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Export Diversification, Upstreamness and Global Value Chains: Experience of Commonwealth Member Countries

Basudeb Guha-Khasnobis and Anwesha Aditya

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By Basudeb Guha-Khasnobis and Anwesha Aditya.

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Abstract

This study examines the determinants of export diversification, in terms of both commodities and destination for a group of Commonwealth member countries for which comparable data are available between 1990 and 2016. The chief innovation of the study lies in its introduction of a measure of participation in global value chains (GVCs) along with the average 'upstreamness' of exports as potential explainers in addition to the usual variables used in the literature, such as income, human capital and physical capital. The summary statistics reveal that export diversification by commodity is lowest for least developed countries (LDCs), followed by small states and small island developing states (SIDS). But the intra-Commonwealth index for LDCs improved significantly during 1995–2010 and stagnated thereafter. Intra-Commonwealth diversification by destination, however, improved across all country groups from 2000, implying a definite impact of Commonwealth heritage for intra-Commonwealth trade. The econometric analyses strongly indicate independent and significant effects of both upstreamness index (UI) and GVC in shaping diversification. Thus, mere participation in value chains is not enough: the exact positioning of countries in the value chain is critical and requires more policy attention. Among the control variables, greater human capital accumulation and physical capital formation seem to be associated with more specialised export structures. This finding can be related to the empirical evidence of non-linearity between export product diversification and economic growth, implying that developing countries benefit from diversification whereas developed countries gain from specialisation.

JEL Classifications: F10, F44, F63
Keywords: export diversification, global value chains, intra-Commonwealth trade, LDCs

Contents

Acronyms and Abbreviations

CCI	Commodity Concentration Index
DVX	Indirect Domestic Value Added
GCF	Gross Capital Formation
GCI	Geographical Concentration Index
GDP	Gross Domestic Product
GDPGR	Growth Rate of GDP Per Capita
GMM	Generalised Method of Moments
GVC	Global Value Chain
ED	Export Diversification
EVI	Economic Vulnerability Index
FDI	Foreign Direct Investment
FVA	Foreign Value Added
GDP	Gross Domestic Product
HC	Human Capital Formation
HDI	Human Development Index
HS	Harmonised System
LDC	Least Developed Country
REER	Real Effective Exchange Rate
SIDS	Small Island Developing State
SITC	Standard International Trade Classification
TARIFF	Tariff Data
TOI	Trade Openness Index
UI	Upstreamness Index
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
WDI	World Development Indicators
WITS	World Integrated Trade Solution

Executive summary

This study examines the determinants of export diversification, in terms of both commodities and destination for a group of Commonwealth member countries for which comparable data are available between 1990 and 2016. Diversification is measured at both intra- and extra-Commonwealth levels.

The chief innovation of the study lies in its introduction of a measure of participation in global value chains (GVCs) along with the average 'upstreamness' of exports as potential explainers in addition to the usual variables used in the literature, such as income, human capital and physical capital.

The summary statistics reveal that export diversification by commodity is lowest for least developed countries (LDCs), followed by small states and small island developing states (SIDS). But the intra-Commonwealth index for LDCs improved significantly during 1995–2010 and stagnated thereafter. Intra-Commonwealth diversification by destination, however, improved across all country groups from 2000, implying a definite impact of Commonwealth heritage for intra-Commonwealth trade.

Next, there was a very significant rise in participation in GVCs for non-small states, non-SIDS and non-LDCs. For LDCs, SIDS and small states, there was practically no increase.

The pattern of average upstreamness index (UI) is not as dramatic as participation in GVCs (GVC) but overall reveals a slight downward trend, which implies exports from Commonwealth countries are on average going slightly downstream (closer to the final consumer). Econometric estimation reveals that both GVC and UI are significant across alternate model specifications. Higher levels of upstreamness are associated with less diversified exports both by commodity and by destination. GVC is significant and negative across all the models, implying that higher values of GVC are associated with greater diversification. Taken together with the finding on UI, a plausible explanation comes from the value added of trade: upstream exports may be less in volume but high in value added for the richer countries.

The study strongly indicates independent and significant effects of both UI and GVC in shaping diversification. Thus, mere participation in value chains is not enough: the exact positioning of countries in the value chain is critical and requires more policy attention. Among the control variables, greater human capital accumulation and physical capital formation seem to be associated with more specialised export structures. This finding can be related to the empirical evidence of non-linearity between export product diversification and economic growth, implying that developing countries benefit from diversification whereas developed countries gain from specialisation.

Tariff is positively significant only for the intra-Commonwealth commodity diversification model, implying that, for intra-Commonwealth trade, higher tariffs lead to greater export product concentration. Theoretical support for this result can be drawn from Krugman (1984), who argues that tariff protection may enable the domestic economy to exploit economies of scale. This may lead to a more specialised export structure. This has an important policy implication regarding the reduction of tariffs for intra-Commonwealth trade in the interest of boosting diversification.

1. Introduction[1]

The growing complexity of global production processes continues to pose new questions, with significant investment in new empirical research required to inform policy. Trade policies are important instruments to promote economic growth and generate employment, leading to broader development outcomes such as the reduction of poverty and inequality. Do they also strengthen the resilience of Commonwealth economies against shocks, which have become frequent of late?

Economic resilience depends significantly on achieving a more diversified export basket, both by destination and by product. In this way, a country can reduce its vulnerability to adverse price changes in one commodity to be offset by favourable changes in others. It can also mitigate demand and supply shocks to trade originating in a country or a region as a result of financial or other forms of crisis. Do intra-Commonwealth trade flows reveal sufficient resilience, measured among other things by their extent of diversification, to act as a buffer against shocks originating elsewhere? It might also be noted that export diversification (ED) is a key component of the Economic Vulnerability Index (EVI) – one of the three benchmarks for least developed country (LDC) graduation.

Meanwhile, deeper understanding of the determinants of ED within Commonwealth countries is expected to lead to the development of new theoretical literature linking diversification to openness, common heritage, terms of trade shocks, human capital, economic growth and employment. The main purpose of this study is to examine the evolution of ED during the period 1990–2016 in 43 Commonwealth countries for which comparable data are available.[2]

Generally, the larger the number of goods exported by a country, the more movements in the world prices of individual goods offset each other on the one hand and prevent overdepletion of natural wealth on the other. Thus, ED helps in stabilising export earnings in the long run (Acemoglu and Zilibotti, 2007) and contributes towards the macroeconomic stability of a country.

Some recent studies look at the determinants of ED (Agosin, 2011). One important aspect that may influence the export structure of a country is its participation in global value chains (GVCs) and trade in intermediate inputs. Import of intermediate inputs, which may be relatively scarce locally in some developing countries, can create an opportunity for those countries to produce new products located further downstream in a supply chain (Benguria, 2014). This notion goes back to the seminal work of Jones and Kierzkowski (2001, 2005). According to them, just like technical progress, fragmentation and trade in intermediate inputs enable countries to produce more final goods from a given stock of primary factor of production. Therefore, greater participation in GVCs (GVC) may lead to greater gains for the countries than when trade is confined to final goods. Gross exports, typically used in gravity models, do not reflect the true export capacity of a country. This is because of the growing fragmentation of production processes and the exponential rise in trade in intermediate products.

To take a simple example, country A may import a bicycle worth US$99 from country B, paint it at home and export the finished bicycle to country C for US$100. While gross exports from A to C would show a value of US$100, the actual contribution of A in the production process is US$1, which is its 'value-added' export and depends on the competitiveness of firms in country A *vis-à-vis* other firms in other countries.

A related policy concern is that export baskets should ideally consist of more products with greater value addition. This aspect is partly related to the 'upstreamness' or 'downstreamness' of (intermediate) goods exports, which are growing in importance as a result of the fragmentation of production. The intuitive idea behind the notion of up/downstreamness is linked to its position in the value chain: how close (downstream) is a product to its final consumer? Antras et al. (2012) developed a rigorous statistical formula to measure up/downstreamness; more recently, Antras and Chor (2017) showed how the upstreamness index (UI) affects cross-country, cross-industry patterns of trade. Stronger country institutions pertaining to the rule of law and financial development

are correlated with a propensity to export in relatively more downstream industries. The authors also suggest a role of relative factor endowments in shaping the degree to which a country's exports appear to concentrate in relatively upstream versus downstream industries. They find that upstreamness is positively related to measures of capital intensity and negatively correlated with skill intensity measures. There is also some (weak) evidence that richer countries, on average, reveal slightly lower values of upstreamness, implying their products/exports reach the final consumer faster.

ED, UI and GVC comprise important attributes of trade patterns as well as intra- and inter-country income distribution. To the best of our knowledge, these three characteristics of trade flows have not been addressed within a unified framework. The main purpose of this paper is to delve into these issues for Commonwealth countries. The paper examines the determinants of ED in a set of Commonwealth countries for which comparable data are available over a sufficiently long period (1990–2016).

Therefore, our primary research question is the following:

Is there a systematic relationship between GVC (appropriately measured) and ED and/or UI? Is the relationship the same for ED by commodities and by destination?

Secondary research questions relevant to policy would be as follows. Are there significant differences between an intra-Commonwealth model and a global model? If so, how can we explain them? What variables can be leveraged within the Commonwealth to maximise the positive synergies of both sets of relationships (e.g. employment creation, gross domestic product (GDP) growth)?

In addition, we address the following questions. What are the potential determinants of a country's position in the supply chain? What is the role of trade policy, such as on the exchange rate and foreign direct investment (FDI), in this context?

The paper is structured as follows. In Section 2, we provide the definitions and measurement of the different variables, both dependent and independent. Section 3 provides the summary statistics in brief (the Annex provides more detailed description of the data following the Commonwealth country classification). Section 4 introduces the econometric methodology and the rationale for it. Section 5 presents the estimation results, including robustness checks. Section 6 concludes.

2. Measurement of ED, UI and GVC

ED: We calculate ED indexes both by commodity and by destination for 43 Commonwealth countries. The indexes are calculated at both the 'world' and the 'intra-Commonwealth' level. The world-level indexes (both by commodity and by destination) take into account the exports of the 43 countries to all other countries (non-members). The intra-Commonwealth-level indexes take into account exports on to other Commonwealth countries in our dataset. A widely used measure of diversification of the export basket is Hirschman's (1945) commodity concentration index (CCI), which is defined as follows:

$$CCI^h = \left[\sum_k \left(\alpha_{kj} \right)^2 \right]^{1/2}$$

where α_{kj} stands for the share of commodity-k in total exports of country-h to the destination country-j. For the world-level index, the destination country is world market and the corresponding index is denoted as CCI^W. Similarly, the intra-Commonwealth-level index is referred to as CCI^{CMW}, which is calculated with respect to the Commonwealth market.

Similarly, the geographical diversification of exports can be measured by geographical concentration index (GCI), defined as

$$GCI^h = [\Sigma_J (\beta_{jh})^2]^{1/2}$$

where β_{jh} is the share of total exports of country-h to partner country-j to total exports of country-h. Just like for the CCI, we calculate GCI^W and GCI^{CMW} where the partner is world and Commonwealth market, respectively.

The index is defined in such a way that higher value of the index corresponds to more concentration and less diversification.

UI: As first proposed by Antras et al. (2012), the measurement of UI stems from the identity below where, for each industry i∈{1, 2,….N}, the value of gross output (Y_i) equals the sum of its use as a final good (F_i) and its use as an intermediate input to other industries (Z_i):

$$Y_i = F_i + Z_i = F_i + \sum_{j=1}^{N} d_{ij} Y_j \quad (1)$$

where, in the last summation, d_{ij} is the dollar amount of sector i's output needed to produce US$1-worth of industry j's output. Iterating this identity, one can express industry I's output as an infinite sequence of terms that reflect the use of this industry's output at different positions in the value chain, starting with final use.

$$Y_i = F_i + \sum_{j=1}^{N} d_{ij} F_j + \sum_{j=1}^{N} \sum_{k=1}^{N} d_{ik} d_{kj} F_j + \sum_{j=1}^{N} \sum_{k=1}^{N} \sum_{l=1}^{N} d_{il} d_{lk} d_{kj} + F_j + ... \quad (2)$$

Building on this identity, one may compute the (weighted) average position of an industry's output in the value chain, by multiplying each of the terms in (2) by their distance from final use plus one and dividing by Y_i:

$$U_{i1} = 1.\frac{F_i}{Y_i} + 2.\frac{\sum_{j=1}^{N} d_{ij} F_j}{Y_i} + 3.\frac{\sum_{j=1}^{N} \sum_{k=1}^{N} d_{ik} d_{kj} F_j}{Y_i} + 4.\frac{\sum_{j=1}^{N} \sum_{k=1}^{N} \sum_{l=1}^{N} d_{il} d_{lk} d_{kj} F_j}{Y_i} + ... \quad (3)$$

It is clear that $U1i \geq 1$ and that larger values are associated with relatively higher levels of upstreamness of industry *i*'s use. Provided $\sum d_{ij}$, ($i = 1$ to N), is <1 for all j (a natural assumption), the numerator of the above measure equals the i-th element of the $N \times N$ 1 matrix $[I - D]$-2 F, where D is an $N \times N$ Input-Output matrix whose (i, j)-th element is d_{ij}, and F is a column matrix with F_i in row i.

Using annual input-output tables, we calculate, for the first time, the UI of the 26 industry groups for all 43 countries for the years 1990–2016. This dataset is unique, and may be used for several other purposes, not restricted to the analysis done in the current paper.

Based on the industry UIs above, we calculate the average upstreamness of total exports of all 43 countries as a weighted average. The weights attached to each industry UI are the share of that industry's exports in total exports of a particular country. This exercise is done at two levels, 'world' and 'intra-Commonwealth'. In the world version, the share of the industry's export to the rest of the world is taken as weight. For intra-Commonwealth, the share of the industry's exports to total exports within the Commonwealth countries is taken as weight. It may be noted that the ED and UI indices are calculated at both intra- and extra-Commonwealth levels. The following notations are self-explanatory: CCI^{W}, CCI^{CMW}, GCI^{W}, GCI^{CMW}, UIW and UI^{CMW}.

GVC: For the 43 countries, GVC is derived from the United Nations Conference on Trade and Development (UNCTAD)-Eora annual database for the period 1990-2016. It is defined as the ratio of DVX (indirect domestic value added) plus FVA (foreign value added) divided by gross exports.

3. Summary statistics

Our data for the calculation of ED come from the World Bank's World Integrated Trade Solution (WITS) data. Standard International Trade Classification (SITC) revision 1 data at 4-digit disaggregation level have been employed for the present purpose, given the longer span of availability over other classifications.[3] The data for UI and GVC, as stated earlier, come from the UNCTAD-Eora database.

Next, we briefly discuss the sources of the control variables of our econometric investigation. As a proxy for human capital formation (HC), we consider mean years of schooling, calculated in terms of average number of years of education received by people ages 25 and older in their lifetime based on education attainment levels of the population. This indicator has been used in the calculation of the Human Development Index (HDI) since 2010 as one of two education indicators (UNDP, 2010, p. 224).

The following data are collected from World Bank's World Development Indicators (WDI).

First, gross capital formation (formerly gross domestic investment), as a percentage of GDP, (GCF) consists of outlays on additions to the fixed assets (which include land improvements, plant,

machinery and equipment purchases; and the construction of roads, railways, schools, offices, hospitals, private residential dwellings and commercial and industrial buildings of the economy plus net changes in the level of inventories). Net acquisitions of valuables are also considered.

Second, the growth rate of GDP per capita (GDPGR) is the annual percentage change of GDP (expressed in constant currency) divided by mid-year population.

Third are tariff data (TARIFF), for which we use weighted mean applied tariff. This is the average of effectively applied rates weighted by the product import shares corresponding to each partner country. In case such an effectively applied rate is unavailable, the most favoured nation rate is used.

Fourth, foreign direct investment (FDI) shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP. It is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital.

Fifth, the trade openness index (TOI) is calculated as the ratio of a country's total trade, the sum of exports plus imports, to the country's GDP = (Exports + Imports)/(Gross Domestic Product). Data are in constant 2010 US dollars.

Table 1 provides summary statistics of the variables used in the paper.

Annex Tables A.1–A.7 provide Commonwealth country classification-wise summary statistics along with the year and country where maximum and minimum values were found, both country and year wise. Annex Table A8 shows the average index values in 2000, 2005, 2010 and 2015 (CCI, GCI, UI both world and Commonwealth and GVC) normalised with respect to their respective 2000 values. Since we are normalising the index values for other years by dividing by their 2000 values, the 2000 value is unity for all variables. The idea is to evaluate the change in index values over five-year intervals across different country groups. Table A8 reveals that GVC compared with 2000 has increased continuously for all the country groups. UI values have slightly reduced since 2000, implying that countries are gradually becoming more downstream. The only exception is the small states group, which has experienced a slight increase in UI^{W} value. However, the movement of export product and destination diversification over time is not clear cut. Mostly, the four ED index values have declined as compared with 2000, implying more diversification over time. The exceptions are small island developing states (SIDS), small states (for CCI) and LDCs (for GCI^{CMW}).

Annex Tables A9–A12 show the index values in 2000, 2005, 2010 and 2013 (CCI, GCI, UI both intra- and extra-Commonwealth and GVC). Table A12 shows the UI values across sectors for all countries in 2013. We choose 2013 as the latest year to demonstrate the index values because these show the largest data availability.

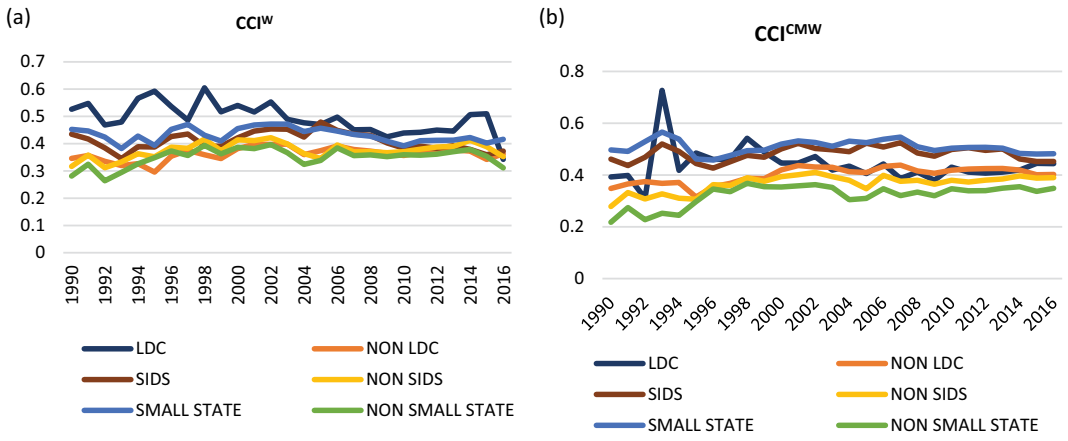
Table 1. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	930	0.3895744	0.1811809	0.0294526	0.9935581
CCI^{CMW}	928	0.4104908	0.2105626	0.0210482	1
GCI^{W}	931	0.4017078	0.1546628	0.1873876	0.9742625
GCI^{CMW}	930	0.5891228	0.1607534	0.2990755	0.9887363
UI^{W}	1,118	2.144027	0.5525874	0.6969979	6.35455
UI^{CMW}	1,118	2.076878	0.4186781	0.4915661	4.66977
GVC	1,161	2.10e+07	6.57e+07	0	5.55e+08
GDPGR	1,161	2.104547	4.135585	−47.50331	37.53553
TARIFF	728	8.695261	8.004897	0	91.27
GCF	999	23.06653	7.591303	−2.424358	58.18793
HC	1,103	7.109248	2.96247	0.8	13.3
TOI	865	0.8188661	0.6304539	0.0462638	3.956673
FDI	1,147	5.86605	22.52265	−43.24448	451.7155
REER	756	104.6379	26.55649	46.01807	275.2927

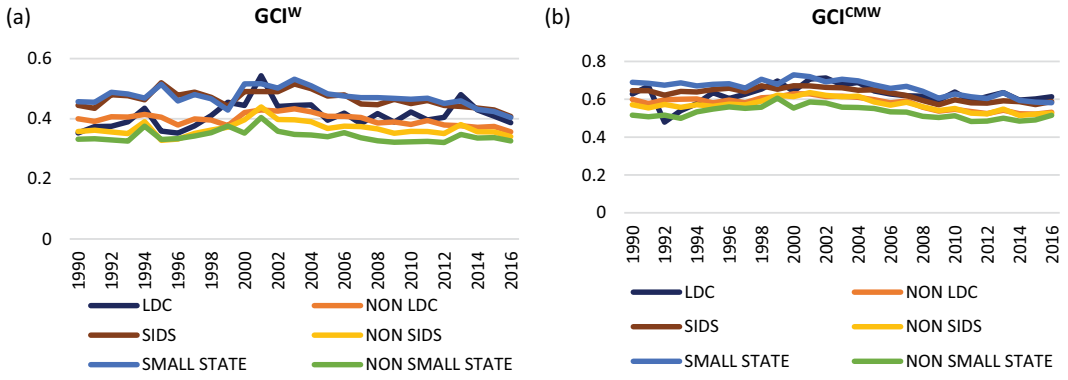
Year-wise data for the same are also available from the authors; they are not reported here in the interest of space.

The following set of graphs shows the evolution of average CCI^{W}, CCI^{CMW}, GCI^{W}, GCI^{CMW}, UI^{W}, UI^{CMW} and GVC for six Commonwealth country groups: LDC, non-LDC, SIDS, non-SIDS, small states and non-small states. Figures 1–4 reveal that ED by commodity is lowest for LDCs, followed by small states and SIDS. But the intra-Commonwealth index for LDCs improved significantly during 1995–2010 and stagnated thereafter. Intra-Commonwealth diversification by destination, however, improved across all country groups from 2000, implying a definite impact of Commonwealth heritage for intra-Commonwealth trade. Next is a very significant rise in GVC for non-small states, non-SIDS and non-LDCs. For LDCs, SIDS and small states, there has been practically

Figures 1a and 1b. CCI^{W} and CCI^{CMW} across country groups over time



Figures 2a and 2b. GCI^{W} and GCI^{CMW} across country groups over time



Figures 3a and 3b. UI^{W} and UI^{CMW} across country groups over time

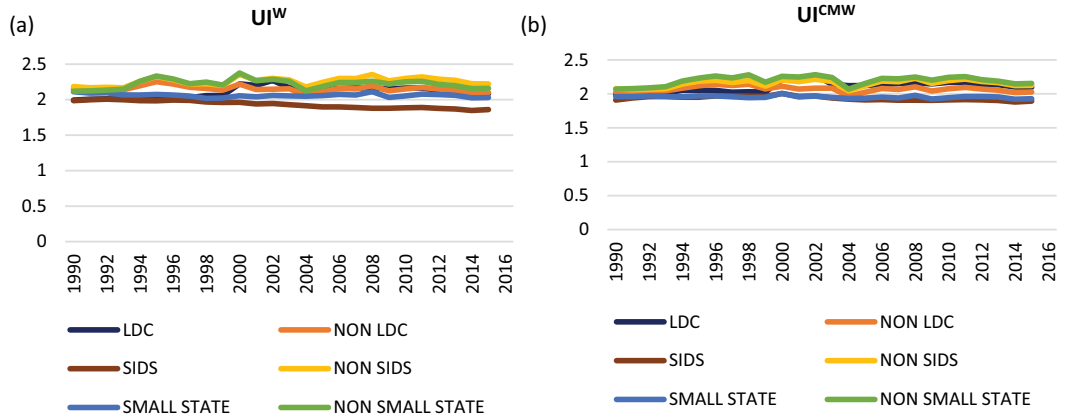
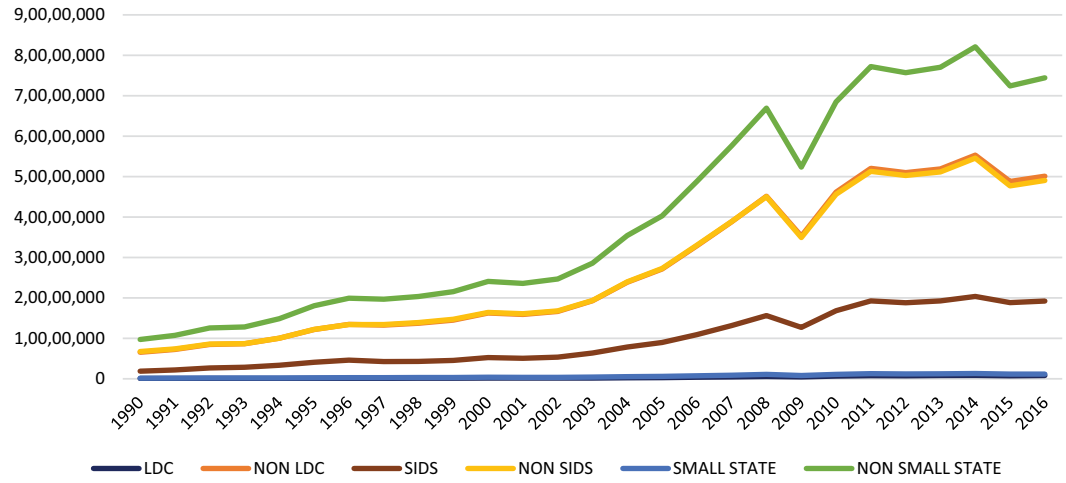


Figure 4. GVC across country groups over time



no increase in GVC. The pattern of average UI is not as dramatic as that of GVC, but overall reveals a slight downward trend, implying that exports from Commonwealth countries are on average moving slightly downstream (closer to the final consumer).

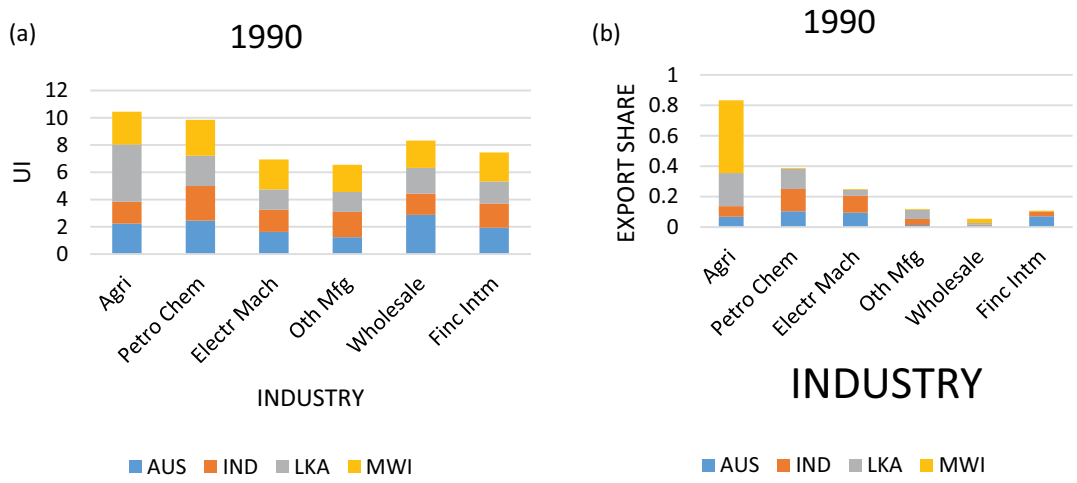
At the end of the Annex, we provide a country-wise depiction of the indices for sharper focus, bringing out country-specific changes over time that the average depiction above may partly blur. The countries were grouped according to their income status.

- For high-income group 1, CCI is less than GCI, implying greater commodity diversification, except The Bahamas. Antigua and Barbuda shows abrupt movements. The indexes also show a spike during the crisis years. Overall, more stability exists in ED intra-Commonwealth.
- For high-income group 2, the UK shows a nearly flat index throughout, while Canada shows some fluctuations in CCI, intra-Commonwealth. With respect to the world, CCI for the UK rises over time (less diversification), whereas Canada has very high GCI.
- In high-income group 3, Seychelles depicts large fluctuations, along with Singapore (whose diversification seems to have gone up during the crisis years).
- In middle-income group 3, Namibia and Samoa stand out as exceptions in improving their ED both intra-Commonwealth and otherwise.
- Similar comparisons can be made for the other income groups. We notice greater fluctuations in ED at both levels, implying, among other things, greater variability (uncertainty). For lower-income group 1, India shows high stability in ED whereas Cameroon shows significant improvement. For the lower-income group 2, Nigeria stands out as an exception where CCI is higher than GCI, implying greater diversification by destination, not commodities.
- For low-income group 3, ED varies widely over time for both. For group 2, Uganda shows a trend reversal with respect to the world after 2010.

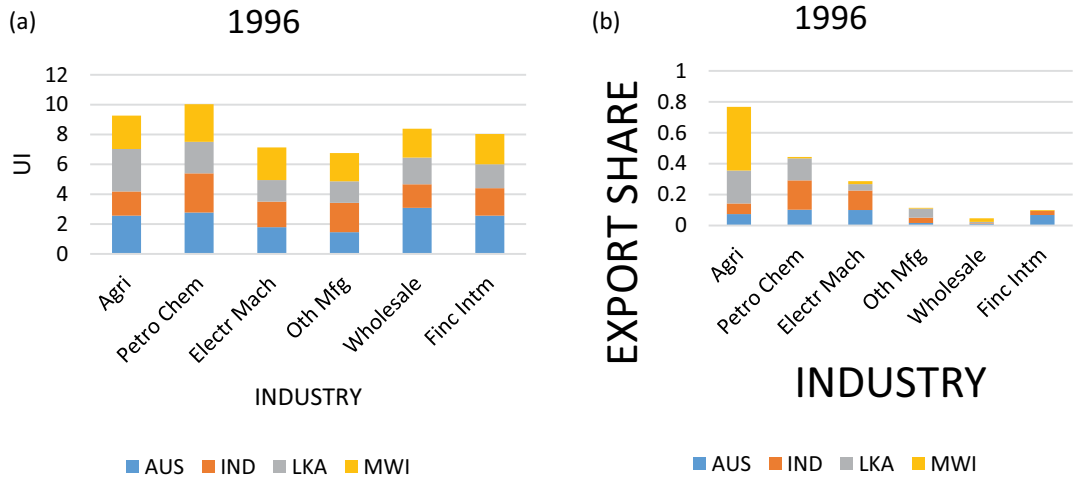
In Figures 5–9, we provide a visual description of UI. It may be noted that there are 26 UI for each of the 43 countries for 26 years: a set of 29,068 numbers. This complete dataset is available from the authors on request. Out of the 26 industry groups, we selected Agriculture; Petroleum, chemical and non-metallic mineral products; Electrical and machinery goods; Other manufacturing; Wholesale trade; and Financial intermediation and Business activities (a blend of manufacturing and service-related industry groups), and the years 1990, 1996, 2002, 2009 and 2015. On each graph, each column represents an industry group. It is split into four parts, reflecting the values of the UI of each of four selected countries, Australia, India, Sri Lanka and Malawi.

With the caveat that the full set of 43 countries and 26 industries may reveal a different picture, these countries of different income categories reveal the highest UI scores for Petroleum, chemical and non-metallic minerals, while Other manufacturing shows some of the lowest scores.

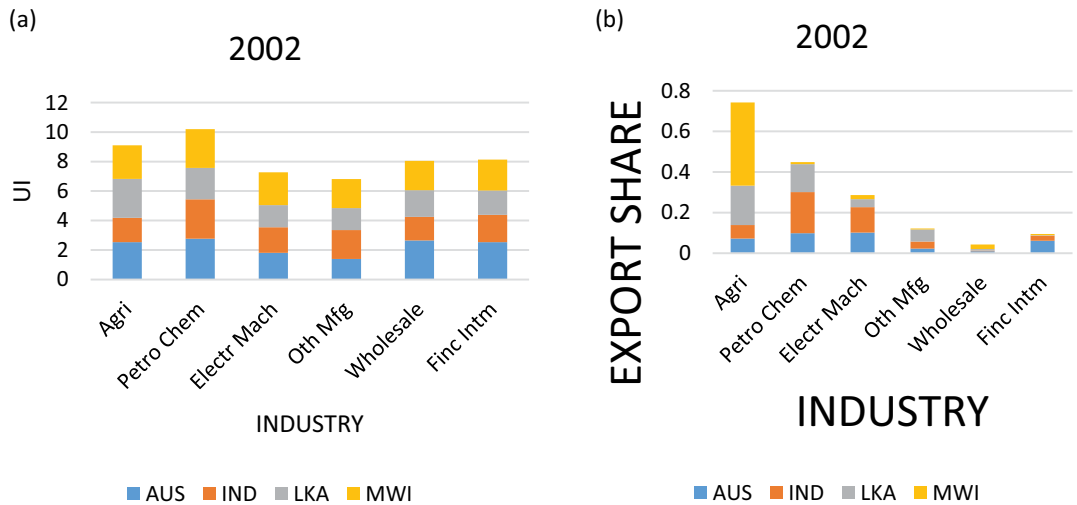
Figures 5a and 5b. UI across industries in 1990 and export share of industries in 1990



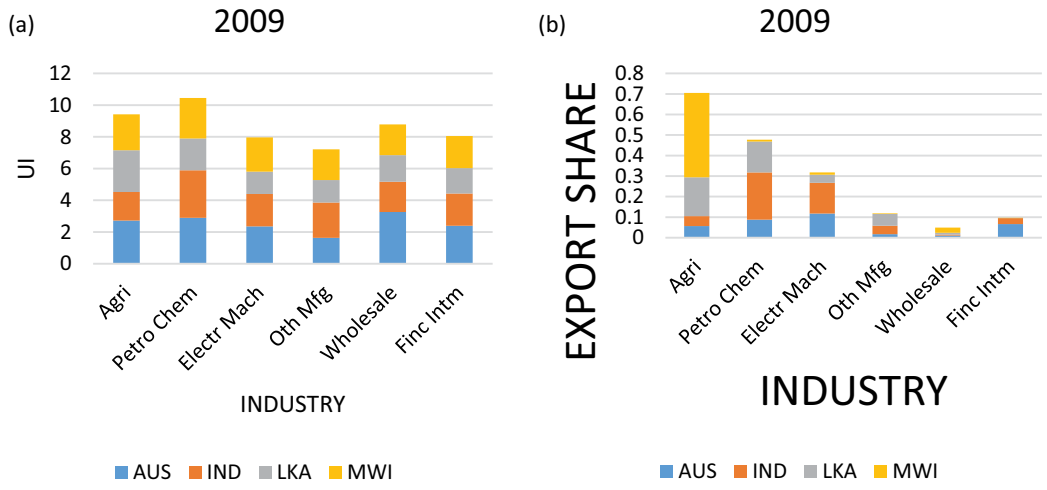
Figures 6a and 6b. UI across industries in 1996 and export share of industries in 1996



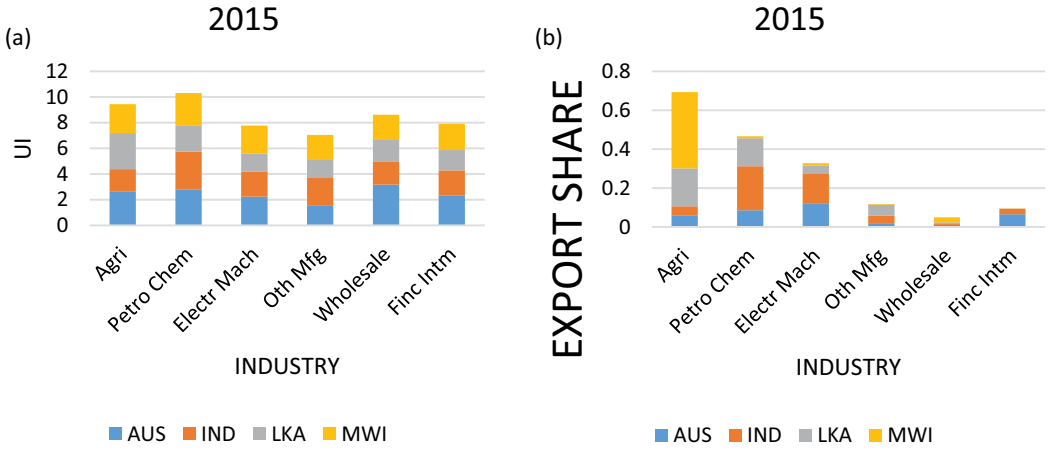
Figures 7a and 7b. UI across industries in 2002 and export share of industries in 2002



Figures 8a and 8b. UI across industries in 2009 and export share of industries in 2009



Figures 9a and 9b. UI across industries in 2015 and export share of industries in 2015



Note: Agri - Agriculture
Petro Chem.- Petroleum, Chemical and Non-Metallic Mineral Products
Electr Mach- Electrical and Machinery
Oth Mfg.- Other Manufacturing
Wholesale - Wholesale Trade
Finc Intm.- Financial Intermediation and Business Activities

4. Econometric methodology

Empirical models are estimated to examine the determinants of ED and UI using the Generalised Method of Moments (GMM) technique at both the world and the intra-Commonwealth levels for commonalities and differences. To investigate the impact of countries' relative position in the supply chain (that is, whether a country is more upstream or downstream) and its participation in a GVC on its export diversification we estimate the following cross-country equation:

$$ED_{ct} = \alpha_0 + \alpha_1 ED_{c\,t-k} + \alpha_2 UI_{ct} + \alpha_3 GVC_{ct} + \alpha_4 X_{ct} + \eta_c + u_{ct} \quad (4)$$

where ED_{ct} is the export diversification in country-c at time t, $ED_{c\,t\text{-}k}$ is the k years lag of ED_{ct}, UI_{ct} is the index of upstreamness

constructed following Antras et al. (2012) of country-c at time t, GVC_{ct} is the measure of GVC of country-c at time t, X_{ct} is the set of potential explanatory variables like HC in years of schooling, GCF as a percentage of GDP, GDP growth rate (per capita), tariff, trade openness and real effective exchange rate. Please note that not all the explanatory variables are included in one model. Rather, we estimate alternate specifications to avoid the problem of multicollinearity. The term η_c is an unobserved country-specific time-invariant effect. For example, the impacts of geography and the role of institutions do not change much over time but vary across countries. u_{ct} is the random disturbance term that varies across both countries and years and is assumed to be uncorrelated over time.

Since our dataset contains both time dimension and cross-section units it warrants a panel data estimation. But with the inclusion of the lagged values of the dependent variable in the set of explanatory variables, static panel data estimation techniques such as fixed or random effects are known to produce biased and inconsistent estimates for the following two reasons.

First, in the dynamic framework, the unobserved effect is correlated with the explanatory variables as $E [\eta_c ED_{c\ t-k}] = E [\eta_c (\alpha_1 ED_{c\ t-2k} + \alpha_2 ED_{c\ t-k} + \eta_c + u_{c\ t-k})] \neq 0$ where the last inequality follows from the assumption that at least $E (\eta_c^2) \neq 0$.

Second, cross-section regression cannot take into account the problem of endogeneity of the explanatory variables. Many of the variables in our model such as GCF and/or HC are endogenous.

This problem of endogeneity can be tackled by using strictly exogenous instruments. However, for practical purposes it is very difficult to find suitable instruments that are highly correlated with the dependent variable but uncorrelated with the explanatory variables. Hence, we resort to the GMM dynamic panel estimation technique developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The estimation process involves taking first differences of the regression equation, which removes the unobserved country-specific time-invariant effects so there is no omitted variable bias. Thus, the following general equation is estimated (with four variants depending on the ED index as specified earlier):

$$\begin{aligned} ED_{ct} - ED_{c\ t-k} &= \alpha_1(Ed_{c\ t-k} - ED_{c\ t-2k}) \\ &+ \alpha_2(UI_{ct} - UI_{c\ t-k}) + \alpha_3(GVC_{ct} - GVC_{c\ t-k}) \\ &+ \alpha_4(X_{ct} - X_{c\ t-k}) + (u_{ct} - u_{c\ t-K}) \end{aligned} \quad (5)$$

Among the advantages of using this methodology is that the lagged values of the explanatory variables can be used as instruments. This deals with the endogeneity problem. Second, in cross-country regression equation, first differencing eliminates the effect of the possible time-invariant country-specific variables, like rule of law, a country's ethnic makeup or its colonial history.

To investigate the dynamic specification of the cross-country growth equation, the system GMM method developed by Arellano and Bover (1995) is employed. Two types of GMM estimators have frequently been used for cross-country regressions. The first-difference GMM estimator, developed by Arellano and Bond (1991), uses first-differenced equations with suitable lagged levels as instruments. Second, the system GMM estimator, developed by Arellano and Bover (1995) and Blundell and Bond (1998), uses in addition equations in levels with lagged differences as instruments. Blundell and Bond (1998) pointed out that, when explanatory variables have a longer persistence effect, their lagged levels may be very weak instruments for the first-differenced equations. To solve the weak instruments problem, they suggest use of an additional set of first-differenced instruments and equations in levels to make the system GMM estimator more efficient. The consistency of the GMM estimator depends on whether the lagged values of the dependent and the other explanatory variables are valid instruments. To test the regression diagnostics, we use two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments used in the estimation process. The null hypothesis is that the instrumental variables are uncorrelated with the error term, and consequently they are valid instruments. It is a test of the over-identifying restrictions asymptotically distributed as chi-squared. If the null hypothesis is not rejected, then the instruments pass the test and are valid by this criterion.

The second test examines the hypothesis that the error term is not serially correlated. Since the estimation technique uses first difference it is likely that first-order serial correlation will be found. Therefore, the relevant specification test to ensure the error terms to be serially uncorrelated is to test for second-order serial correlation in the error term.

5. Estimation results

We have four versions of ED indexes, two each for commodity- and destination-based differentiated as world and intra-Commonwealth. We first test the pairwise correlation between these four indexes. The results, in Table 2, indicate positive but weak correlation between pairs, implying they warrant separate estimation models.

We estimated four variants of the general estimation equation (1) specified above. They are as follows.

$$CCI_{ct}^{W} = \alpha_0 + \alpha_1 CCI_{ct-1}^{W} + \alpha_2 GDPgr_{ct} + \alpha_3 GCF_{ct} + \alpha_4 HC_{ct} + \alpha_5 UI_{ct}^{W} + \alpha_6 GVC_{ct} + \eta_c + u_{ct} \quad (6)$$

$$CCI_{ct}^{CMW} = \alpha_0 + \alpha_1 CCI_{ct-1}^{CMW} + \alpha_2 GDPgr_{ct} + \alpha_3 GCF_{ct} + \alpha_4 HC_{ct} + \alpha_5 UI_{ct}^{CMW} + \alpha_6 GVC_{ct} + \eta_c + u_{ct} \quad (7)$$

$$GCI_{ct}^{W} = \alpha_0 + \alpha_1 GCI_{ct-1}^{W} + \alpha_2 GDPgr_{ct} + \alpha_3 GCF_{ct} + \alpha_4 HC_{ct} + \alpha_5 UI_{ct}^{W} + \alpha_6 GVC_{ct} + \eta_c + u_{ct} \quad (8)$$

$$GCI_{ct}^{CMW} = \alpha_0 + \alpha_1 GCI_{ct-1}^{CMW} + \alpha_2 GDPgr_{ct} + \alpha_3 GCF_{ct} + \alpha_4 HC_{ct} + \alpha_5 UI_{ct}^{CMW} + \alpha_6 GVC_{ct} + \eta_c + u_{ct} \quad (9)$$

Table 2. ED correlation matrix

	CCI^{W}	CCI^{CMW}	GCI^{W}	GCI^{CMW}
CCI^{W}	1			
CCI^{CMW}	0.8*** (0.00)	1		
GCI^{W}	0.28 (0.00)	0.35*** (0.00)	1	
GCI^{CMW}	0.38*** (0.00)	0.54*** (0.00)	0.47*** (0.00)	1

Note: 1. P-values in parentheses. 2. *** Denotes significance at 1% level.

CCI^{W} and CCI^{CMW} represent the commodity ED indexes at the 'world' and 'intra-Commonwealth' levels as explained earlier. Similarly, GCI^{W} and GCI^{CMW} represent the respective destination-based ED indexes, and, UI^{W} and UI^{CMW} represent the respective UI of exports at the world and intra-Commonwealth levels. Tables 3–5 summarise the results.

The GMM dynamic panel estimation results reported in Table 3 reflect the effect of changes in the lagged dependent variable and various explanatory variables previously described. Since we are estimating first-difference regression equation the estimations do not bring forth the effect of any time-invariant omitted variable, including economic geography, institutional quality, rule of law or colonial heritage. One period lag of the dependent variable and all the explanatory variables have been used as instruments. This instrumentation strategy solves the problem of endogeneity of the explanatory variables. In all the estimations, the Sargan tests for over-identifying restrictions give p-values indicating the validity of the instruments. Also, the p-values of AR (2) test imply the error terms are serially uncorrelated in second order. Thus, the instruments are not endogenous.

It is found that the coefficients of lagged concentration index are highly significant at 1 per cent in all the estimations establishing the requirement of a dynamic framework.

UI is significant and positive across all the three model specifications. This implies that higher levels of upstreamness are associated with higher values of export concentration (less diversified exports) by both commodity and destination. One of the main reasons for this may be that countries that mainly export primary commodities (unprocessed), minerals, metals and other raw materials – which are upstream goods – end up having a less diversified export basket by both commodity and

Table 3. GMM dynamic panel estimation results of ED

Explanatory variables	Dependent variable (Y_t)			
	(1) CCI^W	(2) CCI^{CMW}	(3) GCI^W	(4) GCI^{CMW}
Y_{t-1}	0.79*** (0.00)	0.77*** (0.00)	0.70*** (0.00)	0.80*** (0.00)
GDPGR	–0.0008*** (0.00)	0.002*** (0.00)	–0.0003** (0.01)	0.0004 (0.26)
GCF (as % of GDP)	0.0009*** (0.00)	–0.00007 (0.81)	0.002*** (0.00)	0.003*** (0.00)
HC	0.004*** (0.00)	0.009*** (0.001)	–0.00008 (0.96)	0.004* (0.05)
GVC	–2.01e-10 (0.09)	–4.87e-10*** (0.002)	–7.20e-11*** (0.00)	–1.61e-10* (0.05)
UI^W	0.03*** (0.00)		0.03*** (0.00)	
UI^{CMW}		0.02*** (0.00)		0.02*** (0.04)
Sargan test	0.89	0.91	0.93	0.85
AR(2)	0.59	0.39	0.66	0.51
No. of instruments	53	53	53	53
No. of obs	710	711	712	712

Note: 1. P-values in parentheses. 2. *** Denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

Table 4. GMM dynamic panel estimation results of ED with TARIFF as explanatory variable

Explanatory variables	Dependent variable (Yt)			
	(1) CCI^W	(2) CCI^{CMW}	(3) GCI^W	(4) GCI^{CMW}
Y_{t-1}	0.85 *** (0.00)	0.84 *** (0.00)	0.73 *** (0.00)	0.69 *** (0.00)
GDPGR	–0.0004 *** (0.14)	0.001*** (0.00)	7.83e-06 (0.96)	–0.0005** (0.03)
GCF (as % of GDP)	0.003*** (0.00)	–0.0002 (0.61)	0.002*** (0.00)	0.002*** (0.00)
HC	–0.001 (0.56)	0.006** (0.005)	0.003** (0.04)	0.008*** (0.001)
GVC	–1.51e-10 (0.22)	–3.36e-10** (0.05)	–6.52e-11** (0.01)	–8.19e-11 (0.40)
UI^W	0.009 (0.2)		0.02*** (0.00)	
UI^{CMW}		0.02*** (0.02)		0.03** (0.02)
TARIFF	0.0002 (0.49)	0.0007*** (0.00)	–0.00004 (0.75)	0.00002 (0.96)
Sargan test	0.92	0.96	0.99	0.91
AR (2)	0.53	0.98	0.32	0.58
No. of instruments	54	54	54	54
No. of observations	538	540	540	540

Note: 1. P-values in parentheses. 2. *** Denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

Table 5. GMM dynamic panel estimation results of ED with TOI as explanatory variable

Explanatory variables	Dependent variable (Y_t)			
	(1) CCI^{W}	(2) CCI^{CMW}	(3) GCI^{W}	(4) GCI^{CMW}
Y_{t-1}	0.89 *** (0.00)	0.75 *** (0.00)	0.74 *** (0.00)	0.75 *** (0.00)
GDPGR	0.0001 (0.72)	0.002*** (0.07)	0.0003* (0.07)	0.0006 (0.2)
GCF (as % of GDP)	0.0007*** (0.00)	0.001*** (0.00)	0.002*** (0.00)	0.003*** (0.00)
HC	0.0002 (0.92)	0.01*** (0.00)	0.0008 (0.42)	0.009*** (0.00)
GVC	–3.88e-11 (0.65)	–4.15e-10** (0.01)	–2.50e-11 (0.29)	–5.30e-10* (0.00)
UI^{W}	0.005* (0.087)		0.02** (0.02)	
UI^{CMW}		0.01** (0.00)		0.007 (0.35)
TOI	0.008 (0.45)	–0.006 (0.47)	–0.005 (0.15)	0.006 (0.52)
Sargan test	0.98	0.97	0.94	0.94
AR (2)	0.36	0.35	0.79	0.80
No. of instruments	54	54	54	54
No. of observations	606	607	608	608

Note: 1. P-values in parentheses. 2. *** Denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

destination. Usually, these are known to be low-income countries. But a possible counter argument relates to the export of technology (e.g. the design and blueprint of an iPhone), which is a primary input (and highly valuable) whose supply is dominated by advanced economies.

GVC (participation in global value chains) is significant and negative across all the four models, implying that higher values of GVC are associated with lower values of the ED index, implying greater diversification. Taken together with the finding on UI, a plausible explanation comes from the value added of trade: upstream exports may be less in volume but high in value added for the richer countries.

Both HC and GCF are positively and significantly related to ED (except in the CCI^{CMW} model for GCF, and the GCI^{W} model for HC, where the respective coefficients are insignificant, refer to columns 2 and 3 of Table 2). That means greater human capital accumulation and physical capital formation may lead to a more specialised export structure. This finding may be related to the empirical evidence of non-linearity between export product diversification and economic growth, implying that developing countries benefit from diversification whereas developed countries gain from specialisation (Lederman and Maloney, 2007; Hesse, 2008; Aditya and Acharyya, 2013).

For robustness, we introduce a series of additional potential explainers of ED, starting with TARIFF and TOI (defined earlier). The idea is to assess the impact of trade liberalisation carried out by developing countries since the 1990s and that gained momentum after formation of the World Trade Organization.

Table 4 reports the estimation result with average tariff rates (defined above) as an explanatory variable and obtains the following results. TARIFF is positively significant only for the CCI^{CMW} model implying that, for intra-Commonwealth trade, TARIFF leads to greater export product concentration. Theoretical support for this result can be drawn from Krugman

(1984), who argues that tariff protection may enable the domestic economy to exploit economies of scale. This may lead to a more specialised export structure. This has an important policy implication regarding the reduction of tariffs for intra-Commonwealth trade.

Next we introduce TOI, the result of which is reported in Table 5. However, our econometric exercise reveals TOI to be insignificant for all the ED variables. In both these specifications reported in Tables 3 and 4 our variable of interest UI remains positively significant apart from in CCI^{W} with TARIFF (column 1, Table 4) and GCI^{CMW} with TOI (column 4, Table 5).

It is worth mentioning that the present study is not limited to identification of the determinants of ED. We make a novel attempt by examining the probable explanations of a country's relative position in the supply chain, which in turn is relevant for a more diversified export pattern, both product- and destination-wise. We carry out the analysis for two types of country UI – UI^{W} and UI^{CMW}, the respective upstreamness of exports at the world and intra-Commonwealth levels. Historically, a country's position in the supply chain may matter for its current position. These dynamics can be captured by adding lagged values of the dependent variable. Among other potential determinants of UI, we evaluate the role of human capital, investment, FDI inflows and economic growth.

The estimated equations are as follows:

$$UI_{ct}^{W} = \alpha_0 + \alpha_1 UI_{ct-1}^{W} + \alpha_2 HC + \alpha_3 GDPgr + \alpha_4 GCF + \alpha_5 FDI + \eta_c + u_{ct} \quad (10)$$

$$UI_{ct}^{CMW} = \alpha_0 + \alpha_1 UI_{ct-1}^{CMW} + \alpha_2 HC + \alpha_3 GDPgr + \alpha_4 GCF + \alpha_5 FDI + \eta_c + u_{ct} \quad (11)$$

Following the GMM dynamic panel Arellano-Bover estimation technique detailed in the previous section, we test for the determinants of UI, the results of which are reported in Tables 6 and 7. In all the models, the Sargan test of over-identifying restrictions is satisfied, implying that lagged values of the variables

Table 6. GMM dynamic panel estimation results of UI^{W}

Explanatory variables	Dependent variable (Y_t): UI^{W}			
	(1)	(2)	(3)	(4)
Y_{t-1}	0.89 *** (0.00)	0.82 *** (0.00)	0.88 *** (0.00)	1.01 *** (0.00)
GDPGR	0.001 *** (0.00)	0.004 *** (0.00)	0.001 *** (0.0)	–0.0007 (0.19)
GCF (as % of GDP)	0.001 *** (0.00)	0.004*** (0.00)	0.002 *** (0.00)	–0.00001 (0.97)
HC	0.03 *** (0.00)	0.04*** (0.00)	0.04*** (0.00)	0.004 (0.29)
FDI (as % of GDP)	–0.0001*** (0.00)	–0.0007*** (0.00)	–0.0001*** (0.00)	0.0001** (0.04)
TARIFF		0.00003 (0.97)		
TOI			–0.07*** (0.00)	
REER				–0.0004 * (0.07)
Sargan test	0.87	0.87	0.94	0.99
AR(2)	0.40	0.98	0.40	0.70
No. of instruments	52	53	53	53
No. of obs	870	592	733	531

Note: 1. P-values in parentheses. 2. *** Denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

Table 7. GMM dynamic panel estimation results of UI^{CMW}

Explanatory variables	Dependent variable (Y_t): UI^{CMW}			
	(1)	(2)	(3)	(4)
Y_{t-1}	0.83 *** (0.00)	0.60 *** (0.00)	0.83 *** (0.00)	0.98*** (0.00)
GDPGR	0.002*** (0.00)	0.004 *** (0.00)	0.002 *** (0.0)	–0.0001 (0.68)
GCF (as % of GDP)	0.004 *** (0.00)	0.01 *** (0.00)	0.006 *** (0.00)	0.001** (0.009)
HC	0.04 *** (0.00)	0.07*** (0.00)	0.04*** (0.00)	–0.001 (0.79)
FDI (as % of GDP)	–0.0002 *** (0.00)	–0.001*** (0.00)	–0.0002 *** (0.00)	0.00001 (0.86)
TARIFF		0.01*** (0.00)		
TOI			–0.09 *** (0.00)	
REER				–0.0007*** (0.00)
Sargan test	0.81	0.82	0.92	0.99
AR(2)	0.89	0.73	0.92	0.82
No. of instruments	52	53	53	53
No. of observations	870	592	733	531

Note: 1. P-values in parentheses. 2. *** Denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

used as instruments are valid to take care of the problem of endogeneity. The p-values of the AR (2) test indicate there is no second-order auto correlation in the error terms.

As part of our robustness check analysis, we introduce relevant variables of trade liberalisation such as TOI, tariff and real effective exchange rate (REER) in alternate models. It should be noted that there is not much difference in the estimation results for these two types of index presented in Tables 6 and 7. FDI inflows are negatively significant (apart from the GCI^{CMW} model, column 4 of Table 6), which implies greater FDI inflow into the downstream sectors. This finding would suggest a detailed sector-level analysis using the within-country UI values and relating these with the sectoral variations in FDI inflows.

The measures of trade liberalisation, such as tariff, REER and TOI, are negatively significant[4] in most of the specifications, implying their association with greater downstreamness. That means a more liberalised open economy is helpful in promoting the more downstream industries. A reduction in tariff rates encourages the import of intermediate inputs to produce the final consumer good required by the downstream production line, whereas a more protected environment is conducive for the upstream sectors to flourish.

In contrast the analysis reveals that more upstream sectors require greater physical and human capital, as indicated by the positive significance of the GCF and HC variables. This has a huge policy implication for the developing Commonwealth countries, which are capital (both physical and human)-constrained and experience insufficient investment. This particular finding suggests resource-constrained countries should undertake appropriate policies to gain expertise in more of the downstream sectors.

Our analysis further finds that a faster GDPGR has positive significant impacts on upstreamness. When REER is considered, GDPGR and HC become insignificant for both of the UI (column 4 of Tables 6 and 7) whereas GCF loses significance for the UI^{W} model (column 4 of Table 6) and FDI in the UI^{CMW} model (column 4 of Table 7).

6. Concluding remarks

ED is an important policy concern for Commonwealth countries in relation to stability of export earnings and resilience to external shocks. At the same time, recent discourse on trade policy focuses primarily on countries' involvement in GVCs – a phenomenon caused by the fragmentation of production processes and the business strategies of multinational companies of procuring different parts of a product from different destinations at the most competitive rate. In developing countries in particular, efforts are made to increase participation in GVCs. Secondary questions about the effect of GVC participation on export diversification, job creation and domestic value added (hence on growth rates) are not adequately addressed.

We first note that, in general, destination-based ED is higher for non-small and non-LDC countries in the Commonwealth, compared with their commodity-based ED, implying less geographic diversification but more commodity diversification. The opposite seems true of countries belonging to the other groups, although their values tend to fluctuate more and do not reveal clear trends. This finding ought to be taken together with the fact that the rate of growth of GDP has a negative sign in all the ED models, implying that higher growth rates (not *levels*) are associated with greater diversification. This brings us again to the 'non-linearity' between income (developed countries having higher income levels) and diversification, and the fact that, generally speaking, low-income countries have higher growth rates (starting from a lower base).

As far as the upstreamness index is concerned, in the (selective) snapshot for Malawi in agriculture, for example, the share of export of this sector in relatively higher than its upstreamness property. The country has a negligible export share in the relatively manufacturing- and services-oriented sectors. The opposite is true of the non-small and non-LDC countries. It may also be noted that the UI is relatively stable over time, but relative export shares show greater fluctuations. This is expected: the production process (particularly the role of intermediate inputs) is unlikely to vary too much over time, but the growing fragmentation of production and the flow of FDI affect the export basket significantly. The policy question is: where should FDI flow to impart stability in export earnings, raise them at the same time and also generate more employment? This issue requires detailed investigation at the Commonwealth country level.

This paper has produced a very large dataset, hitherto non-existent, on annual ED indexes of both kinds for the Commonwealth countries over a sufficiently long period of time. While the purpose of the paper was to find determinants of ED, the indexes themselves may be used for several other purposes, including their impact on the stability of export earnings, particularly for lower-middle- and low-income countries.

Additionally, the paper produced annual upstreamness indexes for the Commonwealth country industry groups for the first time. Viewing the effects of UI and GVC together raises important issues that require policy attention. GVC and UI influence ED very strongly, more so at the intra-Commonwealth level. Thus, is it sufficient to raise participation in GVCs; attention is also required to the exact position of especially the poorer country's exports. How do they affect broader development challenges such as job creation (for men and women separately) and carbon emission patterns?

Notes

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2 The countries for which sufficient data for the various indicators used in the empirical models are not

available are Dominica, Grenada, Kiribati, Maldives, Nauru, Saint Lucia, St Kitts and Nevis and St Vincent and the Grenadines, Solomon Islands, Tonga, Tuvalu and United Republic of Tanzania

3 We computed the CCI of India for 2010 by choosing rest of the world as a destination using both SITC and HS product classification. The corresponding values were very close, at 0.23 and 0.21, respectively, following the two classifications. Hence, we used SITC nomenclature instead of the HS code to obtain a longer time series.

4 In the UI^W model, the tariff rate has no impact (column 2, Table 6).

References

Acemoglu, D. and F. Zilibotti (1997) 'Was Prometheus Unbound by Chance? Risk Diversification and Growth'. *The Journal of Political Economy* **115**(4): 709–751.

Aditya, A. and R. Acharyya (2013) 'Export Diversification, Composition and Economic Growth: Evidence from Cross-Country Analysis'. *The Journal of International Trade and Economic Development* **22**(7): 959–992.

Agosin, M. R. (2007) 'Export Diversification and Growth in Emerging Economies'. Working Paper 233. Santiago de Chile: Departamento de Economía, Universidad de Chile.

Agosin, M. R., R. Alvarez and C. Bravo-Ortega (2011) 'Determinants of Export Diversification Around the World: 1962-2000'. *The World Economy* **35**(3): 295–315.

Antras, P. and D. Chor (2017) 'On the Measurement of Upstreamness and Downstreamness in Global Value Chains'. Working Paper, October. Cambridge, MA: NBER.

Antras, P., D. Chor, T. Fally and R. Hillberry (2012) 'Measuring the Upstreamness of Production and Trade Flows'. *American Economic Review* **102**(3): 412–416.

Arellano, M. and S. Bond (1991) 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations'. *The Review of Economic Studies*, **58**: 277–297.

Arellano, M. and O. Bover (1995) 'Another Look at the Instrumental Variable Estimation of Error Component Models'. *The Journal of Econometrics* **68**(1): 29–52.

Barro, R. and J. W. Lee (2000) 'International Data on Educational Attainment: Updates and Implications'. Working Paper 42. Cambridge, MA: Center for International Development, Harvard University.

Benguria, F. (2014) 'Imported Intermediate Inputs and Export Diversification in Low-Income Countries'. Paper presented at joint RES-SPR Conference on Macroeconomic Challenges Facing Low-Income Countries, Washington, DC, 30–31 January.

Blundell, R. and S. R. Bond (1998) 'Initial Conditions and Moment Restrictions in Dynamic Panel Data Model'. *The Journal of Econometrics* **87**: 115–143.

Hausmann, R., J. Hwang and D. Rodrik (2007) 'What You Export Matters'. *The Journal of Economic Growth* **12**(1): 1–25.

Hesse, H. (2008) 'Export Diversification and Economic Growth'. Working Paper 21. Washington, DC: Commission on Growth and Development, World Bank.

Hirschman, A. O. (1945) *National Power and the Structure of Foreign Trade*, University of California Press: Berkeley and Los Angeles.

Imbs, J. and R. Wacziarg (2003) 'Stages of Diversification'. *The American Economic Review* **93**(1): 63–86.

Jones, R. W. and H. Kierzkowski (2001) 'A Framework for Fragmentation', in Arndt, S. and H. Kierzkowski (eds) *Fragmentation: New Production Patterns in the World Economy*. Oxford: Oxford University Press.

Jones, R. W. and H. Kierzkowski (2005) 'International Fragmentation and the New Economic Geography'. *The North American Journal of Economics and Finance* **16**(1): 1–10.

Krugman, P. R. (1984) 'Import Protection as Export Promotion: International Competition in the Presence of Oligopoly and Economies of Scale', in Kierzkowski, H. (ed.) *Monopolistic Competition and International Trade*. Oxford: Oxford University Press.

Lederman, D. and W. F. Maloney (2007) 'Trade Structure and Growth', in Lederman, D. and W. F. Maloney (eds) *Natural Resources: Neither Curse nor Destiny*. Palo Alto, CA: Stanford University Press.

Prebisch, R. (1959) 'Commercial Policy in the Underdeveloped Countries'. *The American Economic Review* **49**(2): 251–273.

Rodrik, D. (2006) 'What's So Special about China's Exports?' Working Paper 11947. Cambridge, MA: MIT Press.

Singer, H. W. (1950) 'The Distribution of Gains between the Investing and Borrowing Countries'. *The American Economic Review* **40**(2): 473–485.

UNDP (United Nations Development Programme) (2010) *Human Development Report*. New York: UNDP.

Annex

Table A1a. Summary statistics of all Commonwealth countries

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	930	0.3895744	0.1811809	0.0294526	0.9935581
CCI^{CMW}	928	0.4104908	0.2105626	0.0210482	1
GCI^{W}	931	0.4017078	0.1546628	0.1873876	0.9742625
GCI^{CMW}	930	0.5891228	0.1607534	0.2990755	0.9887363
UI^{W}	1,118	2.144027	0.5525874	0.6969979	6.35455
UI^{CMW}	1,118	2.076878	0.4186781	0.4915661	4.66977
GVC	1,161	2.10e+07	6.57e+07	0	5.55e+08
GDPGR	1,161	2.104547	4.135585	−47.50331	37.53553
TARIFF	728	8.695261	8.004897	0	91.27
GCF	999	23.06653	7.591303	−2.424358	58.18793
HC	1,103	7.109248	2.96247	0.8	13.3
TOI	865	0.8188661	0.6304539	0.0462638	3.956673
FDI	1,147	5.86605	22.52265	−43.24448	451.7155
REER	756	104.6379	26.55649	46.01807	275.2927

Table A1b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Canada	1990	Nigeria	2000
CCI^{CMW}	Canada	2002	Vanuatu	1993
GCI^{W}	Cyprus	2015	Sierra Leone	2001
GCI^{CMW}	South Africa	2013	Lesotho	2000
UI^{W}	Kenya	2005	Nigeria	1995
UI^{CMW}	Kenya	2005	Nigeria	1995
GVC	Guyana	1990–2016	UK	2014
GDPGR	Rwanda	1994	Rwanda	1995
TARIFF	Singapore	2004	Nigeria	1995
GCF	Sierra Leone	1997	Mozambique	1999
HC	Mozambique	1990	Canada	2016
TOI	Zambia	1993	Singapore	2008
FDI	Cyprus	2011	Malta	2007
REER	Zambia	1992	Nigeria	1998

Table A2a. Descriptive statistics of LDCs (N = 10)

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	184	0.490062	0.1441374	0.1005109	0.8663467
CCI^{CMW}	182	0.4385073	0.1358312	0.1806401	1
GCI^{W}	185	0.4184399	0.1516086	0.2133159	0.9742625
GCI^{CMW}	185	0.6341386	0.1490339	0.3713277	0.9887363
UI^{W}	260	2.112573	0.3549666	1.628782	3.923282
UI^{CMW}	260	2.106172	0.3627513	1.663261	3.978415
GVC	270	356521.9	775009.6	19900	4580000
TARIFF	138	10.97906	7.68039	1.37	77.19
GCF	230	20.81227	9.767588	−2.424358	58.18793
HC	255	3.85098	1.585388	0.8	7
GDPGR	270	2.225237	5.841054	−47.50331	37.53553
TOI	222	0.5375318	0.370197	0.0462638	2.429829
FDI	267	4.52547	6.197605	−1.302446	39.4562
REER	162	116.6256	42.04152	46.01807	241.5276

Table A2b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Vanuatu	1993	Sierra Leone	2002
CCI^{CMW}	Uganda	2016	Vanuatu	1993
GCI^{W}	Malawi	2012	Sierra Leone	2001
GCI^{CMW}	Vanuatu	2008	Lesotho	2000
UI^{W}	Lesotho	1998	Rwanda	2000
UI^{CMW}	Mozambique	1998	Rwanda	2000
GVC	Sierra Leone	1990	Bangladesh	2014
GDPGR	Rwanda	1994	Rwanda	1995
TARIFF	Lesotho	2013	Bangladesh	1994
GCF	Sierra Leone	1997	Mozambique	1999
HC	Mozambique	1990	Zambia	2016
TOI	Zambia	1993	Malawi	2016
FDI	Malawi	1991	Mozambique	2013
REER	Zambia	1992	Uganda	1990

Table A3a. Descriptive statistics of countries other than LDCs (N = 33)

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	746	0.3647893	0.1808913	0.0294526	0.9935581
CCI^{CMW}	746	0.4036557	0.2246036	0.0210482	0.9975064
GCI^{W}	746	0.3975584	0.1552319	0.1873876	0.8616254
GCI^{CMW}	745	0.5779443	0.1616949	0.2990755	0.96771
UI^{W}	858	2.153558	0.5996008	0.6969979	6.35455
UI^{CMW}	858	2.068001	0.4340096	0.4915661	4.66977
GVC	891	2.72e + 07	7.39e + 07	0	5.55e+08
TARIFF	590	8.161085	7.991448	0	91.27
GCF	769	23.74076	6.667936	7.053155	53.18668
HC	848	8.089033	2.550961	2.3	13.3
GDPGR	891	2.067974	3.460323	−13.47437	17.49924
TOI	643	0.9159986	0.6715064	0.1288428	3.956673
FDI	880	6.272795	25.47587	−43.24448	451.7155
REER	594	101.3686	19.18519	50.16822	275.2927

Table A3b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Canada	1990	Nigeria	2000
CCI^{CMW}	Canada	2002	Nigeria	2001
GCI^{W}	Cyprus	2015	Botswana	2001
GCI^{CMW}	South Africa	2013	Samoa	2005
UI^{W}	Kenya	2005	Nigeria	1995
UI^{CMW}	Kenya	2005	Nigeria	1995
GVC	Guyana	1990–2016	UK	2014
GDPGR	Antigua and Barbuda	2009	eSwatini	1990
TARIFF	Singapore	2004	Nigeria	1995
GCF	Barbados	1992	Nigeria	1990
HC	Papua New Guinea	1990	Canada	2016
TOI	India	1990	Singapore	2008
FDI	Cyprus	2011	Malta	2007
REER	Nigeria	1992	Nigeria	1998

Table A4a. Descriptive statistics of SIDS (N = 15)

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	318	0.4100477	0.1403638	0.1005109	0.8196225
CCI^{CMW}	316	0.48578	0.1849057	0.1393997	1
GCI^{W}	318	0.4647317	0.1533501	0.2503114	0.8471375
GCI^{CMW}	317	0.624849	0.1605728	0.3713277	0.96771
UI^{W}	390	1.932566	0.3089432	1.38772	2.762606
UI^{CMW}	390	1.934161	0.3199439	1.299293	2.780226
GVC	405	9586875	4.12e+07	0	2.88e+08
TARIFF	216	10.21458	7.111426	0	32.6
GCF	281	24.74075	6.439364	7.053155	51.75133
HC	360	8.126667	2.002313	2.3	11.5
GDPGR	405	2.025648	3.985638	−13.47437	15.50738
TOI	167	1.32048	0.8819931	0.5158129	3.956673
FDI	405	6.033891	6.259924	−7.39173	57.83755
REER	270	101.7283	14.90773	67.25354	160.0871

Table A4b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Vanuatu	1993	Antigua and Barbuda	2009
CCI^{CMW}	Singapore	1990	Vanuatu	1993
GCI^{W}	Singapore	2008	Dominica	1993
GCI^{CMW}	Vanuatu	2008	Samoa	2005
UI^{W}	Belize	1992	Singapore	2011
UI^{CMW}	The Bahamas	1991	Singapore	2011
GVC	Guyana	1990–2016	Singapore	2014
GDPGR	Antigua and Barbuda	2009	Papua New Guinea	1993
TARIFF	Singapore	2004	Seychelles	2005
GCF	Barbados	1992	Guyana	1992
HC	Papua New Guinea	1990	The Bahamas	2011
TOI	Dominica	2009	Singapore	2008
FDI	Trinidad and Tobago	2012	Seychelles	2012
REER	Trinidad and Tobago	1997	Guyana	1993

Table A5a. Summary statistics of counties other than SIDS (N = 28)

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	612	0.3789364	0.1983886	0.0294526	0.9935581
CCI^{CMW}	612	0.371616	0.2125907	0.0210482	0.9975064
GCI^{W}	613	0.3690135	0.1450329	0.1873876	0.9742625
GCI^{CMW}	613	0.5706477	0.1578317	0.2990755	0.9887363
UI^{W}	728	2.257309	0.6174548	0.6969979	6.35455
UI^{CMW}	728	2.153333	0.4447179	0.4915661	4.66977
GVC	756	2.71e+07	7.50e+07	19900	5.55e+08
TARIFF	512	8.054297	8.27641	0.46	91.27
GCF	718	22.4113	7.905156	−2.424358	58.18793
HC	743	6.616285	3.216968	0.8	13.3
GDPGR	756	2.146814	4.21571	−47.50331	37.53553
TOI	698	0.6988525	0.4824156	0.0462638	3.145486
FDI	742	5.774439	27.62487	−43.24448	451.7155
REER	486	106.2544	31.10087	46.01807	275.2927

Table A5b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Canada	1990	Nigeria	2000
CCI^{CMW}	Canada	2002	Nigeria	2001
GCI^{W}	Cyprus	2015	Sierra Leone	2001
GCI^{CMW}	South Africa	2013	Lesotho	2000
UI^{W}	New Zealand	2005	Nigeria	1995
UI^{CMW}	Kenya	2005	Nigeria	1995
GVC	Sierra Leone	1990	UK	2014
GDPGR	Rwanda	1994	Rwanda	1995
TARIFF	Brunei Darussalam	2014	Nigeria	1995
GCF	Sierra Leone	1997	Mozambique	1999
HC	Mozambique	1990	Canada	2016
TOI	Zambia	1993	Malta	2012
FDI	Cyprus	2011	Malta	2007
REER	Zambia	1992	Nigeria	1998

Table A6a. Summary statistics of small states countries (N = 21)

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	425	0.4314029	0.1464007	0.1005109	0.8196225
CCI^{CMW}	423	0.5095342	0.1822618	0.2030795	1
GCI^{W}	425	0.4721868	0.1564833	0.1873876	0.8616254
GCI^{CMW}	424	0.6573784	0.1676413	0.3713277	0.9887363
UI^{W}	546	2.061136	0.6303286	1.38772	5.483477
UI^{CMW}	546	1.953793	0.3709745	1.299293	3.623491
GVC	567	637160	1086568	0	7790000
TARIFF	326	8.353834	6.712146	0.46	32.6
GCF	426	23.92705	6.587122	7.053155	51.75133
HC	522	7.795402	2.074287	2.3	12.1
GDPGR	567	1.972771	3.704615	−13.47437	17.49924
TOI	319	1.110896	0.4397251	0.2858028	3.145486
FDI	556	8.516117	31.755	−43.24448	451.7155
REER	324	102.8924	21.00669	56.50391	207.2926

Table A6b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Vanuatu	1993	Antigua and Barbuda	2009
CCI^{CMW}	Trinidad and Tobago	1993	Vanuatu	1993
GCI^{W}	Cyprus	2015	Botswana	2001
GCI^{CMW}	Vanuatu	2008	Lesotho	2000
UI^{W}	Belize	1992	Brunei Darussalam	2008
UI^{CMW}	The Bahamas	1991	Brunei Darussalam	2008
GVC	Guyana	1990–2016	Trinidad and Tobago	2014
GDPGR	Antigua and Barbuda	2009	eSwatini	1990
TARIFF	Brunei Darussalam	2014	Seychelles	2005
GCF	Barbados	1992	Brunei Darussalam	1992
HC	Papua New Guinea	1990	Cyprus	2016
TOI	Lesotho	1990	Malta	2012
FDI	Cyprus	2011	Malta	2007
REER	Lesotho	2002	Lesotho	1992

Table A7a. Summary statistics of countries other than small states countries (N = 22)

Variable	Obs	Mean	Std. Dev.	Min	Max
CCI^{W}	505	0.3543723	0.1993978	0.0294526	0.9935581
CCI^{CMW}	505	0.3275297	0.1964785	0.0210482	0.9975064
GCI^{W}	506	0.342511	0.1257011	0.1995612	0.9742625
GCI^{CMW}	506	0.5319283	0.1296491	0.2990755	0.9773166
UI^{W}	572	2.223149	0.4530698	0.6969979	6.35455
UI^{CMW}	572	2.194368	0.4280627	0.4915661	4.66977
GVC	594	4.04e+07	8.76e+07	19900	5.55e+08
TARIFF	402	8.972139	8.915504	0	91.27
GCF	573	22.42677	8.206451	−2.424358	58.18793
HC	581	6.492771	3.464885	0.8	13.3
GDPGR	594	2.230333	4.50827	−47.50331	37.53553
TOI	546	0.6482479	0.6619804	0.0462638	3.956673
FDI	591	3.372925	4.888898	−3.811793	39.4562
REER	432	105.9471	30.0116	46.01807	275.2927

Table A7b. Identification of minimum and maximum values

Variable	Minimum value		Maximum value	
	Country	Year	Country	Year
CCI^{W}	Canada	1990	Nigeria	2000
CCI^{CMW}	Nigeria	2002	Nigeria	2001
GCI^{W}	South Africa	2014	Sierra Leone	2001
GCI^{CMW}	South Africa	2013	Gambia	2004
UI^{W}	Kenya	2005	Nigeria	1995
UI^{CMW}	Kenya	2005	Nigeria	1995
GVC	Sierra Leone	1990	UK	2014
GDPGR	Rwanda	1994	Rwanda	1995
TARIFF	Singapore	2004	Nigeria	1995
GCF	Sierra Leone	1997	Mozambique	1999
HC	Mozambique	1990	Canada	2016
TOI	Zambia	1993	Singapore	2008
FDI	New Zealand	2003	Mozambique	2013
REER	Zambia	1992	Nigeria	1998

Table A8. Average index values in 2000, 2005, 2010, 2015 (CCI, GCI, UI both intra and extra Commonwealth and GVC) normalized with respect to 2000

	YEAR	CCI^{W}	CCI^{CMW}	GCI^{W}	GCI^{CMW}	UI^{W}	UI^{CMW}	GVC
LDC	2005	0.870782	0.909728	0.889856	1.002708	0.971732	0.959763832	1.701895
LDC	2010	0.812573	0.965378	0.951745	0.993352	0.973838	0.980376381	3.96341
LDC	2015	0.944073	0.99842	0.920625	0.936071	0.93736	0.948962587	4.40444
NON LDC	2005	0.980384	0.97536	0.970083	0.950295	0.952207	0.958079793	1.670361
NON LDC	2010	0.933381	0.997134	0.906517	0.869585	0.970518	0.981975565	2.838917
NON LDC	2015	0.895785	0.955672	0.890171	0.829451	0.947042	0.959133043	3.001576
SIDS	2005	1.13796	1.044279	0.9697	0.967543	0.966422	0.952621126	1.711737
SIDS	2010	0.909618	0.995175	0.918974	0.889275	0.96031	0.95256631	3.215769
SIDS	2015	0.85237	0.903712	0.876136	0.851401	0.947463	0.944109032	3.595138
NON-SIDS	2005	0.834794	0.881355	0.927463	0.95317	0.952438	0.961341947	1.663403
NON-SIDS	2010	0.895336	0.964907	0.903612	0.898169	0.976197	0.995728085	2.778618
NON-SIDS	2015	0.939402	0.985942	0.897838	0.848786	0.943591	0.962808251	2.905249
SMALL STATE	2005	1.002949	1.011426	0.935008	0.927533	1.001287	0.965181993	1.555831
SMALL STATE	2010	0.86142	0.96968	0.900996	0.860878	0.999805	0.968199049	2.743076
SMALL STATE	2015	0.883348	0.925904	0.821854	0.802202	0.987768	0.961302795	2.914843
NON-SMALL STATE	2005	0.875388	0.87501	0.965213	0.995564	0.919998	0.952809076	1.672277
NON-SMALL STATE	2010	0.930632	0.979858	0.917243	0.926705	0.947755	0.992941536	2.84402
NON-SMALL STATE	2015	0.914666	0.951233	0.956757	0.885901	0.909307	0.952767561	3.007422

Table A9. Index values in 2000 (CCI, GCI, UI both world and Commonwealth and GVC)

Country	CCI^{W}	CCI^{CMW}	GCI^{W}	GCI^{CMW}	UI^{W}	UI^{CMW}	GVC
Antigua and Barbuda	0.34	0.48	0.34	0.69	2.04	1.95	5.81E+04
Australia	0.18	0.15	0.28	0.41	2.46	2.33	2.92E+07
The Bahamas	0.26	0.43	0.79	0.56	1.51	1.44	3.14E+05
Bangladesh	0.58	0.45	0.44	0.62	2.07	2.01	8.84E+05
Barbados	0.23	0.31	0.32	0.47	1.97	2.04	1.95E+05
Belize	0.41	0.61	0.61	0.8	1.67	1.86	1.16E+05
Botswana	0.67	0.79	0.72	0.91	1.59	1.68	2.33E+05
Brunei Darussalam					4.11	2.76	6.36E+05
Cameroon	0.54	0.4	0.36	0.49	2.63	2.42	5.14E+05
Canada	0.04	0.03	0.66	0.62	2.42	2.37	1.37E+08
Cyprus	0.35	0.37	0.27	0.86	1.79	1.75	5.21E+05
Dominica					1.87	1.94	1.02E+06
Fiji					1.95	1.89	1.30E+05
The Gambia	0.51	0.42	0.45	0.57	1.97	2.04	3.56E+04
Ghana	0.32	0.33	0.27	0.57	1.99	1.89	5.45E+05
Guyana	0.4	0.57	0.45	0.62	2.33	2.3	0
India	0.2	0.13	0.26	0.37	2.13	2.11	1.96E+07
Jamaica	0.56	0.53	0.45	0.58	2.14	2.32	5.86E+05
Kenya	0.34	0.44	0.27	0.52	1.79	1.94	6.72E+05
Lesotho	0.59	0.4	0.77	0.99	1.67	1.72	2.39E+04
Malta	0.63	0.7	0.36	0.71	2.55	2.38	8.37E+05
Malawi	0.61	0.34	0.25	0.45	2.04	1.9	9.98E+04
Malaysia	0.27	0.3	0.32	0.66	2.72	2.69	5.81E+07
Mauritius	0.47	0.5	0.43	0.89	1.64	1.63	5.68E+05
Mozambique	0.37	0.27	0.35	0.62	1.78	1.79	1.33E+05
Namibia	0.45	0.6	0.44	0.67	1.96	1.94	2.52E+05
New Zealand	0.16	0.14	0.3	0.61	2.31	2.26	7.24E+06
Nigeria	0.99	0.99	0.47	0.75	4.5	2.81	4.19E+06
Pakistan	0.26	0.27	0.29	0.44	1.88	1.91	2.08E+06
Papua New Guinea	0.53	0.74	0.77	0.78	2.51	2.1	3.95E+05
Rwanda					3.92	3.98	5.72E+04
Seychelles	0.66	0.79	0.48	0.92	1.81	1.89	5.16E+04
Sierra Leone	0.71	0.62			2.01	2	5.70E+04
Singapore	0.33	0.31	0.3	0.65	2.05	2.11	7.29E+07
Sri Lanka	0.38	0.44	0.43	0.7	2.17	1.94	1.51E+06
eSwatini/Swaziland	0.29	0.26	0.61	0.79	2.07	1.93	2.03E+05
Trinidad and Tobago	0.45	0.25	0.48	0.44	2.08	2.75	2.19E+06
Uganda	0.4	0.37	0.33	0.53	2.12	2.13	1.07E+05
UK	0.17	0.19	0.26	0.36	2.28	2.28	1.78E+08
Samoa					1.85	1.79	3.35E+04
South Africa	0.22	0.15	0.23	0.42	2.44	2.31	1.67E+07
Vanuatu					2.05	2.08	3.55E+04
Zambia	0.55	0.69	0.51	0.71	2.59	2.46	2.56E+05

Table A10. Index values in 2005 (CCI, GCI, UI both world and Commonwealth and GVC)

Country	CCI^{W}	CCI^{CMW}	GCI^{W}	GCI^{CMW}	UI^{W}	UI^{CMW}	GVC
Antigua and Barbuda	0.71	0.56	0.34		1.83	1.86	6.87E+04
Australia	0.23	0.19	0.27	0.41	2.59	2.44	5.74E+07
The Bahamas	0.54	0.5	0.64	0.61	1.44	1.38	3.62E+05
Bangladesh	0.52	0.43	0.36	0.59	2.37	2.3	1.54E+06
Barbados	0.22	0.29	0.34	0.46	1.88	1.93	2.06E+05
Belize	0.4	0.56	0.58	0.68	1.51	1.6	1.13E+05
Botswana	0.57	0.77	0.77	0.9	1.7	1.71	2.42E+05
Brunei Darussalam					4.76	3.07	1.37E+06
Cameroon	0.49	0.48	0.33	0.54	2.59	2.36	8.62E+05
Canada	0.04	0.02	0.65	0.53	2.7	2.63	1.92E+08
Cyprus	0.3	0.47	0.32	0.88	1.77	1.69	8.18E+05
Dominica	0.28	0.33	0.72	0.52	1.74	1.8	1.39E+06
Fiji	0.32	0.42	0.36	0.49	1.88	1.76	1.88E+05
The Gambia	0.43	0.45	0.46	0.89	1.99	2.03	2.72E+04
Ghana	0.41	0.5	0.3	0.59	1.82	1.74	8.95E+05
Guyana	0.39	0.58	0.33	0.55	2.12	2.05	0
India	0.19	0.14	0.23	0.38	2.19	2.16	4.76E+07
Jamaica	0.66	0.69	0.37	0.66	2	2.09	6.54E+05
Kenya	0.27	0.3	0.25	0.49	0.7	0.49	1.30E+06
Lesotho					1.79	1.75	4.98E+04
Malawi	0.56	0.34	0.28	0.56	1.94	1.84	1.72E+05
Malaysia	0.24	0.25	0.3	0.61	2.9	2.86	1.01E+08
Malta	0.44	0.47	0.3	0.63	3	2.78	1.31E+06
Mauritius	0.35	0.51	0.38	0.88	1.68	1.66	1.30E+06
Mozambique	0.6	0.39	0.62	0.75	1.87	1.87	2.29E+05
Namibia	0.33	0.4	0.37	0.62	2.45	1.87	4.57E+05
New Zealand	0.16	0.13	0.29	0.62	2.29	2.22	1.24E+07
Nigeria					1.69	2.36	7.55E+06
Pakistan	0.28	0.29	0.29	0.4	1.85	1.87	3.93E+06
Papua New Guinea					2.48	2.04	6.60E+05
Rwanda	0.43	0.48	0.4	0.65	2.52	2.27	5.13E+04
Samoa	0.68	0.87	0.76	0.97	1.83	1.65	4.79E+04
Seychelles	0.75	0.79	0.49	0.92	1.61	1.67	8.59E+04
Sierra Leone					2.46	2.47	7.37E+04
Singapore	0.48	0.38	0.26	0.57	2.6	2.63	1.26E+08

Table A11. Index values in 2010 (CCI, GCI, UI both world and Commonwealth and GVC)

Country	CCI^{W}	CCI^{CMW}	GCI^{W}	GCI^{CMW}	UI^{W}	UI^{CMW}	GVC
Antigua and Barbuda	0.3	0.49	0.4	0.75	1.79	1.82	1.35E+05
Australia	0.32	0.27	0.34	0.42	2.79	2.64	1.09E+08
The Bahamas	0.36	0.71	0.76	0.52	1.43	1.55	4.96E+05
Bangladesh	0.55	0.52	0.32	0.57	2.54	2.48	3.30E+06
Barbados	0.28	0.38	0.34	0.46	1.85	1.87	3.38E+05
Belize	0.44	0.56	0.56	0.8	1.56	1.59	2.08E+05
Botswana	0.49	0.63	0.59	0.81	1.69	1.69	3.63E+05
Brunei Darussalam	0.67	0.87	0.49	0.52	4.88	3.16	2.55E+06
Cameroon	0.43	0.44	0.3	0.51	2.52	2.3	1.71E+06
Canada	0.04	0.04	0.63	0.49	2.59	2.53	2.77E+08
Cyprus	0.23	0.23	0.29	0.6	1.79	1.77	1.36E+06
Dominica	0.21	0.37	0.6	0.45	1.69	1.77	2.03E+06
Fiji	0.34	0.27	0.28	0.48	1.86	1.74	3.63E+05
The Gambia	0.33	0.57	0.38	0.68	2.01	2.08	6.22E+04
Ghana	0.47	0.52	0.24	0.53	1.77	1.71	1.94E+06
Guyana	0.35	0.36	0.27	0.44	2.1	2.03	0
India	0.23	0.13	0.21	0.31	2.42	2.37	1.09E+08
Jamaica	0.4	0.46	0.52	0.6	1.96	1.99	9.38E+05
Kenya	0.26	0.27	0.23	0.46	1.58	1.56	2.67E+06
Lesotho	0.35	0.33	0.78	0.97	1.77	1.75	1.51E+05
Malawi	0.57	0.4	0.24	0.43	1.95	1.87	4.02E+05
Malaysia	0.22	0.23	0.26	0.56	2.72	2.69	1.80E+08
Malta	0.41	0.56	0.28	0.55	3.17	2.94	2.35E+06
Mauritius	0.31	0.47	0.34	0.7	1.65	1.62	1.61E+06
Mozambique	0.54	0.5	0.57	0.84	1.83	1.82	3.77E+05
Namibia	0.31	0.38	0.35	0.64	2.43	1.84	9.43E+05
New Zealand	0.24	0.21	0.29	0.61	2.39	2.31	2.34E+07
Nigeria	0.72	0.75	0.38	0.47	1.61	2.38	1.29E+07
Pakistan	0.25	0.29	0.24	0.39	1.86	1.9	8.25E+06
Papua New Guinea					2.4	2.02	1.65E+06
Rwanda	0.42	0.53	0.34	0.59	2.16	2.01	1.15E+05
Samoa	0.67	0.84	0.68	0.86	1.77	1.68	1.09E+05
Seychelles	0.59	0.77	0.48	0.87	1.54	1.62	2.47E+05
Sierra Leone					2.45	2.48	1.50E+05
Singapore	0.38	0.41	0.25	0.53	2.7	2.73	2.38E+08
South Africa	0.19	0.17	0.21	0.3	2.51	2.33	5.86E+07
Sri Lanka	0.32	0.31	0.28	0.54	1.78	1.69	4.10E+06
eSwatini/Swaziland					1.82	1.72	5.85E+05
Trinidad and Tobago	0.41	0.41	0.49	0.41	2.13	2.63	6.49E+06
Uganda	0.23	0.22	0.27	0.56	2.01	2.09	3.55E+05
UK	0.2	0.17	0.24	0.35	2.27	2.29	4.74E+08
Vanuatu	0.32	0.49	0.34	0.48	1.86	1.99	1.22E+05
Zambia	0.65	0.32	0.56	0.63	3.08	3.12	1.66E+06

Table A12. Index values in 2013 (CCI, GCI, UI both world and Commonwealth and GVC)

COUNTRY	CCI^{W}	CCI^{CMW}	GCI^{W}	GCI^{CMW}	UI^{W}	UI^{CMW}	GVC
Antigua and Barbuda	0.34	0.57	0.36	0.67	1.74	1.78	1.07E+05
Australia	0.34	0.21	0.39	0.39	2.72	2.57	1.27E+08
The Bahamas	0.4	0.7	0.84	0.62	1.42	1.53	5.07E+05
Bangladesh	0.56	0.56	0.29	0.58	2.56	2.5	4.46E+06
Barbados	0.33	0.31	0.36	0.47	1.84	1.87	3.01E+05
Belize	0.34	0.44	0.46	0.6	1.55	1.59	1.99E+05
Botswana	0.68	0.75	0.53	0.76	1.64	1.68	4.86E+05
Brunei Darussalam	0.68	0.73	0.46	0.46	5.02	3.25	3.19E+06
Cameroon	0.51	0.55	0.33	0.5	2.49	2.27	1.64E+06
Canada	0.06	0.03	0.63	0.42	2.56	2.5	3.14E+08
Cyprus	0.27	0.39	0.28	0.72	1.75	1.73	1.35E+06
Dominica	0.19	0.3	0.58	0.41	1.68	1.77	2.55E+06
Fiji	0.35	0.23	0.3	0.44	1.78	1.66	3.42E+05
The Gambia	0.64	0.68	0.52	0.7	2	2.06	5.12E+04
Ghana	0.47	0.45	0.26	0.44	1.78	1.72	2.61E+06
Guyana	0.35	0.48	0.35	0.56	2.32	2.24	0
India	0.25	0.12	0.2	0.32	2.43	2.38	1.33E+08
Jamaica	0.42	0.55	0.52	0.66	1.94	1.99	9.42E+05
Kenya	0.26	0.27	0.22	0.45	1.43	1.43	2.63E+06
Lesotho	0.32	0.33	0.78	0.97	1.79	1.78	1.83E+05
Malawi	0.5	0.38	0.22	0.44	1.93	1.86	4.30E+05
Malaysia	0.23	0.23	0.27	0.56	2.48	2.45	2.02E+08
Malta	0.48	0.58	0.23	0.59	3.38	3.12	2.71E+06
Mauritius	0.3	0.44	0.29	0.61	1.61	1.59	1.80E+06
Mozambique	0.34	0.4	0.41	0.61	1.81	1.8	3.68E+05
Namibia	0.31	0.37	0.33	0.58	2.46	1.83	9.91E+05
New Zealand	0.28	0.22	0.31	0.58	2.33	2.25	2.70E+07
Nigeria	0.83	0.9	0.26	0.48	1.58	2.19	1.49E+07
Pakistan	0.23	0.28	0.24	0.39	1.84	1.89	9.88E+06
Papua New Guinea					2.34	1.96	2.05E+06
Rwanda	0.34	0.48	0.51	0.69	2.14	2.01	1.19E+05
Seychelles	0.7	0.91	0.46	0.91	1.57	1.65	2.08E+05
Samoa	0.53	0.79	0.53	0.81	1.7	1.61	8.62E+04
Sierra Leone			0.87	0.6	2.23	2.25	1.48E+05
Singapore	0.37	0.45	0.26	0.55	2.57	2.6	2.72E+08
South Africa	0.19	0.18	0.21	0.3	2.5	2.32	6.44E+07
Sri Lanka	0.33	0.32	0.3	0.52	1.78	1.69	5.03E+06
eSwatini/Swaziland	0.36	0.36	0.65	0.83	1.81	1.73	5.19E+05
Trinidad and Tobago	0.45	0.35	0.42	0.38	2.13	2.71	7.60E+06
Uganda	0.22	0.22	0.26	0.58	1.96	2.05	3.43E+05
UK	0.19	0.18	0.23	0.34	2.23	2.24	5.11E+08
Vanuatu					1.83	1.96	1.06E+05
Zambia	0.64	0.25	0.46	0.55	3.01	3.07	1.92E+06

ED graphs for individual countries grouped by income status for 1990–2016

Figure A1a. ED for high-income group 1 (Commonwealth level)

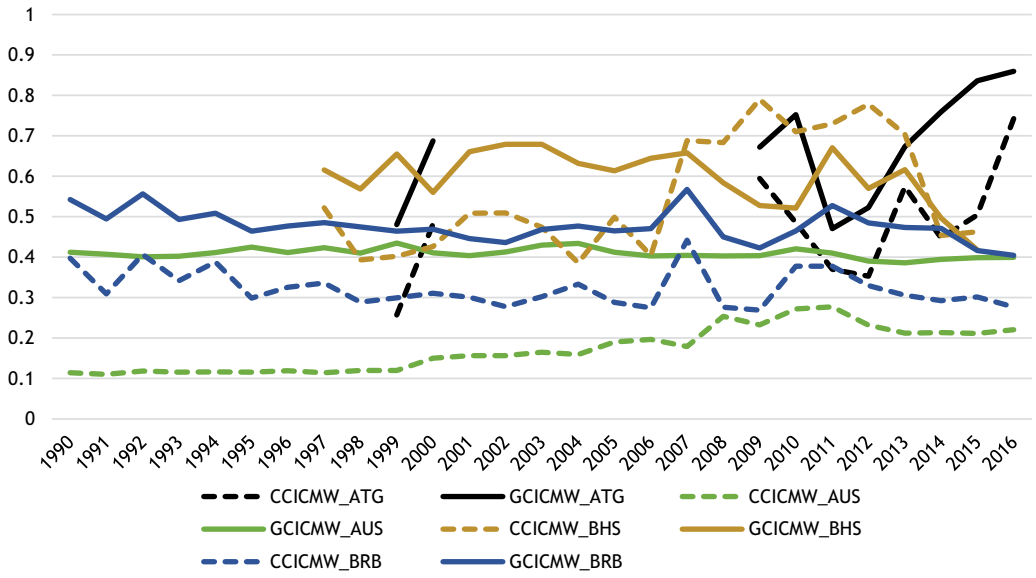
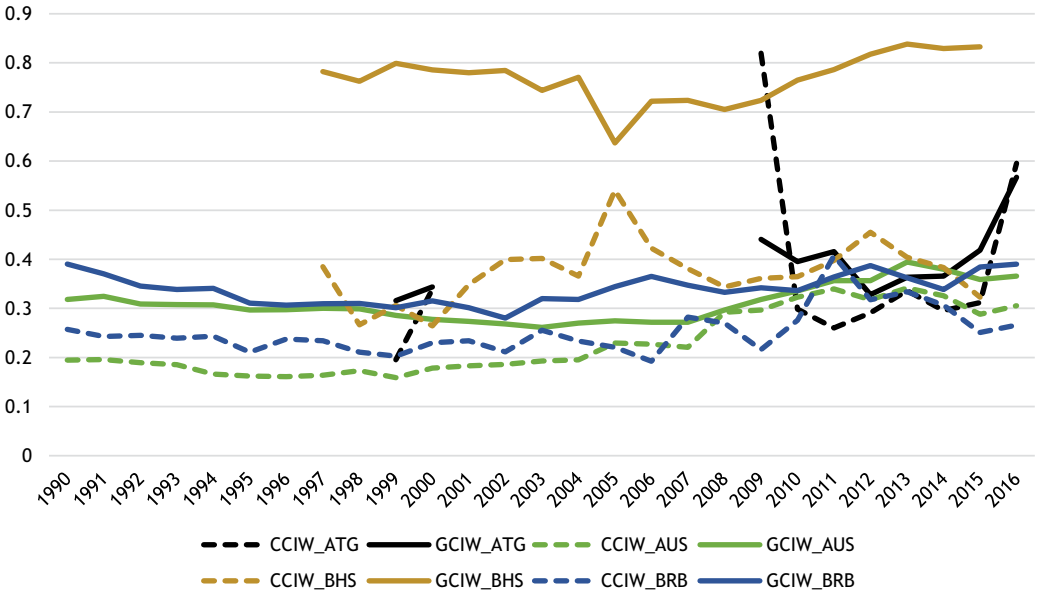


Figure A1b. ED for high-income group 1 (world level)



High-income group 1: ATG, AUS, BHS, BRB

Figure A2a. ED for high-income group 2 (Commonwealth level)

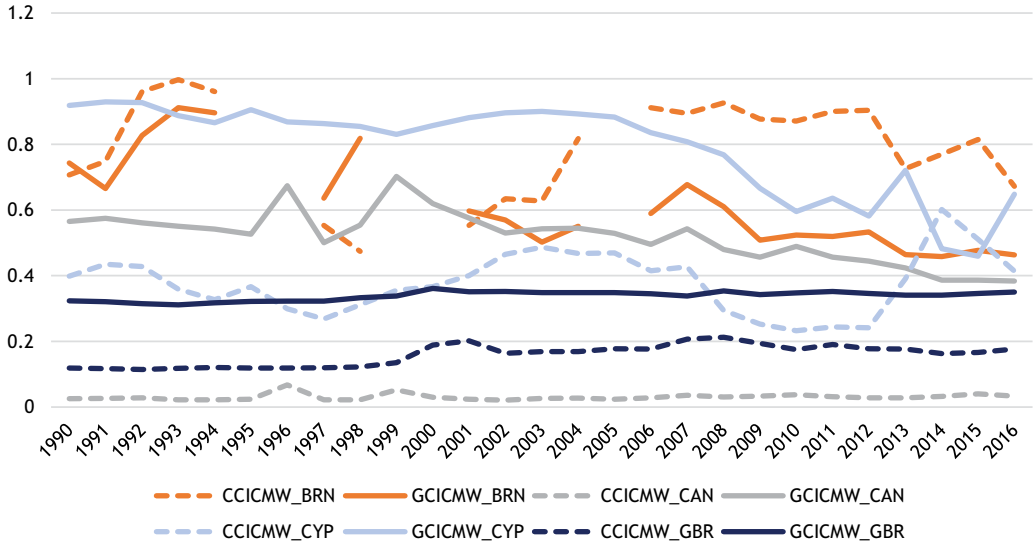
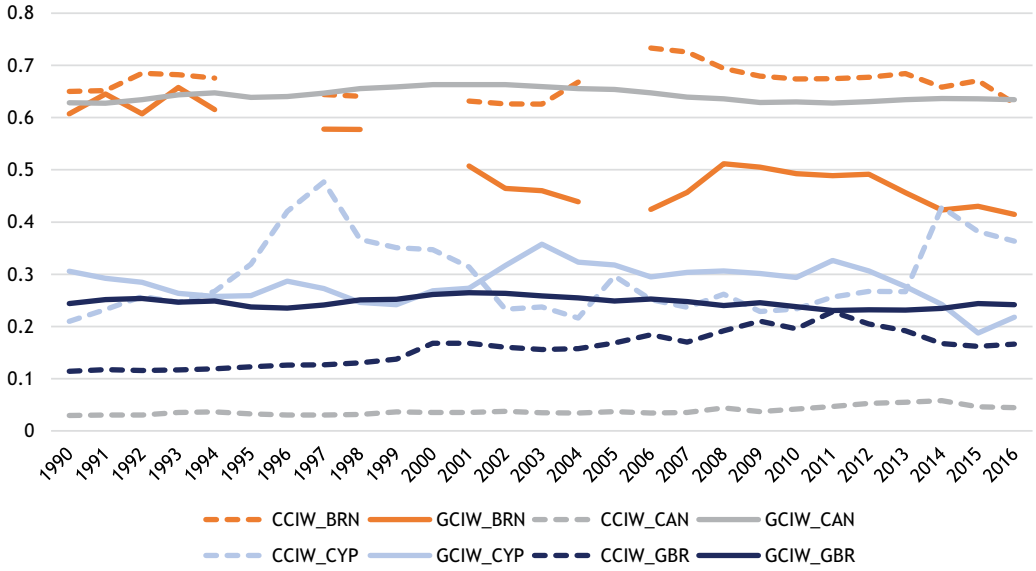


Figure A2b. ED for high-income group 2 (world level)



High-income group 2: BRN, CAN, CYP, GBR

Figure A3a. ED for high-income group 3 (Commonwealth level)

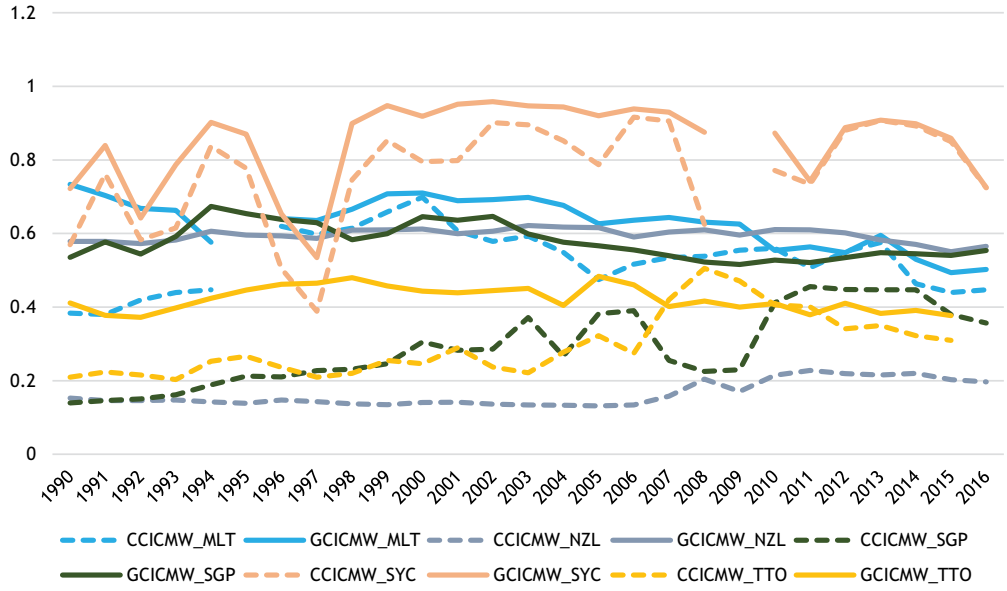
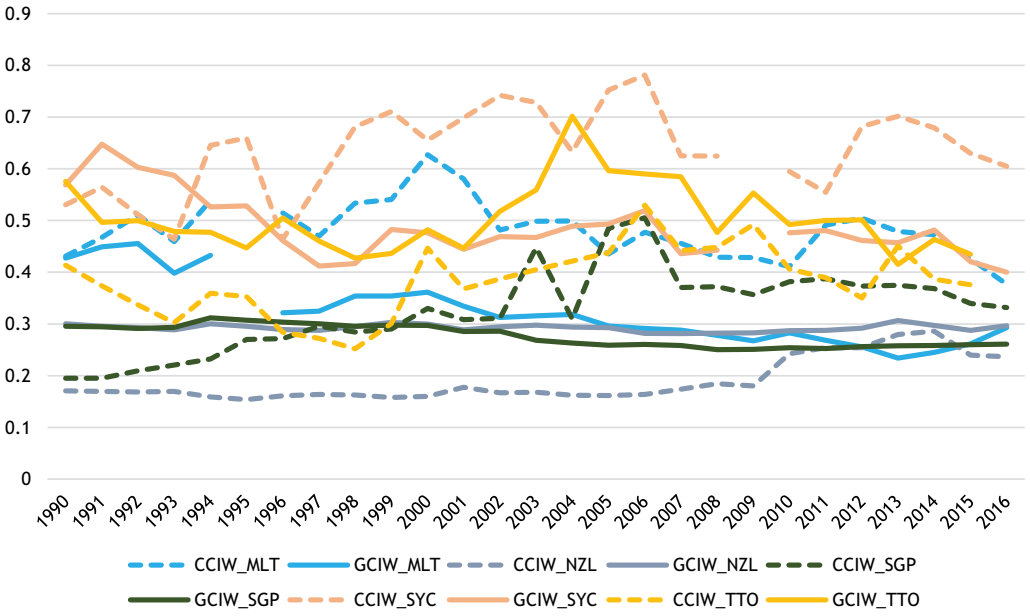


Figure A3b. ED for high-income group 3 (world level)



High-income group 3: MLT, NZL, SYC, SGP, TTO

Figure A4a. ED for upper-middle-income group 1 (Commonwealth level)

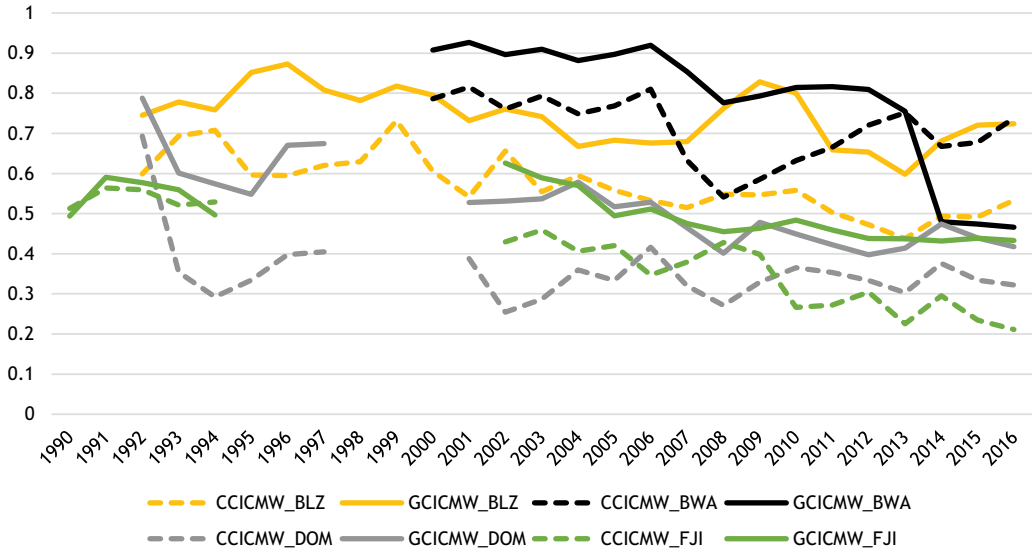
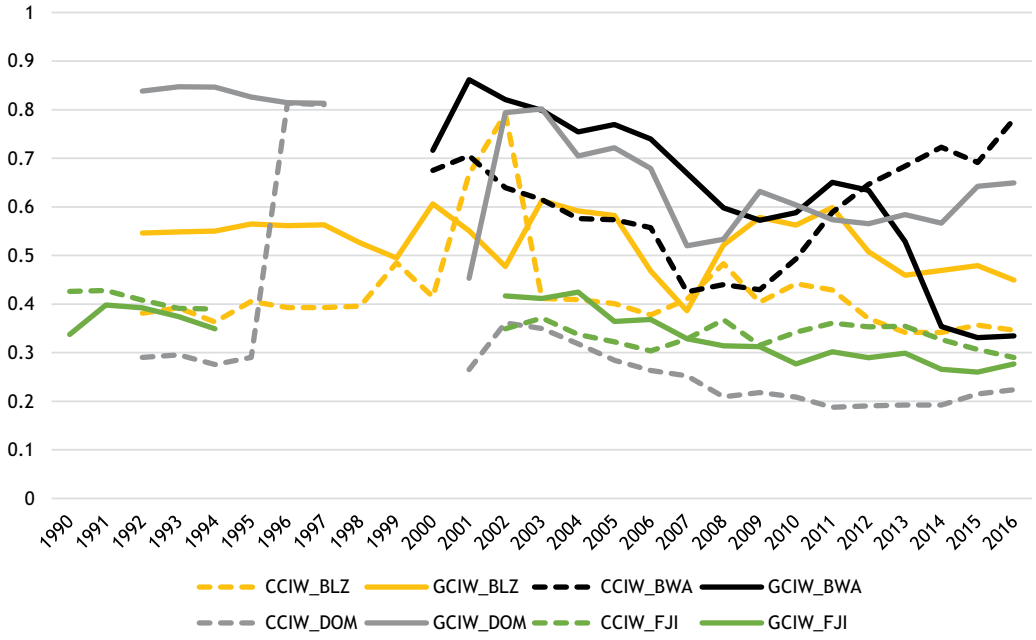


Figure A4b. ED for upper-middle-income group 1 (world level)



Upper-middle-income group 1: BLZ, BWA, DOM, FJI

Figure A5a. ED for upper-middle-income group 2 (Commonwealth level)

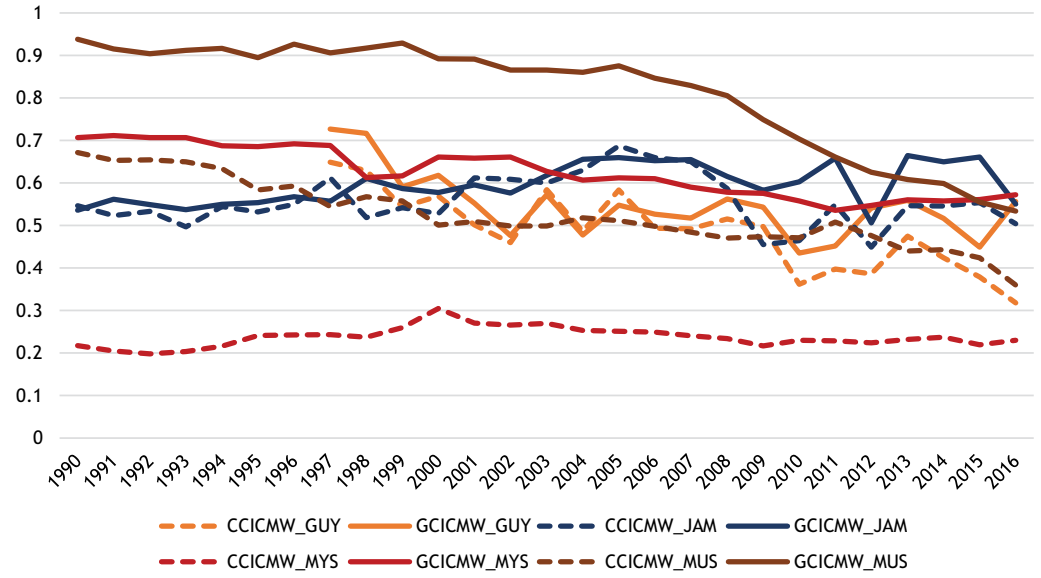
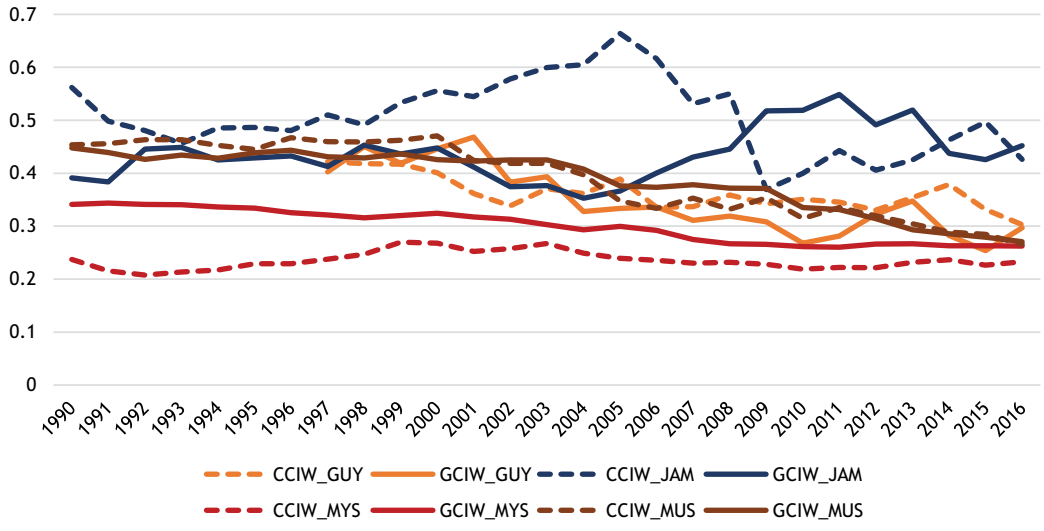


Figure A5b. ED for upper-middle-income group 2 (world level)



Upper-middle-income group 2: GUY, JAM, MYS, MUS

Figure A6a. ED for upper-middle-income group 3 (Commonwealth level)

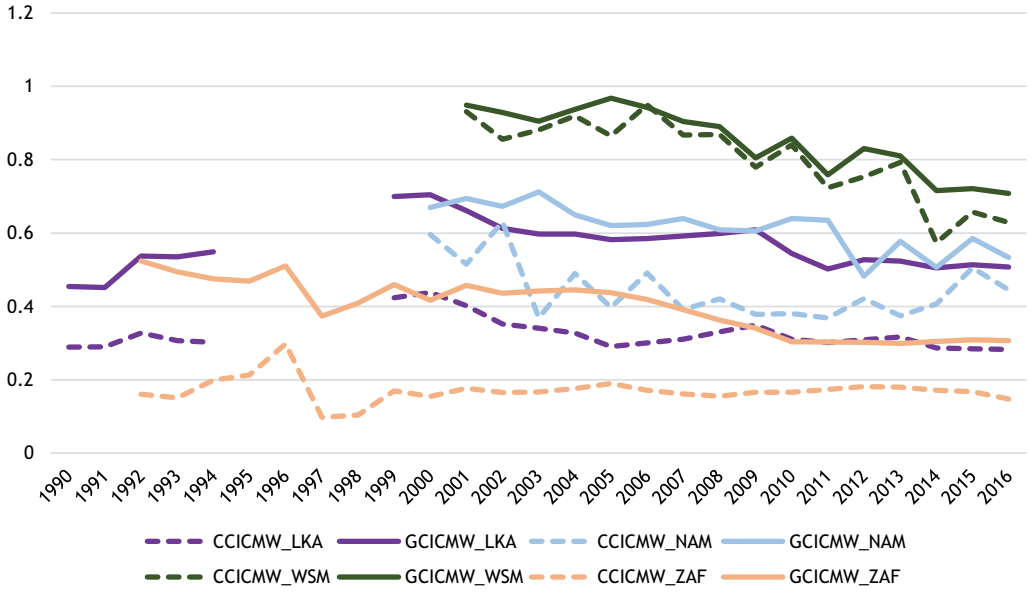
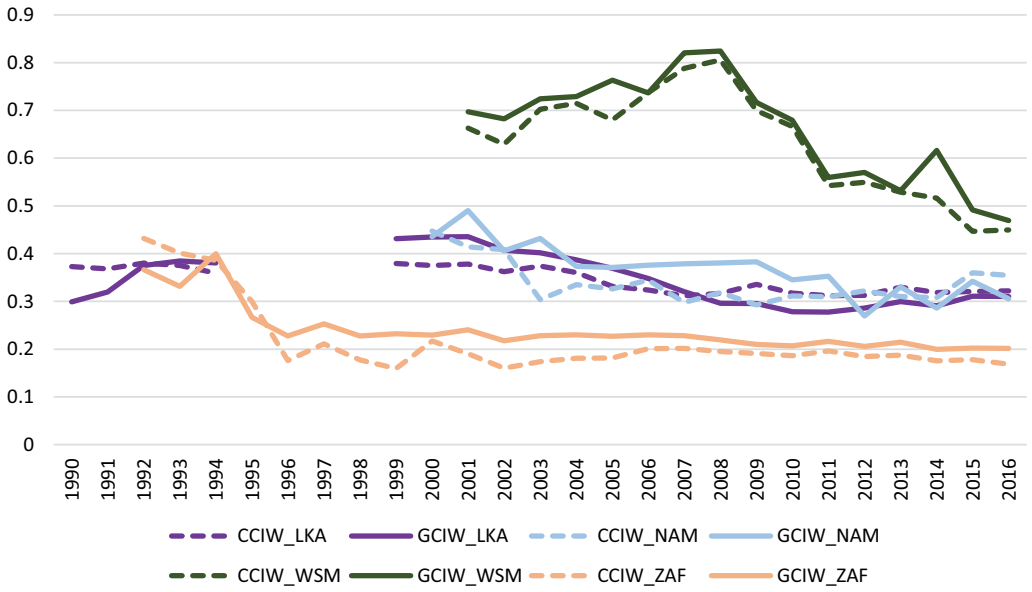


Figure A6b. ED for upper-middle-income group 3 (world level)



Upper-middle-income group 3: NAM, WSM, ZAF, LKA

Figure A7a. ED for lower-middle-income group 1 (Commonwealth level)

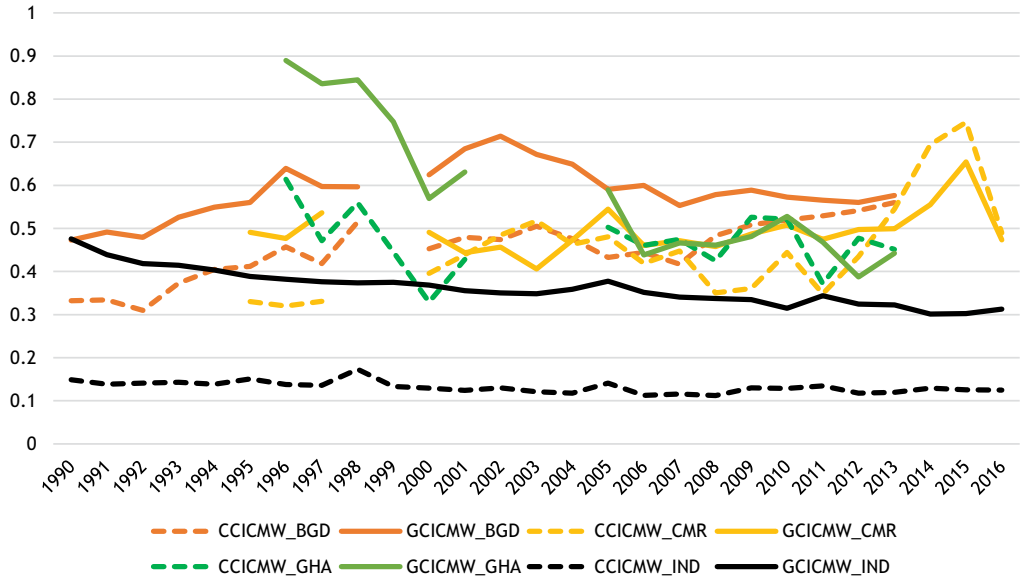
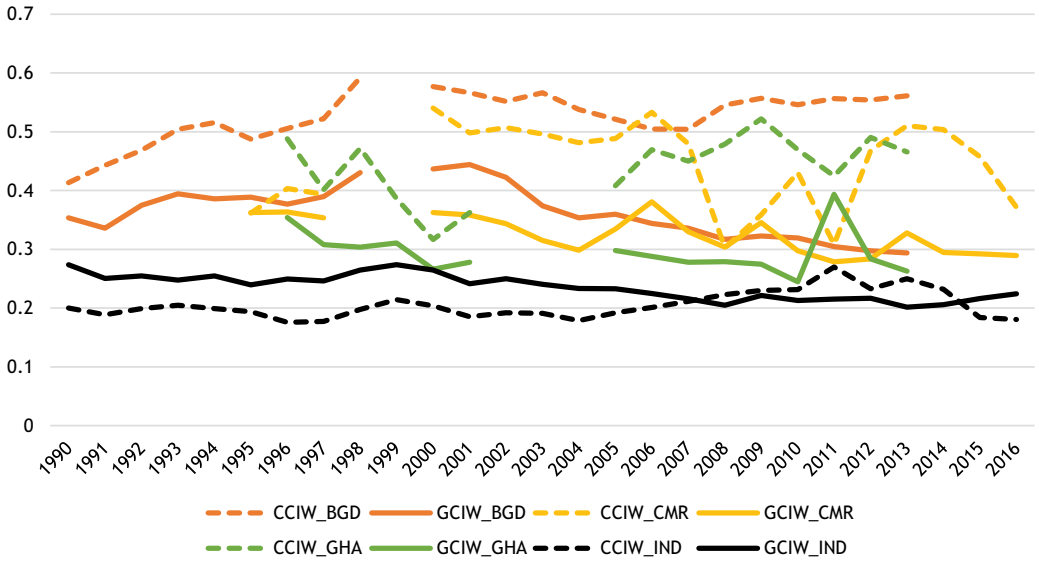


Figure A7b. ED for lower-middle-income group 1 (world level)



Lower-middle-income group 1: BGD, CMR, GHA IND

Figure A8a. ED for lower-middle-income group 2 (Commonwealth level)

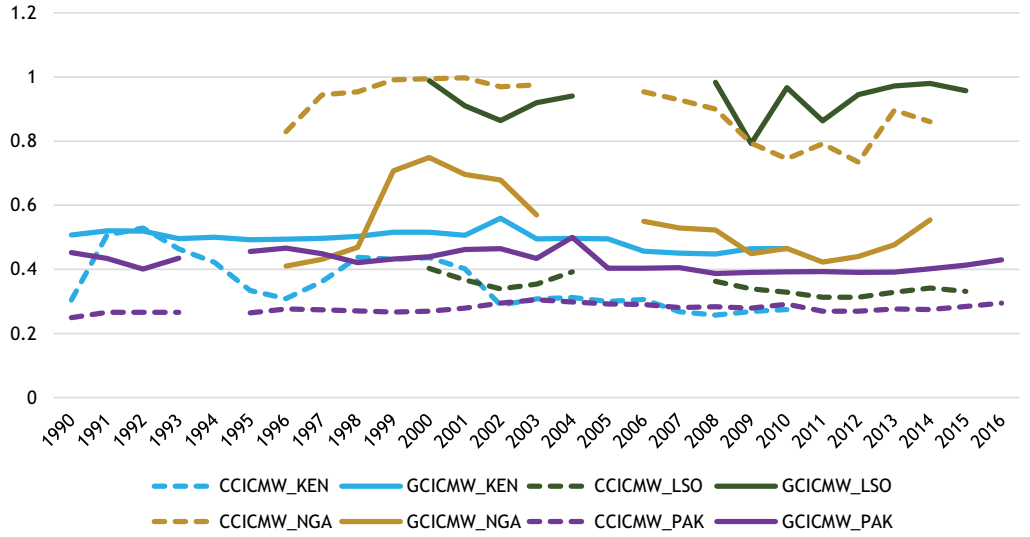
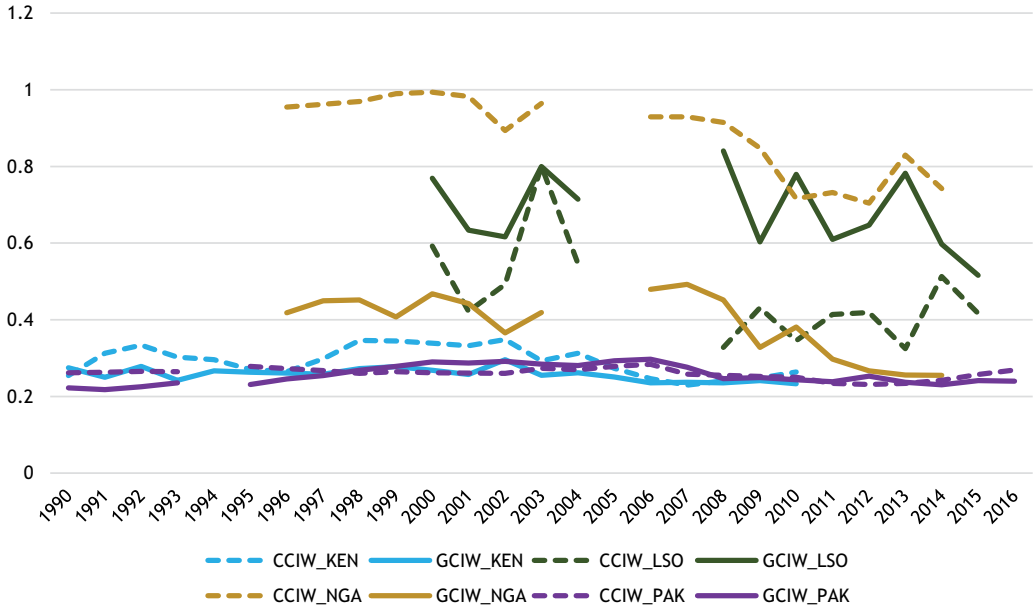


Figure A8b. ED for lower-middle-income group 2 (world level)



Lower-middle-income group 2: KEN, NGA, LSO, PAK

Figure A9a. ED for lower-middle-income group 3 (Commonwealth level)

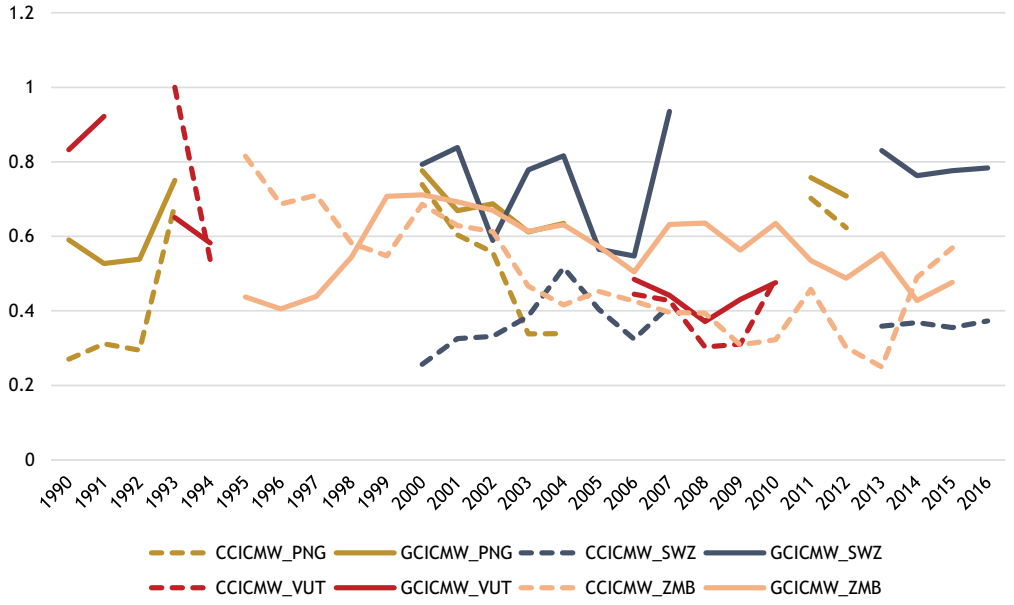
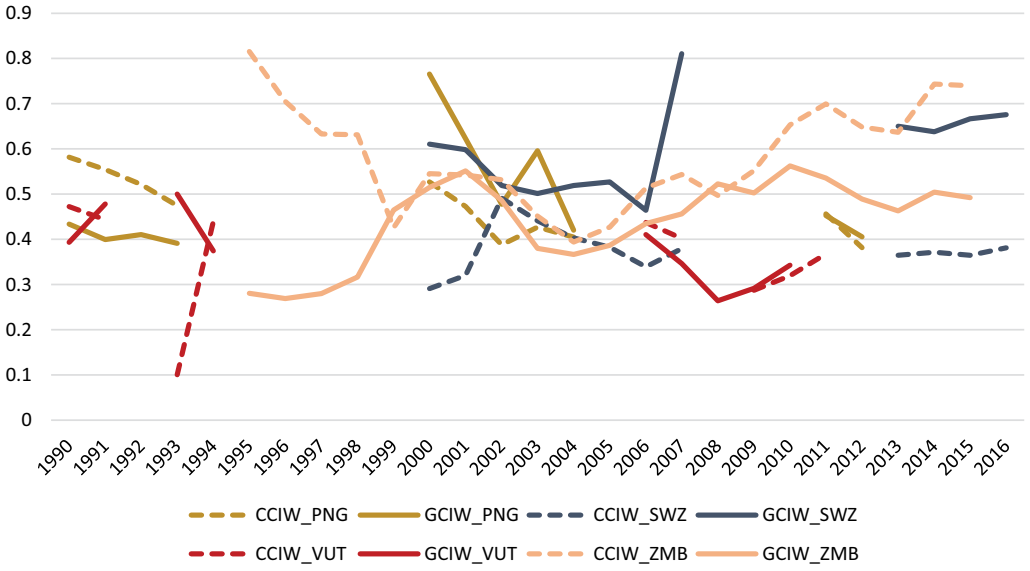


Figure A9b. ED for lower-middle-income group 3 (world level)



Lower-middle-income group 3: PNG, VUT, SWZ, ZMB

Figure A10a. ED for low-income group 1 (Commonwealth level)

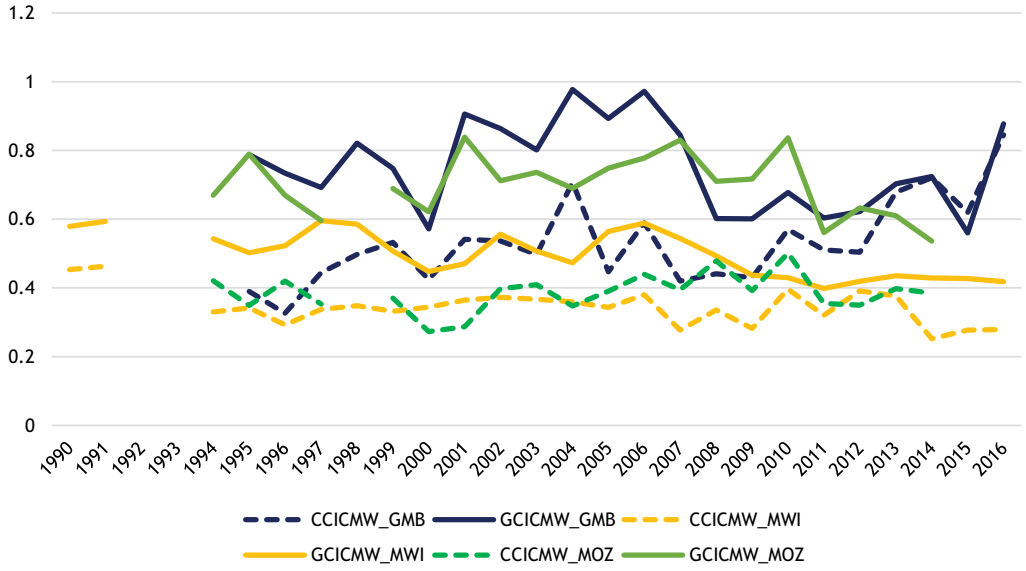
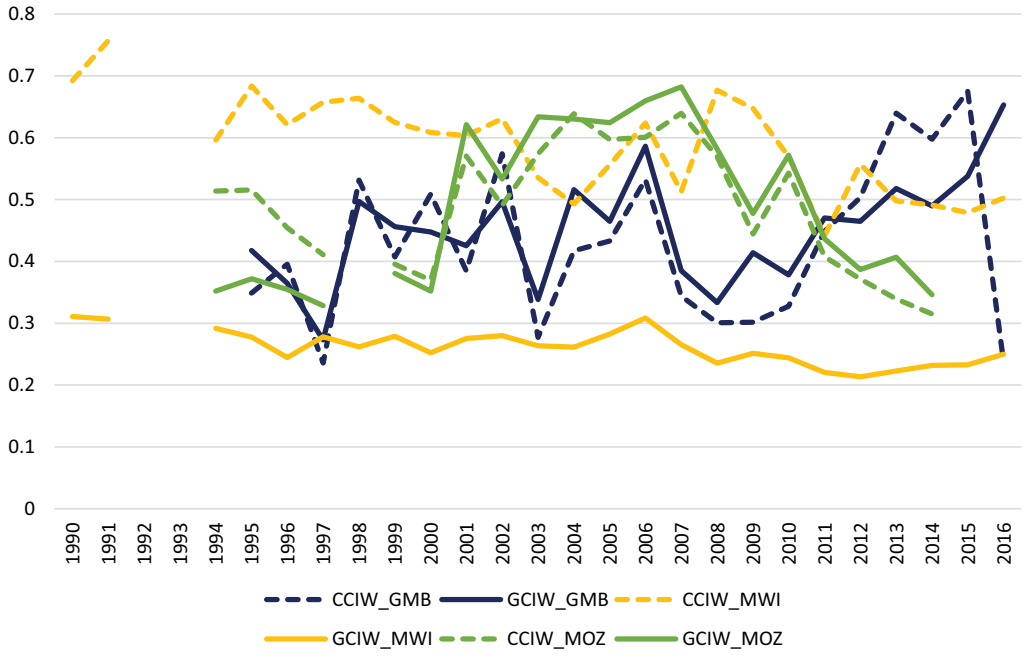


Figure A10b. ED for low-income group 1 (world level)



Low-income group 1: GMB, MWI, MOZ

Figure A11a. ED for low-income group 2 (Commonwealth level)

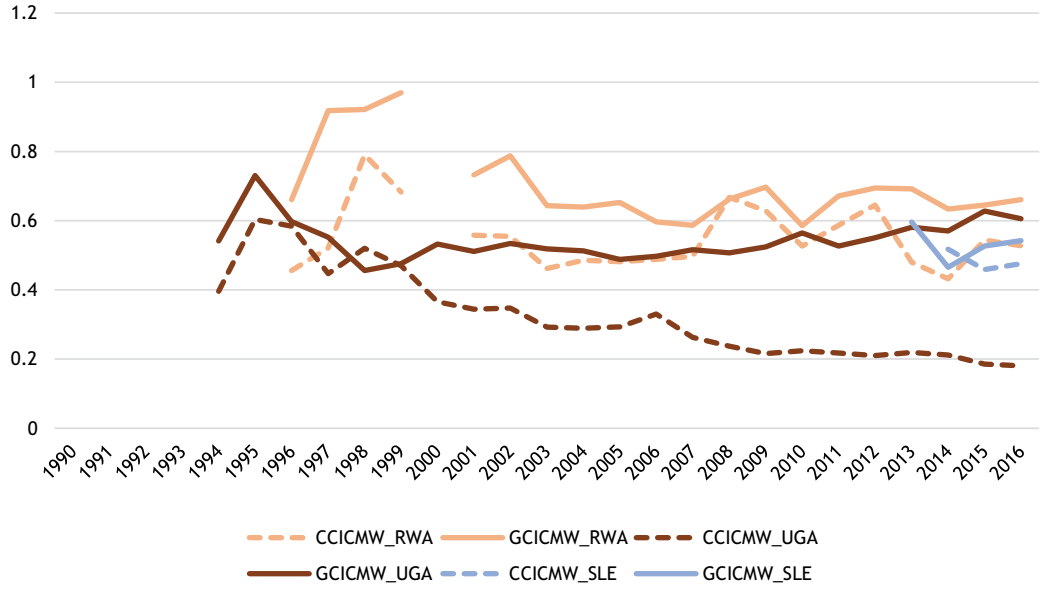
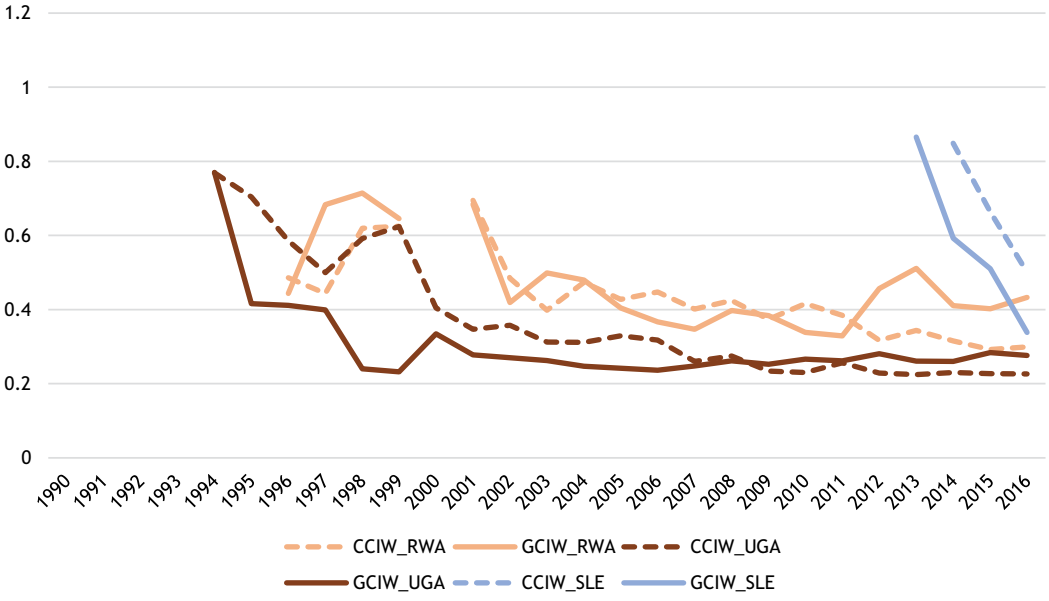


Figure A11b. ED for low-income group 2 (world level)



Low-income group 2: SLE, RWA