Regional Integration and Services in African Value Chains: Retrospect and Prospect

Ben Shepherd

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Bringing Rigour and Evidence to Economic Policy Making in Africa

Regional Integration and Services in African Value Chains: Retrospect and Prospect

By

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List of abbreviations and acronyms

ACFTA	African Continental Free Trade Agreement
ADB	Asian Development Bank
BPO	Business Process Outsourcing
CGE	Computable General Equilibrium
DVA	Domestic Value-Added
FVA	Foreign Value-Added
GATT	General Agreement on Tariffs and Trade
GATS	General Agreement on Trade in Services
GDP	Gross Domestic Product
GVCs	Global Value Chains
10	Input-Output
ITC	International Trade Centre
MRIO	Multi-Region Input-Output
NAFTA	North American Free Trade Agreement
NTMs	Non-Tariff Measures
NQTM	New Quantitative Trade Model
KPO	Knowledge Process Outsourcing
OECD	Organization for Economic Co-operation and Development
SMEs	Small and Medium-sized Enterprises
TiVA	Trade in Value-Added
TRAINS	Trade Analysis Information System
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
VAX	Value-Added Export
WITS	World Integrated Trade Solution
WTO	World Trade Organization

Abstract

This paper takes a first step towards understanding the quantitative evidence on the role of commercial services in African value chains. The available data are largely based on assumptions and modelled estimates, but can nonetheless provide some useful information at an aggregate level. In general, services play an important role in the African regional economy, including through their embodiment in the exports of other sectors through input-output relationships. However, services value chains in the region are mostly composed of domestic value-added, and to a lesser extent inputs sourced from global suppliers. There is very little intra-regional sourcing of commercial services inputs. Simulations using a new quantitative trade model show that intra-regional sourcing could be increased through a derived demand effect following goods market liberalization. In the stylized cases examined, increased use of regional services inputs is not at the expense of globally competitive suppliers, although is some variation at a sub-regional level. As such, it will be important to give a more prominent role to services in discussions of regional integration going forward.

Key words: Trade in services; Global value chains; New quantitative trade model; Input-output analysis.

JEL classification codes: 024; F14; F15.

1. Introduction

Analysis of Global Value Chains (GVCs) has grown markedly in academic and policy circles alike over the last ten years or so. Although GVCs were first identified as "production networks" in East and Southeast Asia in sectors like automobiles and electronics (Ando & Kimura, 2005), it has increasingly been recognized that services are an important part of the equation. Indeed, the servicification of manufacturing is a phenomenon that is now right at the top of the policy agenda, in recognition of the fact that many goods, in fact, consist to a significant extent of value-added originating in services sectors, while other goods bundle services to make the product more appealing or useful to consumers. More than ever, manufacturing and services are closely intertwined: in the GVC context, it is increasingly difficult to separate the two out in any hard and fast way (see Helble & Shepherd, 2019, for an overview).

Bamber et al. (2017), taken up by Hallward-Dreimeir and Nayyar (2017), suggest a three-way classification of services in modern productive systems like GVCs: standalone, embodied, and embedded. Standalone services are those that are offered independently, or which constitute the main core of a productive structure. An example is a restaurant, which offers diners hospitality services. The second category, embodied services, refers to services inputs that are used as intermediates in the production of final goods or services. The most common example is transport services: a manufacturer uses domestic and international transport links to ship their goods to consumers, so the value of the transport services is "embodied" in the final product when it reaches the consumer. Finally, embedded services refer to, for example, apps that can be purchased and used on a personal electronic device. These services are not standalone, in that they can only be used in conjunction with a manufactured good, and they are not embodied in that their value is not typically included in the value of the personal electronic device. Taking all three types of services together, it is clear that the modern world economy is in many senses a services economy.

Africa is no exception to this observation. Figure 1 shows the proportion of GDP and employment that is accounted for by services in Africa, along with the services trade to GDP ratio. In other regions of the world, there is an obvious positive association between per capita income and the prevalence of services in the economy, but it is nonetheless clear that services are an important part of economic life in a low- and middle-income region like Africa as well. The proportion of services in total GDP is over 50% on the continent, and there is some evidence of an increasing trend in the later years of the sample, in line with increasing servicification seen elsewhere. Moreover, Figure 1 likely understates the true importance of services in the economy due to the importance of the informal economy in some countries in the region, including in important services sectors like retail. The figure also shows that services are an increasingly important source of employment in the region. While concern has been expressed by some that premature movement into services may have negative impacts for development and structural change, more recent evidence from around the world shows that productivity differences and differences in productivity growth rates across services sub-sectors are at least as large as those between services and manufacturing (Shepherd, 2019; Hallward-Dreimeir et al., 2021). In Asia, for example, rapid growth in goods trade was accompanied by growth in services trade that was almost as rapid. Ariu (Forthcoming) provides a review of services trade growth in Africa over time.

By contrast, the services trade to GDP ratio in Africa is relatively low, and declining over time. In part, this finding reflects increased trade integration in goods sectors. But it highlights the continent's difficulties in pursuing an active services trade agenda.



Figure 1: Basic data on services, Africa, 2000-2019

Note: Based on a consistent country sample over time to avoid composition effects. Source: World Development Indicators.

From a trade perspective, recent analysis shows that production fragmentation which is at the core of global and regional value chains—is also taking place in services markets, not just in goods. De Backer and Miroudot (2013) show that, while many services are still produced and consumed primarily by small firms within national borders, it is by no means universally true. GVCs are already very active in sectors like business services, where back office operations, call centres, and professional services are frequently provided across borders within a GVC-like structure. Similarly, financial services have seen significant production fragmentation in recent years. Within the African context, a sector not examined by De Backer and Miroudot (2013), namely, tourism, can also be added to the list; tour services can be booked internationally, while aggregator websites located in one country allow access to transport and recreation services in other countries. GVCs are similarly emerging in this sector. As the African Continental Free Trade Agreement (ACFTA) could potentially liberalize trade in services all across the continent, the process of production fragmentation, and the associated rise of services value chains, is likely to intensify. The bottom line is that, services clearly matter to policy makers, business leaders, workers, and consumers in the developing world in general, including in Africa.

Another gloss that has been put on the GVC paradigm by the more recent literature is the importance of regional linkages. International Trade Centre (ITC, 2017) makes the argument, based on a comprehensive review of the data, that most "global" value chains are in fact regional in scope; very few truly span multiple regions. This point is even truer for value chains that involve small and medium-sized enterprises (SMEs), which of course predominate in Africa. As such, although we use the GVC terminology throughout this report, we are conscious that the bulk of the economic activity that will be examined will in fact be regional, rather than truly global in scope. At the same time, it is important to recognize that ITC (2017) suggests there is an inversion in the typical ordering of value-added sourcing in the case of Africa, i.e., that global linkages are more important than regional ones. We return to this issue below, in the context of our own review of the data.

What are the implications of GVCs from a development perspective? Baldwin (2011) puts forward a new model of industrialization and development based on value chain trade. Whereas countries like Korea industrialized by developing full supply chains in particular sectors, those countries currently undergoing rapid industrialization and development, like Vietnam or Mauritius, are specializing in more narrowly defined tasks according to their comparative advantage, while other productive activities take place elsewhere through GVC linkages. Over time, as labour markets tighten and human capital builds up, countries can move up to higher value-added activities within value chains. In the services context, this might mean moving from business process outsourcing (BPO) to knowledge process outsourcing (KPO). This process is expressed as increasing labour productivity over time, combined with more intense trade in intermediate goods and services, mostly taking place within value chains.

This paper draws a number of conclusions that are of policy relevance. First, as noted above, services play an increasingly important role in the regional economy as sources of value-added and employment. Moreover, African countries are increasingly recognizing the role services can play as part of an overall policy of development and structural change. Increasingly, services are no longer regarded as a residual sector, but potentially as part of the motor of economic development and increasing per capita incomes.

The second major conclusion, however, is that, services remain relatively underdeveloped in regional value chains. Africa is in the globally unusual position of relying more heavily on services inputs sourced from world markets than from those sourced regionally. By looking both at results for the continent as a whole and for a selection of countries, the analysis here shows that although realities vary in important ways at the country-level, the overall result is remarkably consistent. The most important nuance is that smaller countries tend to be more open to the internationalization of value chains both in goods and in services than do larger the ones, which is unsurprising in light of the well-known result that larger economies tend to be less open to trade than smaller ones in general terms, not only specifically in terms of value chain integration.

Thirdly, and flowing from the previous point, African value chains in general remain relatively focused on the domestic market. Compared with other parts of the world where GVC development has been more rapid—Asia, in particular—decomposing African gross exports by value-added component, whether in goods or services, shows that the domestic market plays a very important role, typically accounting for 80%-90% of the gross value of exports.

The fourth major conclusion is that, notwithstanding the previous result, services in fact play an important role in regional value chains both in goods and in services. In this regard, though, realities vary considerably at the country-level. But in a general sense, the value chain decomposition of gross exports perhaps highlights that services play a more important role in generating African exports than would be appreciated from looking only at data on gross exports.

Against this background, this paper seeks to add to the understanding of African value chains by focusing on the services dimension, and paying particular attention to quantification. The focus is on embodied services value-added in exports, i.e., the use of commercial services inputs to produce exports. The analysis is, therefore, complementary to work on gross exports of services by Ariu (Forthcoming).

The remainder of this paper is structured as follows. Section 2 introduces a standard quantitative methodology for analysing trade in value-added, which is the cornerstone of GVC analysis in the applied literature, and which makes it possible to combine gross trade data with input-output data to derive indicators of embodied services trade. Section 3 then applies the methodology to data for Africa as a whole, looking in particular at the relationship between regional and global sources of value-added, as well as differences between goods and services. Section 4 then uses a new quantitative trade model to look at the ways in which reductions in trade costs could potentially affect GVC integration in services. Finally, Section 5 concludes and discusses policy implications.

2. Methodology: Quantifying value chain integration

Moving from traditional trade data to TiVA is a challenging empirical exercise, in particular in Africa where trade data are often incomplete. This section outlines the standard methodology from the literature, used to quantify GVC linkages, before moving to its application in the remainder of the report.

What are the data challenges?

This fragmentation of production across borders as implied by the GVC business model, and in particular the large-scale flow of intermediate goods and services, means that traditional trade data are inadequate to properly describe the phenomenon, in particular in the case of services. Standard trade data are measured on a gross shipments basis. In other words, a cellular phone with an import value of US\$500 is recorded as an import of that value, even though its component parts and embodied services have travelled across borders numerous times during the production process, and have also been counted independently in trade statistics. With fragmented production, gross shipments trade statistics tend to significantly overstate the value of trade, and are incompatible with the system of national accounts, which operates on a value-added basis. This is the reason why some countries, like Malaysia, have a trade to GDP ratio in excess of 100%: trade values are measured inclusive of the value of intermediate inputs, but GDP is measured net of intermediate inputs.

A second limitation of standard gross shipments trade data is that they do not identify the sources of value-added, whether goods or services, embodied in a final product. But from a GVC standpoint, this question is of great importance, as it enables analysts to map GVCs both geographically and in product (service) space. With this in mind, applied international trade researchers have developed a variety of techniques to examine the nature and extent of GVCs in goods and services sectors alike.

{B}Multiple methodologies

There is no one, single methodology that makes it possible to capture all important aspects of services value chains comprehensively and definitively. Rather, there are different approaches that have different strengths and weaknesses in terms of capturing important parts of the reality on the ground. Nonetheless, a combination of approaches can be effective in analysing the role of services, including finance, tourism, and transport, in value chains, both in terms of value chains that are specialized in service delivery, and those that use services as intermediate inputs. One option, following Low and Pasadilla (2016), is to adopt an interview and case study approach.

By contrast, this paper takes a quantitative approach using multi-region inputoutput tables (MRIOs). This approach has the advantage of being based on rigorously collected and analysed data, and is well-adapted to producing aggregate statistics. However, it only captures arm's length transactions, and does not take account of services provision that takes place within firms. Similarly, the need to merge trade data with national accounts data to produce the MRIOs means that the data are necessarily highly aggregated, so it is not possible to identify services at a fine level of disaggregation.

A particular limitation of the quantitative approach in the African context is that it relies on the quality of the MRIO itself. There is no official MRIO for Africa, so the standard data source is the privately produced Eora database. However, Eora contains many approximations and interpolations, in particular in smaller, lower income countries. As such, results need to be interpreted cautiously. In particular, individual sector results at the country-level can sometimes be counterintuitive, so it is advantageous to operate at a more aggregate level in most cases. The loss of detail is the price of obtaining meaningful results. More broadly, given the importance of assumptions and modelled estimates in the Eora database, particularly in the African context, it is important to see this research as the first step in better understanding value chain linkages in the region, not as the last word on it.

Quantifying GVC linkages: The Leontief approach

Johnson and Noguera (2012) provide the initial development of the TiVA concept in the literature, and we follow their approach here. More precisely, they combine standard trade data in gross shipments terms with a MRIO (in their case, from the Global Trade Analysis Project) to compute the domestic value-added content of exports. This concept of trade is compatible with the national accounts, and takes full account of the use of domestic and imported intermediates in producing exports. Fundamentally, this approach decomposes the gross value of exports into two components: domestic origin value-added (DVA), and foreign origin value-added (FVA). The latter is embodied in exported goods as intermediate goods or services originating in another country. As such, a lower ratio of DVA to gross exports—known as the VAX ratio—is consistent with a higher degree of international production sharing, which is commonly interpreted as indicating a greater degree of GVC integration.

To see how the approach works in practice, we start with an input-output (IO) table. An IO table has three basic components: a matrix of intermediate goods demand, a matrix of final demand, and a matrix of value-added or primary inputs. Historically, IO tables were prepared for a single country at a time. The concepts can easily be extended to a multi-country case, however. Considering the row sum approach, we can use matrix algebra to represent the production system for G countries and N sectors as follows:

$$AX + Y = X \tag{1}$$

Where: X is the gross output matrix, A is the matrix of input-output coefficients, and Y is the matrix of goods used for final demand. It is immediately clear that AX is the intermediate use matrix as in the example above.

Equation 1 can be rearranged by grouping terms and solving for X:

$$Y = X - AX = X(I - A)$$

$$\therefore X = (I - A)^{-1}Y \equiv BY \quad (2)$$

The matrix B is the Leontief inverse. From basic matrix algebra, we know that:

$$(I - A)^{-1} = I + A + A^2 + A^3 + \cdots$$
(3)

Considering the structure of the A matrix, this means that each element of the Leontief inverse captures the full direct and indirect output requirements in one sector of a unit of output from another sector.

In a standard MRIO context, we observe AX but not A. We therefore need to recover A in order to form the Leontief inverse. To do that, we use element-wise division. For any element (i,j) of A, we have:

$$a_{ij} = \frac{(AX)_{ij}}{X_i} \tag{4}$$

Calculating the elements of A in this way makes it possible to recover the whole matrix, and then in turn to calculate the Leontief inverse B.

We turn next to an analysis of value-added. We define \hat{V} as the matrix of valueadded shares, or the value-added coefficients matrix. This matrix is obtained by summing across rows in A, putting those elements on the diagonal of a square matrix, and subtracting it from an appropriately dimensioned identity matrix. In other words:

$$\widehat{V} = I - diag\left(\sum_{i}^{GN} a_{i,1} \cdots \sum_{i}^{GN} a_{i,12}\right)$$
(5)

The next step is to calculate a matrix T_v as follows:

$$T_{\nu} = \hat{V}BE = \begin{bmatrix} \hat{\nu_1} & 0 & \cdots \\ 0 & \hat{\nu_2} & 0 \\ \vdots & 0 & \ddots \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} & \cdots \\ b_{21} & b_{22} & \cdots \\ \vdots & \vdots & \ddots \end{bmatrix} \begin{bmatrix} e_1 & 0 & \cdots \\ 0 & e_2 & 0 \\ \vdots & 0 & \ddots \end{bmatrix}$$
(6)

Where: E is a matrix with gross exports on the diagonal, and zeros elsewhere.

The T_v matrix contains the value-added content of production in each country shipped to each other country. In other words, it provides a combination of domestic and foreign value-added depending on the country pair chosen. Table 2 clearly makes the point. Each diagonal element represents domestic value-added in exports (DVA), while the sum of the remaining elements in each column represents foreign value added in exports (FVA). To keep the exposition clear, the table is presented at the country-level, but it can equally well be repeated at the country-sector level. The computation makes it possible to compute summary measures, such as total DVA and FVA, by country or by country-sector. But applying appropriate sums makes it possible to calculate other measures of interest, such as FVA for particular regions (e.g., the immediate sub-region and the rest of the world), or DVA and FVA from services only.

	Country 1	Country 2	Country 3		Country N
Country 1	T_v^{11}	T_v^{12}	T_{v}^{13}	•••	T_v^{1N}
Country 2	T_v^{21}	T_v^{22}	T_v^{23}	•••	T_v^{2N}
Country 3	T_{v}^{31}	T_{v}^{32}	T_{v}^{33}	•••	T_v^{3N}
Country N	T_{v}^{N1}	T_v^{N2}	T_v^{N3}	•••	T_{v}^{NN}

Table 1: Value-added content of trade matrix

Source: Aslam et al. (2017).

Limitations of the Leontief approach

While the Johnson and Noguera (2012) approach is powerful and widely used, it does not always provide consistent results. Wang et al. (2013), for example, show that it breaks down at a disaggregated level, i.e., when looking at exporter-importer-sector triples. There are also issues with the way it tracks indirect value-added use. Other approaches, such as the one developed by Wang et al. (2013), are fully consistent at a disaggregated level. But they usually start from the opposite end of the value chain, i.e., they focus on use rather than origin.

In this report, we prefer the original Johnson and Noguera (2012) approach as it is better suited than the later contributions to identifying sectoral value-added origins in gross exports. It is also straightforward to use this approach to identify different geographical scopes of GVC linkages, specifically intra- and extra-regional. We avoid the main problem with this approach by not descending to the country-pair level of disaggregation, and not looking at indirect value-added measures. For our purposes, the basic insight and division of gross exports into DVA and FVA is sufficient to provide important insights into the operation of value chains in Africa, and in particular in the case study countries.

An additional limitation that needs to be stressed relates to data reliability. The only MRIO with coverage of African countries (48 out of 55) is Eora. But as a private initiative, it is not subject to the kind of quality control that MRIOs produced by international organizations see, such as the OECD and ADB products. Many observations are based on modelled or imputed data. Results are, therefore, presented as indicative only, in the interests of stimulating further discussions on GVC linkages in Africa. Future work using better data will no doubt fine tune the findings presented here.

3. Value chain integration in Africa: A focus on services

As discussed in the foregoing, the Johnson and Noguera (2012) approach makes it possible to decompose gross exports into DVA (value-added sourced from the exporting economy) and FVA (value-added sourced elsewhere). Within those two broad classifications, we can identify two further sets of distinctions. First, we can distinguish between value-added originating in goods sectors and that originating in services sectors. Second, we can distinguish within FVA between value-added that originates intra-regionally and that which originates extra-regionally (globally). For example, if the US exports business services to Kenya and they are used there to produce exports of cut flowers, then the Johnson and Noguera (2012) approach would identify the value-added of the business services as foreign value-added originating extra-regionally from a services sector. By contrast, if Nigeria exports paper to Mali and that country uses it to produce exports of tourism services, the approach would identify the value-added in the paper as originating intra-regionally in a goods sector. Following this approach, any country's gross exports can be decomposed. not only into domestic and foreign origin components, but also into goods and services origins, and extra- and intra-regional origins.

A key limitation in this approach relates to the treatment of foreign direct investment (FDI). If an American firm purchases a subsidiary in Kenya and sells services there that are then embodied in Kenyan exports, those services are recorded as domestic in origin. The reason is that the national accounts, on which the Eora MRIO is based, use a locational principle to organize transactions, not an ownership principle. So conclusions as the level of intra- and extra-regional value-added in African exports does not speak to the role played by inward FDI in generating some proportion of domestic value-added. The trade concept at play is direct exports and imports, not the modes of supply recognized by the General Agreement on Trade in Services (GATS).

Before proceeding to the analysis, Table 2 shows the definition of "commercial services" used in this paper. The primary research objective is to understand the role of embodied trade of commercial services, so the rest of the economy—which covers primary sectors, manufacturing, and non-commercial services—is aggregated into an "other" category. In all, commercial services in this approach covers nine subsectors that capture the key aspects of the category in the Eora's 26 sector harmonized format. For readability, all figures refer to "commercial services" simply as "services", and so need to be understood as excluding those non-commercial sectors included in the "other" category.

Commercial Services	Other
Construction	Agriculture
Financial Intermediation and Business Activities	Education, Health and Other Services
Hotels and Restaurants	Electrical and Machinery
Maintenance and Repair	Electricity, Gas and Water
Post and Telecommunications	Fishing
Recycling	Food & Beverages
Retail Trade	Metal Products
Transport	Mining and Quarrying
Wholesale Trade	Other Manufacturing
	Others
	Petroleum, Chemical and Non-Metallic Mineral Products
	Textiles and Wearing Apparel
	Private Households
	Public Administration
	Re-export & Re-import
	Transport Equipment
	Wood and Paper

 Table 2 :
 List of sectors included in the Eora MRIO

Source: Eora database.

Figure 2 shows results, summing output from Eora into five continental aggregates. The idea of Figure 2 is to put Africa's performance in terms of GVC linkages into global perspective, before looking in more detail at the continent's specificities. It is immediately clear from the figure that Africa's gross exports tend to include a greater proportion of DVA than is the case for other regions, particularly Asia and Europe. In other words, FVA is lower, and GVC linkages are correspondingly smaller in Africa's use of services to produce its exports is, nonetheless, very comparable to what is seen elsewhere: indeed, it is the highest within the sample, at 41%, just ahead of Europe and only slightly behind America. This result highlights the importance of services in Africa's trade, albeit largely indirectly through embodiment in other sectors' exports. But a third important finding from Figure 2 is that Africa's services embodied in gross exports are primarily domestic in origin, so services GVC linkages are relatively weak compared with what is seen elsewhere: Africa's total of 5% is the lowest of any of the five continental aggregates.

A final finding from Figure 2 is that, in line with ITC (2017), Africa appears to be the only aggregate region where GVC sourcing is primarily from outside the region. Intra-regional GVC linkages only account for 0.4% of the value of gross exports in Africa, compared with more than 8% in Europe. Many reasons could lie behind this result, from trade barriers within the region, to patterns of comparative advantage. But the key takeaway for the purposes of this report is that regional GVC integration, including in services, is underdeveloped in Africa relative to other world regions. As such, there is considerable scope to boost performance in the future, in particular as regional integration initiatives bear fruit.





The upper panel of Figure 3 puts the data in dynamic context, by looking at the evolution of the value-added components of Africa's gross exports between 2000 and 2015. As the figure shows, there is little evidence of a secular trend towards greater internationalization of trade in Africa, in a GVC sense. In 2000, FVA accounted for 12.6% of African gross exports, but in 2015 the number had only increased to 13.2%. During this period, other regions—particularly Asia—saw rapid increases in this type of GVC integration. The picture for regional value-added in gross exports is even grimmer than this analysis would suggest: its proportion of African gross exports only increased from 1.16% to 1.18% over the 15-year sample period, so there was essentially no change in the regionalization of African value chains, which, as discussed above, is low in international comparison. Similarly, the proportion of services origin valueadded only increased from 4.9% to 5.3% over the sample period; so while there is evidence of servicification of African value chains, it is primarily occurring through input sourcing outside the region.

Source: Eora database and author's calculations.





Note: Continent (upper panel) and regions, 2015 (lower panel). Source: Eora database, and author's calculations.

Percent

The main gloss on these results is that 2015 is actually a low point for GVC integration in the region compared with the few years preceding it. While the picture would be slightly more encouraging if the sample ended in 2013 or 2014, it would not be fundamentally different.

The lower panel of Figure 3 focuses in on 2015, but breaks the data out by African subregion. In interpreting the figure, it is important to keep in mind the relative proportions of each subregion in total African exports: Northern Africa accounts for 35% of the continent's total exports, followed by Southern Africa at 33%; the other regions play a smaller role, with Western Africa at 15%, Middle Africa at 11%, and Eastern Africa at 7%. It makes clear that there are substantial differences in the makeup of GVC trade across the continent, but the domestic value chains predominate everywhere. However, that dominance is less pronounced in Southern Africa and Eastern Africa than elsewhere. Those two regions give a greater degree of importance to imported intermediates relative to domestically sourced intermediates, though the pattern of relative reliance on extra-, rather than intra-regional, sourcing remains pronounced even in these more internationalized sub-regions.

Figure 4 provides further detail by looking at individual sectors, still aggregating all regional economies into Africa as a whole. The graph is in percentage terms, so it is important to keep the relative size of sectors in mind. Mining and quarrying accounts for 34% of Africa's total exports, followed by petroleum, chemical, and mineral products at 11%, transport and metal products both at 7%, and agriculture at 6%. It limits consideration to "other" sectors only, so each listed sector is an output sector that potentially contains embodied commercial services value-added. In the discussion here, the focus is on goods sectors rather than other residual or non-commercial categories, as they are quantitatively small relative to goods trade.

In Figure 4, each bar indicates the percentage of gross exports in each sector that is accounted for by the listed categories of value-added. While there is more variation than is suggested by the overall total presented above, the general feature of African value chains-that they are largely composed of DVA-does not change. Leaving to one side residual or non-commercial categories, there is no sector where DVA accounts for less than 64% of the gross value of exports, and the figure is far larger in most cases. Indeed, the most internationalized African commercial GVC in goods (excluding residual sectors)—transport equipment—stands out relative to the others, as it incorporates significantly more FVA in percentage point terms than the next most internationalized sectors. It has an FVA percentage of gross exports equal to 35.8%, compared with electrical and machinery at 22.6%, and other manufacturing at 22.5%; so it is more than ten percentage points higher than the next sector. Notwithstanding this, the overall result that within FVA, the main component is from outside the region is not challenged at all by the sectoral data: in other manufacturing, the sector with the best developed regional GVC structure, the proportion of regional value-added in gross exports is only 2.9%, while in food and beverage it is 2.6%. So the overwhelming majority of FVA in Africa's gross exports of goods comes from extra-regional sources. Finally, the data show that commercial services use varies considerably from sector to sector, but that the main inputs are domestic (by far the largest) and extra-regional: in no sector does intra-regional services value-added account for more than 0.8% of gross exports (other manufacturing). Having said that, the importance of services overall is considerable: in mining, services value-added accounts for 35.7% of gross exports, while in textiles and clothing it is 34.9%; even in agriculture, the figure is 20.5%. So commercial services clearly play an important role in African goods GVCs, albeit primarily through domestic sourcing, and to a lesser extent, extra-regional sourcing.



Figure 4 : Value-added breakdown of gross exports by sector other than commercial services, Africa only, 2015 (% of total)

Source: Eora database and author's calculations.

Figure 5 looks at the components of gross exports of commercial services by sector, again focusing only on Africa. Of course, the role of services overall is much larger than in the goods sectors presented in Figure 4. But other than that one important difference, the general pattern that emerges from the data is very similar. GVC linkages are again relatively limited, in single digits in percentage point terms in many cases, although some small sectors have higher rates. Focusing on the major commercial services, construction stands out at 14.1%, and transport at 10.4%. But in these figures, only a small part of services value-added is sourced regionally: just 1% in construction (relative to the value of gross exports); in the other major commercial services sectors, the proportion of regional services value-added in gross exports is less than 1%. So in an important sense, African services value chains are even less internationalized (i.e.,

relatively more reliant on DVA) than their counterparts in goods sectors. There could be many reasons for this outcome, ranging from restrictive policies to comparative advantage. Similarly, it stands out that, extra-regional services value-added is typically a more important component of gross exports of services than intra-regional services value-added.





An important question in relation to the analysis in Figure 4 and Figure 5 relates to the sectoral composition of services inputs that make up the commercial services value-added that is embodied in gross exports. Figure 6 investigates this question, by decomposing total services sector value-added in exports into its sectoral components; it aggregates across all origins, i.e. domestic, regional, and extra-regional. The top panel looks at other sectors, while the bottom panel focuses on commercial services. The most important finding is that sectors like finance and business services, transport, and wholesale and retail trade, as well as telecoms, are the largest suppliers of inputs to goods exporting sectors. That is, the data on services inputs embodied in goods exports are not distorted by the importance of relatively low value-added per worker sectors like tourism, which is captured by the hotels and restaurants aggregate. The point remains true in terms of services exports as well (lower panel), although the role of tourism is larger there. Nonetheless, the conclusion that modern, relatively high value-added per worker services sectors account for the lion's share of embodied value-added in gross exports remain true.

Source: Eora database and author's calculations.

Figure 6: Breakdown of commercial services value-added embodied in gross exports by sector; other sectors (upper panel), and commercial services (lower panel)



Source: Eora database and author's calculations.

The overall picture that emerges from this review of the regional data is that, African GVCs have a relatively high reliance on DVA, and correspondingly low reliance on FVA, relative to what is seen elsewhere in the world. One gloss on this result is that the analysis treats sales by foreign-owned firms as DVA, not FVA, since the national accounts are organized on a locational principle rather than an ownership principle. But there is no inconsistency with the results reported above and findings elsewhere (e.g., Hoekman & Sanfilippo, forthcoming) to the effect that inward FDI in Africa significantly targets services sectors: those inflows contribute to services DVA in gross exports. In addition, and in line with ITC (2017), the data show that international sourcing privileges extra-regional rather than intra-regional arrangements, which is again unusual in international comparison. This result sits well with the findings of De Melo and Twum (2021), who similarly emphasize the relative importance of extraregional linkages for African involvement in GVCs. These findings could suggest that trade cost reductions have been relatively skewed away from regional partners over time. The proportion of the gross value of exports accounted for by services valueadded is important to keep in mind though: it is of real quantitative significance even in sectors like agriculture. But, once again, it mostly consists of DVA, and what FVA there is, is sourced extra-regionally for the most part. Having said this, an important additional conclusion is that, relatively high value-added per worker commercial services account for the largest proportion of embodied services value-added in exports, either of goods or of other services.

4. Simulating the impact of changes in trade costs

The previous section presented a broad brushed overview of what the data have to say about African GVCs in general, focusing on the balance between DVA and FVA, as well as the relative importance of value-added originating in services and goods sectors. This section uses that analysis as a starting point; then asks how the observed pattern of GVC integration might differ if trade costs were to be reduced in various ways. To do so, it uses a new quantitative trade model (NQTM), following the terminology in Ottaviano (2015), based on Aichele and Heiland (2018). The section starts with an intuitive description of the model, which is fully set out in the appendix. It then states the counterfactual simulations, and presents results.

An NQTM with GVC integration

Aichele and Heiland (2018) provide a general modelling framework that can map changes in iceberg trade costs to patterns of value-added trade (i.e., GVC linkages) at a disaggregated level. This section explains in detail how the model works, focusing on intuition. Full technical details are in the appendix.

The general approach falls into the NQTM family, in which trade is governed by a standard structural gravity model, but which also has a full general equilibrium structure with multiple countries, multiple sectors, and input-output relationships across sectors. While CGE models are extensively used in policy settings, NQTMs like the one used here, are increasingly finding application in the academic literature as testbeds for exploring policy-relevant questions. Examples include Caliendo and Parro (2015), who examine the trade and welfare impacts of NAFTA; Dhingra et al. (2017), who look at the effect of the UK's exit from the European Union, and Aichele and Heiland (2018), who consider the GVC integration impacts of China's WTO Accession. The key advantage of this class of models over traditional CGE approaches is "a tighter connection between theory and data thanks to more appealing micro-theoretical foundations and careful estimation of the structural parameters necessary for counterfactual analysis" (Ottaviano, 2015). In concrete terms, this means that the model deals with bilateral trade in the same general way that is common in the international trade theory literature, i.e., through a structural gravity equation. Production and consumption functions follow standard approaches in that literature as well, as indeed is implied by the previous sentence. In

terms of structural parameters, the model has only one per sector, recently precisely estimated by Egger et al. (2018) using the same general framework, rather than the thousands of parameters typically found in CGE models. While these points support the use of an NQTM in the present paper, it is true that there is as yet little "head to head" evidence on how results differ between, say, the Caliendo and Parro (2015) model and the standard Global Trade Analysis Project model. Future research could usefully examine this question.

The model used in this paper includes multiple countries and multiple sectors. On the consumption side, representative consumers in each country consume the final output of each sector under Cobb Douglas preferences with fixed expenditure shares.

The production side nests the Ricardian model of Eaton and Kortum (2002) in a multi-sector input-output framework. Intermediate goods producers in each sector use labour and a composite intermediate good from all sectors as inputs. They transform inputs into output using constant returns to scale technology under perfect competition. But countries differ in their underlying level of Ricardian productivity, which determines the technology parameters of intermediate goods production. Production of the composite intermediate—which is incorporated in intermediate goods themselves and also in final goods—uses constant elasticity of substitution technology across a set of intermediate varieties sourced from the lowest cost supplier. Assuming a particular statistical distribution for Ricardian productivity (Fréchet) makes it possible to pin down this input sourcing arrangement for given parameters.

Producers in each country can, in principle, ship their output to any or all of the other countries, as well as domestically to their own country. On each route, including domestically, shipments are subject to iceberg trade costs, composed of tariff and non-tariff components. Following Aichele and Heiland (2018), trade costs vary by end-use, so intermediate shipments can be subject to different tariff and non-tariff trade costs from final goods shipments. When the model is estimated econometrically (see Equation 10), it is standard to use extensive fixed effects to control for observable and unobservable country-time and pair-specific factors. Tariffs change in the country pair-time dimension, and so can be included as explanatory variables. Similarly, membership of trade agreements or of the GATT/ WTO system also varies by country pair and by time period, and so can be included to capture NTM effects. However, this point is of secondary importance for the present paper because there is no econometric estimation: it is a purely computational exercise, based on a "thought experiment" where tariffs are reduced to a given level, and the question is as to the counterfactual values of trade and production. The relationship between tariffs and iceberg trade costs is one to one, with tariffs in ad valorem power form.

The above set up yields an expression for bilateral trade (including internal shipments) that follows the standard structural gravity framework. Collecting terms gives bilateral trade for an exporter-importer-sector triple in terms of exporter-sector

and importer-sector fixed effects, and bilateral trade costs. As in standard structural gravity models, there is a single trade elasticity that governs the sensitivity of bilateral trade to changes in trade costs. The model takes the following form (using equation numbering from the appendix):

$$\pi_{ni}^{j\nu} = \frac{X_{ni}^{j\nu}}{X_{n}^{j\nu}} = \frac{\lambda_{i}^{j} \left[c_{i}^{j} \kappa_{ni}^{j\nu}\right]^{-\theta^{j}}}{\sum_{h=1}^{N} \lambda_{h}^{j} \left[c_{h}^{j} \kappa_{nh}^{j\nu}\right]^{-\theta^{j}}} = d_{i}^{j} d_{n}^{j} \kappa_{ni}^{j\nu} \overset{-\theta^{j}}{\longrightarrow}$$
(10)

Where: π_{ni}^{jv} is the import share for country *n* from country *i* in sector *j* by end-use *v*; λ_i^j and θ^j are parameters of the Fréchet distribution; c_i^j is the cost of an input bundle; κ_{ni}^{jv} is iceberg trade costs; d_i^j are exporter-sector fixed effects; and d_n^j are importer-sector fixed effects. As Equation 10 makes clear, it is possible to estimate the gravity model consistently while only directly observing trade costs and the trade elasticity.

Standard adding up constraints, with an exogenous trade deficit, close the model. Goods markets clear and expenditure is set equal to output. National income is then the sum of labour income, rebated tariff income, and the exogenous trade deficit. Since the trade deficit is exogenous, there is no explicit modelling of savings or investment decisions in the model, and thus the role of inward FDI is abstracted (cf. Hoekman & Sanfilippo, forthcoming).

From a policy perspective, it is important to examine how the model can be used to look at changes in key economic variables following a shock to trade policies, as captured by iceberg trade costs. First, a key characteristic of the model is that it incorporates both tariffs and non-tariff measures (NTMs). A shock to tariffs has direct consequences for tariff revenue, whereas a shock to NTMs only has an indirect effect driven by changes in trade flows; in other words, NTMs simply waste resources by impeding transactions, without generating any revenue, as is standard in the literature (e.g., De Melo & Shepherd, 2018).

Solving the counterfactual using the exact hat algebra approach of Dekle et al. (2007) makes it possible to specify a shock in terms of a proportional change in iceberg trade costs, and to map it to changes in trade flows through changes in the costs of inputs and final goods prices in consumption, while respecting general equilibrium constraints. An important advantage of this approach is that, since it works in proportional changes, factors that are held constant simply cancel out and do not need to be observed in the baseline. So it is not necessary to have, for example, estimates to total NTM-related trade costs, or technology, or input prices, in order to solve the model using, for example, a change in ad valorem tariffs. Of course, when data are in fact observed, as is the case for tariff, then proportional changes can be constructed using them. The point is simply that, even in the absence

of comprehensive observations, as in the case of NTMs, it is still possible to simulate the effects of an assumed proportional change.

The counterfactual solution respects the technological parameters of sectoral input-output relationships, as well as underlying Ricardian technology in the economy. The counterfactual solution yields changes in exports and imports, which can then be used to construct changes in real national income as an indicator of welfare changes. Provided that a policy change can be expressed in terms of a proportional change in iceberg trade costs, the model provides a very flexible framework for understanding its economic implications. Of course, counterfactual simulations are ceteris paribus: the assumption is that there is a proportional change in trade costs, but that no other parameters change. In other words, there are no exogenous shocks to technology or preferences, nor are their exogenous shocks to income. However, an important advantage of this approach to model solution is that it is not necessary to observe baseline levels of trade costs: all that is needed is the proportional change. This point is an important one, since tariffs are typically observed, but the universe of NTMs, including in services sectors, is not.

Building on Aichele and Heiland (2018), it is also possible to take the counterfactual solution methodology a step further. It can be manipulated to yield a full counterfactual input-output table, in addition to the observed one for the baseline. Given that the model has input-output data and trade flows, it is straightforward to use it to produce baseline and counterfactual changes in GVC integration using the Johnson and Noguera (2012) approach discussed above. In other words, it is possible to map a shock to iceberg trade costs, not only to standard economic aggregates like trade flows and national income, but also to the split between DVA and FVA in gross exports, or to the value- added origins of gross export flows.

For the analysis in this paper, the model's mechanism can be summarized straightforwardly, with full details in the appendix. The shock is defined as a change in iceberg trade costs due to a change in tariffs or NTMs. Changes in trade costs affect the relative prices of traded goods, both for final consumption and for use as intermediate inputs. Changes in the prices of intermediates introduce a second round of price changes for final goods. The counterfactual equilibrium is then a set of trade flows, wages, prices, input costs, and trade flows that both satisfy the newly prevailing trade costs and the requirements that markets clear, and that expenditure equals output subject to an exogenous trade deficit. This approach requires iterative solution of a system of nonlinear equations.

To produce this rich set of outputs, the model only needs as inputs MRIO estimates of the sectoral trade elasticities, and a vector of shocks to tariffs and NTMs separately for intermediate and final goods. This paper uses the Eora MRIO that was already analysed in the previous section. Although the model incorporates structural gravity, there is in fact nothing to estimate in the present case: the counterfactuals I specify below can be coded as functions of data and parameters only, without the need to estimate additional trade cost elasticities. For counterfactual simulation, the base year is 2015, which is the latest year currently available. The Eora data cover 48 of 55 African countries, along with all other major trading economies, and most other countries as well, for a total of 185 disaggregated countries. Table 2 gives the sectoral disaggregation, distinguishing between services and other sectors. The sectoral classification is the same for the simulations as for the descriptive statistical analysis above.

Estimates of the sectoral trade elasticities come from Egger et al. (2018). Although those authors work with a different data source (the World Input-Output Database), the sectoral aggregation is based on standard national accounts aggregates, and so can visually concord to Eora sectors. Their estimation approach uses the same general modelling framework as in this paper, so there is no issue of correspondence between estimated and theoretical parameters: they use structural relationships to identify the trade elasticities.

The other key input is a vector of proportional changes in iceberg trade costs. As noted above, trade costs consist of two components: tariffs and NTMs. Tariffs are sourced from UNCTAD's TRAINS database, accessed through the World Bank's WITS server. The base year is 2015, and tariffs are based on effectively applied rates that take full account of preferential tariffs, as well as ad valorem equivalents of specific tariffs. NTMs, on the other hand, cannot easily be observed in ad valorem equivalent terms. So I take advantage of the exact hat algebra approach to specify counterfactual scenarios in terms of proportional changes in NTMs. As a result, I do not need to observe the baseline level of NTM restrictiveness.

Given that the counterfactual scenarios, described below, focus on changes to intra-African tariffs, Table 3 lists average tariff rates by sector for intra-African trade. Rates are moderate to somewhat high in most cases by world standards.

Sector	Tariff
Agriculture	12.948
Electrical and Machinery	7.532
Fishing	11.748
Food & Beverages	15.784
Metal Products	10.873
Mining and Quarrying	4.192
Other Manufacturing	11.269
Petroleum, Chemical and Non-Metallic Mineral Products	6.567
Textiles and Wearing Apparel	18.241
Transport Equipment	8.346
Wood and Paper	12.454

Table 3 : Simple average applied ad valorem tariffs, intra-African trade, 2015 (%)

Source: TRAINS database, and author's calculations.

Counterfactual scenarios

The model described above is very flexible in terms of the counterfactual scenarios it can accommodate. As a starting point for understanding the link between policies and GVC aspects of services in Africa, I focus on what could be termed the "derived demand" impact of policy changes in goods markets. While services are on the African regional integration agenda, in the short term, AfCFTA will only deal directly with goods markets, principally tariffs, but also potentially some impacts on NTMs.

As such, is there anything to say about the ways in which policy changes in goods markets—tariff reductions, and cuts in NTM restrictiveness—could spill over to services markets? I showed above that a significant proportion of the value of gross exports of goods from the region is in fact made up of embodied services value-added, derived from input-output relationships. As such, it is natural to expect that lowering tariffs, for example, could boost regional demand for goods, which would in turn increase the demand for services inputs used within those goods value chains. This question is one that the model can respond to directly.

With this framework in mind, I define two counterfactual simulation scenarios:

- Elimination of tariffs on intra-regional trade: I set counterfactual tariffs on intra-African trade equal to zero, as a simple version of a long-term full AfCFTA implementation. In the short term, tariff reductions are much more complex due to the use of sensitive product lists. But the objective of tariff-free intra-regional trade is clearly stated at a policy level. So this scenario captures a stylized implementation of continental free trade, limited to the imposition of tariff-free movements of goods within the region.
- 2. Elimination of tariffs on intra-regional trade, and reduction in the restrictiveness of intra-regional NTMs by 10%: In addition to setting counterfactual tariffs on intra-African trade to zero, this scenario imagines some progress on NTMs as well. In the model, NTMs—like tariffs—are captured through iceberg parameters, so a 10% cut is simply 0.9 in proportional terms. As noted above, the model does not need an observation of baseline ad valorem equivalents for NTMs in order to conduct the simulation. So this second scenario looks at the potential for a more ambitious regional integration agenda, moving beyond tariffs to include NTMs, to boost goods trade further, and thus increase derived demand for services even more strongly.

Simulation results

In reporting results, I focus in on the GVC aspects of the model, as that is the area of primary interest here. Figure 7 shows value-added originating within Africa as a proportion of Africa's gross exports, distinguishing between services and other sectors. The upper panel is for Africa as a whole, while the lower panel breaks out results by sub-region. Three points emerge clearly from Figure 7. First, the derived demand channel can clearly lead to servicification of regional value chains, as evidenced by levels of regional value-added in gross exports that are higher in both of the counterfactual scenarios relative to the 2015 baseline. However, an important gloss on this result is that, even with the complete elimination of intra-regional tariffs and a significant reduction in intra-regional NTMs, the impact is not particularly large: the proportion of regional value-added, particularly in services, relative to gross exports remains low. So while the derived demand channel is important, it is by no means a panacea for bringing about greater servicification of regional value chains.

The second point to emerge from Figure 7 is that, given the nature of the counterfactuals, it is unsurprising that changes for value-added originating in goods sectors are much larger than for services value-added. The reason is that for goods, there is not only a derived demand effect at play: making goods flow more easily within the region also makes it easier to source goods market inputs from African suppliers, so there is a greater incentive to regionalize value chain activity.

Thirdly, the role of NTMs in facilitating regional trade is clearly important, as impacts for both sectors under scenario 2 are considerably larger than for scenario 1. So even though Africa is starting from a relatively high global benchmark in terms of tariffs, it will be important for policy makers to focus on NTMs as well if they are to make best use of regional integration to promote increased sourcing of inputs from within Africa. Reducing intra-regional trade costs boosts the regional sourcing of intermediate inputs, including from services sectors.

In addition to these points, the lower panel of Figure 7 highlights the importance of sub-regional heterogeneity in the effects of liberalization on services in African GVCs. While the general pattern is the same across scenarios even at a disaggregated level, the quantitative importance of the effects is noticeably different, ranging from a large effect in Southern Africa to a minimal one in Western Africa. The effect for the continent as a whole—the sum of its component parts—is therefore influenced by the weight of the large regional economies: indeed, the Western Africa result suggests that Nigeria's use of services in value chains changes relatively little under the counterfactual, likely because value chains are so heavily domestic in orientation. So for policy work, breaking these results out at the country-level would be an important input into analysis and decision-making.

A key concern for any regional integration programme is the capacity for trade diversion. This concern is all the more evident in a GVC context: facilitating intraregional trade could lead to distorted input-sourcing decisions, whereby local producers are induced to source less from competitive global suppliers and more from potentially less competitive regional suppliers. This concern is particularly acute in the case of sourcing services inputs in Africa: given that services tend to be relatively intensive in human and financial capital, there are many sub-sectors in which Africa generally has a comparative disadvantage. So the risk of trade diversion in a GVC context is that regional integration ultimately undermines the global competitiveness of downstream producers.





Notes: 2015 baseline and counterfactuals (upper panel); same data by African sub-region (lower panel). Source: Author's calculations.

Figure 8 considers this possibility by looking at extra-regional value-added in Africa's gross exports under the two counterfactual scenarios, relative to the observed 2015 baseline. In this particular scenario, the concern of GVC input trade diversion generally does not materialize: both scenarios see slightly increased proportions of globally sourced inputs in services as well as in goods. The changes are small in both cases, but they serve to show that even a relatively ambitious regional integration programme in Africa would not lead to a wholesale switching of input sourcing arrangements from global to regional suppliers. Indeed, comparing Figure 8 and Figure 7 makes clear that, under both scenarios, the dominant foreign value-added in African exports would be extra-regional in nature.

The only nuance required in this analysis comes from the lower panel of Figure 8. There is evidence of limited value-added trade diversion in Northern Africa. However, the result does not generalize to other African sub-regions. In policy work, detailed analysis of country-level results would be required as an input into decision-making to ensure that trade diversion effects are not significant at a disaggregated level.



Figure 8 : Extra-regional value-added as a percentage of gross exports, Africa, services sectors and others



Note: 2015 baseline and counterfactuals (upper panel); same data by African sub-region (lower panel). Source: Author's calculations.

5. Conclusions and policy implications

This paper has examined the available data on value chains in Africa, focusing on services. Services play two main roles in the value chain context: they contribute part of the gross value of goods exports through embodiment as intermediate inputs, and they act as value chains in their own right by internationalizing the production and consumption of services themselves. The focus here has been on quantitative evidence, which in turn implies a major caveat on the analysis: services are poorly measured in many countries in Africa, both in the national accounts, and in particular in trade data. While the analysis here is based on the best available information, it relies heavily on modelling assumptions used to produce MRIOs including African countries, and so is subject to refinement and rethinking as better data become available in the future.

Subject to that caveat, a number of conclusions emerge clearly from the data review. First, services play an increasingly important role in the regional economy as sources of value-added and employment. The GDP shares of industry and services have generally been growing as the region moves away over time from its historical reliance on primary industries. Moreover, African countries are increasingly recognizing the role services can play as part of an overall policy of development and structural change. Increasingly, services are no longer regarded as a residual sector, but potentially as part of the motor of economic development and increasing per capita incomes.

The second major conclusion, however, is that, services remain relatively underdeveloped in regional value chains. ITC (2017) has already shown that Africa uses relatively little in terms of intra-regional inputs within its value chains. The analysis here confirms that result, and shows that it applies to the specific cases both of services within goods value chains, and also to services value chains specifically. In both cases, Africa is in the globally unusual position of relying more heavily on services inputs sourced from world markets than from those sourced regionally. By looking both at results for the continent as a whole and for a selection of countries, the analysis here has shown that, although realities vary in important ways at the country-level, the overall result is remarkably consistent. The most important nuance is that smaller countries tend to be more open to the internationalization of value chains both in goods and in services than do larger ones, which is unsurprising in light of the well-known result that larger economies tend to be less open to trade than smaller ones in general terms, not only specifically in terms of value chain integration. Thirdly, and flowing from the previous point, African value chains in general remain relatively focused on the domestic market. Compared with other parts of the world where GVC development has been more rapid—Asia in particular—decomposing African gross exports by value-added component, whether in goods or services, shows that the domestic market plays a very important role, typically accounting for 80%-90% of the gross value of exports. Another way of expressing this finding is that GVCs and regional GVCs are underdeveloped in Africa relative to other world regions.

The fourth major conclusion is that, notwithstanding the previous result, services in fact play an important role in regional value chains both in goods and in services. In this regard, though, realities vary considerably at the country-level. But in a general sense, the value chain decomposition of gross exports perhaps highlights that services play a more important role in generating African exports than would be appreciated from looking only at data on gross exports. This point is an important one in light of the first finding, which highlighted the importance of services in production and employment: they are also important in trade, both in their own right, and as inputs into the production of other tradeable goods and services.

What do these findings mean in policy terms? It is important to be clear that domestic orientation of value chains is not a positive characteristic of trade from a development perspective. Maximizing the proportion of domestic value-added in gross exports is not a sensible objective for a developing country policy maker, because the available evidence suggests that DVA and FVA are complements, not substitutes. This feature of GVCs means that overall sectoral growth—which translates into more income and jobs—is faster when there is some degree of openness to FVA. This idea sits well with the experience of the rapidly developing Asian countries, which have shown that openness in input markets can help drive productivity growth over the medium to long term. So an important objective for African policy makers should be to increase the degree of internationalization of value chains, both in goods and in services.

A second important policy implication, however, is that, just as maximizing the proportion of DVA in gross exports is not a sensible objective, neither is boosting intraregional trade always the best approach to increasing incomes and living standards. There is extensive evidence that openness to trade—in general—is part of most successful development strategies, although the precise nature and extent of that openness vary significantly from country to country. However, openness means to world markets in general, of which regional markets are part. Specifically in the context of services value chains, it would be dangerous to focus on boosting intra-regional linkages potentially at the expense of global linkages, because it would go against the fundamental pattern of comparative advantage in many services sectors. So policy makers should concentrate on openness, but not only to intra-regional trade flows.

Thirdly, simulation results show that a derived demand channel means that greater goods market integration under AfCFTA could lead to increased sourcing of services inputs from the region. Importantly, this increase would generally not be at the price of globally competitive suppliers outside the region. In other words, in the

two counterfactual scenarios analysed here, the risk of GVC input trade diversion does not materialize in a large-scale way.

Finally, and subject to the previous points, there is a strong case for giving services a more prominent role in regional policy discussions. While some countries, like Rwanda, have explicitly included commercial services within the scope of their industrial policies, it will be important for regional policy makers to work together on frameworks to reduce trade costs in services markets. While some degree of intraregional liberalization can help, given both the size of the underlying trade costs and the need to ensure access to high quality inputs at competitive prices, it will also be important to look at ways of limiting effective discrimination vis-a-vis extra-regional suppliers. Moving forward on services in the context of AfCFTA could be very beneficial in terms of boosting regional GVC activity, but only if close attention is paid to limiting the risk of trade diversion.

Notes

1. The classification of countries into sub-regions comes from UnctadStat.

References

- Aichele, R. and I. Heiland. 2018. "Where is the value added? Trade liberalization and production networks". Journal of International Economics, 115(C): 130–44.
- Anderson, J. and E. van Wincoop. 2004. "Trade costs". Journal of Economic Literature, 42(3): 691–751.
- Ando, M. and F. Kimura. 2005. "The formation of international production and distribution networks in East Asia". In T. Ito and A. Rose, eds., International Trade in East Asia. Chicago: University of Chicago Press.
- Ariu, A. 2022. "Services trade in Africa: Structure and growth". Paper presented at the AERCWorkshop on 'Value Chain Development, Trade, and Economic Transformation in Africa'.African Economic Research Consortium, Nairobi, forthcoming.
- Aslam, A., N. Novta and F. Rodrigues-Bastos. 2017. "Calculating trade in value-added". IMF Working Paper No. 2017/178. International Monetary Fund, Washington, D.C., July.
- Baldwin, R. 2011. "Trade and Industrialization after globalization's second unbundling: How building and joining a supply chain are different and why it matters". NBER Working Paper No. 17716. National Bureau of Economic Research, Cambridge, MA, December.
- Bamber, P., O. Cattaneo, K. Fernandez-Stark, G. Gereffi, E. van der Marel and B. Shepherd. 2017. "Diversification through servicification". Report prepared for the World Bank.
- Caliendo, L. and F. Parro. 2015. "Estimates of the trade and welfare effects of NAFTA". Review of Economic Studies, 82(1): 1–44.
- De Backer, K. and S. Miroudot. 2013. Mapping Global Value Chains. OECD Trade Policy Paper No. 159. Organization for Economic Co-operation and Development, Paris.
- Dekle, R., J. Eaton and S. Kortum. 2007. "Unbalanced trade." American Economic Review, 97(2): 351–55.
- De Melo, J. and B. Shepherd. 2018. "The economics of non-tariff measures: A primer". In J. de Melo and A. Nicita, 2018, Non-Tariff Measures: Economic Assessment and Policy Options for Development, Geneva: United Nations Conference on Trade and Development.
- De Melo, J. and A. Twum. 2021. "Prospects and challenges for supply chain trade under the African Continental Free Trade Area". Journal of African Trade, 8(2): 49–61.
- Dhingra, S., H. Huang, G. Ottaviano, J. Paulo Pesso, T. Sampson and J. van Reenen. 2017. "The costs and benefits of leaving the EU: Trade effects". Economic Policy, 32(92): 651–705.
- Eaton, J. and S. Kortum. 2002. "Technology, geography, and trade". Econometrica, 70(5): 1741–79.
- Egger, P., M. Larch. S. Nigai and Y. Yotov. 2018. "Trade costs in the global economy: Measurement,

aggregation, and decomposition". WTO Working Paper. World Trade Organization, Geneva, May.

- Hallward-Driemeier, M. and G. Nayyar. 2017. Trouble in the Making? The Future of Manufacturing-Led Development. Washington, D.C.: The World Bank.
- Hallward-Driemeier, M., G. Nayyar and E. Davis. 2021. At Your Service? The Promise of Services Led Development. Washington, D.C.: The World Bank.
- Helble, M. and B. Shepherd (eds.). 2019. Leveraging Services for Development: Policies and Prospects. Manila: Asian Development Bank.
- Hoekman, B. and M. Sanfilippo. 2022. "FDI, value chains, and economic development in Africa".
 Paper presented at the AERC Workshop on 'Value Chain Development, Trade, and Economic Transformation in Africa'. African Economic Research Consortium, Nairobi, forthcoming.
- International Trade Centre (ITC). 2017. Small and Medium Enterprise Competitiveness Outlook 2017: The Region—A Door to Global Trade. Geneva: International Trade Centre.
- Johnson, R. and G. Noguera. 2012. "Accounting for intermediates: Production sharing and trade in value-added". Journal of International Economics, 86(2): 224–36.
- Koopman, R., Z. Wang, and S.-J. Wei. 2014. "Tracing Value-Added and Double Counting in Gross Exports". American Economic Review, 104(2): 459-94.
- Low, P. and G. Pasadilla (eds). 2016. Services in Global Value Chains: Manufacturing-Related Services. Singapore: World Scientific.
- Ottaviano, G. 2015. "European integration and the gains from trade". In H. Badinger and V. Nitsch, eds., Routledge Handbook of the Economics of European Integration. London: Routledge.
- Shepherd, B. 2019. "Ricardian comparative advantage in services sectors". In M. Helble andB. Shepherd, eds., Services-Led Development: Prospects and Policies. Tokyo: AsianDevelopment Bank Institute.
- Wang, Z., S.J. Wei and K. Zhu. 2013 (Revised 2018). "Quantifying international production sharing at the bilateral and sector levels". NBER Working Paper No. 19677. National Bureau of Economic Research, Cambridge, MA, November.

Appendix: Model description

Consumption side

The consumption side of the model comes from Caliendo and Parro (2015). A measure Ln of representative households in *N* countries (subscript) maximizes Cobb Douglas utility by consuming final goods in *J* sectors (superscript), with consumption shares α_n^j summing to unity.

$$u(C_n) = \prod_{j=1}^{J} \left(C_n^j\right)^{\alpha_n^j}$$

Production side

The production side of the model also comes from Caliendo and Parro (2015) via Aichele and Heiland (2018), which can be seen as a multi-sector generalization of Eaton and Kortum (2002). As in Aichele and Heiland (2018), there is provision for different shares in intermediate and final consumption.

Each sector produces a continuum of intermediate goods, $\omega^{j} \in [0,1]$. Each intermediate good uses labour and composite intermediate goods from all sectors. Intermediate goods producers have production technology as follows:

$$q_n^j(\omega^j) = z_n^j(\omega^j) [l_n(\omega^j)]^{\beta_n^j} \prod_{k=1}^J [m_n^{k,j}(\omega^j)]^{\gamma_n^{k,j}}$$
(A2)

Where: $z_n^j(\omega^j)$ is the efficiency of producing intermediate good ω^j in country n; $l_n(\omega^j)$ is labour; $m_n^{k,j}(\omega^j)$ are the composite intermediate goods from sector k used for the production of intermediate good, ω^j ; and β_n^j is the cost share of labour and $(1 - \beta_n^j)\gamma_n^{k,j}$ is the cost share of intermediates from sector k used in the production J

of intermediate good, ω^{j} , with $\sum_{k=1}^{J} \gamma_{n}^{k,j} = 1$.

Production of intermediate goods exhibits constant returns to scale with perfect competition, so firms price at marginal cost. The cost of an input bundle can, therefore, be written as follows:

$$c_n^j = \Upsilon_n^j w_n^{\beta_n^j} \left(\prod_{k=1}^J \left(P_n^{k_m} \right)^{\gamma_n^{k,j}} \right)^{1-\beta_n^j} \tag{A3}$$

Where: $P_n^{k_m}$ is the price of a composite intermediate good from sector k; w is the wage; and Y_n^j is a constant.

Producers of composite intermediate goods in country *n* and sector *j* supply their output at minimum cost by purchasing intermediates from the lowest cost suppliers across countries, similar to the mechanism in the single sector model of Eaton and Kortum (2002).

Composite intermediate goods from sector *j* are used in the production of intermediate good ω^k in amount $m_n^{j,k}(\omega^k)$ in all sectors *k*, as well as final goods in consumption C_n^j . The composite intermediate is produced using CES technology:

$$Q_n^j = \left[\int r_n^j \left(\omega^j \right)^{1 - \frac{1}{\sigma^j}} d\omega^j \right]^{\frac{\sigma^j}{\sigma^j - 1}}$$
(A4)

Where: *r* is demand from the lowest cost supplier, and σ is the elasticity of substitution across intermediate goods within a sector.

Solving the producer's problem gives an expression for demand:

$$r_n^j(\omega^j) = \left(\frac{p_n(\omega^j)}{P_n^j}\right)^{-\sigma^j} Q_n^j \tag{A5}$$

Where: $p_n(\omega^j)$ is the lowest price of a given intermediate good across countries; and $P_n^j = \left[\int p_n(\omega^j)^{1-\sigma^j} d\omega^j\right]^{\frac{1}{1-\sigma^j}}$ is the CES price index.

Trade costs and equilibrium

Trade costs consist of tariff and NTM components as in Aichele and Heiland (2018), in the standard iceberg formulation for imports by country n from country i, with trade costs potentially differing by end use (intermediate, m, or final, f):

$$\kappa_{ni}^{jv} = \left(1 + t_{ni}^{jv}\right) * \tilde{t}_{ni}^{jv}, v \ni (m, f)$$
(A6)

Where: t is the ad valorem tariff, and \tilde{t} is NTM-related trade costs, including potentially policy measures but also geographical and historical factors that drive a wedge between producer prices in the exporting country and consumer prices in the importing country (Anderson & Van Wincoop, 2004). Unlike in Caliendo and Parro (2015), I assume that all sectors are tradeable; this assumption accords with the reality in our data, where sectors are sufficiently aggregate that trade always takes place, at least to some degree.

With this definition of trade costs, the price of a given intermediate good in country n is:

$$p_n^j(\omega^j) = \min_i \frac{c_i^j \kappa_{ni}^{jm}}{z_i^j(\omega^j)}$$
(A7)

As in Eaton and Kortum (2002), the efficiency of producing ω^j in country *n* is the realization of a Fréchet distribution with location parameter $\lambda_n^j \ge 0$ and shape parameter $\theta^j > \sigma^j - 1$. The intermediate price index can, therefore, be rewritten as:

$$P_n^{jm} = A^j \left[\sum_{i=1}^N \lambda_i^j \left(c_i^j \kappa_{ni}^{jm} \right)^{-\theta^j} \right]^{\frac{1}{\theta^j}}$$
(A8)

Where A^{*j*} is a constant.

Then from the utility function, prices are:

$$P_n^f = \prod_{j=1}^N \left(\frac{P_n^{jf}}{\alpha_n^j}\right)^{\alpha_n^j} \tag{A9}$$

Bringing together these ingredients gives a relationship for bilateral trade at the sector level that follows the general form of structural gravity, but developed in an explicitly multi-sectoral framework and with different relations for intermediate and final consumption:

$$\pi_{ni}^{jv} = \frac{X_{ni}^{jv}}{X_{n}^{jv}} = \frac{\lambda_{i}^{j} \left[c_{i}^{j} \kappa_{ni}^{jv}\right]^{-\theta^{j}}}{\sum_{h=1}^{N} \lambda_{h}^{j} \left[c_{h}^{j} \kappa_{nh}^{jv}\right]^{-\theta^{j}}}$$
(A10)

For analytical purposes, a key feature of the gravity model in Equation 10 is that the unit costs term depends through Equation 3 on trade costs in all sectors and countries. This result is an extension of the multilateral resistance reasoning in Anderson and van Wincoop (2004) to the case of cross-sectoral linkages.

Goods market equilibrium is defined as follows, where Y is the gross value of production:

$$Y_n^j = \sum_{i=1}^N \frac{\pi_{in}^{jm}}{1 + t_{in}^{jm}} X_i^{jm} + \sum_{i=1}^N \frac{\pi_{in}^{jf}}{1 + t_{in}^{jf}} X_i^{jf}$$
(A11)

With:

$$X_{n}^{jm} = \sum_{k=1}^{J} \frac{\pi_{in}^{jm}}{1 + t_{in}^{jm}} \gamma_{h}^{j,k} (1 - \beta_{h}^{k}) Y_{h}^{k}$$
(A11)

$$X_n^{jf} = \alpha_n^j I_n \tag{12}$$

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National income is the sum of labour income, tariff rebates, and the exogenous trade deficit:

$$I_n = w_n L_n + R_n + D_n \tag{A12}$$

The model is then closed by setting income equal to expenditure:

$$\sum_{j=1}^{J} X_n^{jm} \sum_{i=1}^{N} \frac{\pi_{ni}^{jm}}{1 + t_{ni}^{jm}} + \sum_{j=1}^{J} X_n^{jf} \sum_{i=1}^{N} \frac{\pi_{ni}^{jf}}{1 + t_{ni}^{jf}} - D_n = \sum_{j=1}^{J} Y_n^j$$
(A13)

Where: I represents final absorption as the sum of labour income, tariff revenue, and the trade deficit; *R* is tariff revenue, and trade deficits sum to zero globally and to an exogenous constant nationally. So aggregate trade deficits are exogenous, but sectoral deficits are endogenous.

Caliendo and Parro (2015) show that the system defined by equations A3, A8, A10, A11, and A13 can be solved for equilibrium wages and prices, given tariffs and structural parameters.

Counterfactual simulation

Using exact hat algebra (Dekle et al., 2007), it is simpler to solve the model in relative changes than in levels. This process is equivalent to performing a counterfactual simulation in which a baseline variable v is shocked to a counterfactual value v', and the relative change is defined as $\hat{v} = \frac{v}{v}$. Aichele and Heiland (2018) show that counterfactual changes in input costs are given by:

$$\hat{c}_n^j = \hat{w}_n^{\beta_n^j} \left(\prod_{k=1}^J \hat{P}_n^{k_m \gamma_n^{k_j}} \right)^{1 - \beta_n^j} \tag{A14}$$

The change in the price index is:

$$\widehat{P}_{n}^{jv} = \left[\prod_{i=1}^{N} \pi_{ni}^{jv} \left[\widehat{\kappa}_{ni}^{jv} \widehat{c}_{i}^{j}\right]^{-\theta^{j}}\right]^{-\frac{1}{\theta^{j}}}$$
(A15)

The change in the bilateral trade share is:

$$\hat{\pi}_{ni}^{jv} = \left[\frac{\hat{\kappa}_{ni}^{jv}\hat{c}_{i}^{j}}{\hat{P}_{n}^{jv}}\right]^{-\theta^{j}} \tag{A16}$$

Counterfactual intermediate goods and final goods expenditure are given by:

$$X_{n}^{jm'} = \sum_{k=1}^{N} \gamma_{n}^{j,k} \left(1 - \beta_{n}^{k}\right) \left(\sum_{i=1}^{N} X_{i}^{km'} \frac{\pi_{in}^{km'}}{1 + t_{in}^{km'}} + X_{i}^{kf'} \frac{\pi_{in}^{kf'}}{1 + t_{in}^{kf'}}\right)$$
(A17)

With:

$$X_n^{jf'} = \alpha_n^j I_n' \tag{A18}$$

$$I_{n}^{'} = \widehat{w}_{n} w_{n} L_{n} + \sum_{j=1}^{J} X_{n}^{jm'} \left(1 - F_{n}^{jm'} \right) + \sum_{j=1}^{J} X_{n}^{jf'} \left(1 - F_{n}^{jf'} \right) + D_{n} \quad (A19)$$

The trade deficit condition requires:

$$\sum_{j=1}^{J} F_{n}^{jm'} X_{n}^{jm'} + \sum_{j=1}^{J} F_{n}^{jf'} X_{n}^{jf'} - D_{n} = \sum_{j=1}^{J} \sum_{i=1}^{N} X_{i}^{jm'} \frac{\pi_{in}^{jm'}}{1 + t_{in}^{jm'}} +$$
(A20)
$$\sum_{j=1}^{J} \sum_{i=1}^{N} X_{i}^{jf'} \frac{\pi_{in}^{jf'}}{1 + t_{in}^{jf'}}$$

The change in welfare is given by the change in real income:

$$\widehat{W}_n = \frac{\widehat{I_n}}{\prod_{j=1}^J (\widehat{p}_n^{jf})^{\alpha_n^j}}$$
(A21)

The relative change in trade costs is given by the definition of the counterfactual simulation, and in our specification can cover NTMs as well as tariffs. Solving the model using exact hat algebra makes it possible to conduct the counterfactual experiment without data on productivity, and importantly, without trade costs data other than those that are being simulated; due to the multiplicative form of iceberg trade costs, solution in relative changes means that trade cost components, such as geographical and historical factors, which are constant in the baseline and counterfactual simply cancel out. The parameters β_n^j (cost share of labour), $(1 - \beta_n^j)\gamma_n^{k,j}$ (cost share of intermediates), and α_n^j (share of each sector in final demand) can be calibrated directly from the baseline data, as can value-added $(w_n L_n)$. Egger et al. (2018) provide updated estimates of the trade elasticity θ^j at the same level of disaggregation used in our data.

Caliendo and Parro (2015) develop an iterative procedure for solving the model, which I follow here in the modified version developed by Aichele and Heiland (2018).

Trade in value-dded

I follow Aichele and Heiland (2018) in extending the Caliendo and Parro (2015) framework to consider value-added trade, which helps identify the proportion of gross value trade that is considered to take place within GVCs. I differ from them, however, in the concept of value-added trade that I use. They use Johnson and Noguera (2012) and Koopman et al. (2014) but as Wang et al. (2013) point out, the measures derived in those papers only provide consistent results at an aggregate level; I am interested in a bilateral and sectoral disaggregation, so I follow the same basic approach of Aichele and Heiland (2018) but then apply the key result from Wang et al. (2013) when it comes time to decompose gross value trade into its value-added components.

Given the model setup described in the previous subsection, Aichele and Heiland (2018) derive input-output coefficients as follows:

$$(1 + t_{ih}^{km})a_{ih}^{k,j} = \pi_{ih}^{km}(1 - \beta_h^j)\gamma_h^{k,j}$$
(A22)

Where: *a* is the input-output coefficient; and $(1 - \beta_h^j)\gamma_h^{k,j}$ is the cost share of intermediates from sector k.

Equation 22 makes clear that if the model data set includes a baseline input-output table (A), as is necessary, then it is straightforward to calculate a counterfactual input-output matrix (A'), using the outputs of the counterfactual solution defined above. I can then analyse GVC linkages in exactly the same way as set out in Section 2 of the main text, distinguishing between observed and counterfactual (simulated) values.



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