Policy Research Working Paper 8937

The Extent of GVC Engagement in Sub-Saharan Africa

Johannes Van Biesebroeck
Emmanuel B. Mensah

WORLD BANK GROUP
Africa Region
Office of the Chief Economist
July 2019

Policy Research Working Paper 8937

Abstract

This paper exploits information from two different datasets to provide a novel and multi-dimensional picture of the engagement of all sub-Saharan African countries in global value chains (GVCs). It documents in detail the nature of the underlying data and the way it is used to construct several indicators of GVC engagement. As a companion to the paper, the data files are made available to interested researchers. While it is impossible to summarize the broad range of experiences that we document, two patterns stand out. First, the level of GVC engagement of most countries in sub-Saharan Africa is rather low, especially for their manufacturing sectors. Second, while there is increased GVC engagement over time in some countries, this pattern is by no means universal. The average engagement for the region over the time period studied (1995–2018) is not even positive on average across countries for several indicators.

This paper is a product of the Office of the Chief Economist, Africa Region, commissioned as part of the *'Industrialization for Jobs in Africa'* regional study. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://www.worldbank.org/prwp. The authors may be contacted at jo.vanbiesebroeck@kuleuven.be.

The extent of GVC engagement in sub-Saharan Africa

Johannes Van Biesebroeck Emmanuel B. Mensah

Keywords: global value chains, integration, trade, input-output

JEL codes: N67, F15, F63

1. Introduction

The ability of different countries around the world to integrate into global value chains (GVC) has become an important policy topic. Unfortunately, there is little systematic evidence to compare the relative success of different countries. The available evidence focuses mostly on the very macro level, comparing overall GVC engagement at the country level, or on the very micro level, studying case studies of specific industries in one country or an even smaller geographic area. Our objective is to provide some systematic cross-country evidence of GVC engagement at intermediate levels of detail using two widely-used data sources.

A large literature studies GVCs of specific industries, often even limited to narrow geographic areas, based on detailed case studies.[1] Such an approach is particularly valuable to understand the key drivers that explain the different vertical organization of industries. Case studies can also provide detailed insights into how the nature of buyer-supplier interactions are shaped by industry-specific requirements for coordination and collaboration along the value chain. For example, Gereffi, Humphrey and Sturgeon (2005) draw heavily on such case studies to develop their model of optimal governance of GVCs.

An almost entirely disconnected literature studies interactions between sectors of different countries using global input-output databases. Such a data source collects the aggregate interactions between the economies of different countries through buyer-supplier relationships at the sectoral level. For example, a global input-output table will indicate what fraction of inputs used by the transportation equipment industry of Germany is imported from the basic metal industry of Japan. In turn, it will also indicate what fraction of these German-made vehicles are sold as inputs to other industries or consumed as final demand, both domestically and for all potential export destinations in the world.[2] An important summary statistic on GVC engagement that can be constructed using this type of information is the value added to gross output ratio (Johnson and Noguera, 2012).

A drawback from the perspective of learning about the GVC integration of firms or industries in sub-Saharan countries is that most widely-used datasets tend to focus on larger and more developed economies. However, we will demonstrate that two existing and freely-available data sources can be effectively used to study GVCs in sub-Saharan Africa. The first data source is the World Bank Enterprise Surveys (WBES). It contains firm-level responses to surveys conducted at semi-regular intervals in almost all developing countries. Across all sub-Saharan economies and survey years, the WBES provides access to responses from a total of 35,902 firms between 2002 and 2018. In most countries, more than one survey has been conducted over this period, which makes it possible not only to gauge the average level of GVC engagement in each country, but also its growth over time.

More details on the type of information contained in the WBES, both in terms of sample coverage and included variables, will be discussed in Section 2.1. Given the wide range of

[1] A broad overview of the literature studying GVCs using case studies can be obtained from the list of publications of the Global Value Chain Initiative: https://globalvaluechains.org/

[2] Timmer et al. (2015) illustrates the construction of one particular global input-output table, the WIOD, and the possible applications of this research tool using the global automotive industry as an example.

topics covered in the standard WBES questionnaire, it allows for investigations on a wide range of research questions. Here, we will build on the approach suggested in Chapter 6 of Taglioni and Winkler (2004). They describe how consistent indicators for three dimensions of GVC integration can be calculated based on responses to the WBES surveys and they illustrate the results for a few countries.

In Section 2.2 we calculate these three indicators for each country in sub-Saharan Africa and illustrate some patterns that emerge. We exploit both the firm, country, and time dimension of the surveys to document the range and depth of GVC integration and the rate of change over time. A table in the Appendix shows the averages and changes over time for all individual countries, averaged over all survey years. We also make a data file with the firm-level indicators an a set of firm characteristics available to interested researchers. We show how patterns of GVC engagement differ along a few dimensions of interest, e.g. they differ between foreign-owned and domestic firms, between large and small firms, or between manufacturing and service firms. This rich source of information can be exploited to condition on several more firm characteristics of interest. For example, the data also records each firm's location, detailed sector, capital intensity, owner characteristics, and many more dimensions of firm heterogeneity.

While it is useful to explore the extent that firms integrate in GVCs in its own right, the WBES information can also be used to construct the average extent of integration for each country. However, the representativeness of the surveyed firms for the entire economy will naturally vary by country. Freund and Pierola (2015) have shown that a few firms account for an extremely large fraction of exports in most developing countries. To have a sense of the fraction of a country's interaction with the world economy that the sample of firms represents, we calculate for each country-year survey the ratio between the aggregate exports over all sampled firms and the aggregate exports for the country as recorded in the UN Comtrade database. On average, this fraction is 19%, but it ranges widely across countries, which is important to keep in mind if one wants to generalize from the WBES results.

The second source of information that we exploit is the multi-region input-output table (MRIO) which is part of the Eora database. In contrast with two widely-used comparable global IO tables, the WIOD (maintained by researchers at the University of Groningen) and the TiVA database (of the OECD), the Eora database includes information on all countries in the world, including all individual sub-Saharan African economies.[3] Naturally, the more disaggregate country dimension comes at the cost of greater reliance on proportionality assumptions and imputations, but the advantage is that the MRIO includes bilateral input flows between all African country-sector pairs. As a result, it provides an unprecedented wealth of information on the regional production network in Africa and its connections with the rest of the world economy.

In order to exploit the staggering amount of information, as discussed below the full MRIO contains more than 24 million input-coefficients, we need to aggregate the table to reduce its dimensionality. We describe the process of collapsing the global IO table in a set of country-

[3] In the WIOD and TiVA databases, the African countries are grouped together in one or two country-groupings or in the rest-of-the-world aggregate.

specific smaller IO tables in detail in Section 3.1. The next step is to calculate a set of indicators that summarize the GVC engagement of each country. We describe the four indicators that we focus on in Section 3.2.

One of the indicators that we calculate is the percent of domestic value added that is contained in the exports of each sub-Saharan African country. This indicator is one of the few instances where detailed information from sub-Saharan Africa appears in World Bank (2017), a highly influential volume containing recent research on the role of GVCs in development. Table 7.4, which is taken from IMF (2015), shows the complement, the percent of foreign value added in exports that is also calculated using the Eora data. While extremely interesting, it only shows the ratio for the aggregate economy. Given the dominance of the agriculture sector in most countries and the importance of domestic value added in agriculture everywhere, the aggregate pattern shown is unlikely to be representative for the comparable fraction in the manufacturing sector, which is our primary interest. We discuss both the aggregate fraction and the fraction for manufacturing in Section 3.5.

The other GVC indicators that measure the importance of foreign input sourcing and exporting of intermediate inputs or final products are also calculated separately for all sectors (in each country). They record interactions with eight different regions in the world, two of which are defined relative to the country of interest, and they are available for three years that are each ten years apart (1995, 2005, 2015). Together these are more indicators than can be easily described in this report. We therefore make all four indicators that are each defined at the level of (i) the African country of interest, (ii) eight domestic sectors, (iii) eight partner regions (including itself), and (iv) three years, available in a data file.

The overarching message from the analysis is that the large increase in international trade and the disintegration of production chains that the world economy has witnessed over the last 15-20 years has touched the manufacturing sectors in most sub-Saharan countries only lightly. Two patterns underscore this conclusion. Foreign sourcing of intermediates has increased a lot more than firms' own exporting activities. The extent of international engagement by domestic firms in sub-Saharan Africa also remains vastly smaller than that of multinational firms active in the region.

Taglioni and Winter (2014) show in a case study for the agribusiness in 2012 that the GVC engagement of firms in Ghana, Kenya, and Mozambique lagged that of Vietnamese firms. According to our results, the average values across those three African countries of the three GVC indicators that we consider, is almost exactly the same as for the entire group of sub-Saharan countries we study here. It suggests that the lagging GVC integration is common to much of the region's economy. At the same time, our results also identify countries which are ahead of the average. It is remarkable that not a single country exceeds the region's average on all three indicators. If we focus on the two indicators that measure foreign sourcing and export participation of (smaller) domestic firms, 10 of the 44 countries score above average on both. However, this group is mainly composed of smaller countries which tend to be more

open to trade everywhere. Only a few large countries, in particular Cameroon, Chad and Tanzania, have firms that are systematically more than average globally engaged.[4]

The main message from the analysis based on the input-output tables is similar: foreign sourcing is rising more quickly than exporting. One summary measure that underscores this evolution is the decline in the domestic value added to gross exports ratio for the manufacturing sector in exactly half of the countries in the sample. The same measure increases for most countries when calculated economy-wide, but this gives a biased impression as it is inflated by the rising importance of the service industry. Apart from the low overall GVC engagement, the input-output results also show the remarkably low regional integration of production. At the same time, neighboring or more distant sub-Saharan countries were systematically the regions that showed the most variation in importance across countries. It implies that some strong local value chains exists – in particular the economies around South Africa are more strongly integrated in that production network.

The remainder of this paper is organized as follows. In Section 2 we discuss the information contained in the WBES, the fraction of each country's exports that the surveys represent, and the results on firm-level and country-level indicators of GVC engagement that we calculate from this data. In Section 3 we discuss how we constructed similar indicators of GVC engagement at the industry-level using the multi-region input-output table of Eora. We illustrate a number of patterns for the sub-Saharan African region, averaging over individual countries, focusing explicitly on the inputs sourced from various regions and the nature of the export linkages between different regions. In the conclusions, in Section 4, we highlight a few patterns that stand out using both data sources.

2. Firm-level information on input sourcing and sales destinations

2.1 World Bank Enterprise Survey

Through the Enterprise Surveys portal, the World Bank makes a series of firm-level datasets available to researchers.[5] They are based on surveys of random samples of firms conducted in all developing countries, which are surveyed at semi-regular intervals using the same questionnaire. This survey tool has been developed over several years, based on the experiences with the Regional Program of Enterprise Development (RPED) that surveyed firms in several African countries between 1991 and 1996 and the Business Environment and Enterprise Performance Surveys (BEEPS) which is an ongoing project surveying countries in Europe and central Asia.[6]

[4] Other, smaller economies in this category include Benin, Djibouti, Lesotho, Mauritania, Mauritius, Niger, and Togo.

[5] All data is freely downloadable at http://www.enterprisesurveys.org/.

[6] The older RPED data can be downloaded from the data portal of the Centre for the Study of African Economies at Oxford University: https://www.csae.ox.ac.uk/data. More recent BEEPS data is integrated in the Enterprise Surveys portal, but additional information and complete data from 1999 to 2016 can be found at https://ebrd-beeps.com/data/.

The datasets are based on stratified random samples of firms, which as much as possible are drawn from the universe of eligible firms. Stratification is by size, location, and sector. Extensive meta-data for each survey documents in detail the sampling frame and aspects of the survey implementation. In some countries, only firms in the manufacturing sector are sampled, but in most cases service sector firms are included as well. An important advantage of this source of information is that all the data (including meta-data) are easily accessible online. Surveys are conducted in several years for most countries which makes it possible to trace country-level patterns over time. The surveys include a large number of variables, making it possible to research a broad range of topics. One disadvantage is that, in contrast with the original RPED sampling frame that had an annual frequency, it is not possible to follow firms over time. As a result, it is not possible to estimate firm-level productivity controlling for the fundamental simultaneity problem of productivity and input choice (Van Biesebroeck, 2008).

In Table A.1 in the Appendix, we show the number of firms sampled in each survey. The average over all 94 surveys in sub-Saharan Africa is 382 observations. It ranges from a low of 75 in Lesotho in 2003 to a high of 2,676 in Nigeria in 2014. The earliest survey is in 2002 and every year new surveys are added to the database. In the average year, 5.5 surveys are organized, but they are not spread equally over time. In 2008 and 2012 not a single country was surveyed. When we started our work to harmonize the data, only a single survey for 2018 could be included.[7]

While these surveys are not specifically aimed to be nationally representative, due to the three dimensions of stratification, these samples are likely to cover a substantial fraction of total exports. Freund and Pierola (2015) have documented the remarkable concentration of trade in very few enterprises for a sample of 32 developing countries. They show that, on average, the top 5 firms account for one third of aggregate exports, and this fraction is even higher for manufacturing products.
Using the information in the UN Comtrade dataset, we calculate total exports and total manufacturing exports for each country-year in which we observe a firm-level survey. In Table 1, we report the ratio of the sum of exports of the sampled firms divided by aggregate exports. The average fraction across all surveys is 19%. In only 23 of the 94 (country-year) surveys is the average below 5%, while in 24 cases it exceeds 25%. It underscores that by surveying a relatively small number of firms, a significant fraction of a country's exports can be accounted for. We therefore expect our results to be broadly representative of the experience of exporters and importers in many these countries.

[7] Only counting the years with survey activity between 2002 and 2017, there is an average of 6.6 surveys in each year.

Table 1: Fraction of aggregate exports accounted for by sampled firms

Country	2002	2003	2004	2005	2006	2007	2009	2010	2011	2013	2014	2015	2016	2017	2018
Angola					0.2			0.1							
Benin			51				11						15		
Botswana					6			2							
Burkina Faso					10		6								
Burundi					3						6				
Cameroon					28		21						9		
Cape Verde					0		45								
CAR									5						
Chad							9								19
Congo							6								
Côte d'Ivoire							23						18		
DRC					9			0		6					
Djibouti										18					
Eritrea	3						5								
Ethiopia	15				?				9			14			
Gabon							7								
Gambia					5										
Ghana						7				10					
Guinea					15								1		
Guinea-Bissau					1										
Kenya		22				19				50					
Lesotho		100					43						32		
Liberia							0.1							4	
Madagascar				37			14			36					
Malawi				29			12				24				
Mali		7				11		2					9		
Mauritania					26						18				
Mauritius				43			70								
Mozambique						2									
Namibia					41						30				
Niger				84			6							5	
Nigeria						4		?			4				
Rwanda					15				6						
Senegal		39				45					37				
Sierra Leone							0.3							4	
South Africa		17				13									
South Sudan											1				
Sudan											0.1				
Swaziland					33								20		
Tanzania		11			13					3					
Togo							37						65		
Uganda		24			23					34					
Zambia	51					12				24					
Zimbabwe									9				8		

Note: The statistics show the ratio of total exports across all firms sampled in a survey (calculated from the firm-level World Bank Enterprise Surveys), relative to the aggregate national exports for the same year (calculated from the UN Comtrade data). Average exchange rates for the year from IMF are used to convert local currencies.

In a few instances, the fraction is relatively low using aggregate exports, but higher if we calculate the ratio limited to manufacturing firms in the numerator and to manufactured products in the denominator. For example, the firms surveyed in Angola account for less than 1% of aggregate exports, which are dominated by oil. Limited to manufacturing, the ratio is 16.8% in 2006 and 2.4% in 2010.

The rich information in the enterprise surveys opens up a wealth of opportunities for research. Information is collected for the following broad modules, which focus on the composition of inputs and outputs, interactions with the external environment, and the identification of obstacles to operation or growth. The standard questionnaire contains the following modules:

A. Control information: stratification variables, type of accounting, interviewer,…
B. General information: owner, year of establishment, quality certification,…
C. Infrastructure and services: problems, connection requests,…
D. Sales and supplies: type and value of sales
E. Degree of competition
G. Land: also questions related to construction permits
I. Crime
J. Business-government relations: type spent, incidence of corruption,…
K. Finance: source and value for different types
L. Labor: employment by type
M. Investment climate constraints: rank the severity of various obstacles
N. Performance: cost components

2.2 Extent of firm-level integration in GVCs

The different modules of the questionnaires allow one to zoom in on a variety of topics that are relevant to GVC integration. For example, the questions make it possible to assess the importance of the following issues:

- Growth constraints: some frequently-mentioned constraints, e.g. lack of demand, could be much less of a problem for firms active in GVCs.
- Conflict resolution: weak domestic institutions are often an impediment to business development. For firms active in GVCs, relational contracts (i.e. incentives coming from the continuation value of a relationship) could be effective substitutes for formal institutions (as in Van Biesebroeck, 2014)
- Employment/Capital: the surveys contain very detailed information on the structure of employment and types of capital which could be used to investigate necessary conditions for effective integration in GVCs.

More specifically, Taglioni and Winkler (2014) describe how some of the measures that have been calculated in the GVC literature using a variety of data sources in a variety of countries, can also be calculated using the WBES information. An important advantage of this data source is that the necessary questions have been posed identically and in the exact same situation in all the different countries. An additional advantage is that the data represent a

random sample of firms using three levels of stratification—sector, firm size, and region—and in some surveys weights are provided to calculate a nationally representative average.

In particular, the questions in the survey allow one to calculate the following three measures:

(1) What fraction of inputs of multinational firms is sourced from domestic suppliers?

(2) What fraction of inputs of domestic producers is imported?

(3) What fraction of output of domestic supplier firms is exported?

In the Appendix, we provide the exact details of how the different questions in the survey can be used to obtain results at the firm level for each of these three GVC indicators. In each case, the fraction of inputs sourced domestically or imported and the fraction of output exported is asked directly, meaning that it does not require a division of two numbers that are potentially reported inconsistently. To make the result more comparable with results in the literature, the average fraction is calculated on a sample limited to a subset of firms (which varies by question).

Note, however, that for the second and third indicators, we cannot calculate the respective fractions limited to domestic producers (measure 2) or suppliers (measure 3). In most surveys in sub-Saharan countries, the question to distinguish between producers and suppliers is not asked. Instead, for the second measure we report the fraction of imported inputs by small, domestic manufacturing firms, where small firms are identified as firms with fewer than 20 full-time equivalent employees.

In Table 2, we report the results for all three GVC indicators. The column with "levels" average the firm-level responses across all surveys that have been conducted in a country, i.e. potentially combining different survey years. For the columns with "changes", we first calculate the country-level averages separately for each survey year and then calculate the change in country average for the last two years a survey is available. For countries where only a single survey is conducted, no value can be calculated for changes. Because the time between surveys varies across countries, we standardize all changes. We first calculate the change per year, but in the table and figures we report the implied change over a 5.8 year period, which is the average time between the last two survey years. At the bottom of each column, we report the population weighted average across all countries that report information.

Results vary a lot across countries. While multinationals on average report to source 44% of their inputs domestically, this varies from 5% in Djibouti to 95% in Sudan. The extent of local sourcing increases on average by 8% over time, but recall that the time period over which this change is calculated differs by country. For example, the increase of 32% for Ethiopia compares averages for two surveys that are 13 years apart, while the increase of 1% for Rwanda only spans a five-year period.

Table 2: The levels and changes of three GVC indicators (country-level averages)

	Domestic sourcing by MNEs		Foreign sourcing by small, domestic manufacturers		Exporting by domestic producers	
Country	Level	Change	Level	Change	Level	Change
Angola	.52	.38	.31	-.21	.01	.02
Benin	.29	-.01	.31	.04	.10	.03
Botswana	.35	-.02	.47	.16	.03	.01
Burkina Faso	.38	.15	.56	-.65	.05	-.01
Burundi	.38	-.01	.33	.14	.04	.05
Cameroon	.46	-.02	.29	-.04	.07	.03
Cape Verde	.26	.42	.51	-.15	.02	.08
CAR	.45		.52		.06	
Chad	.43	-.04	.51	-.01	.07	.00
Congo	.34		.33		.04	
Côte d'Ivoire	.62	-.16	.16	.05	.04	.04
DRC	.51	.12	.19	.06	.02	.03
Djibouti	.50		.68		.10	
Eritrea	.67	.31	.07	.08	.04	-.04
Ethiopia	.57	.09	.06	-.20	.05	.01
Gabon	.34		.61		.06	
Gambia	.06		.46		.01	
Ghana	.48	-.16	.32	.24	.05	.03
Guinea	.28	-.09	.41	.11	.03	-.01
Guinea-Bissau	.36		.46		.03	
Kenya	.51	.05	.16	.10	.14	.11
Lesotho	.30	.01	.36	-.10	.13	.02
Liberia	.53	-.09	.29	-.05	.02	
Madagascar	.42	.17	.18	-.35	.12	-.03
Malawi	.45	.05	.33	.22	.04	-.03
Mali	.37	-.05	.25	.01	.05	.03
Mauritania	.42	.09	.54	.13	.10	.11
Mauritius	.23	.22	.40	-.49	.20	-.36
Mozambique	.62		.14		.02	
Namibia	.32	-.03	.43	-.16	.04	-.01
Niger	.20	.21	.80	-.25	.08	.02
Nigeria	.60	-.07	.12	.03	.07	.10
Rwanda	.36	.01	.38	-.44	.02	.00
Senegal	.46	.01	.19	-.12	.07	.01
Sierra Leone	.53		.39		.02	
South Africa	.72	.17	.11	-.14	.08	-.12
South Sudan	.38		.51		.02	
Sudan	.95		.36		.05	
Swaziland	.44	.10	.16	.02	.06	.01
Tanzania	.53	.00	.23	.14	.07	.05
Togo	.24	.12	.40	-.03	.15	-.03
Uganda	.56	.00	.09	.11	.07	.05
Zambia	.56	.01	.19	-.08	.06	.03
Zimbabwe	.68	-.05	.23	.13	.03	.01
Average (weighted)	.524	.035	.217	-.028	.065	.031

Notes: Statistics for the levels are calculated as the average fraction for each country, pooling the responses of all firms across surveys conducted in several years. Statistics for the changes are calculated by comparing the country-level average in the last two years a survey is conducted. Values are missing for countries where only a single survey is conducted. The averages are weighted by population.

To provide some more detail on the firm-level distribution of this sourcing measure and its evolution over time, we show more detail in Figure 1. The top graph contains a smoothed kernel distribution of the histogram over all 3,473 multinationals that we observe in the sample pooling all sub-Saharan African countries. The average fraction of inputs sourced domestically is 48%, but the standard deviation of 40% is extremely large, especially for a variable that only ranges from 0% to 100%. The graph shows the reason for this dispersion: the distribution is bi-modally shaped, with a substantial fraction of MNEs reporting that they source everything locally, while a slightly higher fraction of MNEs report importing all inputs. The remainder of firms is spread quite evenly over all intermediate values. Apart for the two mass points at 0% and 100%, the distribution is almost uniform.

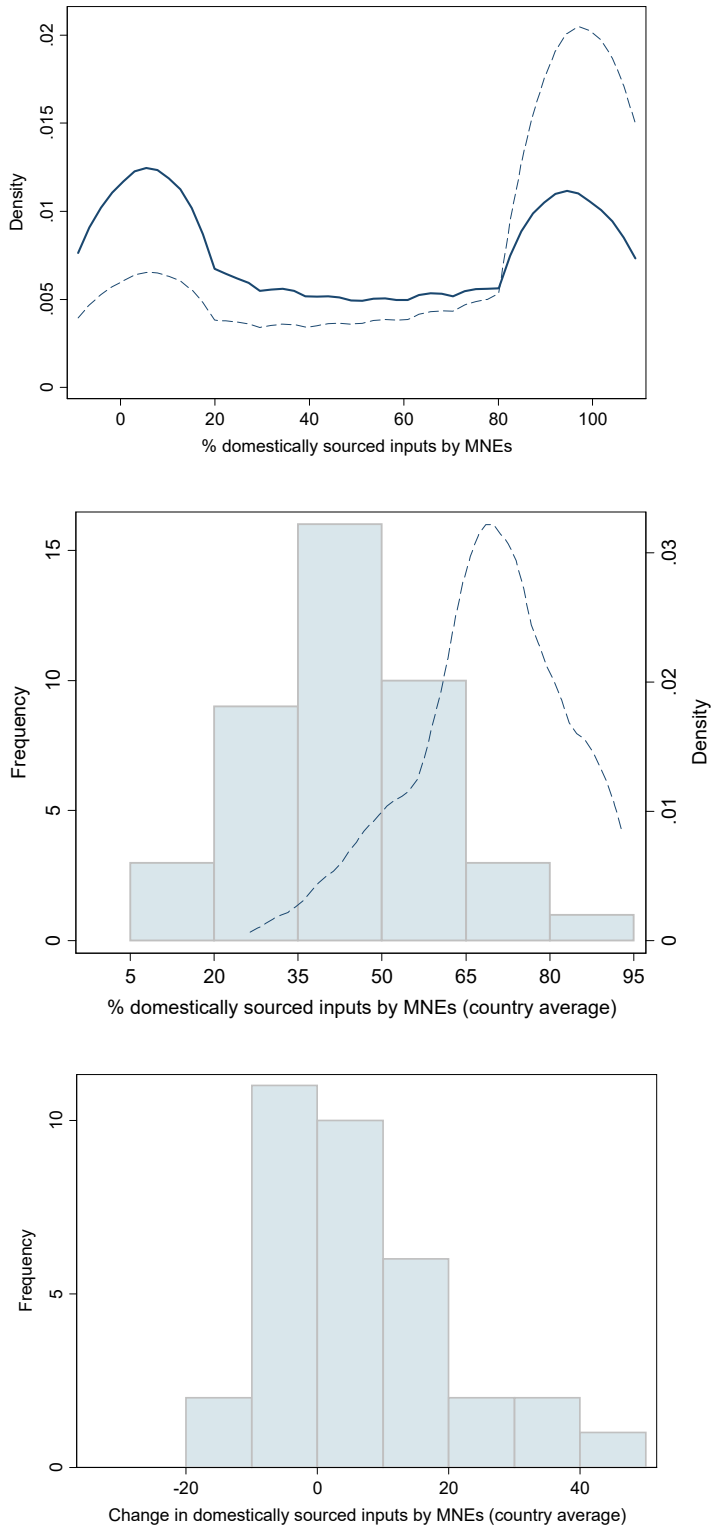
The dashed line on the same graph shows the comparable distribution of domestic sourcing for non-MNEs. These are mostly privately-owned domestic firms, but the sample also contains some state-owned firms and a small category of "other" firms. Compared to MNEs, many more of these firms source all their inputs domestically, but even here there is a mass point at 0%, only with fewer firms. Comparing the solid and the dashed line clearly shows that multinationals source a lot less domestically, as expected.

The second graph of Figure 1 is based on the same firm-level information, but shows the distribution of domestic sourcing for MNEs aggregated by country, i.e. the statistics in the first column in Table 2. The aggregation is across all firms and all survey years, but aggregated separately for each country. The bars show the full histogram for MNE sourcing using the country-frequency on the left axis. The dashed line shows the corresponding smoothed histogram for non-MNEs. The average rate of domestic sourcing by MNEs is 44% if all country were given equal weight, which is quite a bit lower than the population weighted average of 52% reported at the bottom of Table 2.

The standard deviation is still remarkably high across countries. The MNEs that occupy the mass points at the minimum or the maximum of the domestic sourcing range tend to be disproportionately located in different countries. For a country to obtain an average of domestic sourcing equal to 80%, there have to be a lot of firms that report domestic sourcing in excess of 90%. The reverse is true for a country-level average of 10%, there must be many MNEs that import all their inputs. Note, however, that these averages are calculated from a relatively small number of firms for each country, which allows for relatively dispersed averages across countries. The country-means for which the distribution is shown in the middle panel are calculated based on the responses of only 77 firms, on average.

Averaging to the country level, brings out the difference in sourcing patterns between MNEs and other firms. The mode of the distribution of MNEs is around 40%, while it is almost 70% for other firms. There are very few countries where domestic firms report to be importing at least 50% of their inputs, while this is the case for the average MNE in two thirds of all countries.

Figure 1: Fraction of inputs that are sourced domestically by multinationals



Notes: The top graph shows the fraction pooling all firm-year observations. The middle graph shows the distribution of the country-average pooling over all survey years. The bottom graph shows the change in the country-average between the last two survey years for countries with multiple surveys (standardized to represent the change over 5.8 years). The dashed lines in the top two graphs are comparable statistics for non-MNEs.

Finally, the bottom graph of Figure 1 shows the changes in domestic sourcing of MNEs. We first calculated the country average separately for each survey and then calculated the change in the average between the last two survey years for each country (standardized to represent the change over 5.8 years, the average time between two surveys). For almost two thirds of all countries, the intensity of domestic sourcing increased. The average increase of +3.5% across all countries tends to underscore the magnitude of the change. For a third of all countries (11 out of 34) the measure increased by more than 10%, while for only 2 countries it declined by more than 10%.

Given that there are on average 2.04 surveys per country, each country-year average is calculated using approximately 38 firm responses. It is no surprise then, that the standard deviation for the country-level changes is even higher than for the levels. Another reason for caution is that for some countries the annualized change is calculated for two years that are relatively close and then extrapolated for a 5.8 year period that is standardized over all countries. This is likely to raise the importance of measurement error.

The second GVC measure we have calculated is the fraction of inputs of domestic producers that is imported. As shown in the Appendix, the WBES in principle contains a question that allows one to distinguish between firms that sell finished or semi-finished goods mostly to final consumers and firms that sell intermediate inputs. Taglioni and Winkler (2014) propose to calculate this second GVC measure only for the subsample of producer firms, i.e. excluding suppliers. Unfortunately, in most surveys conducted in sub-Saharan countries this question was not posed to the firms. The harmonized dataset available on the WBES web site does not contain the responses to this question.

For comparability across countries and over time, we calculated the measure for all domestic firms, i.e. firms that report to be at least 90% private-owned by domestic owners, including both producers of final goods and supplier firms. It would make the results on indicator (2) for all domestic firms very close to one minus the results on indicator (1) for the set of firms that were reported in the dashed lines of Figure 1, already discussed above. To make the results more interesting, we show the results for the second indicator in Table 2 and Figure 2 only limited to the subset of small firms in the manufacturing sector. These are firms for which entering global value chains is likely to provide the greatest potential gains, but also pose non-trivial challenges.

Results in the third and fourth columns of Table 2 indicate that the average fraction of imported intermediate inputs across all countries is 22%. The fraction is higher in smaller countries as the unweighted average stands at 34%. Given that small firms in Africa are really quite small, employing on average only nine workers, even the weighted average is relatively high. Somewhat surprisingly, however, the fraction is not growing over time. For the average country, it even declined slightly by 3%. The variation across countries is 17%, which is exactly as large as for the first indicator. But given the lower absolute value of the mean, it implies greater variability.

Not surprisingly, the correlation between the first two GVC indicators is negative. Countries where MNEs source a lot domestically tend to be countries where small, domestic manufacturers import little. With a partial correlation statistic of -0.64 this relationship is surprisingly strong. The experience of MNEs and small domestic firms is thus remarkably

similar. The correlation in the change over time is also negative, but at -0.23 their evolution over time is less closely related than the average sourcing tendency.

Figure 2 again contains the same three graphs as in the case of the first indicator, but now showing the fraction of imported inputs by small, privately-owned, domestic manufacturing firms. We see again two mass points in the distribution, but the mass point for full foreign sourcing is much less important. Nevertheless, it is remarkable that almost 10% of these small manufacturers report to be importing at least 95% of all their inputs.

Less surprising is that many domestic firms report no imports at all. Over the entire sample of domestically owned manufacturing firms, this fraction stands at 51%. Comparing by firm size, 60% of small firms report no imported inputs which is quite a bit smaller than the 40% of larger firms (the dashed line) that report no imported inputs. When imports are positive, they are relatively large. Firms that import any inputs, import on average 57% of their total needs and this average still reaches 45% when we exclude firms that import everything.

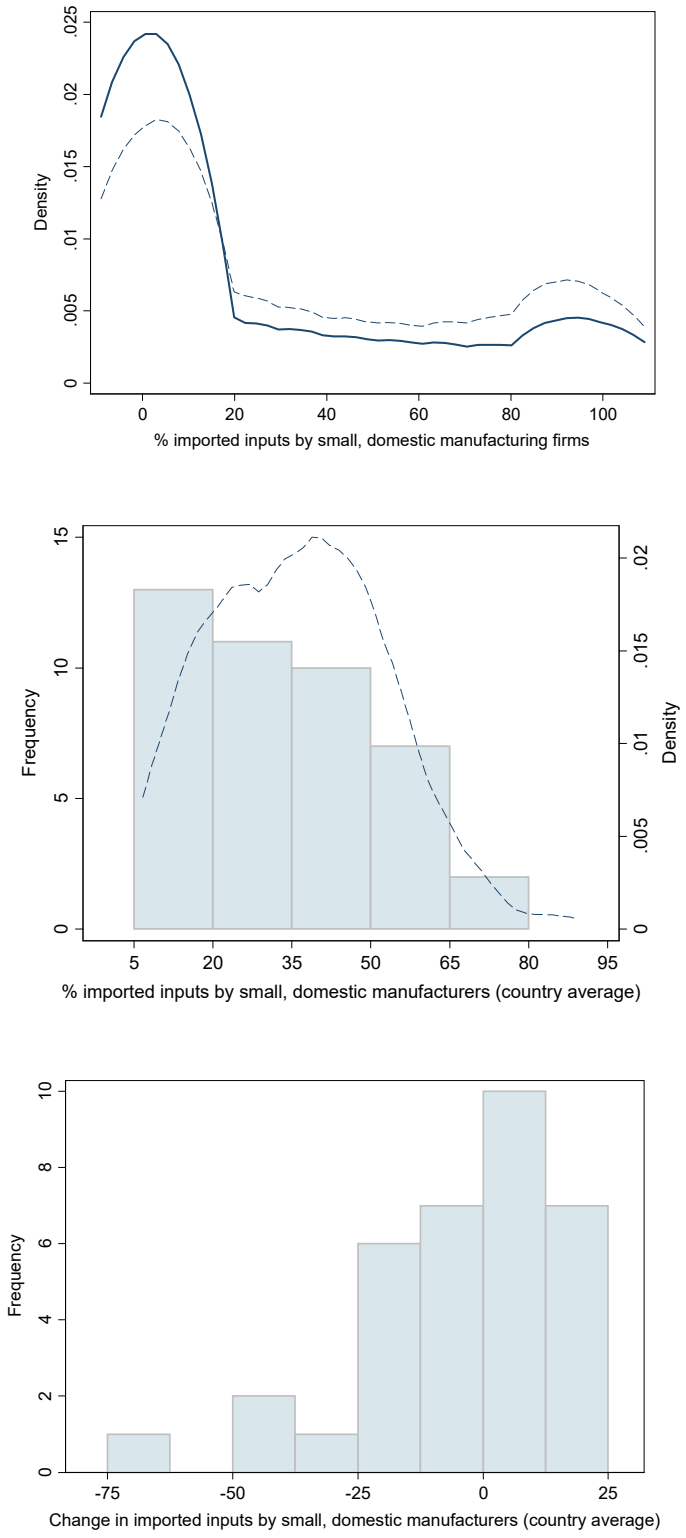
Differences across countries in the second graph are again very large. For a large number of countries, small manufacturers import very little, i.e. less than 10%, but this experience is by no means universal. The number of countries in the successive bins with higher import averages declines only gradually. While 13 countries have an average between 5% and 20%, there are still 10 countries with an average between 50% and 65%.

The difference with the average import tendency of larger firms, which is shown by the dashed lines in Figure 2, is not that large. The mean difference is only 10 percentage points: 33% for small manufacturers versus 43% for larger manufacturers. Given that median employment for larger firms is seven times higher, 8 versus 55 full-time equivalent workers, the sourcing patterns of these two groups of firms are relatively similar. The difference is even smaller if firms not importing anything are omitted.

Foreign sourcing by small firms is on average not growing over time. It decreased for exactly half of all countries when we compare the last two survey years. In 5 of these countries, the decline in the average import share even exceeds 25%, while such a large increase is never observed. The average for many countries declined even though the potential for growth tends to be larger than the potential for decline, as the average across countries only stands at 22%.

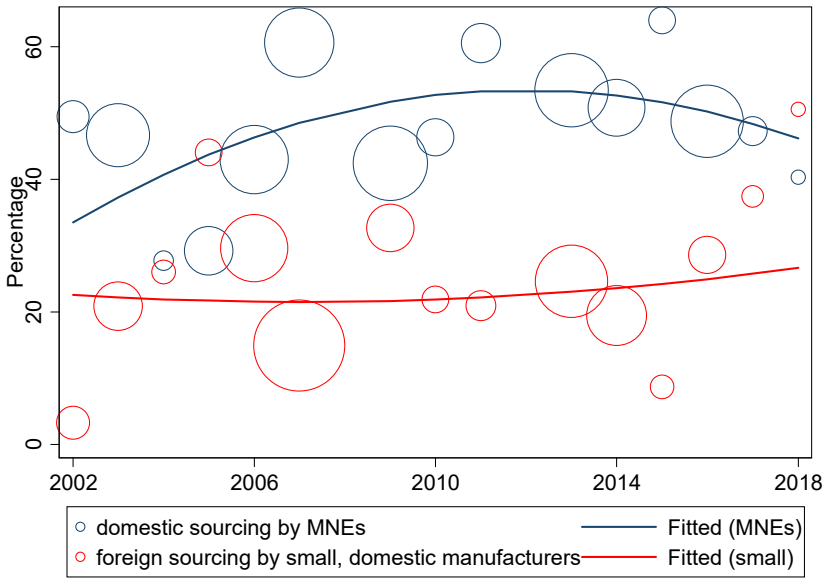
This evolution of greater importance of domestically sourced inputs that we documented for MNEs in Figure 1 mirrors the pattern for small, domestic manufacturers in Figure 2. In the former case, it could be interpreted as a positive evolution as foreign firms tend to produce higher quality products and will only source locally when they find inputs of acceptable quality. Javorcik (2004) even presents evidence that MNEs often help domestic suppliers improve their productivity and output quality. Greater domestic sourcing by small domestic firms is less of a positive development, as we expect these firms to rely predominantly on domestic markets. A high and increasing fraction of locally sourced inputs could indicate high or increasing barriers to access foreign inputs or a focus on lower quality outputs for which the quality of domestically sourced inputs suffices.

Figure 2: Fraction of their inputs that are imported by small, domestic manufacturers



Notes: The top graph shows the fraction pooling all firm-year observations. The middle graph shows the distribution of the country-average pooling over all survey years. The bottom graph shows the standardized change in the country-average between the last two survey years for countries with multiple surveys. The dashed lines in the top two graphs are comparable statistics for domestic manufacturers employing at least 20 workers.

Figure 3: Evolution of sourcing patterns



Note: The circles show the average values for the two GVC measures averaging over the firms in all countries that were surveyed in a given year. The magnitude of the circles show reflect the number of firms surveyed. The fitted line is obtained from a firm-level regression of each GVC measure on year and year-squared, controlling for country-fixed effects.

However, we should be careful not to infer too much from country averages. In Figure 3 we plot the average values for the two GVC measures—domestic sourcing by MNEs and foreign sourcing by small, domestic manufacturers—by year, but now averaged over all countries surveyed in each year. The size of the circles indicate how many firm-level observations were used to calculate each annual average. The fitted lines are calculated by a regression at the firm level on year and year-squared, controlling for country-fixed effects. The linear coefficients show the predicted signs for both measures, positive for the first measure and negative for the second, but it is clear that the non-linear component in the evolution should not be overlooked. In both cases, the coefficient on the year-squared variable has the opposite sign.

Domestic sourcing by MNEs (in blue) increases over most of the sample, but the negative square term implies that this effect gets weaker towards the end of the sample and by 2014 the square term even dominates. Once the average share of domestic sourcing reached 50% it stopped growing. The decline in foreign sourcing by small manufacturers (in red) shows an almost imperceptible negative trend in the first few years. The positive square terms starts dominating already from the middle of the sample period and overturns the negative linear trend. In the second part of the sample period, small firms even increase their foreign sourcing slightly.

With the third GVC measure, we turn our attention to the export orientation of these sub-Saharan African firms. Taglioni and Winkler (2014) propose to calculate this measure only for the subsample of supplier firms which sell their output to other firms and not to final consumers directly. Calculated that way the measure is supposed to capture to what extent

firms in African manufacturing sectors are integrating in global supply chains. Unfortunately, as was the case for the second measure, the necessary question to identify suppliers was not included in the surveys for most firms. For comparability, we show the results for all domestic, privately-owned firms, combining both producers and suppliers.

The results in columns (5) and (6) of Table 2 show the average for each country and the change over time. The average fraction of output that is exported is naturally low, averaging only 6% across all countries. Over time, it went down slightly, again confirming that the globalization process that transformed the economies of many other countries has not been a very strong force in sub-Saharan Africa.

Naturally, the distribution of firm-level exports is dominated by firms that do not export at all, which is clearly visible in the top graph of Figure 4. Among domestic firms, only 15% export anything. Among exporters, shown in the dashed line, the fraction of output exported declines gradually, but there is again a mass point at one: 12% of firms that export a positive amount, report to be exporting their entire production. The median value for exporters is 30% and the average is 42%. It is clearly a bimodal distribution with equally important mass points at 20% and 100%.

Averaged over all firms in a country, in the middle graph, the fraction exported ranges from 1% to 20%. The distribution is concentrated among the lowest values. Only in Mauritius does the average reach 20% and for only five countries is the average between 10% and 15.2%.[8] The country-average limited to exporters smooths over the bimodal distribution at the firm level. The average is almost normally distributed with a very high (unweighted) mean around 45%. When firms export, they export a lot. We expect exporters to perform a lot better on most performance dimensions, for example achieve higher productivity (Van Biesebroeck, 2005).

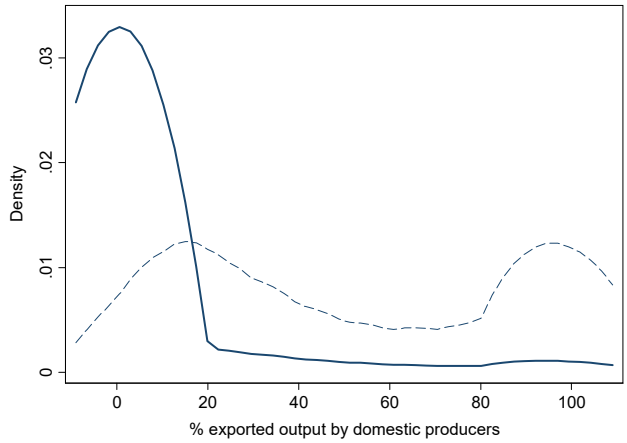
Naturally the average fraction of output exported is larger if we limit the sample to manufacturing firms, but the difference is not huge. Slightly more than half of the domestic firms in the sample are in the manufacturing sector. On this sample, the average export intensity is 8.6%, while it is 4.2% for other firms. Among manufacturing firms, only 22% export, while exporters represent fewer than 10% of non-manufacturers.

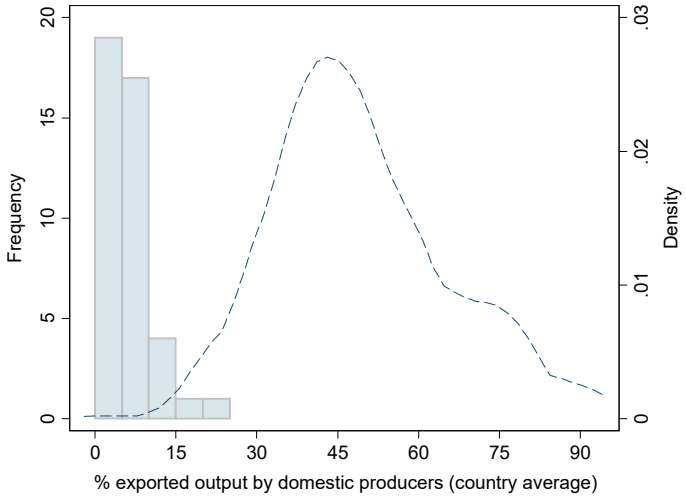
The results for the changes in the average export intensity indicate that there twice as many countries where exporting increased as decreased. The average change, across the 33 countries for which we can calculate it, is 3.1 percentage points. The median change is only half as large. The standard deviation is rather large (at 7.9), but this is driven by a single negative outlier. Only 7 of the 33 countries show a change in export intensity of more than 5% either positive or negative.

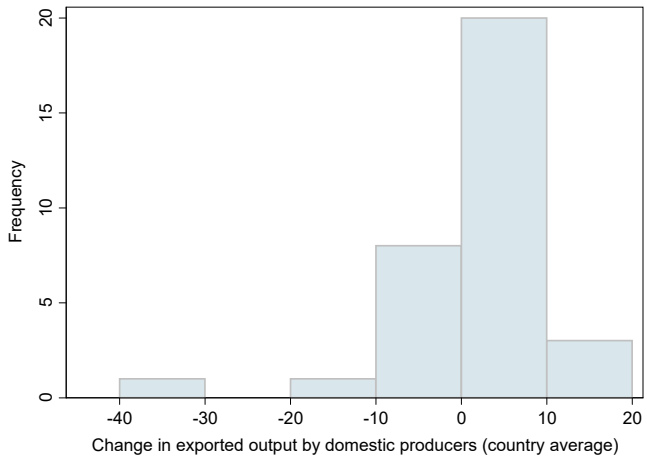
In sum, we can conclude that only few firms export, firms that do export a lot, but the fraction of exporters is barely growing over time.

[8] The question on exported output has missing observations for all firms in the surveys of Liberia and Sierra Leone in 2009.

Figure 4: Fraction of output that is exported by domestic privately-owned producers







Notes: The top graph shows the fraction pooling all firm-year observations. The middle graph shows the distribution of the country-average pooling over all survey years. The bottom graph shows the standardized change in the country-average between the last two survey years for countries with multiple surveys. The dashed lines in the top two graphs show the fraction exported limited to the sample of exporters.

3. Sector-level bilateral input-output table

3.1 EORA: World MRIO data

The multi-region input-output table (MRIO) that is part of the Eora database provides an in-depth window on the GVC integration of sub-Saharan countries. There exists several alternative input-output databases, but this is the only version where there is enough country detail to study African countries individually.[9] Unavoidably, this level of detail comes at a cost, which is the greater reliance on imputations and proportionality assumptions to complement the relatively sparse data for some countries. The underlying data that we use is freely downloadable and the construction of the various components is described in detail in Lenzen et al. (2012, 2013).[10]

We use the global MRIO table that contains information for 190 countries over the 1990-2015 period for a simplified set of 26 harmonized sectors. These dimensions imply that just the matrix of bilateral input coefficients at the country-industry level is a (190*26) by (190*26) square matrix that contains more than 24 million coefficients. In addition, there are columns for 6 final demand components that add another 5.6 million pieces of information. Moreover, this information is available for 26 years.[11] Clearly, in order to learn something from this gigantic source of information, we will need to aggregate and zoom in on particular areas of interest. Along the three dimensions—time, industry, country—we made the following choices.

Time

We observe a different IO table for 26 consecutive years, but the structure of the economy and the bilateral trading relationships only change gradually over time. Therefore, we only used the information for three equidistant years: 1995, 2005, 2015. In the analysis we will look both at the current composition of input-output relationships using the most recent IO table for 2015 and we will consider changes over time. The data file that we make available contains all indicators calculated for all three years.

Industries

The next step in the analysis is to reduce the sectoral detail. In total there are 26 harmonized industries, but we combine them into the following nine more broadly defined

[9] A widely-used alternative is the World Input-Output Database (WIOD) (http://www.wiod.org/home) constructed and maintained by researchers at the Groningen Growth and Development Centre. The 2016 release covers 43 individual countries (including the 28 EU member states) and a rest-of-the-world aggregate, the period 2000 to 2014, and a decomposition into 56 sectors and 5 final demand components. A second alternative is the Trade in Value Added (TiVA) database (http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm). The most recent 2016 edition of this resource covers more countries (63) but at a lower sectoral detail (34) for the period 1995 to 2011.

[10] http://worldmrio.com/

[11] In total, the entire database consists of almost 770 million values, most of which are naturally indistinguishable from zero, but not exactly zero.

sectors as follows (in brackets are the number of original industries that are combined in the broad sector):

1. Agriculture
2. Fishing
3. Mining and quarrying
4. Manufacturing (8): Food & beverages; Textiles & wearing apparel; Wood & paper; Petroleum, chemical & non-metallic mineral products; Metal products; Electrical & machinery; Transport equipment; Other manufacturing
5. Utilities and construction (3): Recycling; Electricity, gas & water; construction
6. Trade (4): Maintenance & repair; Wholesale trade; Retail trade; Hotels & restaurants
7. Business services (3): Transport; Post & telecommunications; Financial intermediation & business activities
8. Social and household services (4): Public administration; Education, health & other services; Private households; Others
9. Re-export and re-import

In addition, there are six components of final demand in the full table.[12] In our analysis, we do not distinguish between final demand that comes from consumers or that represents capital formation or inventories. Hence, we aggregate all six components together into a single final demand vector.

Countries

To make the country-detail more manageable, we also have to aggregate here. Given that we are interested in sub-Saharan countries, it is natural to collapse all trade-flows with countries outside of the region into the following groups:

4. OAF (Other African countries): South Africa and North African countries, i.e. Morocco incl. Western Sahara, Algeria, Tunisia, Libya, Egypt.
5. EUC (EU28): the 28 EU countries
6. USA (United States)
7. CHN (China): including Hong Kong and Macau
8. ROW (rest of the world): there already is a ROW category in the original Eora database, but we enlarge this group, adding all countries not in sub-Saharan Africa, nor in regions 4 to 7.

In addition, we distill the information of the full, integrated MRIO table into a series of country-specific (and year-specific) input-output tables, one for each sub-Saharan country. Breaking-up the information by country is a more efficient way of maintaining some regional detail than working with a single IO table that includes all 45 sub-Saharan countries with the above 5 regions. Given that a single IO table for the 45 countries of interest and the 5 regions listed above would still contain more than 200,000 coefficients, it would still be very difficult to distill useful insights from it. Moreover, bilateral trading relationships between many individual countries in the region are extremely limited.

[12] The 6 final demand components are final consumption by households, non-profit institutions, and government, as well as gross fixed capital formation, changes in inventories, and the net change in valuables.

The country-specific IO tables that we construct partition all sub-Saharan countries exhaustively in three groups, and these three countries/regions are added to the above list:

1. OWN: the country being considered itself
2. CLO (Close sub-Saharan African countries): countries neighboring the country considered
3. FAR (Faraway sub-Saharan African countries): the remaining countries from the region.

Hence, in total there will be 9 industries with 1 final demand vector and 8 countries/regions, which makes for an IO table with approximately 5000 coefficients. While the total amount of information in the 45 country-specific tables with these dimensions is comparable to the single, regional alternative, most of the information in the different tables is identical and will not be used.[13] In our analysis, we will primarily concern ourselves with the interactions between the country of interest and the different regions. It means that we will use the first nine rows and the first nine columns of each country-specific IO table to construct the GVC indicators of interest.

3.2 GVC indicators

From the 45 country-specific IO tables for each of the three selected years, we now proceed to calculate a number of ratios that are of particular interest to illustrate the GVC participation of the different countries. There is still too much information to be able to show results in any exhaustive way. Each metric of interest that we can calculate, we observe in 9,720 cases: (45 sub-Saharan countries) x (8 origin or destination regions) x (9 sectors) x (3 years). In addition to the level of each indicator, we are also interested in another 6,480 changes for the same indicators over the 1995-2005 and 2005-2015 time periods.

To convey as much of this rich information as possible, we report information in three different ways. First, we make available a data file that contains the complete information for all countries, partners, industries, and years for each of the metrics we consider. Second, in the Appendix, we report for each metric one table with the results for all countries and partner-regions but limited to a single industry (manufacturing) and a single year (2015).[14] Third, we discuss below some patterns that we believe are of interest at a more aggregate level, for example the average change over all sub-Saharan countries.

Based on the collapsed country-specific IO tables, we calculate the following four dimensions of GVC participation:

1. Share of imported intermediate inputs: by dividing the sector- and region-specific flows of intermediates in the different rows of the IO table with the total output of each

[13] The national IO structure in the 5 regions (4-8) and the bilateral interactions between these regions is identical in each of the 45 tables and we only need to calculate that information once.

[14] For the fourth metric that we consider, the domestic value added in gross exports, there is no partner-country dimension, hence we report results for all 3 years and the 2 decadal changes.

of the sectors in the considered country (OWN), we can measure the extent of international sourcing from each of the 8 country groups.[15]

2. Export share towards intermediate input use: by dividing the value of production that is used as intermediate inputs in each of the 8 destination regions—shown in different columns of the IO table—with the total output of the sector, we can measure the extent of integration into GVCs as a supplier.
3. Export share towards foreign final demand: we similarly divide the export flows consumed as final demand in the eight regions with the sectoral output to measure the general outward orientation of different countries.
4. Domestic value added in gross exports: we use the extraction method proposed in Los, Timmer and de Vries (2016) to calculate the value added to export ratio (VAX) that was introduced by Johnson and Noguera (2012). We perform these calculations for the entire economy as well as for the manufacturing sector alone.

3.3 Patterns in international sourcing

The first thing we document is to what extent each country sources intermediate inputs from abroad. Table A.2 in the Appendix list the shares for all countries and origins for the manufacturing industry in 2015. On average (using population weights to aggregate countries), local value added within the industry is 41% and 59% of the output value consists of purchased intermediates. By far the most important source of purchased inputs are the other industries within in the same country. On average they account for 45% of total output value or approximately three quarters of all purchased inputs. Together, local value added and domestically sourced intermediates account for 85% of the total value of the manufacturing industries in sub-Saharan Africa and only the remaining 15% is imported.

An important pattern to point out is that the results for some countries seem highly unbelievable. For several countries, the local value added share is implausibly low, e.g. for Tanzania (-2%), Somalia (3%), and Djibouti (7%), but it is difficult to know with certainty whether this reflects reality or not. Value added in the manufacturing sector of Cape Verde represents only 11% of the output value, but we cannot rule out that the type of industries they specialize in explains this low average. In some cases, for example for Somalia and Djibouti, the very low share of value added goes together with a very high share of domestically sourced inputs. It is possible that the nature of the industrial structure and vertical integration within the country explains these outliers.

At the other extreme, the value added share is extremely high in some countries, e.g. for Ethiopia (90%) and Nigeria (64%). We have double checked our calculations and we are certain that outlying coefficients are the result of unusual patterns in the underlying information from the MRIO and not a mistake in the aggregation procedure. In a few cases, there seem to be clear errors in the underlying data. For example, the sum of the value added

[15] Together with the share of output that is accounted for by value added from the sector itself, all components combined sum to one.

and domestic inputs for Sudan is 99.9%. Low imports are expected for this country, but the almost entire absence of any notable import flows at least raises the suspicion that imports and domestic values are not recorded in the same units.[16]

Omitting the five most extreme outliers, does not greatly affect the cross-country averages for value added (38%) and domestically sourced inputs (48%) or the average importance of foreign sourcing (14%). The main message is that one should be careful with the data for some countries, but outliers tend to compensate each other with minimal impact on the overall pattern for the region.

Another important pattern is that the share of value added and domestically sourced intermediates are negatively correlated. As a result, the coefficient of variation (the ratio of the standard deviation to the average) for value added is 0.49 and for the share of domestic inputs it is 0.29, but there is much less variation for the sum, with a coefficient of variation of only 0.15. It suggests that even though countries differ a lot in the extent of vertical integration of their firms, the share of imported varies a lot less across countries.

Among the different sourcing destinations, Europe and the rest of the world (ROW) aggregate are by far the most important trading partners, respectively accounting for slightly more and slightly less than 5% of total output value created in the sector. Together they accounted for three quarters of all imported inputs in 1995 and 2005, but this lowered to two thirds in 2015. Other African countries are the next most important sourcing origin, but as could be expected, its importance varies widely across countries. For countries that neighbor South Africa, e.g. Botswana, Namibia and Swaziland, these imports are almost as important as domestically sourced inputs. This not the case for countries bordering North African countries.

Inputs imported from neighboring countries, i.e. within the sub-Saharan African region, are surprisingly unimportant. Together they account, on average, for 0.7% of total output value. This is only one twentieth of all imported inputs, which is not negligible, but notably lower than in regions with more integrated manufacturing sectors, such as the European Union or South-East Asia. Across all inputs sourced from sub-Saharan Africa, it is interesting to note that neighboring countries account for fully half even though they only represent one tenth of sub-Saharan African countries. Proximity is important. Finally, it is noteworthy that the importance of distant countries within the region (FAR) is the most variable input share. The coefficient of variation is 2.50 which is more than an order of magnitude larger than for the overall import share (where it was 0.15). For two thirds of all countries its share of total output is below 0.5%, but for the remaining countries it averages more than 2.5%.

[16] If one is specifically interested in some of these countries, in particular Ethiopia or Sudan, it is plausible that some of these problems can be fixed by inspecting the underlying Eora data. Recall that we have aggregated the full IO table to country-specific tables eliminating some of the country and sector detail. In the source data, any misuse of local versus foreign currencies or a multiplication or division by 1000 in some years would be relatively easy to spot. In the more aggregated table that we work with it is hard to be certain because miscoded statistics are averaged with correct statistics.

Table 3: Summary of international sourcing (manufacturing)

	Value added	Dom. sectors	Neigh-bors	Other SSA	Other Africa	EU	USA	China	Rest of the World
Mean share 1995 (%)	.305	.547	.005	.005	.018	.066	.006	.003	.046
Mean share 2005 (%)	.363	.488	.006	.005	.017	.065	.005	.007	.046
Mean share 2015 (%)	.384	.479	.007	.007	.016	.057	.004	.010	.034
Coef. Variation (2015)	.491	.289	1.167	2.500	2.412	.607	1.000	1.111	.750
Change 1995-2015									
- percentage point	.079	-.068	.002	.002	-.002	-.009	-.002	.007	-.012
- percent	.259	-.124	.400	.400	-.111	-.136	-.333	2.333	-.261

Notes: Averages and standard deviation calculated using 40 of the 45 countries (without ETH, SDS, SUD, TZA, ZMB out of precaution for potential data problems). Population-weighted means are reported.

Finally, imports from the United States are remarkably unimportant, averaging less than one tenth of the value of imports coming from the EU. Its importance declined notably from 1995 to 2015. Imports from China are also not extremely important yet. The average share at 1.0% is only about two thirds of the value share of imports from within the sub-Saharan African region, but this share is growing rapidly.

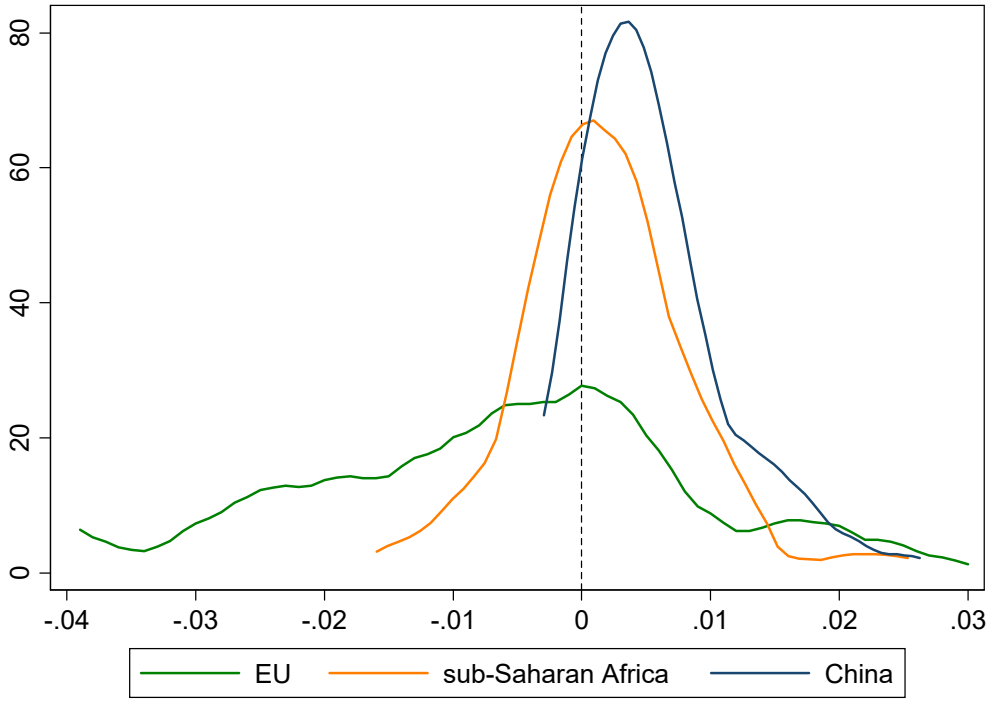
In Table 3 we summarize the averages shares for all three years and also show the coefficient of variation across countries for each component for 2015. At the bottom of the table, we further show the percentage point change from 1995 to 2015, both in percentage point changes and also in percentage change to highlight the important relative changes. Out of precaution, these averages omit a number of countries where the source data is somewhat suspect.[17]

Some of these changes are very similar across all countries in the sample, while other patterns are not shared by most countries. In Figure 5 we show a kernel density—a smoothed histogram—of the percentage point changes in the share of inputs sourced from several regions/countries. It highlights, in particular, that the increase in sourcing from China is shared by every single country in the region. The base level of imports in 1995 was very low, but the growth rate is high. The entire distribution lies on the positive side of the graph. The mean change, in percentage points, is only 0.6%, but in percentage terms, the mean increase is 67% and even the median is 73%. This is clearly a widely-shared pattern.

The increase in sourcing from China is compensated by reduced sourcing from the United States. This decline is also relatively broadly shared, but the changes are small. In Figure 5, we also show the change in the sourcing share from the European Union. Its much higher import share allows for a much wider range in country experiences and the graph shows a much flatter and more dispersed distribution. While country experiences differ quite widely, the majority of the distribution lies on the negative size of the graph and some absolute changes are quite sizeable.

[17] We omit the following countries in these calculations: Ethiopia, South Sudan, Sudan, Tanzania, and Zambia. Not all these countries necessarily have data problems for all indicators, but we erred on the side of caution only to make sure that the patterns show in Table 3 are representative for the distribution across countries.

Figure 5: Distribution of changes in sourcing intensity from three regions across all sub-Saharan countries



Notes: Percentage point change in the share of intermediates sourced from each of these three regions/countries. Lines shows the smoothed distribution (histogram) across the different countries.

Finally, the most lightly colored line (in orange) shows the change in import intensity from other countries in the same region. It combines imports from neighbors (CLO) and further-away sub-Saharan countries (FAR), but excludes domestically sourced inputs. The mode of the distribution is around zero, but almost three quarters of the countries imported more from within the region in 2015 than in 1995.

3.4 Patterns in export orientation

Turning to the importance and type of exports, we start by summarizing the country-level information for the manufacturing sector in 2015 that is reported in full detail in Table A.3 and Table A.4 in the Appendix, respectively for output that is used as intermediate inputs and output consumed as final demand.[18] In Table 4 we show the average share of output consumed domestically and exported separately in all three years, and we break this down further by use, i.e. intermediate inputs or final demand.

[18] Again, the data for some countries might suffer from some problems. We report statistics for all countries in the Appendix. In the tables in this section, we omit the data for five countries as a precautionary measure. They are four of the same countries as were flagged in the section on sourcing, i.e. Ethiopia, South Sudan, Sudan, and Tanzania, as well as Zimbabwe.

Table 4: Summary of export intensity (manufacturing)

	For intermediate inputs		For final demand	
	domestic	export	domestic	export
Mean share 1995 (%)	.580	.049	.347	.024
Mean share 2005 (%)	.508	.065	.395	.031
Mean share 2015 (%)	.463	.055	.455	.027
Coefficient of Variation (2015)	.251	.927	.215	1.889
Change 1995-2015				
- Mean change (%)	-.117	.006	.108	.003
- SD of change (norm.)	.175	.636	.163	.481

Notes: Averages and standard deviation are calculated using 40 of the 45 countries (without ETH, SDS, SUD, TZA, ZWE out of precaution for potential data problems). Population-weighted mean shares are reported. The standard deviation of the change is normalized by the average share in 2015, just as in the case of the coefficient of variation.

Overall, the total share of output that is exported is slightly below one eight throughout the entire sample period. Exports represent a similar share of output for both types of goods, intermediates or final products. There is, however, a lot of variation across countries. The coefficient of variation that we report normalizes the standard deviation by the mean share. These statistics are relatively high for the export shares. Even combining all different export destination, the coefficient of variation is 0.93 and 1.89. In particular, variation across countries for the importance of exporting is higher than for the importance of input sourcing from abroad.

Over time, the average export shares changed very little. This is somewhat surprising as the rapid pace of globalization over the last twenty years has increased export exposure tremendously for many other countries. Almost the entire decline in the importance of demand from domestically sourced intermediates, which on average fell by almost 12 percentage points from 1995 to 2015, is taken up as increased domestic final demand. Much of the globalization trend seems to have bypassed the manufacturing sector of sub-Saharan Africa. One interesting trend is that the slight increase in the average export share by 0.9 percentage points is only for one thirds due to exports for final demand, and the remainder by exports of intermediate inputs, which could indicate successfully integrating as suppliers in GVCs. However, this change was even stronger from 1995 to 2005, but partly reversed afterwards.

The standard deviations across countries of the change in export shares—normalized by the average shares—are much higher than the variation in change of domestic shares. In particular, for exports of intermediate inputs the experience of countries seems to differ quite a lot. As the shares of the four types of demand, must sum to one, we expected changes in shares to be negatively correlated. In Table 5 we show the cross-country correlation between the changes of the various shares.

If output were highly specialized, we would have expected the strongest negative correlation between the changes in the two shares for intermediates inputs, on the one hand, and between the two final demand shares on the other hand. That is not what the results in Table 5 show. Correlations are negative, as expected, for inputs, but not for final demand.

Increases in final demand exports are almost entirely unrelated to changes in sales of domestic final demand (the partial correlation statistic is +0.06).

There are, however, two strong relationships in Table 5. The two types of domestic sales, for intermediate input use and for final demand use, are extremely strongly correlated. The partial correlation statistic of -0.99 suggests almost perfectly inverse changes. The substitution in the average shares that was implied in Table 4, i.e. a decrease in domestic input use coupled with an increase in domestic final demand, seems to be taken place systematically across most countries. This is especially remarkable as almost 30% of countries experienced an *increase* in domestic input use, but in those cases this was coupled with a decrease in domestic final demand.

Table 5: Correlation between changes in domestic sales and exports (manufacturing)

	Inputs domestic	Inputs exported	FD domestic	FD exported
Inputs domestic	1			
Inputs exported	-0.617	1		
Final demand (FD) domestic	-0.992	0.519	1	
Final demand (FD) exported	-0.171	0.683	0.061	1

Notes: Calculated for the percentage point change from 1995 to 2015 using 40 of the 45 countries (without ETH, SDS, SUD, TZA, ZWE out of precaution for potential data problems), using 2015 population weights.

The other correlation that stands out is a strong *positive* relationship between the two export shares. When countries increase exports, they do so for both types of products, intermediates and final products. With a partial correlation statistic of +0.68, this co-movement is also rather strong.

In sum, these patterns suggest that output is more specialized by region than by type of consumer. If exports increase, for example due to improved market access or advantageous exchange rate evolution, all exports benefit, both intermediates and final products. Because the two domestic sales components dominate the total, they can barely grow simultaneously by keeping more exports at home. If domestic demand for final products is strong, firms will lower domestic sales of intermediate products, and vice versa.

We next investigate the destination of exports. By far the two most important destinations for manufacturing exports are the rest of the world aggregate and the EU, as shown in Table 6. The former is particularly important for intermediate inputs, while the latter is slightly more important for final products. Together they account for 67% of intermediate input exports, but only 55% of final product exports. The three most geographically close sources of export demand (CLO, FAR, and OAF), equally important for final products as for inputs. Note that exports to the three African destinations show by far the lowest ratio of inputs to final products. In contrast, exports to China show a strong reverse pattern, they are entirely dominated by intermediate inputs.

Table 6: Export destinations (2015, percentages)

	Manufacturing			Agriculture		
	Intermediate inputs (II)	Final demand (FD)	Ratio (II/FD)	Intermediate inputs (II)	Final demand (FD)	Ratio (II/FD)
Rest of the world	.267	.081	3.3	.228	.097	2.4
European Union	.203	.084	2.4	.383	.106	3.6
Neighbors	.096	.036	2.7	.031	.008	3.9
Other SSA countries	.049	.049	1.0	.019	.030	0.6
United States	.033	.025	1.3	.015	.006	2.5
Other African countries	.028	.021	1.3	.022	.008	2.8
China	.024	.003	8.0	.041	.005	8.2

Notes: Population weighted weighted averages across 40 of the 45 countries (without ETH, SDS, SUD, TZA, ZWE out of precaution for potential data problems).

In the last two columns of Table 6 we show the corresponding statistics for agricultural exports. The top two destinations are the same, and they even account for 80% of all exports (compared to two thirds in the case of manufacturing). For most export destinations, the relative importance of intermediate input exports is (relatively) higher for agriculture than for manufacturing output. The greater importance of intermediate goods exports, accounting for 74% in agriculture against only 70% in manufacturing, indicates that these products are still processed abroad before reaching final consumers. An often-suggested way to increase the manufacturing sector in sub-Saharan African region would be to expand processing activities domestically.

Finally, in Table 7 we report the export intensity for all broad industry groupings that we created.[19] Tables A.3 and A.4 in the Appendix contains the detailed country-destination breakdown for manufacturing, but it is useful to put those statistics in perspective. According to the Eora data, the average share of manufacturing in GDP is only 12% across the sub-Saharan countries (population weighted). The most important sector is business services, which also includes transportation, communication, and finance.

Naturally, the share of agriculture would be a lot higher if shares were calculated in terms of employment. The very low average share in GDP of 5.4% for agriculture suggests that it excludes agricultural output for own consumption in the household. We have not manipulated these shares, but report them as they appear in the Eora dataset. It is important to realize that all work with Eora assigns this low a percentage to the agriculture sector. The unweighted average across countries is slightly higher, but still only 6.4%.

The first four entries in Table 7 are the goods-producing industries, and they have the highest export shares. It is notable, however, that exports are not zero for the other sectors. Given the large overall size of the three service sectors listed in the bottom rows, their contribution to aggregate exports are not negligible. The average export share for manufacturing is 8%, as indicated already in Table 4. Compared to the other goods-producing sectors, its exports contain much more final products.

[19] The sector "re-export and re-import" is omitted from the table as it accounts for less than 0.1% of GDP.

Table 7: Export intensity across sectors (2015, percentages)

	Share of GDP	Domestic sales		Exports		
		Intermediate inputs	Final demand	Total	Intermediate inputs	Final demand
Agriculture	.054	.605	.161	.233	.169	.065
Fishing	.003	.715	.184	.102	.081	.021
Mining and quarrying	.019	.425	.009	.566	.560	.006
Manufacturing	.123	.463	.455	.082	.055	.027
Utilities and construction	.074	.262	.716	.021	.015	.006
Trade	.140	.246	.710	.045	.029	.016
Business services	.393	.459	.509	.032	.024	.008
Social & household services	.193	.062	.918	.019	.013	.007

Notes: Population weighted averages across 40 of the 45 countries (without ETH, SDS, SUD, TZA, ZWE out of precaution for potential data problems).

In terms of GDP, manufacturing accounts for 12% of the economy, but its share rises to 19% if we measured it in terms of gross output. Value added within the manufacturing sector is only around 25% of total output, while it averages between 40 and 65% for the other sectors. This is important because export shares are calculated as a fraction of gross output. Combining information on the value added share of each sector with its share of GDP and its total export share, we can calculate each sector's importance for total exports. This ranking, averaging over all countries, is: (1) manufacturing 25%, (2) mining and quarrying (21%), (3) agriculture 20%, (4) business services (16%), and (5) trade 10%.

3.5 Domestic value added in gross exports

The previous calculations illustrate what fraction of output is exported for each country and what fraction of national production that each country accounts for, but this only gives a partial view on the importance of trade in value creation. It only summarizes international trade linkages in the final production step. For example, when inputs are sourced domestically, not all of their value added will be added by domestic sectors.

Johnson and Noguera (2012) have argued that the usual trade statistics provide a misleading picture on the importance of international trade as countries' relative or absolute trade exposure is influenced by the intermediate inputs that are often imported first and later leave the country embedded in exports. They proposed to calculate a value added in gross output (VAX) ratio which divides the domestic value added that is embedded in a country's exports by the directly observed gross export flows. There are several reasons why this ratio could deviate from unity. Exports can contain imported intermediates, either directly or through the inputs sourced from other sectors in the country. Greater integration of production chains internationally is likely to raise export flows more rapidly than the amount of value added that crosses borders.

These embedded imported inputs give rise to two measurement problems: reflection and redirection. A fraction of a country's exports will not be consumed abroad, but will return to that same country embedded in other imports. This phenomenon unambiguously lowers the VAX ratio. At the same time, some exports from country 1 to country 2, will be embedded in the exports of country 2 and be consumed in country 3. The good flows in this example lower

the VAX ratio from country 1 to country 2, but they simultaneously raise the VAX ratio from country 1 to country 3 as they contribute to the exports of value added, without any direct export transactions.

Timmer et al. (2015) calculate the aggregate VAX index for a range of countries using four different global input-output databases. While the exact values for each country varies a bit for different sources, the overall country rankings is quite similar. Unfortunately, they do not include the Eora data in their calculations, but we expect similar results also for this source of information as it is constructed using similar official data sources. The VAX ratios are highest for more isolated countries that specialize in exports of raw materials, e.g. Russia and Australia, while it is lowest for smaller countries that are strongly integrated in regional production networks, such as smaller EU countries, e.g. Luxembourg and Slovakia.

The VAX ratio can also be calculated for specific sectors. In that case, the sector-specific VAX ratio will also deviate from unity as its exports will embody domestic value added from other sectors if some inputs are sourced domestically. At the same time, a sector's VAX ratio will increase to the extent that its output is embedded in exported products of other sectors.

Los, Timmer and de Vries (2016) proposed a very intuitive way to calculate the domestic value added content in exports using the extraction method. The idea is to set the final demand for one country's output in the rest of the world equal to zero, but leave the entire production structure, both domestically and internationally, unchanged. Foreign sectors will still use inputs from this country in their production structure, but they will no longer have direct final demand for its output. We can solve this modified IO system for the counterfactual vector of GDP values in each country-sector. The difference between the actual GDP of a country and this counterfactual GDP equals the domestic value added contained in a country's exports.

The domestic value added content of trade can also be calculated on a bilateral basis, but we are only interested in each country's total domestic value added, summing up across all of its export destinations. In practice, we start from the country-specific IO tables that we discussed earlier and collapse them one step further, combining all export destinations. This leads to the following IO system, that we represent here in simplified form:

$$GO = A * GO + \sum_{i=\{c,row\}} FD_i \quad \longrightarrow \quad GO = (1 - A)^{-1} * \sum_i FD_i$$

The *GO* vector stacks the gross output vector of both countries, first the country under study and below the rest of the world aggregate. The number of rows are twice the number of sectors *S* in the IO table. The FD_c vector similarly stacks the final demand of country *c* for both types of products: the first *S* elements is demand for output of country *c* itself and the next *S* entries is demand for output produced in the rest of the world. The FD_{row} vector similarly stacks all final demand from the rest of the world, with again demand for output from country *c* in the first *S* rows of the vector. The matrix *A* is the global IO matrix that has dimensions (2*S*) x (2*S*). Using the input coefficients in matrix *A*, we can calculate value added once we know the gross output of a country-sector.

As discussed above, we can simply replace the actual final demand from the rest of the world for products from country *c*, i.e. the first *S* elements in the FD_{row} vector, by zero. We then solve for a counterfactual *GO* vector that will imply lower equilibrium output from all

sectors. It is likely that the brunt of the adjustment will fall on industries from country c, but even output in the rest of the world will decline as less production in country c will lead to lower demand for imported intermediates, etc. The Leontief inverse $(1 - A)^{-1}$ takes into account all interactions in the global production network. As we keep technology constant, the counterfactual *GO* vector can be used to calculate counterfactual value added in all sectors and counterfactual GDP. We do this exercise separately for all sub-Saharan countries.

The same algorithm can also be used to calculate the domestic value added specifically for a single sector. We simply set the demand for the rest of the world for output from a particular sector to zero and solve the system as described above. In practice, we calculated the VAX ratio for the manufacturing sectors in our countries, which means that we only set the fourth value in the FD_{row} vector to zero.

The full results for all three years, both for aggregate VAX and manufacturing VAX, are reported in Table A.5 in the Appendix. Data problems for Sudan and South Sudan make it impossible to calculate the ratios in the first two years.

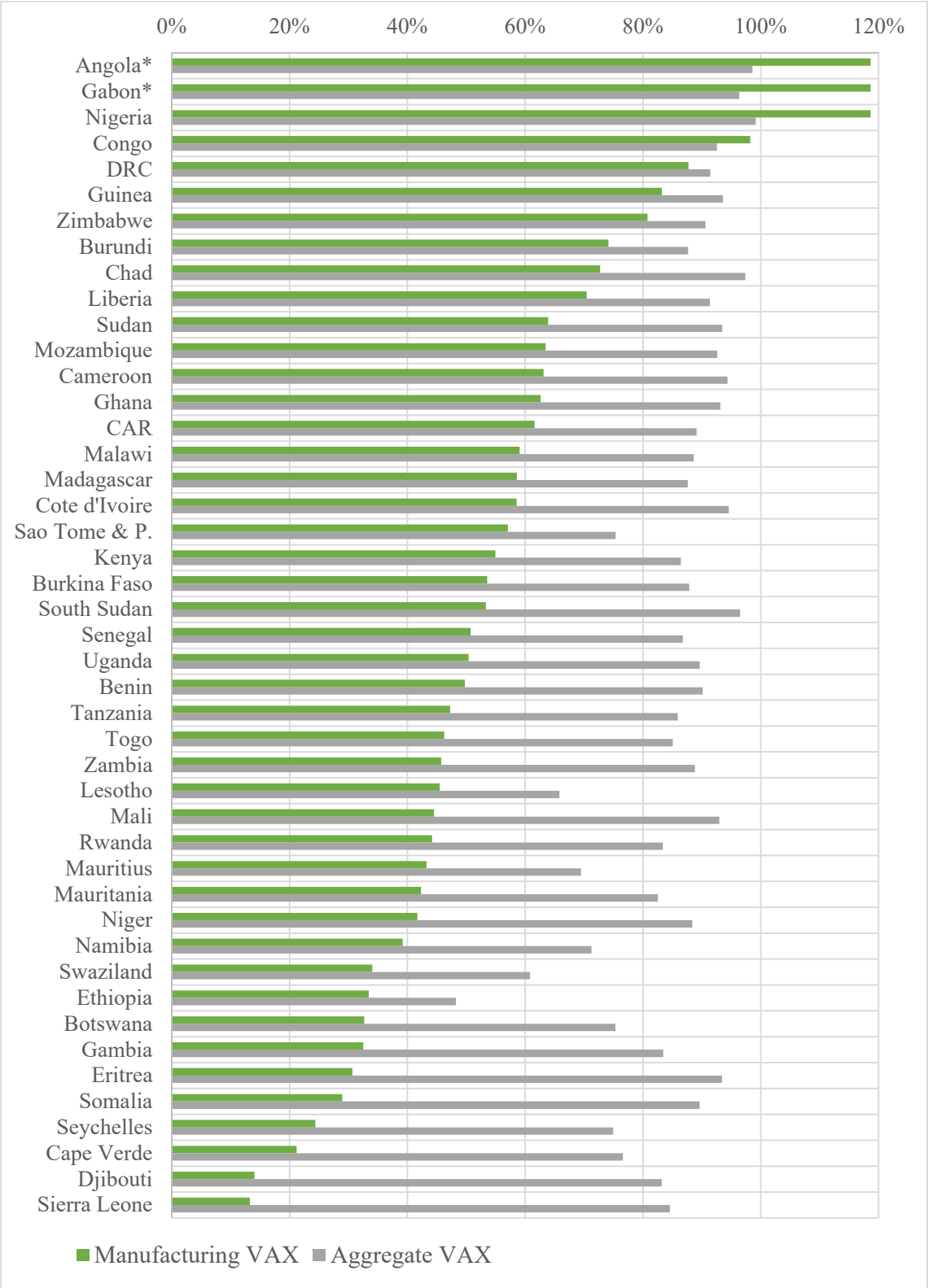
The average over all countries increases over time for both measures. However, this is somewhat misleading as the ratios for Angola are particularly high, especially for the manufacturing sector. The importance of its oil exports are skewing those results. The same is true for the manufacturing VAX ratios of Gabon and Nigeria. Excluding those three oil-producing countries from the averages, as well as Ethiopia for which the VAX ratio suddenly doubles to 99% in 2015, we find the following evolution for the aggregate VAX ratio over the three years (1995, 2005, and 2015): 58.3%, 56.5%, 58.5%.

The corresponding evolution over the three years, limited to manufacturing is: 38.2%, 38.0%, 36.4%. It means that the complement, i.e. foreign value added embedded in a country's exports, has increased slightly over time. However, out of the 39 countries for which we can reliably calculate the manufacturing VAX, the ratio increased for 19 countries and decreased for only 20 countries. Greater integration in GVCs is certainly not a dominant trend affecting all countries. The statistics limited to the manufacturing sector also indicate that one should exercise caution with aggregate statistics. In most countries the service sector has now become the largest share of the formal economy and domestic value added is very high in that sector. The same high ratio of domestic value added also holds for the agriculture sector. As a result, the importance of domestic value added in overall exports is systematically higher than limited to the manufacturing sector.

In Figure 6 we show the VAX ratios for the manufacturing sector (in green) and for the aggregate economy (in grey) for all countries in sub-Saharan Africa. Countries are sorted by declining manufacturing VAX. For two oil producers, Angola and Gabon, we have top-coded the values at the value of Nigeria to make the figure fit on the page. For three other countries, namely Somalia, Ethiopia, and Tanzania, we show the values for 2005 as their 2015 values are likely to suffer from data problems.

We can distill two general messages from this graph. First, the range of manufacturing VAX across different countries in the region span the entire possible range. For some countries, more than 80% of the value of their exports consists of value added that is sourced from abroad. From other countries, even some non-oil exporters, more than 80% of the export value is sourced domestically.

Figure 6: Value added to gross export ratio (VAX) for 2015



Note: Countries are sorted by declining manufacturing VAX. * Values for Angola and Gabon are top-coded at the value of Nigeria. The values shown for Ethiopia, Somalia and Tanzania are for 2005, because the 2015 results looked implausible.

Second, in many countries there is a large difference between the VAX ratios for the entire economy and the ratio limited to manufacturing. This reflects both varying importance of manufacturing in the overall economy across countries and variation in the share of manufacturing in their exports. Moreover, it can also reflect differences in the structure of their manufacturing sectors, which were already apparent from the sourcing results presented earlier.

Finally, in Figure 7we show the percentage points change in VAX ratios from 1995 to 2015. The green bars are for manufacturing exports and the grey bars for the total economy change. While the total economy VAX ratio increased for most countries, this was not the case for the manufacturing VAX. A large number of countries, in the bottom half of the graph, show opposing trends for both measures.

The main reason for the much more positive evolution of the overall VAX ratio is that the relative importance of different sectors changed in many countries. In particular the service sector became more important and this had a sectoral VAX very close to one. Such a compositional change can raise the overall VAX without changing the nature of sourcing of production at the sectoral level. Changes within the manufacturing suggest that the experience was very heterogeneous across the continent.

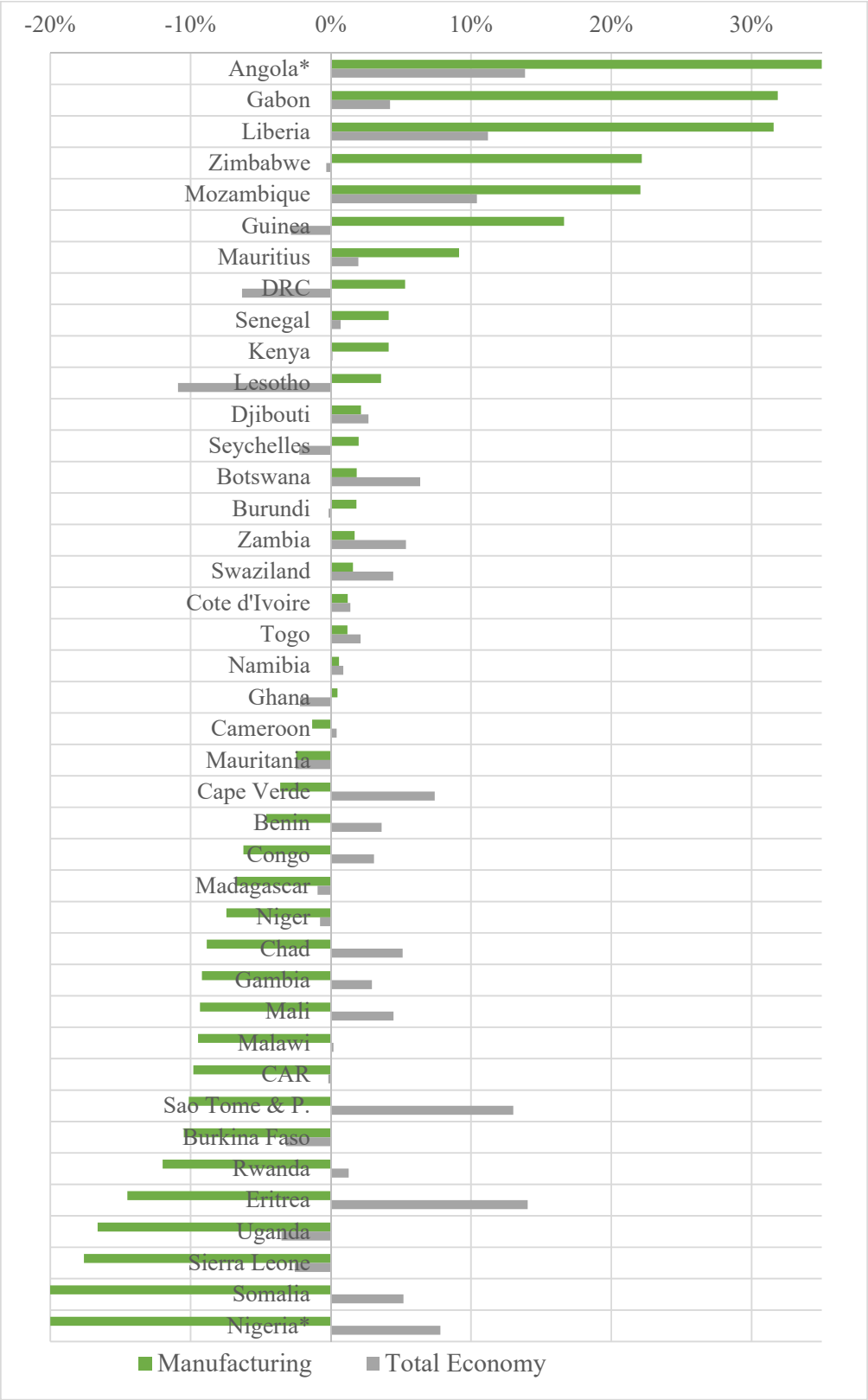
4. Conclusions

Based on two very different sources of information we are able to give a systematic overview of the extent that firms in sub-Saharan Africa engage in GVCs. It is difficult to summarize our findings, especially because a major objective was to present detailed results in a uniform way across all countries. By making the data files with all our indicators, both at the firm-level for all countries and at the country-level based on the detailed input-output calculations, available, one can explore further in which country and what dimension there are positive evolutions. They allow interested researchers or policymakers to look specifically at the countries or sectors of greatest interest. They also allow one to focus mostly on levels of GVC integration or changes over time. In the summaries we presented, we showed different ways how the data can be presented.

No single conclusion will do justice to the experience of all countries. Some of the GVC indicators that we discussed do show systematically closer engagement with the world economy, but any such trends are never shared universally in the region. We do wish to highlight two general patterns that showed up consistently across many countries and using both types of information.

We would say that, overall, the results give more reason for pessimism than optimism. The last two decades has been a period of rapid globalization and the economies of many countries outside of Africa has been transformed by their closer integration in a global production network. There is evidence of such a pattern for some countries, but GVC engagement in most sub-Saharan economies is not very deep. Most striking is that there are very few signs of a systematic deepening over time that is shared across most of the countries for any of the indicators. While some economies experienced growth in foreign sourcing and export intensity on some dimension, this is by no means a universal pattern.

Figure 7: Change in the value added to gross export ratio (percentage points, 1995-2015)



Note: Countries are sorted by declining change in manufacturing VAX. * Values for Angola and Nigeria are top or bottom coded.

It is striking that the one evolution over time that is shared by every single sub-Saharan country is greater sourcing of inputs from China. It is a positive development in the sense that these economies are able to tap into low-cost sources of supply, but it is not an indicator of a strongly developing manufacturing sector in these countries. This is especially true given that the simultaneous explosion in demand from China is showing up much more weakly in growing exports of manufacturing goods from sub-Saharan Africa to China.

References

Bernard, A.B., J.B. Jensen, P.K. Schott (2009). "Importers, exporters and multinationals: A portrait of firms in the US that trade goods," in T. Dunne, J.B. Jensen, M.J. Roberts (eds.) *Producer Dynamics: New Evidence from Micro Data*. University of Chicago Press.

Freund, C., M.D Pierola (2015). "Export superstars," *Review of Economics and Statistics* 97(5): 1023-1032.

Gereffi, G., J. Humphrey, T. Sturgeon (2005). "The governance of global value chains," *Review of International Political Economy* 12(1): 78-104.

International Monetary Fund (2015). *Regional Economic Outlook: Sub-Saharan Africa, Navigating Headwinds*. World Economic and Financial Surveys. Washington, DC: IMF.

Javorcik, B.S. (2004). "Does Foreign Direct Investment increase the productivity of domestic firms? In search of spillovers through backward linkages," *American Economic Review* 94(3): 605-627.

Johnson, R.C., G. Noguera. 2012. "Accounting for intermediates: Production sharing and trade in value added," *Journal of International Economics* 86(2): 224-236.

Lenzen M., K. Kanemoto, D. Moran, A. Geschke (2012). "Mapping the structure of the world economy," *Environmental Science & Technology* 46(15): 8374-8381.

Lenzen, M., D. Moran, K. Kanemoto, A. Geschke (2013). "Building Eora: A global multi-regional Input-Output database at high country and sector resolution," *Economic Systems Research* 25(1): 20-49.

Los, B., M.P. Timmer, G. de Vries (2016). "Tracing value-added and double counting in gross exports: Comments," *American Economic Review* 106(7): 1958-1966.

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer, G.J. De Vries (2015). "An illustrated user guide to the world input-output database: The case of global automotive production," *Review of International Economics* 23(3): 575-605.

Van Biesebroeck, J. (2005). "Exporting raises productivity in sub-Saharan African manufacturing firms," *Journal of International Economics* 67(2): 373-391.

Van Biesebroeck, J. (2008). "The sensitivity of productivity estimates: Revisiting three important debates," *Journal of Business and Economic Statistics* 26(3): 311-328.

Van Biesebroeck, J. (2014). "Productivity, exporting and financial constraints of Chinese SMEs," IDB Working Paper No. 506.

World Bank (2017). *Measuring and Analyzing the Impact of GVCs on Economic Development*, Global Value Chain Development Report 2017, Washington D.C., World Bank Group.

Appendix

Calculating firm-level GVC indicators using responses to questions in the WBES

(1) What fraction of inputs of multinational firms is sourced from domestic suppliers?

Multinational firms can be identified using the following question:

- Question: What percentage of this firm is owned by each of the following?
- Answer: ___% foreign private individuals, companies, or organizations.

➢ Foreign ownership of at least 10% qualifies a firm to be considered a multinational.

On the subset of multinational firms, the share of domestic inputs can be obtained by

- Question: As a proportion of all material inputs or supplies purchased [that year], what percentage of this establishment's material inputs or supplies were of domestic origin?
- Answer: ___% material inputs or supplies of domestic origin.

(2) What fraction of inputs of domestic producers is imported?

Domestic firms can be identified using the following question:

- Question: What percentage of this firm is owned by each of the following?
- Answer: ___% domestic private individuals, companies, or organizations.

➢ Domestic ownership of at least 90% qualifies a firm to be considered domestic.

Producers can be identified using the following question:

- Question: In the past fiscal year, this establishment's production falls into which category?
- Possible answers include (1) only goods for sale to final consumers, (2) semi-finished goods used as inputs by other firms, (3) mostly finished goods but also some semi-finished goods, and (4) mostly semi-finished goods but also some finished goods.

➢ Typical producer firms should focus mainly on the production of final goods, so categories 1 and 3 are the most appropriate to take into account.

➢ This question is not covered in all Enterprise Surveys, so the measure in some cases can only be calculated for all domestic firms' (rather than only producers') share of imported inputs.

Based on domestic producers only, the firm's share of imported inputs can be obtained.

- Question: As a proportion of all material inputs or supplies purchased that year, what percentage of this establishment's material inputs or supplies were of foreign origin?
- Answer: ___% material inputs or supplies of foreign origin.

(3) What fraction of output of domestic supplier firms is exported?

Domestic firms can be identified as for indicator (2)

Suppliers can be identified using the same question as used for indicator (2), if it is included in the survey:

- Typical supplier firms should mainly focus on the production of intermediate goods, so categories 2 and 4 are the most appropriate to take into account.

Based on domestic suppliers only, the share of exports in output can be calculated from:

- Question: In the past fiscal year, what percentage of this establishment's sales fell in each of the following categories?
- Possible answers include (1) national sales, (2) indirect exports (sold domestically to a third party that exports products), and (3) direct exports.
- The export share can be computed based on answer 3 only or on the sum of 2 and 3.

Table A.1: Number of sub-Saharan African firms sampled in each of the World Bank Enterprise Surveys

Country	2002	2003	2004	2005	2006	2007	2009	2010	2011	2013	2014	2015	2016	2017	2018
Angola					425			360							
Benin			197				150						150		
Botswana					342			268							
Burkina Faso					139		394								
Burundi					270						157				
Cameroon					172		363						361		
Cape Verde					98		156								
CAR									150						
Chad							150								153
Congo							151								
Côte d'Ivoire							526						361		
DRC					340			359		529					
Djibouti										266					
Eritrea	79						179								
Ethiopia	427								644			848			
Gabon							179								
Gambia					174										
Ghana						494				720					
Guinea					223								150		
Guinea-Bissau					159										
Kenya		284				657				781					
Lesotho		75					151						150		
Liberia							150							151	
Madagascar				293			445			532					
Malawi				160			150				523				
Mali		155				490		360					185		
Mauritania					237						150				
Mauritius				212			398								
Mozambique						479									
Namibia					329						580				
Niger				125			150							151	
Nigeria						1,891					2,676				
Rwanda					212				241						
Senegal		262				506					601				
Sierra Leone							150							152	
South Africa		603				937									
South Sudan											738				
Sudan											662				
Swaziland					307								150		
Tanzania		276			419					813					
Togo							155						150		
Uganda		300			563					762					
Zambia	207					484				720					
Zimbabwe									599				600		

Table A.2: Share of domestic value added, domestically sourced intermediates, and imported intermediates by region (manufacturing, 2015)

Country	VA	OWN	CLO	FAR	OAF	EUC	USA	CHN	ROW
AGO	29.4%	62.3%	0.6%	0.0%	1.6%	3.9%	0.3%	0.1%	1.8%
BDI	32.4%	57.7%	0.1%	1.1%	0.4%	3.3%	0.2%	0.4%	4.6%
BEN	24.4%	64.0%	0.5%	0.9%	0.2%	7.2%	0.2%	0.7%	2.0%
BFA	25.6%	62.2%	0.4%	0.5%	0.2%	7.4%	0.2%	0.4%	3.1%
BWA	23.6%	40.3%	0.1%	0.1%	32.7%	1.3%	0.2%	0.2%	1.5%
CAF	24.5%	65.5%	0.7%	0.6%	0.1%	4.2%	0.2%	0.2%	4.0%
CIV	29.2%	63.2%	0.0%	0.3%	0.2%	5.2%	0.1%	0.6%	1.2%
CMR	31.8%	58.5%	0.2%	0.3%	0.2%	6.8%	0.2%	0.6%	1.3%
COD	22.9%	64.8%	1.3%	0.5%	3.4%	5.1%	0.1%	0.6%	1.4%
COG	27.4%	60.1%	0.4%	0.4%	0.7%	5.9%	0.7%	0.5%	3.9%
CPV	11.0%	68.4%	0.2%	0.5%	0.2%	15.0%	0.4%	0.7%	3.6%
DJI	7.0%	77.1%	0.0%	0.8%	0.4%	5.9%	0.4%	2.1%	6.4%
ERI	14.7%	79.7%	0.0%	0.4%	0.1%	2.8%	0.2%	0.2%	2.0%
ETH	90.4%	2.1%	0.2%	0.2%	0.3%	3.1%	0.2%	0.7%	2.9%
GAB	27.6%	62.8%	0.3%	0.3%	0.2%	6.9%	0.5%	0.3%	1.1%
GHA	46.8%	40.5%	0.1%	0.1%	0.9%	6.1%	0.5%	1.6%	3.3%
GIN	27.2%	53.5%	0.8%	0.4%	0.3%	10.3%	1.0%	1.4%	5.0%
GMB	14.3%	72.5%	0.4%	0.8%	0.2%	6.7%	0.3%	0.7%	4.2%
KEN	37.8%	46.1%	0.3%	0.2%	1.4%	5.6%	0.4%	0.9%	7.3%
LBR	31.1%	59.0%	0.0%	0.8%	0.2%	1.9%	0.3%	0.3%	6.4%
LSO	25.6%	53.4%	1.0%	1.3%	0.1%	4.8%	0.5%	1.9%	11.4%
MDG	29.7%	56.3%	0.5%	0.1%	0.8%	6.4%	0.4%	2.8%	2.9%
MLI	19.4%	69.7%	1.4%	0.4%	0.7%	5.2%	0.2%	0.7%	2.3%
MOZ	43.4%	43.9%	0.4%	0.1%	7.7%	1.9%	0.1%	0.3%	2.2%
MRT	26.6%	54.9%	0.6%	1.1%	0.6%	11.9%	0.3%	0.4%	3.6%
MUS	35.1%	34.2%	0.4%	0.2%	3.6%	8.5%	0.3%	5.7%	12.0%
MWI	27.3%	56.6%	0.9%	0.5%	8.8%	1.8%	0.2%	0.6%	3.3%
NAM	30.9%	39.2%	0.1%	0.1%	26.3%	1.6%	0.2%	0.2%	1.4%
NER	33.1%	48.7%	2.0%	2.4%	0.4%	7.9%	0.7%	1.1%	3.7%
NGA	64.4%	20.5%	0.1%	0.1%	0.4%	7.8%	0.8%	1.6%	4.3%
RWA	20.0%	66.7%	0.8%	1.8%	0.5%	5.2%	0.3%	0.6%	4.1%
SDS	21.1%	77.3%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	1.5%
SEN	35.5%	50.2%	0.0%	0.6%	0.4%	9.1%	0.2%	1.0%	3.0%
SLE	10.2%	67.2%	0.1%	1.4%	0.4%	11.2%	0.7%	1.5%	7.4%
SOM	3.4%	92.9%	0.1%	0.4%	0.1%	0.7%	0.1%	0.1%	2.3%
STP	25.2%	50.5%	0.4%	2.0%	0.4%	8.2%	0.9%	0.6%	11.8%
SUD	24.5%	75.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SWZ	23.7%	40.4%	0.1%	0.2%	34.2%	0.4%	0.1%	0.1%	1.0%
SYC	17.0%	63.7%	0.8%	0.4%	3.7%	4.7%	0.3%	0.5%	8.9%
TCD	17.0%	79.6%	0.2%	0.1%	0.1%	1.7%	0.1%	0.0%	1.1%
TGO	22.5%	61.8%	1.9%	1.0%	0.2%	8.7%	0.2%	0.6%	3.2%
TZA	-2.1%	59.3%	3.7%	0.2%	5.4%	11.0%	0.7%	2.6%	19.2%
UGA	25.1%	60.5%	4.0%	0.1%	1.3%	3.1%	0.1%	0.5%	5.3%
ZMB	28.2%	0.9%	0.1%	7.7%	1.2%	0.1%	0.3%	2.0%	59.5%
ZWE	76.9%	0.6%	0.2%	16.3%	2.7%	0.3%	1.0%	1.9%	0.0%
Average	40.6%	44.5%	0.8%	0.7%	1.6%	5.4%	0.4%	1.0%	5.1%

Notes: VA is value added, OWN is domestically sourced intermediates, and the different import regions are neighboring sub-Saharan countries (CLO), other countries in the region (FAR), other African countries (OAF), EU28 member states (EUC), the United States (USA), China (CHN), and the rest of the world (ROW). Averages are population weighted.

Table A.3: Share of output sold as intermediates in different regions (manufacturing, 2015)

Country	OWN	EXP	CLO	FAR	OAF	EUC	USA	CHN	ROW
AGO	68.9%	0.4%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%
BDI	53.2%	2.5%	0.0%	0.3%	0.1%	0.4%	0.0%	0.1%	1.7%
BEN	57.3%	2.4%	1.0%	0.2%	0.1%	0.3%	0.0%	0.0%	0.8%
BFA	61.3%	2.4%	0.1%	0.1%	0.0%	0.5%	0.0%	0.0%	1.7%
BWA	44.6%	3.9%	0.3%	0.4%	0.0%	0.5%	0.1%	0.0%	2.6%
CAF	58.7%	3.7%	0.3%	0.3%	0.0%	1.1%	0.1%	0.1%	1.9%
CIV	54.2%	14.6%	0.5%	1.5%	0.2%	9.2%	2.2%	0.0%	1.0%
CMR	55.0%	7.9%	0.2%	0.5%	0.1%	5.4%	1.0%	0.1%	0.7%
COD	67.7%	1.3%	0.0%	0.1%	0.0%	0.5%	0.1%	0.1%	0.5%
COG	62.8%	7.3%	0.1%	0.1%	0.0%	1.0%	1.2%	3.7%	1.1%
CPV	56.5%	5.3%	1.5%	0.4%	0.1%	0.8%	0.1%	0.1%	2.5%
DJI	52.0%	5.6%	0.0%	0.8%	0.1%	0.8%	0.1%	0.1%	3.8%
ERI	56.7%	3.8%	0.0%	0.4%	0.1%	0.6%	0.1%	0.1%	2.5%
ETH	5.5%	85.9%	0.1%	1.0%	0.2%	9.1%	2.4%	0.3%	72.8%
GAB	64.2%	2.3%	0.1%	0.1%	0.1%	1.5%	0.2%	0.0%	0.3%
GHA	35.7%	12.5%	0.9%	0.2%	0.1%	6.8%	2.2%	0.1%	2.1%
GIN	39.4%	3.6%	0.1%	0.4%	0.3%	0.6%	0.1%	0.0%	2.2%
GMB	63.0%	3.7%	0.0%	0.5%	0.1%	0.9%	0.1%	0.1%	2.1%
KEN	42.5%	7.9%	3.1%	0.8%	0.1%	2.1%	0.2%	0.2%	1.4%
LBR	55.9%	16.3%	0.0%	0.5%	0.1%	11.9%	0.1%	0.1%	3.5%
LSO	58.5%	3.2%	0.0%	0.2%	0.0%	0.3%	0.2%	0.0%	2.5%
MDG	54.7%	7.3%	0.4%	0.1%	0.1%	5.1%	0.2%	0.3%	1.2%
MLI	59.2%	1.6%	0.2%	0.2%	0.0%	0.4%	0.1%	0.0%	0.7%
MOZ	43.4%	3.7%	0.1%	0.1%	1.8%	0.9%	0.1%	0.0%	0.7%
MRT	43.9%	11.2%	0.0%	1.3%	0.1%	4.3%	0.0%	1.4%	4.1%
MUS	23.0%	11.9%	0.7%	0.4%	0.3%	7.5%	0.2%	0.3%	2.4%
MWI	58.1%	4.0%	0.4%	0.4%	1.1%	1.2%	0.1%	0.0%	0.9%
NAM	39.0%	12.8%	5.4%	0.2%	0.0%	4.6%	0.2%	0.0%	2.3%
NER	34.5%	8.7%	0.3%	0.3%	0.2%	6.4%	0.1%	0.0%	1.4%
NGA	22.1%	5.6%	0.1%	0.0%	0.0%	0.9%	1.8%	0.1%	2.7%
RWA	56.9%	1.8%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	1.5%
SDS	68.1%	2.1%	0.0%	0.2%	0.0%	0.1%	0.0%	0.1%	1.6%
SEN	49.1%	9.3%	0.6%	0.8%	0.1%	7.0%	0.1%	0.1%	0.7%
SLE	35.6%	7.8%	0.0%	0.5%	0.2%	2.6%	0.7%	0.1%	3.7%
SOM	60.6%	2.2%	0.0%	0.2%	0.0%	0.3%	0.1%	0.0%	1.6%
STP	53.9%	9.4%	0.1%	1.0%	0.2%	1.8%	0.3%	0.2%	6.0%
SUD	63.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%
SWZ	43.3%	16.8%	1.1%	1.4%	0.0%	4.0%	1.2%	0.1%	8.9%
SYC	40.4%	19.5%	0.3%	0.5%	0.2%	11.6%	2.0%	0.1%	4.7%
TCD	70.4%	1.8%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	1.5%
TGO	59.1%	5.8%	1.8%	1.2%	0.1%	1.0%	0.0%	0.1%	1.6%
TZA	59.2%	5.8%	0.9%	0.2%	0.2%	1.6%	0.2%	0.3%	2.4%
UGA	58.2%	1.6%	0.5%	0.1%	0.1%	0.3%	0.0%	0.0%	0.5%
ZMB	50.0%	17.3%	2.0%	0.3%	2.2%	2.3%	0.1%	6.0%	4.5%
ZWE	0.2%	98.0%	0.1%	1.2%	0.1%	1.4%	0.3%	0.0%	94.9%
Average	42.9%	15.3%	0.4%	0.3%	0.2%	2.6%	0.8%	0.2%	10.7%

Notes: OWN are intermediates sold domestically and IMP are exported intermediates (the sum of the next 7 columns). The different export regions are neighboring sub-Saharan countries (CLO), other countries in the region (FAR), other African countries (OAF), EU28 member states (EUC), the United States (USA), China (CHN), and the rest of the world (ROW). Averages are population weighted.

Table A.4: Share of output sold as intermediates in different regions (manufacturing, 2015)

Country	OWN	EXP	CLO	FAR	OAF	EUC	USA	CHN	ROW
AGO	30.4%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%
BDI	43.8%	0.5%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.3%
BEN	38.9%	1.4%	0.8%	0.1%	0.1%	0.0%	0.0%	0.0%	0.3%
BFA	35.6%	0.8%	0.1%	0.0%	0.0%	0.3%	0.0%	0.0%	0.3%
BWA	48.6%	2.8%	0.9%	0.8%	0.0%	0.6%	0.1%	0.0%	0.5%
CAF	36.7%	0.9%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.5%
CIV	23.8%	7.4%	0.4%	1.1%	0.1%	4.1%	0.6%	0.0%	1.1%
CMR	35.3%	1.7%	0.2%	0.5%	0.0%	0.7%	0.1%	0.0%	0.2%
COD	30.5%	0.4%	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%	0.1%
COG	28.9%	0.9%	0.1%	0.1%	0.0%	0.2%	0.4%	0.0%	0.2%
CPV	34.8%	3.5%	2.0%	0.2%	0.1%	0.6%	0.0%	0.0%	0.6%
DJI	40.4%	2.0%	0.0%	0.5%	0.0%	0.2%	0.0%	0.0%	1.3%
ERI	38.5%	1.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.7%
ETH	0.1%	8.5%	0.0%	0.6%	0.0%	3.2%	1.1%	0.0%	3.6%
GAB	33.0%	0.5%	0.0%	0.1%	0.0%	0.3%	0.0%	0.0%	0.1%
GHA	46.8%	5.0%	0.8%	0.2%	0.0%	2.6%	0.4%	0.0%	1.0%
GIN	55.4%	1.6%	0.1%	0.2%	0.0%	0.4%	0.0%	0.0%	0.8%
GMB	32.0%	1.2%	0.0%	0.4%	0.1%	0.2%	0.0%	0.0%	0.5%
KEN	43.8%	5.9%	2.7%	0.9%	0.0%	1.4%	0.4%	0.1%	0.5%
LBR	20.9%	6.9%	0.0%	0.2%	0.0%	5.6%	0.0%	0.0%	1.0%
LSO	32.0%	6.3%	0.0%	0.1%	0.0%	0.1%	5.7%	0.0%	0.3%
MDG	29.4%	8.6%	0.4%	0.1%	0.0%	6.1%	1.1%	0.1%	0.7%
MLI	38.3%	0.9%	0.2%	0.1%	0.0%	0.3%	0.1%	0.0%	0.2%
MOZ	50.9%	2.0%	0.1%	0.0%	1.0%	0.4%	0.0%	0.0%	0.4%
MRT	30.4%	14.4%	0.0%	1.3%	0.0%	7.3%	0.0%	2.3%	3.5%
MUS	41.5%	23.6%	1.1%	0.6%	0.3%	14.1%	4.7%	0.6%	2.3%
MWI	32.8%	5.2%	0.5%	0.6%	2.7%	0.9%	0.3%	0.0%	0.3%
NAM	33.4%	14.8%	6.5%	0.2%	0.0%	5.6%	0.1%	0.0%	2.4%
NER	53.7%	3.2%	0.8%	0.1%	0.2%	1.6%	0.1%	0.0%	0.4%
NGA	70.6%	1.6%	0.1%	0.1%	0.0%	0.4%	0.4%	0.0%	0.7%
RWA	41.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
SDS	29.3%	0.5%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.4%
SEN	35.8%	5.8%	0.4%	0.5%	0.1%	4.4%	0.0%	0.2%	0.3%
SLE	52.7%	3.9%	0.0%	0.2%	0.1%	2.3%	0.2%	0.0%	1.2%
SOM	36.8%	0.4%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.3%
STP	35.1%	1.6%	0.0%	0.3%	0.0%	0.2%	0.0%	0.0%	1.0%
SUD	35.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
SWZ	26.5%	13.5%	0.9%	1.9%	0.0%	2.4%	1.5%	0.0%	6.6%
SYC	28.4%	11.7%	0.5%	0.2%	0.2%	8.3%	0.5%	0.0%	1.9%
TCD	27.5%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.2%
TGO	30.2%	4.9%	2.2%	1.7%	0.0%	0.5%	0.0%	0.0%	0.4%
TZA	29.3%	5.8%	1.0%	0.2%	0.1%	1.2%	1.5%	0.2%	1.6%
UGA	39.0%	1.3%	0.5%	0.1%	0.1%	0.1%	0.0%	0.1%	0.3%
ZMB	28.7%	4.0%	2.6%	0.1%	0.7%	0.2%	0.0%	0.0%	0.3%
ZWE	0.0%	1.7%	0.0%	0.4%	0.1%	0.2%	0.0%	0.0%	1.0%
Average	38.4%	3.3%	0.4%	0.2%	0.1%	1.2%	0.4%	0.0%	0.9%

Notes: OWN is output sold as final demand domestically and EXP is final demand from exports (the sum of the next 7 columns). The different export regions are neighboring sub-Saharan countries (CLO), other countries in the region (FAR), other African countries (OAF), EU28 member states (EUC), the United States (USA), China (CHN), and the rest of the world (ROW). Averages are population weighted.

Table A.5: Domestic value added as a fraction of gross exports

Country	Total Economy			Manufacturing		
	1995	2005	2015	1995	2005	2015
AGO	85%	96%	99%	381%	631%	765%
BDI	88%	73%	88%	72%	60%	74%
BEN	87%	89%	90%	54%	54%	50%
BFA	91%	92%	88%	64%	64%	54%
BWA	69%	79%	75%	31%	40%	33%
CAF	89%	86%	89%	71%	60%	62%
CIV	93%	90%	95%	57%	56%	59%
CMR	94%	93%	94%	64%	64%	63%
COD	98%	93%	91%	82%	83%	88%
COG	89%	95%	93%	104%	86%	98%
CPV	69%	70%	77%	25%	20%	21%
DJI	81%	75%	83%	12%	14%	14%
ERI	79%	82%	93%	45%	50%	31%
ETH	64%	48%	102%	48%	33%	99%
GAB	92%	92%	96%	125%	136%	157%
GHA	95%	93%	93%	62%	62%	63%
GIN	96%	77%	94%	67%	75%	83%
GMB	80%	73%	83%	42%	31%	33%
KEN	86%	82%	86%	51%	48%	55%
LBR	80%	82%	91%	39%	48%	70%
LSO	77%	79%	66%	42%	52%	46%
MDG	89%	83%	88%	65%	63%	59%
MLI	88%	89%	93%	54%	54%	45%
MOZ	82%	89%	93%	41%	58%	63%
MRT	85%	75%	83%	45%	42%	42%
MUS	68%	66%	69%	34%	37%	43%
MWI	88%	81%	89%	69%	60%	59%
NAM	70%	73%	71%	39%	41%	39%
NER	89%	86%	88%	49%	47%	42%
NGA	91%	98%	99%	157%	147%	119%
RWA	82%	85%	83%	56%	75%	44%
SDS			97%			53%
SEN	86%	85%	87%	47%	44%	51%
SLE	87%	84%	85%	31%	25%	13%
SOM	90%	90%	95%	27%	29%	7%
STP	62%	66%	75%	67%	27%	57%
SUD			93%			64%
SWZ	56%	53%	61%	32%	27%	34%
SYC	77%	73%	75%	22%	26%	24%
TCD	92%	97%	97%	82%	88%	73%
TGO	83%	79%	85%	45%	44%	46%
TZA	89%	86%	53%	49%	47%	-4%
UGA	93%	89%	90%	67%	62%	50%
ZMB	83%	83%	89%	44%	44%	46%
ZWE	91%	80%	91%	59%	48%	81%
Average	87.0%	85.0%	91.4%	87.0%	90.5%	92.4%

Notes: Domestic value added is calculated using the extraction method of Los et al. (2016). The numerator in the columns for manufacturing only count the value added in the country's manufacturing sector. Averages are population weighted.