysia, oil seeds for Canada, meat (cattle/sheep/goats/horse) and wheat for Australia and food products NEC for India. As mentioned above, the most relevant importing hub is final demand in Nigeria. Other relevant importing hubs are vegetable oils and fats and food products NEC from Malaysia, as well as food products NEC and vegetable oils and fats from India.

GVC 7: textiles and apparel in the world

This GVC describes the relationship between the inputs, outputs and transformation of

Figure 33. Important sectors in GVC 6 (1995 constant millions of US$)

Sector	Exports	Cummulative	Sector	Imports	Cummulative
Food products nec	151,225.32	33.4%	Food products nec	157,892.29	46.9%
Vegetable oils and fats	68,608.09	48.6%	Vegetable oils and fats	36,222.09	57.7%
Oil seeds	55,485.96	60.9%	Final Demand	30,459.03	66.7%
Vegetables/ fruit/ nuts	52,177.12	72.4%	Meat: cattle/sheep/goats/horse	15,343.47	71.3%
Wheat	32,132.33	79.5%	Animal products nec	14,456.39	75.6%
Cereal grains nec	26,782.29	85.5%	Vegetables/ fruit/ nuts	13,046.82	79.4%
Meat: cattle/sheep/goats/horse	24,548.60	90.9%	Raw milk	11,994.52	83.0%
Sugar	10,597.92	93.2%	Sugar	9,905.97	86.0%
Animal products nec	7,179.63	94.8%	Cattle/sheep/goats/horses	9,290.75	88.7%
Meat products nec	7,019.76	96.4%	Cereal grains nec	7,725.17	91.0%
Cattle/sheep/goats/horses	5,032.62	97.5%	Beverages and tobacco products	5,853.27	92.7%
Fishing	2,898.14	98.1%	Wheat	5,629.08	94.4%
Crops nec	2,892.19	98.8%	Oil seeds	5,068.76	95.9%
Processed rice	2,801.83	99.4%	Meat products nec	4,620.45	97.3%
Beverages and tobacco products	1,008.19	99.6%	Processed rice	2,942.73	98.2%

Source: authors

Figure 34. Important regions/countries in GVC 6 (1995, constant millions of US$)

Region/Country	Exports	Cummulative	Region/Country	Imports	Cummulative
Rest of the World	213,189.68	47.2%	Rest of the World	135,289.80	27.3%
United States of America	77,185.52	64.2%	China	47,890.84	47.4%
China	31,795.50	71.3%	United States of America	33,213.63	64.6%
Brazil	30,788.07	78.1%	Japan	31,676.82	71.5%
Canada	21,287.38	82.8%	Nigeria	29,906.83	77.6%
Malaysia	19,630.68	87.1%	Russian Federation	14,892.79	83.7%
Australia	14,574.85	90.3%	Korea	10,926.69	88.9%
India	11,724.97	92.9%	India	6,664.60	92.0%
Russian Federation	9,558.81	95.0%	Malaysia	5,641.78	94.4%
New Zealand	4,984.28	96.1%	Brazil	4,240.21	95.5%
Korea	3,064.65	96.8%	Canada	3,188.78	96.4%
Japan	2,958.27	97.5%	Pakistan	2,134.62	97.3%
South Africa	2,192.71	98.0%	Bangladesh	1,804.42	98.1%
Kenya	1,977.72	98.4%	South Africa	1,787.60	98.5%
Sri Lanka	1,821.56	98.8%	Kenya	1,362.87	98.9%

Source: authors

Figure 35. Top five geo-economic hubs in GVC 6 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Rest World-Food products nec	78,858.00	17.4%	Rest World-Food products nec	64,940.00	19.3%
Rest World-Vegetables/ fruit/ nuts	47,853.00	28.0%	Nigeria-Final Demand	29,861.00	28.2%
Rest World-Vegetable oils and fats	38,100.00	36.5%	Japan-Food products nec	25,694.00	35.8%
China-Food products nec	24,410.00	41.9%	United States of America-Food products nec	21,635.00	42.2%
United States of America-Food products ne	22,649.00	46.9%	China-Food products nec	19,832.00	48.1%

Source: authors

Figure 36. Top five geo-economic hubs related to the Commonwealth countries in GVC 6 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
Malaysia-Vegetable oils and fats	16,482.00	55.0%	Nigeria-Final Demand	29,861.00	28.2%
Canada-Oil seeds	5,534.90	71.7%	Malaysia-Vegetable oils and fats	2,836.30	79.8%
Australia-Meat: cattle/sheep/goats/horse	5,314.20	72.9%	Malaysia-Food products nec	2,766.50	81.5%
Australia-Wheat	5,253.40	74.1%	India-Food products nec	2,057.10	87.2%
India-Food products nec	5,036.70	78.6%	India-Vegetable oils and fats	1,641.00	87.7%

Source: authors

textiles and apparel around the world. The exporter/importer sectorial hubs in this GVC are textiles and clothing. Plant-based fibre and wool/silk-worm cocoons have lower contributions (Figure 37).

The geographic location of these sectors is spread widely over the world and the Commonwealth. Exporting hubs are the Rest of the World, the Rest of the European Union, China, the USA and India. India, Bangladesh and Pakistan are the most important hubs for the textiles/apparel GVC within the Commonwealth. Importing hubs in this GVC are the Rest of the World, the Rest of the European Union, China, the USA and Japan. Bangladesh and India are the most relevant importers within the Commonwealth (Figure 38).

Figure 39 shows the top five economic sectors by location in the textiles/apparel GVC. Global export/import hubs are textiles from China, and textiles and clothing from the Rest of the World and the Rest of the European Union.

Figure 40 shows the top five geo-economic hubs related to the Commonwealth in this GVC. Important import/export sectors related to the Commonwealth in the textiles/apparel GVC are: textiles in India, clothing and textiles in Bangladesh, and textiles in Pakistan and the United Kingdom.

Figure 37. Important sectors in GVC 7 (1995 constant millions of US$)

Sector	Exports	Cummulative	Sector	Imports	Cummulative
Textiles	294,704.88	68.1%	Textiles	154,930.52	61.7%
Wearing apparel	116,244.01	95.0%	Wearing apparel	88,500.15	97.0%
Plant-based fibers	17,702.53	99.1%	Plant-based fibers	5,696.97	99.3%
Wool/ silk-worm cocoons	3,987.61	100.0%	Wool/ silk-worm cocoons	1,687.67	99.9%

Source: authors

Figure 38. Important regions/countries in GVC 7 (1995, constant millions of US$)

Region/Country	Exports	Cummulative	Region/Country	Imports	Cummulative
Rest of the World	121,824.28	28.2%	Rest of the World	83,261.10	33.2%
Rest of European Union	107,746.74	53.1%	Rest of European Union	59,466.03	56.9%
China	93,257.89	74.6%	China	32,292.04	69.7%
United States of America	21,310.20	79.5%	United States of America	21,816.48	78.4%
India	17,302.70	83.5%	Japan	10,553.18	82.6%
Bangladesh	17,030.72	87.5%	Korea	7,077.40	85.5%
Korea	12,263.54	90.3%	Bangladesh	5,985.80	87.8%
Pakistan	7,914.80	92.1%	India	5,822.00	90.2%
Japan	7,696.21	93.9%	Brazil	4,738.11	92.0%
United Kingdom	6,718.32	95.5%	United Kingdom	3,639.26	93.5%
Australia	5,204.04	96.7%	Pakistan	3,158.30	94.8%
Sri Lanka	3,122.09	97.4%	Canada	2,562.55	95.8%
Malaysia	2,697.28	98.0%	Russian Federation	1,880.06	96.5%
Brazil	2,446.18	98.6%	Sri Lanka	1,738.52	97.2%
Canada	1,946.07	99.0%	Australia	1,717.64	97.9%
South Africa	922.52	99.2%	Malaysia	1,631.08	98.6%
New Zealand	843.71	99.4%	South Africa	1,288.63	99.1%

Source: authors

Figure 39. Top five geo-economic hubs in GVC 7 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
China-Textiles	92,999.00	21.5%	Rest World-Textiles	42,466.00	16.9%
Rest World-Textiles	67,243.00	37.0%	Rest World-Wearing apparel	36,372.00	31.4%
Rest EU-Textiles	62,504.00	51.5%	Rest EU-Textiles	33,873.00	44.9%
Rest World-Wearing apparel	50,886.00	63.2%	China-Textiles	30,719.00	57.1%
Rest EU-Wearing apparel	44,453.00	73.5%	Rest EU-Wearing apparel	25,426.00	67.3%

Source: authors

Figure 40. Top five geo-economic hubs related to the Commonwealth countries in GVC 7 (1995, constant millions of US$)

Region/Country and Sector	Exports	Cummulative	Region/Country and Sector	Imports	Cummulative
India-Textiles	14,690.00	76.9%	India-Textiles	5,620.20	78.1%
Bangladesh-Wearing apparel	9,798.90	84.5%	Bangladesh-Textiles	3,656.00	85.8%
Pakistan-Textiles	7,914.80	86.4%	Pakistan-Textiles	3,158.30	88.4%
Bangladesh-Textiles	6,945.10	91.3%	United Kingdom-Textiles	2,356.30	90.4%
United Kingdom-Textiles	3,901.90	92.2%	Bangladesh-Wearing apparel	2,206.50	91.3%

Source: authors

4. Intra-Commonwealth trade network analysis

In this section, we explore complex network analysis for the trade network between the Commonwealth countries only. The GTAP database includes trade data for 26 Commonwealth countries, for which analysis has been undertaken from 1995 to 2011. In this analysis, we treat the Commonwealth member countries as the nodes and their trade relationship (export) as the edges. In the following paragraphs, we summarise the key findings:

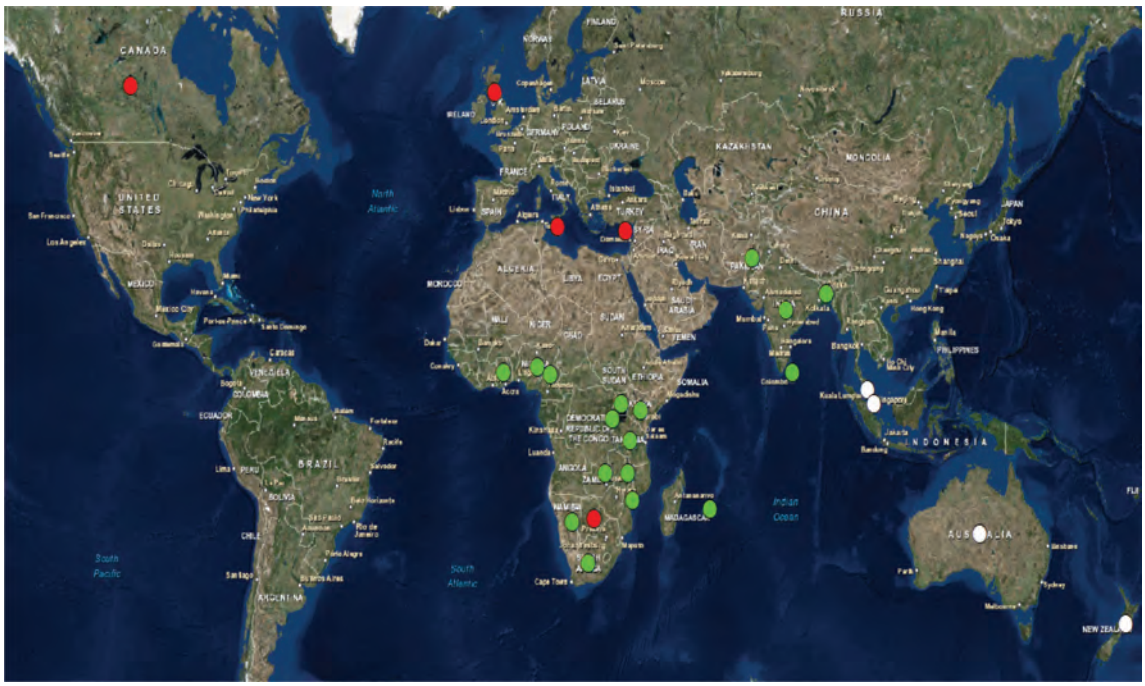
The Intra-Commonwealth Trade Network has three clusters (as of 2011): (1) Asia and Africa; (2) Europe; (3) Australia

For the year 2011, the Intra-Commonwealth Trade Network (ICTN) had three clusters based on trade activities in which the nations are densely connected internally. However, it is possible that different clusters may still be connected. Cluster 1 (Asia and Africa) includes most of the Asian (except Malaysia and Singapore) and African countries (except Botswana). Cluster 2 (Europe) includes the United Kingdom, Malta and Cyprus. However, Canada and Botswana are also found in this cluster. Cluster 3 (Australia) includes Australia and New Zealand. However, Malaysia and Singapore are part of this cluster as of 2011. Figure 41 shows the geo-locations of these clusters (green: cluster 1; red: cluster 2; and white: cluster 3). Clusters can change over time based on trade relationship and trade volume. Each Commonwealth nation contributes a share of total and individual trade in each cluster and this share is predominant in its own cluster. This information is presented in Appendix 3 (Table A3.1) using India, Nigeria, Botswana, Canada, Australia and Malaysia as examples.

The Intra-Commonwealth Trade Network is getting denser and increasing trade partnerships over time

Density refers to the proportion of trade partnerships that exists out of maximum possible partnerships. ICTN density is increasing over time, which indicates more recent trade

Figure 41. Clusters in the Intra-Commonwealth Trade Network (2011)



Source: authors

activities. However, degree refers to the total number of partnerships belong to each Commonwealth nation on average, which also shows an increasing trend. These findings are presented in Figure 42 and Figure 43, respectively.

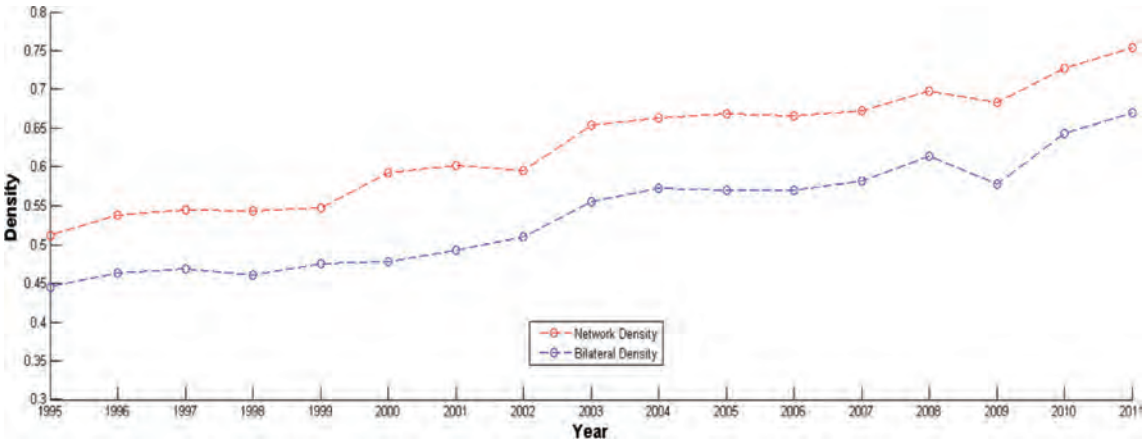
The Intra-Commonwealth Trade Network is increasing the level of trade; however, this is becoming less central

Strength refers to the total monetary value of trade (imports plus exports) associated with a Commonwealth nation. Commonwealth countries have, on average, been increasing their trade amount over time (Figure 44). However, centrality refers to cumulative topological presence of a node (or link) in the shortest paths between each pair of nodes. More specifically, BC indicates how important or central a node (country) or link (pair of countries) is. ICTN is becoming less central on average (Figure 45). However, both intra-Commonwealth and within-cluster strength and centrality evolution for all the countries (based on rank) has been presented in Appendix 3 (Table A3.2–Table A3.5).

Separate homophily evolution for Commonwealth countries

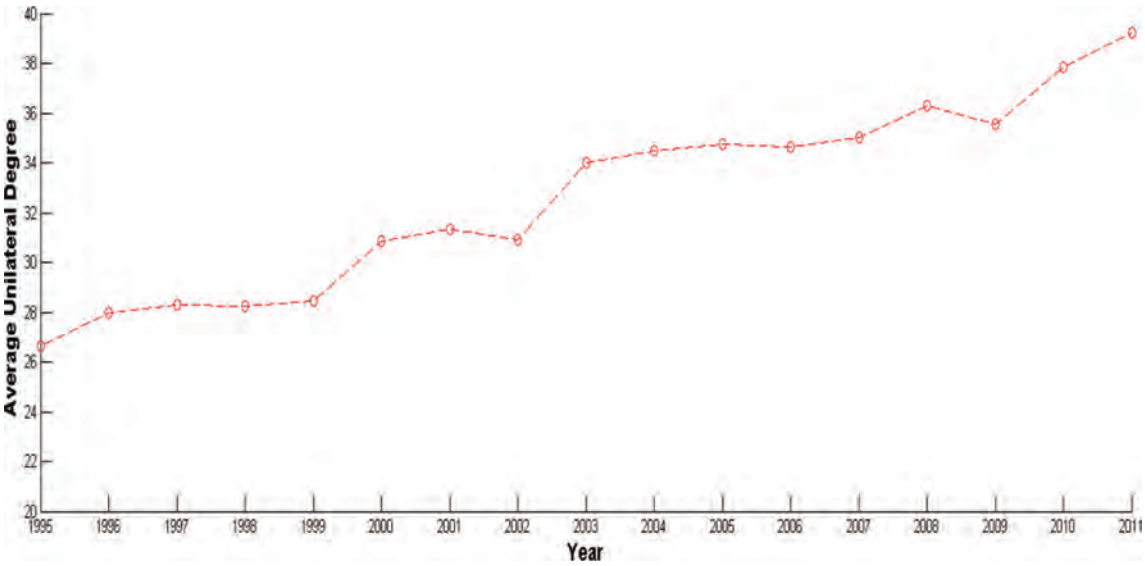
Homophily refer to the similarity of nodes (nations) with their partners based on the amount of trade. This value ranges from –1 (complete heterophily) to +1 (complete homophily). When homophily tends to +1, it indicates

Figure 42. ICTN density over time



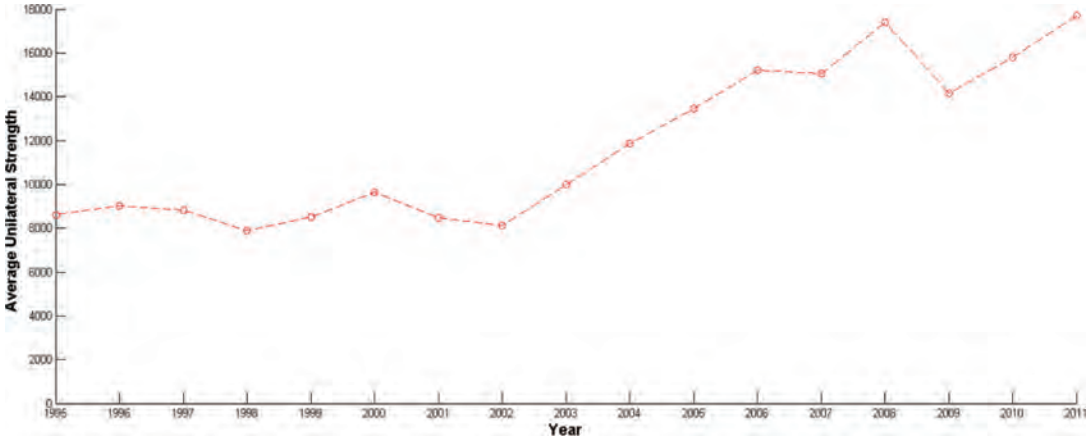
Source: authors

Figure 43. Intra-Commonwealth Trade Network degree (average) over time



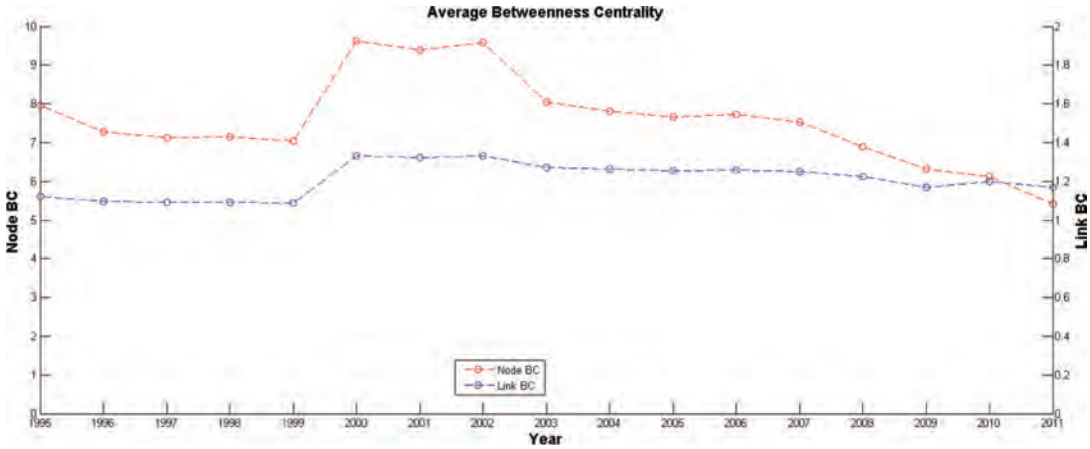
Source: authors

Figure 44. ICTN strength (average) over time (1995, constant millions of US$)



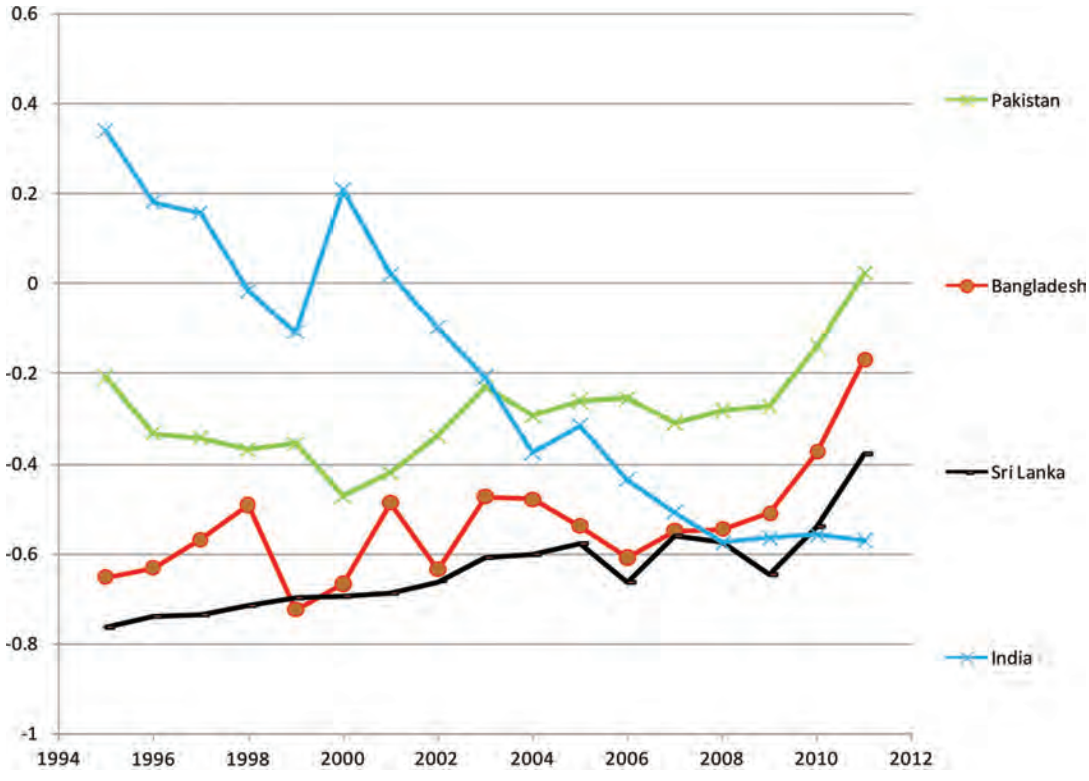
Source: authors

Figure 45. Intra-Commonwealth Trade Network centrality (average) over time



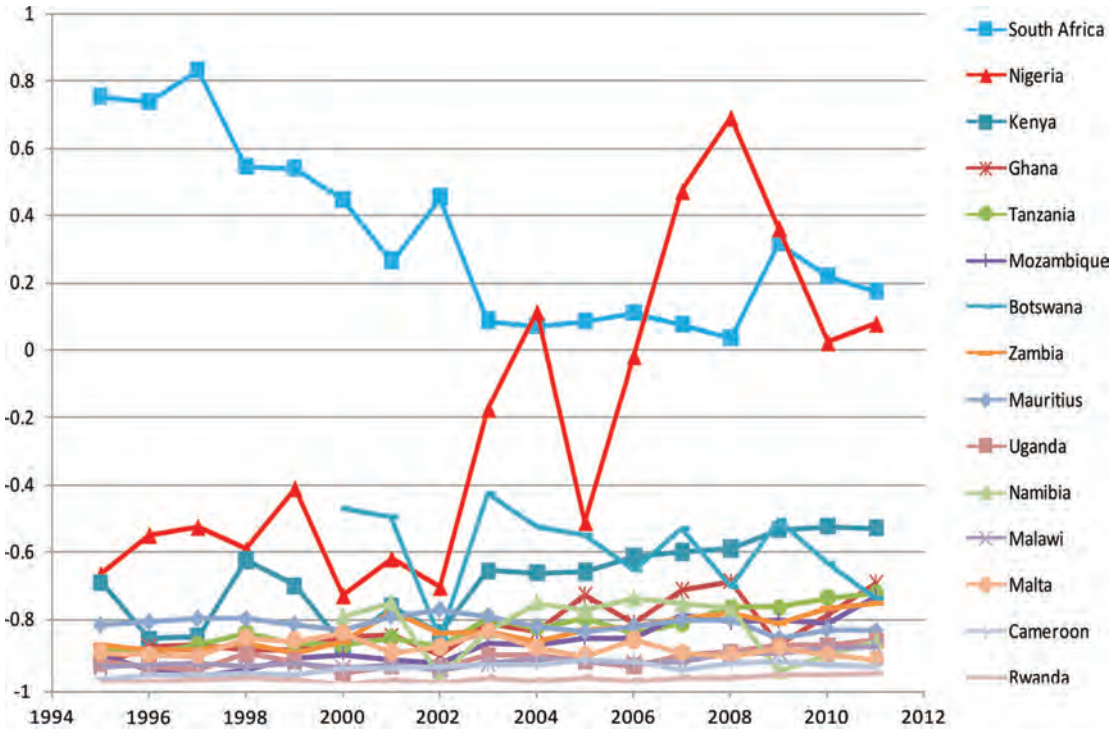
Source: authors

Figure 46. Homophily evolution (Asia)



Source: authors

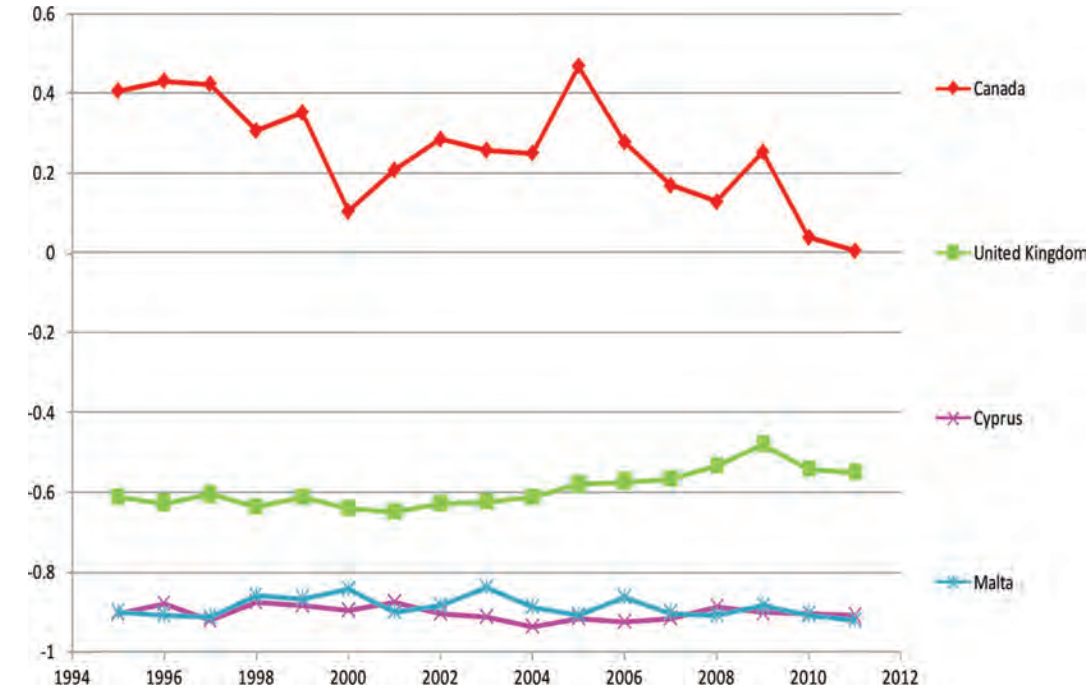
Figure 47. Homophily evolution (Africa)



Source: authors

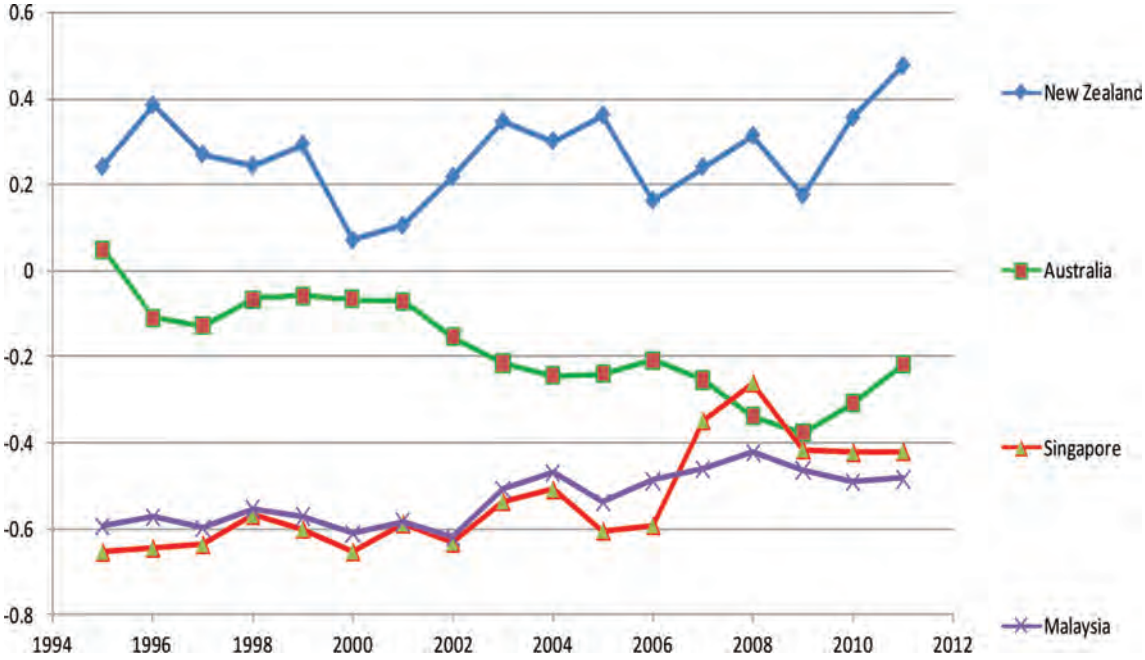
that either high-trade countries are trading more with high-trade countries or low-trade countries are partnering more with low-trade countries. However, when this value tends to –1, it indicates that high-trade countries are trading more with low-trade countries and vice versa. Our analysis indicates that India is currently trading more with dissimilar countries compared with Bangladesh, Pakistan and Sri Lanka (Figure 46). However, South Africa and Nigeria are trading

Figure 48. Homophily evolution (Europe and Canada)



Source: authors

Figure 49. Homophily evolution (Australia, New Zealand, Malaysia and Singapore)



Source: authors

with both similar and dissimilar countries as they tend to zero (Figure 47). This finding also applies for Canada (Figure 48). However, most of the African countries are trading with dissimilar partners. The United Kingdom, Malta and Cyprus have been consistent in terms of their dissimilarity with trading partners. Although New Zealand has similar partners recently, Australia, Malaysia and Singapore are trading more with dissimilar partners (Figure 49).

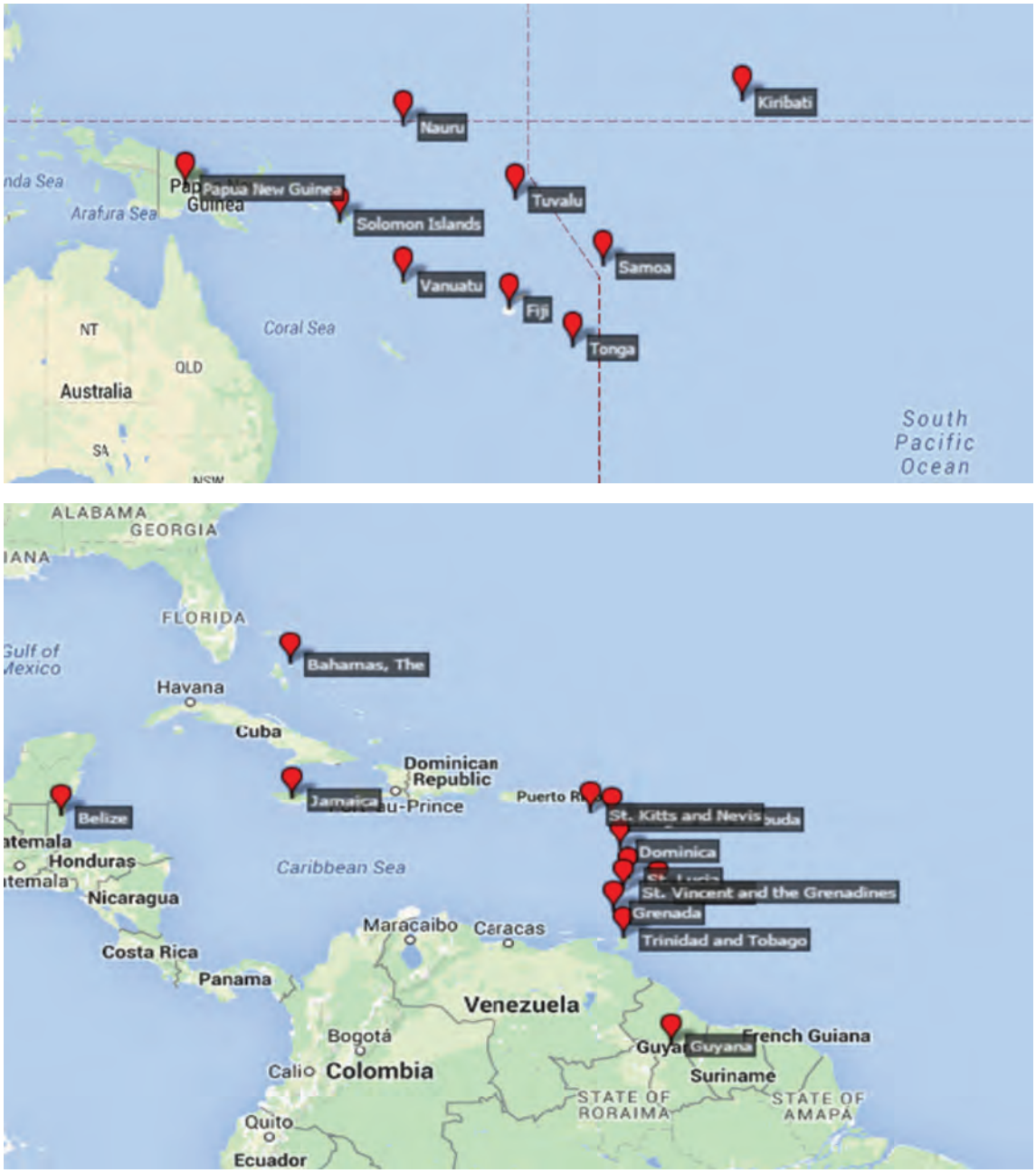
5. Trade network visualisations

In this section, we present different visualisation figures for the trade network at different levels of resolution. For the macro-analysis, where trade relationships both between Commonwealth and non-Commonwealth countries are considered, the visualisation is presented in Figure 1 for the year 2010. For this network, the weights of the links are presented in proportion to the relative trade activity that takes place for a given pair of countries. A similar visualisation is presented for the ICTN in Figure 50. These figures are created by using the original trade values for a given year by using the GTAP data. However, the Commonwealth includes small islands in the Pacific (nine islands) and the Caribbean (twelve islands), which are important members of the Commonwealth as shown in Figure 51. In order to explore how trade volume evolves in these islands over time (i.e. growth of trade), the Commonwealth trade data have been normalised to 2010 trade value. In order to account for the scaling issue and to visualise better, the value of trade growth is truncated at 2. These network graphs are presented in Figure 52 and Figure 53 for the Pacific and the Caribbean islands, respectively. The links in these graphs are colour coded from cyan (0) to white (1) to yellow (2). Here, 0 indicates no trade or no growth, 1 indicates equal amount of trade relative to 2010 value and 2 indicates growth of 2 or over. In order to capture the total trade of a given country with respect to others, a different visualisation is presented in Figure 54 and Figure 55. For the directionality of all these graphs, the clockwise (left to right) direction represents export for given pair of countries.

Figure 50. Intra-Commonwealth Trade Network (2010)

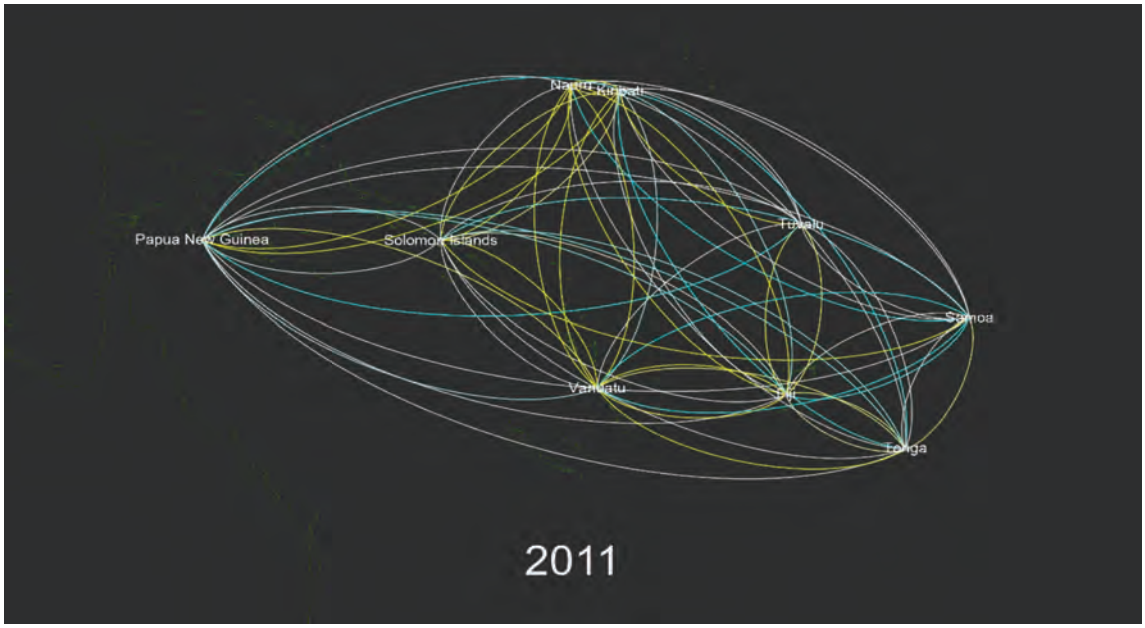
Source: authors

Figure 51. Pacific and Caribbean Islands in the Commonwealth



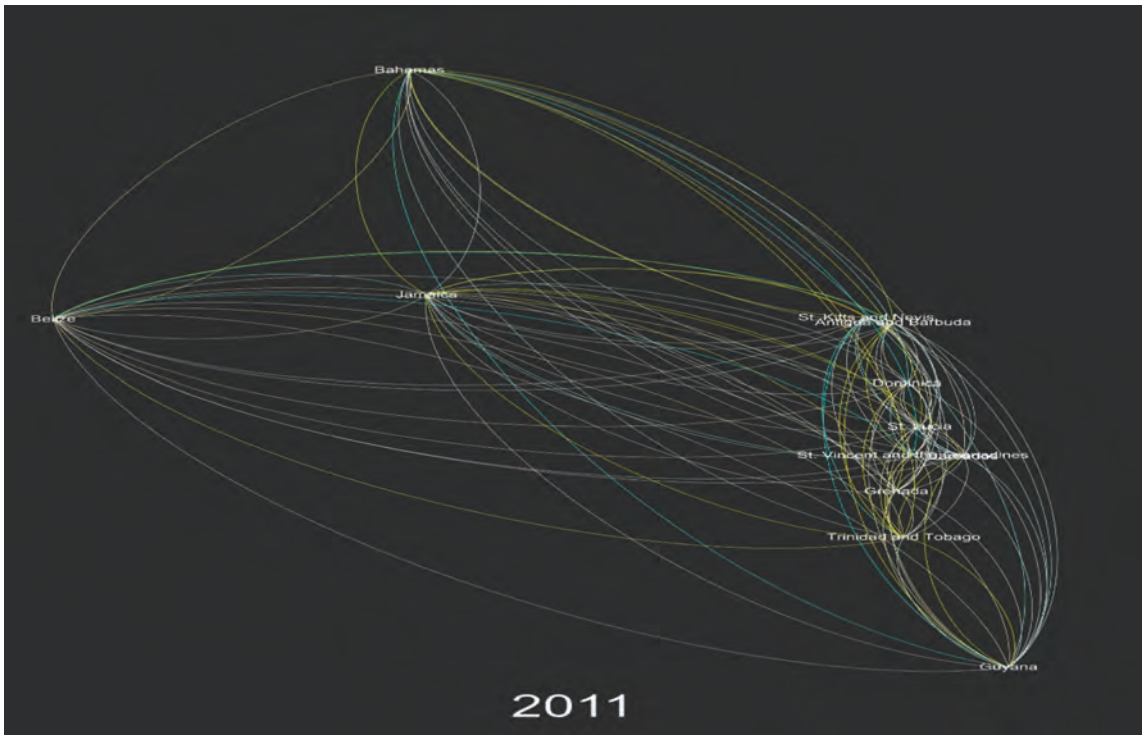
Source: authors

Figure 52. Trade network for Pacific islands (2011)



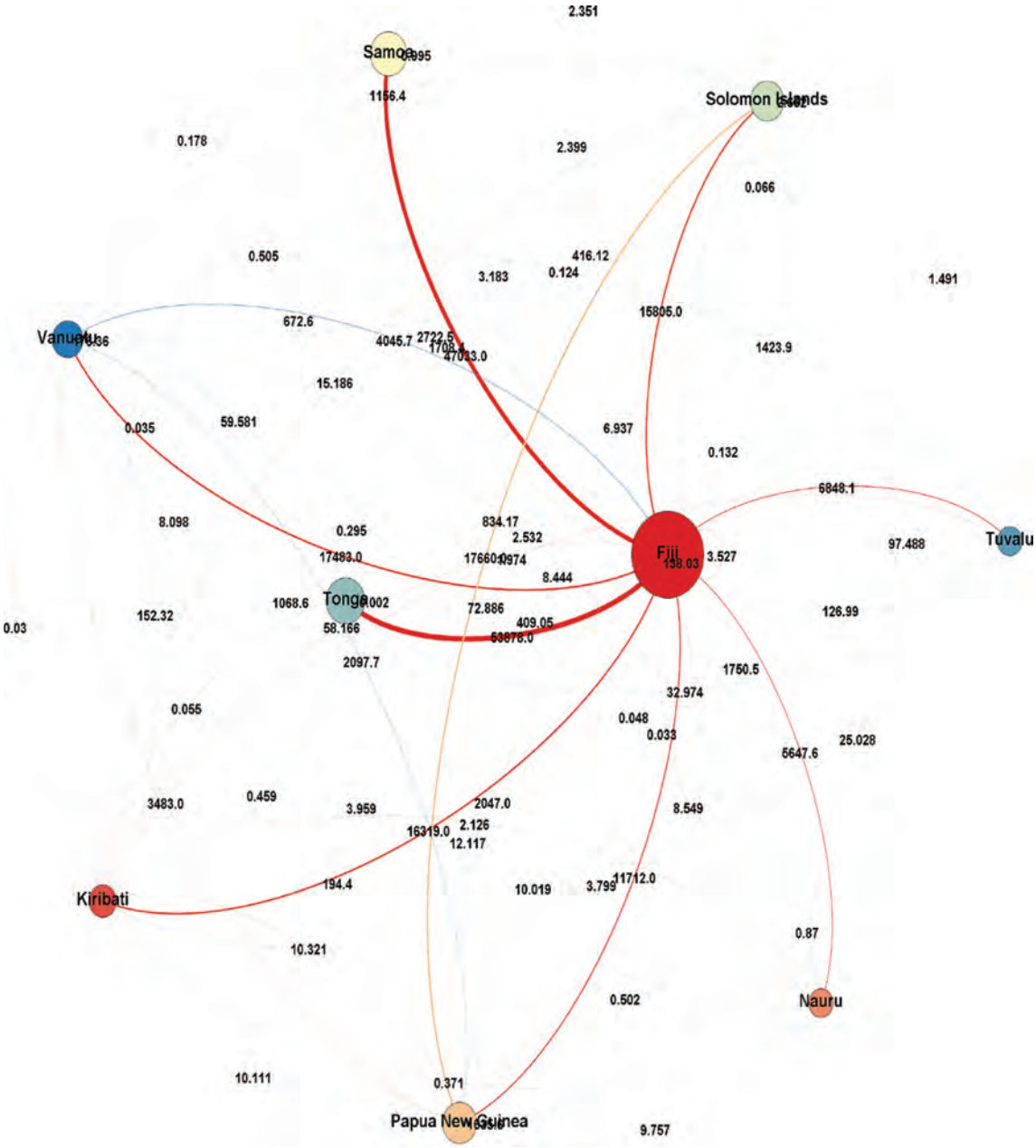
Source: authors

Figure 53. Trade network for Caribbean islands (2011)



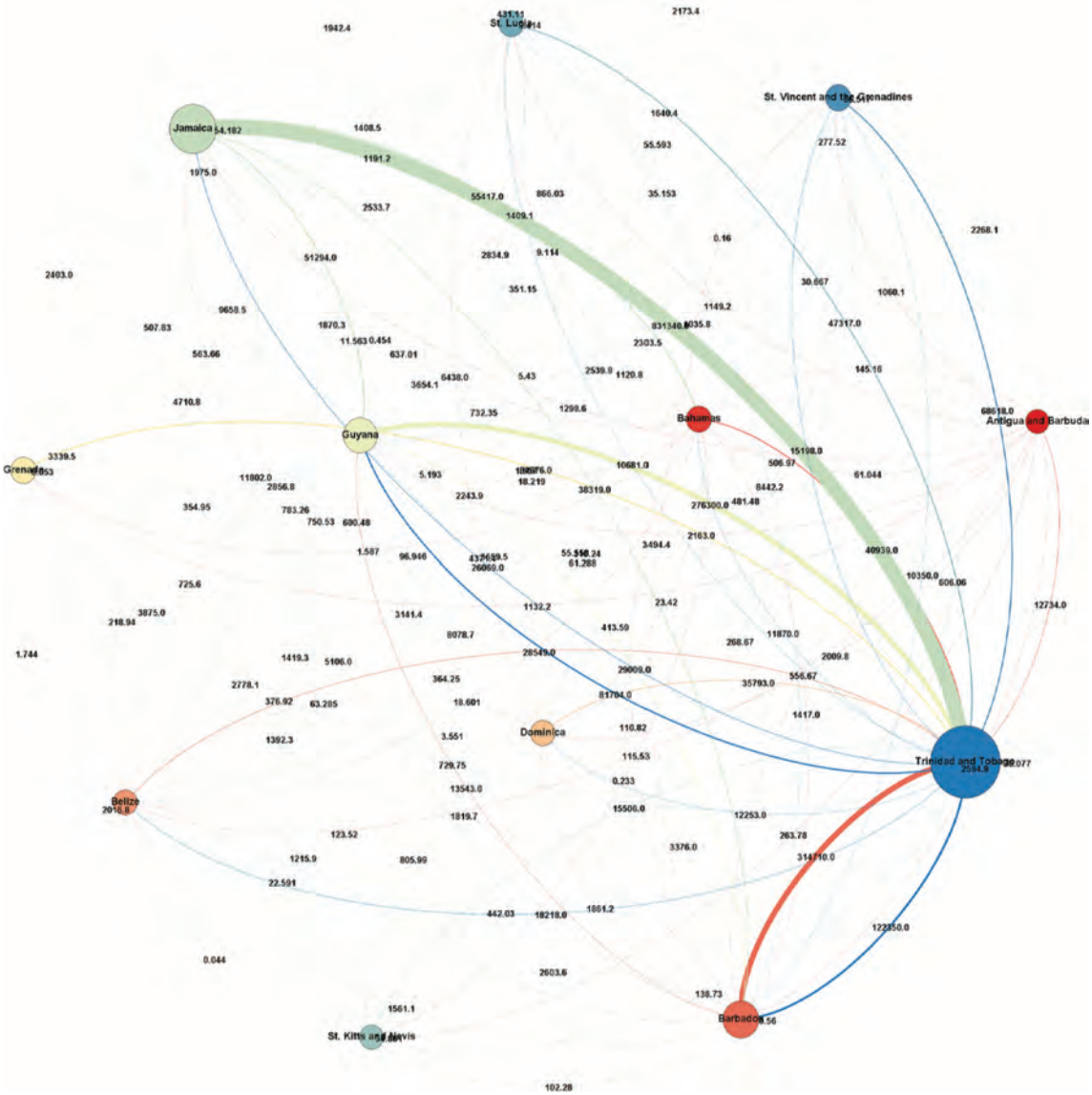
Source: authors

Figure 54. Trade network for Pacific islands (2011)



Source: authors

Figure 55. Trade network for Caribbean islands (2011)



Source: authors

6. Conclusion

The three strongly connected country clusters identified in this study provide an indication to the policy-makers in different Commonwealth countries of how their country has evolved over time within these clusters. We observe that these clusters are distributed across different countries, thereby allowing trade growth in those regions and offering the potential for interregional partnerships. Further study will identify more specifically the regional trade agreements (RTAs) and their potential impact on future trade, as well as the strategies that lower economy countries in Africa and Asia need to implement for a robust trade growth. If a country can associate itself with more than one cluster, this is desirable from the perspective of trade promotion, because it opens up several venues of trading goods. In our analysis, for example, we find that South Africa has moved across the three clusters over the years; this may have played a part in its emergence as one of the 'BRICS' countries (i.e. Brazil, Russia, India, China, South Africa). Furthermore,

by virtue of being associated with South Africa, several other African countries, such as Kenya, Tanzania, Uganda, Rwanda, Mozambique and Malawi, have strengthened their trade over a number of years. RTAs have helped shape the clusters we observe in the study. Relating our findings to the information trade agreements in Appendix 3, we can infer that the emergence of RTAs among European and African countries has resulted in the formation of European and African clusters; moreover, the overlap between the two may be explained by the several Euro-African RTAs. Other economies, many of which are stronger and bigger than the individual African and European countries, form the other cluster; of these, the North American Free Trade Agreement (NAFTA) could explain why Canada and the USA can be in the same cluster. China's trade reforms, which have helped position it as a leading trade player on the global trade map, explain its major role in this cluster, whereas Brazil and India have similar reasons to remain in this cluster.

There are three policy lessons from our identification of clusters:

1. The trade policy objective of a country has to include association with as many countries in different clusters as possible.
2. Association with countries that have played a prominent part in different clusters could help trade promotion and strengthening.
3. RTAs play an important part in helping a country position itself in the global trade arena. Therefore, countries should pursue RTAs in a prioritised manner, with suitable partners, by keeping points 1 and 2 above in mind.

India has been increasing its trade with similar economies in recent years, whereas Canada has been doing this for many years. Nevertheless, we suggest that trading with countries that have similar trade strength is desirable. However, other major countries such as China, South Africa and the USA have followed the strategy of associating with countries with opposing levels of trade strength. Weaker countries would be most likely to gain from trade with stronger countries, whereas stronger countries could also gain by trading mutually with similar countries. Among the poorer Commonwealth countries, however, it appears that there is a negative effect of associating with similar, weaker economies. Therefore, countries should examine the feasibility of these two different types of strategies while negotiating their RTAs.

In terms of sectors, the textiles, clothing, automotive and chemicals sectors are important for the Commonwealth countries, in particular the United Kingdom, Canada and India. Developed Commonwealth countries (apart from India and Malaysia) dominate the heavy machinery and other technologically intensive sectors, as well as the metals sector, and energy products dominate the GVCs in general, particularly those from Commonwealth countries such as India, Nigeria, Singapore, the United Kingdom and Canada. In general, developing countries are dominant in the lower ends of the GVC, implying that upgrading to a more advanced part of the GVCs is required for the countries to emerge more strongly.

The results obtained from the ICTN analysis are limited to trade activities within the Commonwealth countries. These do not necessarily convey any insight similar to that of the International Trade Network, which includes both the Commonwealth and non-Commonwealth countries. ICTN analysis was undertaken more at a micro-level and the implications are relevant for trade between Commonwealth countries only. Different visualisation techniques are explored to represent trade partnerships relative to one another.

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Appendices

Appendix 1: regions and sectors considered in the study

Table A1.1 summarises the nations and regions considered in this study. The first three columns show the countries from the Commonwealth. The last column presents other countries/regions required to analyse the global trade network properly. Although Brunei, Dominica, Jamaica and Trinidad and Tobago are part of the Commonwealth, there are no trade data available for these countries. These data are provided by GTAP.

Table A1.2 summarises the economic sectors considered in this study. These data are provided by GTAP.

Table A1.1. Regions/countries considered in the study

	Commonwealth			Other
Australia	Malawi	Rwanda	Brazil	
Bangladesh	Malaysia	Singapore	China	
Botswana	Malta	South Africa	Japan	
Cameroon	Mauritius	Sri Lanka	Korea	
Canada	Mozambique	Tanzania	Rest of the European Union	
Cyprus	Namibia	Uganda	Rest of the World	
Ghana	New Zealand	Zambia	Russian Federation	
India	Nigeria	UK	USA	
Kenya	Pakistan	*Other		

Source: authors

Table A1.2. Economic sectors considered in the study

	Economic sectors		
Paddy rice	Wool/silk-worm cocoons	Processed rice	Mineral products NEC
Wheat	Forestry	Sugar	Ferrous metals
Cereal grains NEC	Fishing	Food products NEC	Metals NEC
Vegetables/ fruit/ nuts	Coal	Beverages and tobacco products	Metal products
Oil seeds	Oil	Textiles	Motor vehicles and parts
Sugar cane/ sugar beet	Gas	Clothing	Transport equipment NEC
Plant-based fibres	Minerals NEC	Leather products	Electronic equipment
Crops NEC	Meat: cattle/sheep/ goats/horse	Wood products	Machinery and equipment NEC
Cattle/sheep/goats/ horses	Meat products NEC	Paper products/ publishing	Manufactures NEC
Animal products NEC	Vegetable oils and fats	Petroleum/coal products	Final demand
Raw milk	Dairy products	Chemical/rubber/plastic prods	

Source: authors

Appendix 2: summary of statistical network-analysis metrics

This appendix provides an overview of several statistical network-analysis tools used in this study.

***Degree(i)*:** total number of connections related to a node *i* (i.e. total number of trade partners). *Degree* can be disaggregated into *in-degree* (total importer partners), and *out-degree* (total exporter partners) (Figure A2.1(a)).

***Strength(i)*:** total weight of connections related to a node *i* (Horvath 2011) (i.e. total value of trade). *Strength* can be disaggregated into *in-strength* (total value of imports) and *out-strength* (total value of exports) (Figure A2.1(b))

***Betweenness Centrality, BC(i) or BC(i, j)*:** indicates how important/central a node *i*/arc *(i, j)* is for the specific network (Newman 2010). It is obtained by counting the number of times these elements are included in the shortest paths between every node duplet (Figure A2.1(c)).

***Average Nearest Neighbour Strength (ANNS*:** ($\hat{\imath}$) measures the average value of trade handled by neighbour partners $\hat{\jmath}$ of a node $\hat{\imath}$. Equation (1) describes its computation, where $\sum_{\hat{\jmath}}(a_{\hat{\imath}\hat{\jmath}}+a_{\hat{\jmath}\hat{\imath}})$ $\hat{\imath}$ is the *degree* of $\hat{\imath}$(in + out), and $\sum_{\hat{\jmath}}\sum_{h}(W_{\hat{\jmath}h}+W_{h\hat{\jmath}})$ is the *strength* (in + out) of neighbour partners $\hat{\jmath}$, ($\hat{\imath}$, $\hat{\jmath}$) such that $a_{\hat{\imath},\hat{\jmath}}=1$. Notice that *h* are the neighbor partners of $\hat{\jmath}$. In general, *ANNS*($\hat{\imath}$) considers both importing and exporting nodes. However, it can be used to compute more disaggregated metrics, that is, $ANNS_{out-in}$ ($W_{h\hat{\jmath}}=a_{\hat{\imath},\hat{\jmath}}=0$), $ANNS_{out-out}$ ($W_{h\hat{\jmath}}=a_{\hat{\jmath},\hat{\imath}}=0$), $ANNS_{in-out}$ ($W_{\hat{\jmath}h}=a_{\hat{\jmath},\hat{\imath}}=0$), and $ANNS_{in-in}$ ($W_{\hat{\jmath}h}=a_{\hat{\jmath},\hat{\imath}}=0$) (Figure A2.1(g)).

$$ANNS(\hat{\imath})=\frac{\sum_{\hat{\jmath}}\sum_{h}(w_{\hat{\jmath}h}+w_{h\hat{\jmath}})}{\sum_{\hat{\jmath}}(a_{\hat{\imath}\hat{\jmath}}+a_{\hat{\jmath}\hat{\imath}})} \quad (1)$$

***Homophily*:** value between 1 and –1 used to measure the level of assortativity (~1) or disassortativity (~–1) in a network. Assortative networks are those where similar nodes connect to each other (i.e. connections mostly within high-trade nodes and within low-trade nodes). In disassortative networks, dissimilar nodes are connected (i.e. connections mostly between high-trade and low-trade nodes (Newman 2010)). *Homophily* is computed using Pearson correlation between *strength* and (node/neighbour level), or between *strength* (*i*) *and ANNS*(*i*)*strength*(*j*) (bilateral level) (Figure A2.1(e)).

***Node homophily* (*i*) (*NH*(*i*)):** value between and –1 used to measure the level of assortativity (~–1) or disassortativity () related to a node. Assortative nodes are those connected to similar nodes (i.e. connected to other nodes that, on average, move similar levels of trade). Disassortative nodes connect to dissimilar nodes (i.e. connect to other nodes that, on average, move more/less levels of trade). Equation (2), developed by the research team, describes the computation of this metric:

$$NH(i)=2\frac{min\{Strengt\,h(i),ANNS(i)\}}{max\{Strengt\,h(i),ANNS(i)\}}-1 \quad (2)$$

***Clustering coefficient, (CC*):** measures the proportion of triangular loops related to node observed in the data as compared with all possible loops and its standardised arc weights (Fagiolo 2007) (Figure A2.1(f)).

***Community detection*:** method to extract community structures (clusters or GVCs) of large weighted directed networks. This research uses the Louvain Method for *community detection* (Blondel *et al.* 2008) (Figure A2.1(g)).

***Normalised mutual information (NMI)*:** used to quantify the evolution of GVCs (Danon *et al.* 2005). Measures how clusters (GVCs) change with respect to the last year. $NMI\in[0,1]$, $NMI=1$ indicates exact GVCs in consecutive years. $NMI=1$ indicates completely different GVCs.

These statistical-network-analysis tools are applied to the time series of the international trade network.

Figure A2.1. Illustration and summary of statistical network-analysis tools

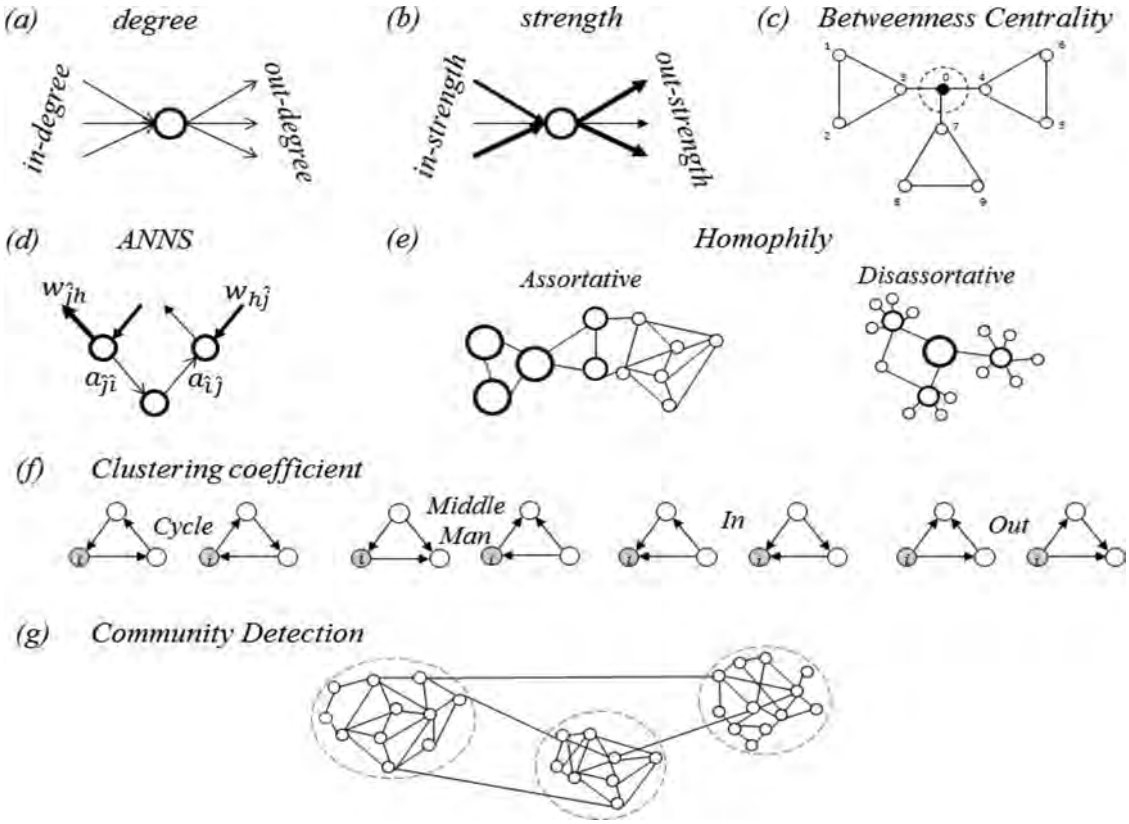


Table A2.1. Regional trade agreements signed by African countries since 1990

RTA name	Date of entry into force	Countries included
Common Market for Eastern and Southern Africa (COMESA)	8 December 1994	Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libyan Arab Jamahiriya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, Zimbabwe
East African Community (EAC)	7 July 2000	Kenya, Tanzania, Uganda
East African Community (EAC)–Accession of Burundi and Rwanda	1 July 2007	Burundi
Rwanda		
Economic and Monetary Community of Central Africa (CEMAC)	24 June 1999	Gabon, Cameroon, the Central African Republic, Chad, the Republic of the Congo, Equatorial Guinea
Economic Community of West African States (ECOWAS)	24 July 1993	Benin, Burkina Faso, Ivory Coast, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo, Cape Verde
EFTA–Egypt	1 August 2007	Iceland, Liechtenstein, Norway and Switzerland, Egypt
EFTA–Morocco	1 December 1999	Morocco, Iceland, Liechtenstein, Norway and Switzerland
EFTA– Southern African Customs Union	1 May 2008	Iceland, Liechtenstein, Norway, Switzerland

(continued)

Table A2.1. (continued)

RTA name	Date of entry into force	Countries included
Republic of South Africa, Botswana, Lesotho, Swaziland		
EFTA–Tunisia	1 June 2005	Tunisia, Iceland, Liechtenstein, Norway, Switzerland
Egypt–Turkey	1 March 2007	Egypt, Turkey
EU–Algeria	1 September 2005	European Union (UK, Cyprus and Malta are members), Algeria
EU–Cameroon	4 August 2014	European Union (UK, Cyprus and Malta are members), Cameroon
EU–Côte d'Ivoire	1 January 2009	European Union (UK, Cyprus and Malta are members), Ivory Coast
EU–Eastern and Southern Africa States Interim EPA	14 May 2012	European Union, Mauritius, Madagascar, Seychelles, Zimbabwe
EU–Egypt	1 June 2004	European Union, Egypt
EU–Morocco	1 March 2000	European Union, Egypt
EU– South Africa	1 January 2000	European Union, South Africa
EU–Tunisia	1 March 1998	European Union, Tunisia
Pan-Arab Free Trade Area (PAFTA)	1 January 1998	The current signatories stated below are 'as notified by the Parties'. However, please note that Algeria and the Palestinian Authority of the West Bank and the Gaza Strip are now parties of PAFTA
Southern African Customs Union	15 July 2004	
Southern African Development Community (SADC)	1 September 2000	The current signatories stated below are 'as notified by the Parties'. However, please note that Democratic Republic of Congo; Madagascar and Seychelles are now parties of SADC
Turkey–Mauritius	1 June 2013	
Turkey–Morocco	1 January 2006	
Turkey–Tunisia	1 July 2005	
USA–Morocco	1 January 2006	

Source: authors

Table A2.2. Regional trade agreements signed by the Pacific Island countries since 1990

RTA name	Date of entry into force	Countries included
Association of Southeast Asian Nations– Australia–New Zealand	1 January 2010	Australia, Brunei Darussalam, Malaysia, Myanmar, New Zealand, the Philippines, Singapore, Vietnam, Thailand, People's Democratic Republic of Lao, Cambodia, Indonesia
Australia–Chile	6 March 2009	Australia, Chile
China–New Zealand	1 October 2008	China, New Zealand
EU–Papua New Guinea / Fiji	20 December 2009	Papua New Guinea, the European Union, Fiji
Hong Kong, China–New Zealand	1 January 2011	Hong Kong, China–New Zealand
Japan–Australia	15 January 2015	Japan–Australia
Republic of Korea–Australia	12 December 2014	Republic of Korea–Australia
Malaysia–Australia	1 January 2013	Malaysia–Australia

(continued)

Table A2.2. (continued)

RTA name	Date of entry into force	Countries included
Melanesian Spearhead Group	1 January 1994	Fiji, Papua New Guinea, Solomon Islands, Vanuatu, New Caledonia
New Zealand–Chinese Taipei	1 December 2013	New Zealand–Chinese Taipei
New Zealand–Malaysia	1 August 2010	New Zealand–Malaysia
New Zealand–Singapore	1 January 2001	New Zealand–Singapore
Pacific Island Countries Trade Agreement	13 April 2003	Cook Islands, Fiji, Kiribati, Micronesia, Nauru, Niue, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
Singapore–Australia	28 July 2003	
South Pacific Regional Trade and Economic Cooperation Agreement	1 January 1981	Cook Islands, Australia, Fiji, Marshall Islands, Micronesia, Nauru, New Zealand, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Kiribati, Niue
Thailand–Australia	1 January 2005	
Thailand–New Zealand	1 July 2005	
Trans-Pacific Strategic Economic Partnership	28 May 2006	New Zealand, Singapore, Brunei Darussalam, Chile
USA–Australia	1 January 2005	

Source: authors

Table A2.3. Regional trade agreements signed by Canada since 1990

RTA name	Date of entry into force
Canada–Chile	30 July 1997
Canada–Colombia	7 October 2011
Canada–Costa Rica	13 January 2003
Canada–Honduras	5 February 2015
Canada–Israel	15 January 1997
Canada–Jordan	10 April 2013
Canada–Panama	10 April 2013
Canada–Peru	31 July 2009
Canada–Republic of Korea	20 January 2015
EFTA–Canada	4 August 2009
North American Free Trade Agreement (NAFTA)	29 January 1993

Source: authors

Table A2.4. Regional trade agreements signed by the European Union

RTA name	Date of entry into force
EU–Georgia	1 September 2014
EU–Rep. of Moldova	1 September 2014
EU–Central America	1 August 2013
EU–Colombia and Peru	1 March 2013
EU–Republic of Korea	1 July 2011
EU–Serbia	1 February 2010
EU–Papua New Guinea/Fiji	20 December 2009
EU–Côte d'Ivoire	1 January 2009

(continued)

Table A2.4. (continued)

RTA name	Date of entry into force
EU–CARIFORUM States EPA (Caribbean)	1 November 2008
EU–Bosnia and Herzegovina	1 July 2008
EU–Montenegro	1 January 2008
EU–Albania	1 December 2006
EU–Algeria	1 September 2005
EU–Egypt	1 June 2004
EU–Lebanon	1 March 2003
EU–Chile	1 February 2003
EU–Jordan	1 May 2002
EU–San Marino	1 April 2002
EU–Former Yugoslav Republic of Macedonia	1 June 2001
EU–Mexico	1 July 2000
EU–Israel	1 June 2000
EU–Palestinian Authority	1 July 1997
EU–Faroe Islands	1 January 1997
EU–Turkey	1 January 1996
EU–Andorra	1 July 1991

Source: authors

Appendix 3: Intra-Commonwealth trade network analysis

Table A3.1. Relative trade share contribution (2011)
(a) Percentage of total trade in different clusters

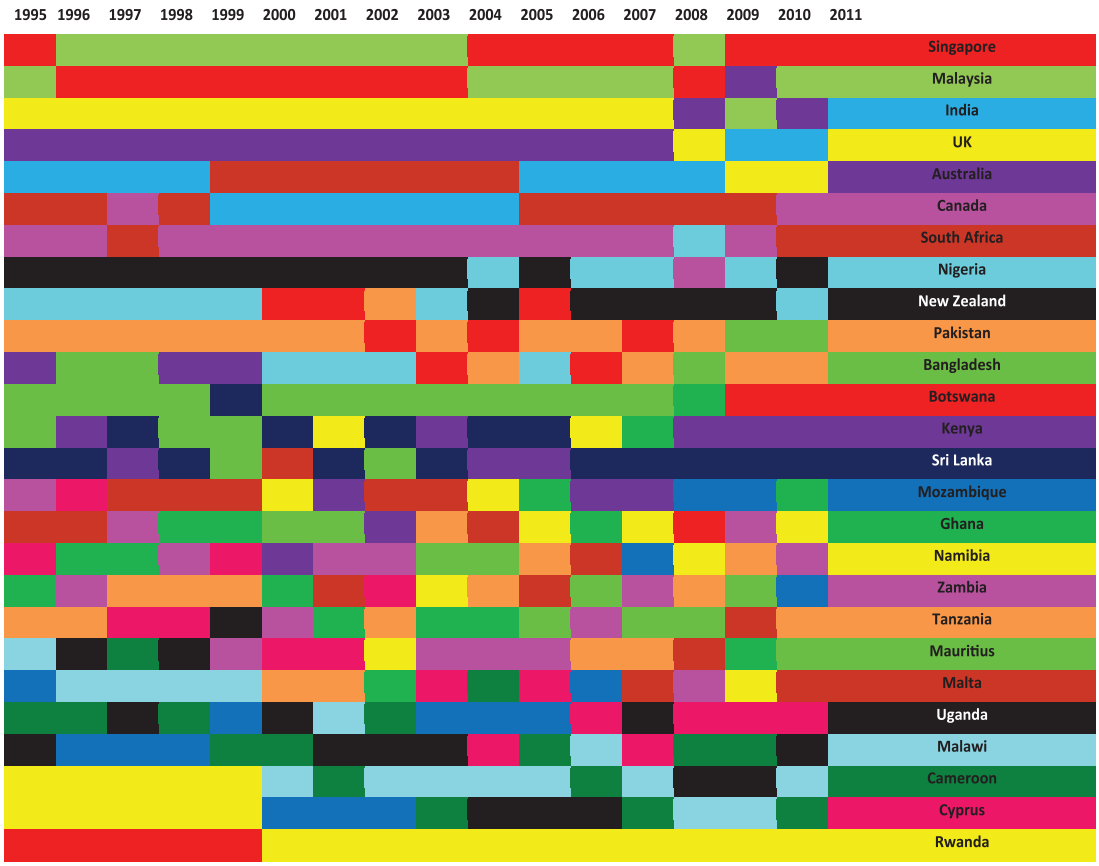
Relative trade share contribution (2011) Total trade in different clusters (%)	Cluster 1	Cluster 2	Cluster 3
India	**17.56**	15.41	14.15
Nigeria	**6.27**	1.92	0.58
Botswana	0.45	**2.32**	0.01
Canada	4.79	**17.25**	3.86
Australia	7.59	8.87	**12.90**
Malaysia	9.42	4.82	**22.56**

(b) Percentage of individual trade in different clusters

	Relative trade share contribution Individual trade in different clusters (%)		
	Cluster 1	Cluster 2	Cluster 3
India	**42.83**	19.23	37.94
Nigeria	**78.45**	13.60	7.95
Botswana	22.93	**76.31**	0.75
Canada	23.64	**55.46**	20.91
Australia	29.28	16.03	**54.69**
Malaysia	25.95	5.77	**68.28**

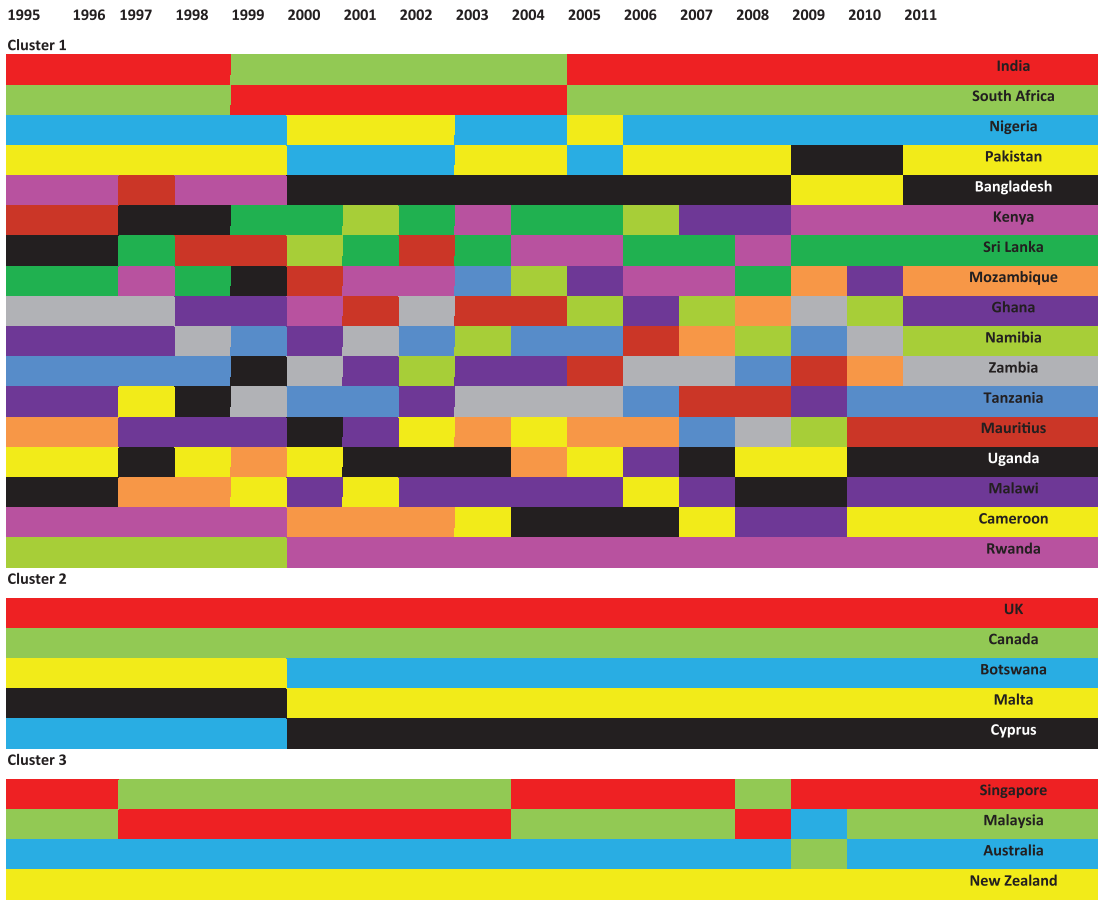
Source: authors

Table A3.2. ICTN strength (export) evolution (all nations)



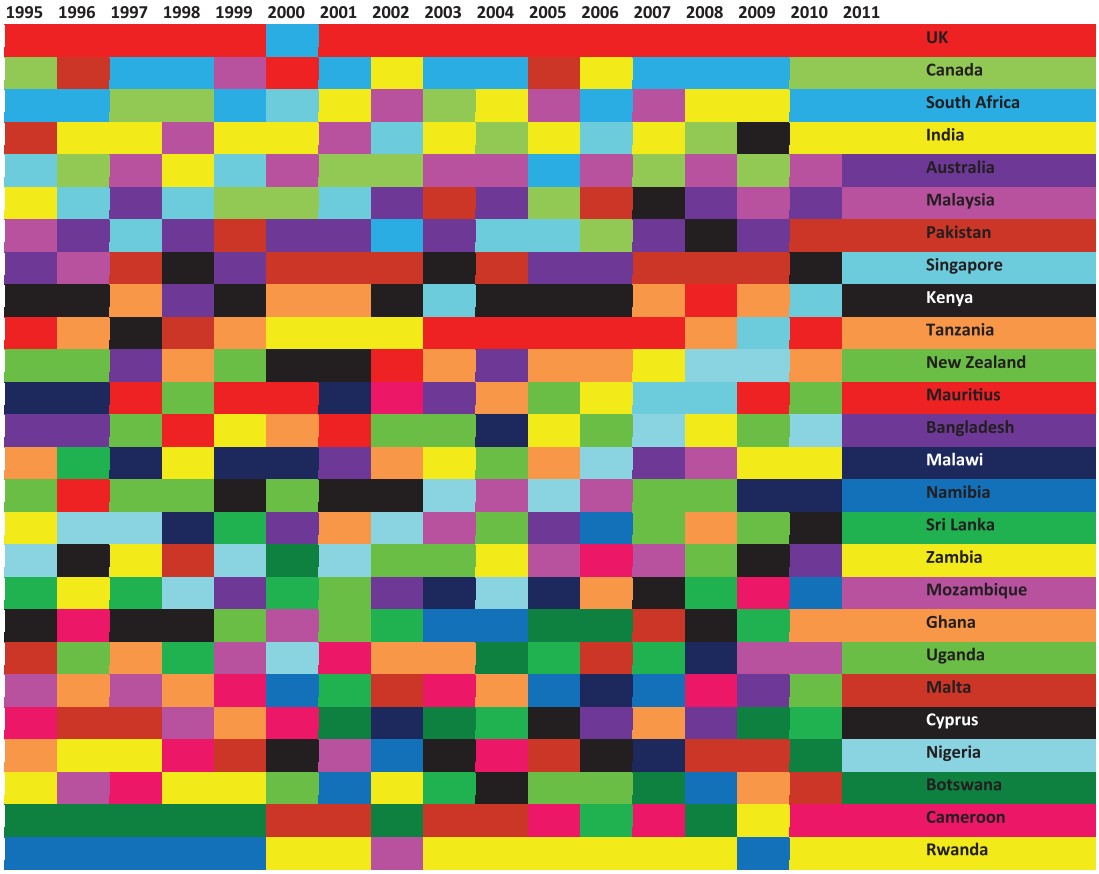
Note: colours signify the position of a given country over the time period

Table A3.3. ICTN strength (export) evolution (within cluster)



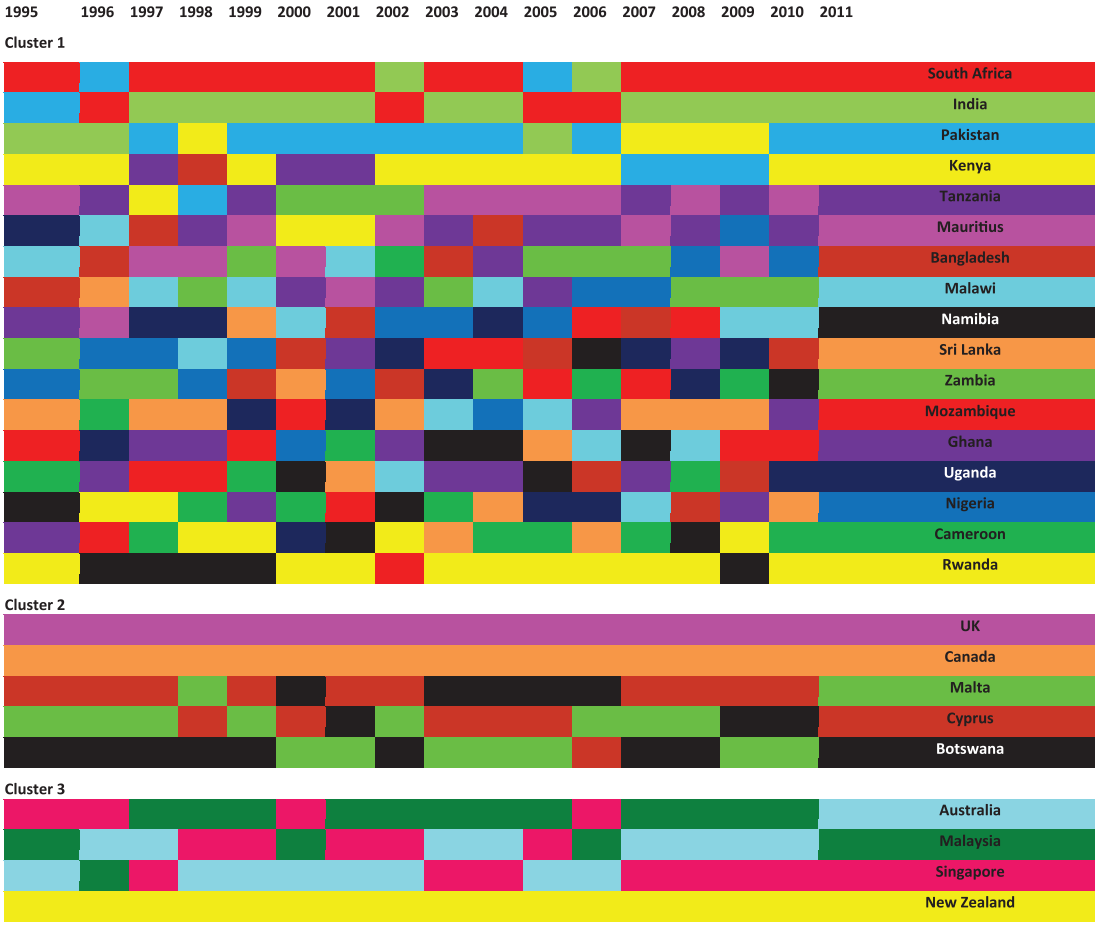
Note: colours signify the position of a given country over the time period

Table A3.4. ICTN centrality evolution (all nations)



Note: colours signify the position of a given country over the time period

Table A3.5. ICTN centrality evolution (within cluster)



Note: colours signify the position of a given country over the time period

Source: authors