

A Macro and Micro Analysis of Value Chain Trade in Africa

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A Macro and Micro Analysis of Value Chain Trade in Africa

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List of abbreviations and acronyms

| | |
|--------|--|
| ADB | Asian Development Bank |
| AERC | African Economic research Consortium |
| AfCFTA | African Continental Free Trade Area |
| ASEAN | Association of Southeast Asian Nations |
| BEC | Broad Economic Category |
| CEPII | Centre d'Études Prospectives et d'Informations Internationales |
| EAC | East African Community |
| ECOWAS | Economic Community of West African States |
| EDD | Exporter Dynamics Database |
| FVA | Foreign Value-Added |
| FDI | Foreign Direct Investment |
| GDP | Gross Domestic Product |
| GVCs | Global Value Chains |
| I-O | Input–Output |
| ICIO | Inter-Country Input–Output |
| IGAD | Intergovernmental Authority on Development |
| ILO | Labour Organization |
| KRA | Kenya Revenue Authority |
| LS-BE | Least Squares Between Effects |
| MENA | Middle East and North Africa |
| MRIO | Multi-Region Input-Output |
| MVA | Manufacturing Value-Added |
| OECD | Organisation for Economic Co-operation and Development |
| P&C | Parts and Components |
| PWT | Penn World Table |
| RECs | Regional Economic Communities |
| SADC | Southern African Development Community |

| | |
|--------|--|
| TiVA | Trade in Value-Added |
| UNCTAD | United Nations Conference on Trade and Development |
| UNIDO | United Nations Industrial Development Organization |
| WBES | World Bank Enterprise Surveys |
| WDI | World Development Indicators |
| WGI | Worldwide Governance Indicators |
| WDR | World Development Report |
| WIOD | World Input Output Database |

Abstract

Africa's participation in global value chains (GVCs) is not well documented compared to the developed world. Clearly understanding GVC participation levels is critical to enable evidence-based policy. This paper assesses Africa's GVC participation from both macro and micro perspectives using three sources of data, and empirically estimating determinants of GVC participation across the data. The analysis relies on databases based on global input-output tables, customs-level data, and survey data from which measures of GVCs are constructed. We find that aggregate GVC data masks disparities, as Africa's proportion of firms that participate in GVCs is comparable to other regions, but the level of Africa's GVC trade is much lower. A common theme in the multi-country empirical results across two sets of data is the positive relationship between political stability and backward GVC participation of African countries. Comparatively, improvement in political stability and proximity to major regional hubs are more relevant for Africa than other regions. For single country analyses, the consistent result is that FDI is positively associated with backward GVC participation, both at the firm-level and country-level of analysis. This highlights how much institutions and the need to attract FDI are relevant in promoting Africa's future engagements in global values chains. The inconsistencies in the data, however, suggest the need to consider establishing protocols and database that help understand Africa's GVC participation more coherently to enable policy makers to make informed decisions.

Key words: *Global value chains; Firms; Africa.*

JEL classification codes: *F1; D22.*

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1. Introduction

International trade has expanded rapidly since the 1990s through the global value chains (GVCs) that account for a rising share of international trade, global GDP, and employment. Such production fragmentation means that intermediate goods cross borders multiple times along the chain, often passing through many countries more than once. Researchers have struggled to develop a coherent empirical portrait of global value chains (Johnson, 2018). One of the primary reasons is that national income accounts are designed to capture traditional trade and economic activities and do not provide adequate information on global value chains. Thus, several databases are introduced to study GVC participation of countries, but they have limited coverage of African countries, and they have sporadic updating.

As a result, Africa's participation in GVC is not well documented compared to the developed world (Van Biesebroeck & Mensah, 2019; Alhassan et al., 2021). Further, it is not clear how the GVC participation level is sensitive to databases employed. The GVC participation of African countries and Regional Economic Communities (RECs) could differ depending on the type of GVC measure employed. Clearly understanding the strength and the drawback of each GVC database and measurement technique is critical to enable evidence-based policy, especially when discussing African countries. Addressing gaps in the measurement of global value chains is thus important, both for advancing our understanding of how the modern global economy works and for addressing policy questions. Understanding the databases and precisely measuring Africa's GVC participation is critical to devise such policies to encourage firms to take on feasible and lucrative parts of the chain.

This study attempts to address this challenge by comprehensively quantifying and comparing Africa's global and regional value chain participation across multiple data sets at both micro and macro data. First, we conduct a comprehensive overview of GVCs in Africa at the continental, sub-regional, and country levels, comparing with other continents, between regions within Africa and within country-firm characteristics across different sources of data. We use three sets of data as follows: United Nation Conference for Trade and Development (UNCTAD-Eora) data, World Bank Enterprise Survey (WBES) data, as well as two sets of customs-level data. WBES and customs data are used for both macro- and firm-level analysis. Second, we follow the World Bank Development Report 2020 framework (World Bank, 2019) to conduct empirical analysis across the three data sets—across and within countries in a panel,

including firm-level analysis—using probit models. This includes major factors such as endowments, market size, geography, and institutions, in order arrive at a set of consistent policy implications of results.

Our results reveal that, the share of GVC firms in Africa is comparable to other regions, contrary to the results from the multi-country aggregate data. Important differences within Africa are observed: for example, countries in East and Southern Africa perform better than those in other regions within Africa. There are also differences in the characteristics of GVC firms in Africa and other regions, including most GVC firms being foreign-owned in other regions but not Africa, which could signal the need for further investment openness.

A common theme in the multi-country empirical results (using WBES and Eora) is the positive relationship between political stability and backward GVC participation of African countries. This highlights how much institutions are relevant in promoting Africa's future engagements in global value chain activities. Comparatively, improvement in political stability and proximity to major regional hubs are more relevant for African countries than other regions. When we focus on a single country (Uganda and Kenya) and compare GVCs in the same macroeconomic conditions and business climate across all the three data sets (WBES, EORA, and customs data) at a micro- and macro-level, the consistent result is that FDI is positively associated with backward GVC participation of these African countries, both at the firm-level and country-level of analysis. This consistency remains when FDI was measured in values and when proxied by foreign-ownership of firms in WBES data. Apart from the need to attract FDI, African countries, preferably the African Continental Free Trade Area (AfCFTA) Secretariat, may consider establishing protocols and database that help understand Africa's GVC participation more coherently to enable policy makers to make informed evidence-based decisions.

This paper is in line with a growing literature on the need to further refine GVC measures. At the country-level, Borin and Mancini (2019) argue the need to further refine the existing measures to address the problem of 'double counting' in international trade.¹ Others propose related approaches to tackle some of the questions which are not adequately answered by the currently available GVC databases and literature (see, Nagengast & Stehrer, 2016; Cadestin et al., 2018; Los & Timmer, 2018; Johnson, 2018). This paper is also in line with the micro-oriented perspectives of measuring GVCs, which rely on firm-level data. Yeats (1999) first suggested a product-based approach to measuring the fragmentation of production processes across countries. Later many adopted the Broad Economic Category (BEC) classification to pursue such studies. More recently, customs transaction data at the firm-level has been used to measure GVC activities (Antràs, 2020). Unlike other cases, the transaction between firms and their foreign partner can be observed instead of inferred (World Bank, 2019). Moreover, firm-level heterogeneity could be observed, which is vital to understand determinants of GVC activities (Antràs, 2020). Another related set of literature is studies that rely on firm-level survey data.²

We improve on these studies by constructing two firm-level backward GVC

measures for nearly all countries in Africa, comparing across the data sets. Such information is useful to understand GVC in detail and craft suitable policies.³ As such, our key contribution is in systematically comparing Africa's GVC engagement: whilst this has been done (e.g., Van Biesebroeck & Mensah, 2019), we compare country-level GVC participation across at least three sets of data and conduct empirical analysis to understand the key determinants and possible (in)consistencies, and how data on Africa can help improve the key messages from the literature. While studies such as Casella et al. (2019) do this, their focus is limited to developed countries. To the best of our knowledge, this paper is the first to attempt this cross-data analysis for Africa's GVC participation, at both firm and country level, and may shed light on the extent to which global Input-Output tables provide an accurate description of value-added trade across countries.

The rest of this paper is organized as follows. Section 2 provides the data sources and how GVCs are defined in the paper; Section 3 provides and compares GVC trends at continental, country, and firm levels; Section 4 provides the empirical strategy, while Section 5 presents the results; and finally, Section 6 concludes the study.

2. Data and defining GVCs

Several attempts have been made to produce metrics capturing countries' and industries' global value chain activities over the past two decades. These measures analyse GVCs, either from a macro or micro perspective. The widely used macro-oriented GVC databases such as the World Input Output Database (WIOD), OECD-TiVA (Organisation for Economic Co-operation and Development–Trade in Value-Added), United Nation Conference for Trade and Development [UNCTAD-Eora], and Multi-region Input Output (MRIO) database depend on global input-output tables and help capture the contribution of GVCs in total international trade. We use three sets of data for the analysis: the UNCTAD-Eora data for macro (country-level) analysis, the World Bank Enterprise Surveys (WBES) and customs-level data for both country and firm-level analysis.

Country-level GVCs: Data and sources

The GVC participation of countries is captured using backward, forward, and overall GVC participation. The backward GVC measure is the share of foreign value-added in export, the forward GVC measure is the share of indirect value-added in exports, and the overall GVC measure is the sum of the forward and backward GVC measures.

$$\textit{Backward GVC} = \frac{\textit{Foreign Value Added}(FVA)}{\textit{Export}} \quad (1)$$

$$\textit{Forward GVC} = \frac{\textit{Indirect Value Added}(DVX)}{\textit{Export}} \quad (2)$$

$$\textit{GVC} = \frac{\textit{FVA} + \textit{DVX}}{\textit{Export}} \quad (3)$$

The above is obtained from the UNCTAD-Eora data, which covers 189 countries, including all African countries—except for Benin, Burkina Faso, Congo, Eritrea, Ethiopia, Guinea, Libya, Sudan, and Zimbabwe—from 1990 to 2019. The primary data sources are I-O tables. The second step involves connecting national tables using international trade data and estimating flows from each export sector in each origin country to each importing sector in each destination country.⁴ After obtaining the

first estimate of a multi-region input-output (MRIO) table, the resulting trade data are balanced through an industry-level balancing condition: the total output produced by each sector must equal the sum of the inputs used by that sector. The time series is constructed iteratively by starting with an initial year estimate, balancing it with all the starting year constraints, which is helpful for a smooth transition between years. The main limitations are that the tables are gathered from different sources, so different assumptions are used to interpolate missing values. Additionally, the sector-to-sector level data in the database are inferred or estimated.

We also use the WBES and customs data to analyse country-level trends by aggregating them to country levels. GVC firms are defined as described in the next subsection. Similarly, the customs data is used at the product-country level for Kenya and Uganda as the countries for which customs data for both imports and exports is available. In these cases, we analyse the share of intermediate goods in trade, the share of manufacture of Parts and Components (P&C) + Semi-finished goods within intermediate goods and key partners, closely following Gaulier et al. (2019).

Firm-level GVCs: Data and sources

The firm-level GVC definitions we adopted are centred on the fact that firms are simultaneously engaged in exporting goods and importing intermediate inputs. We use WBES and the Kenyan customs data for the firm-level analysis (as the Ugandan customs data, which ranges from 2013 to 2018, does not have firm identifiers). As stated by De Gortari (2019) and Antràs (2020), firm-level information on importing and exporting can also be used to shed light on the extent to which global Input-Output tables provide an accurate description of value-added trade flows across countries.

For GVC definition using WBESs and firm-level customs data, we closely follow Van Biesebroeck and Mensah (2019). A GVC firm is defined based on two conditions. First, a GVC firm should engage in export either directly or indirectly. Second, it should directly import inputs and supplies from abroad for its production process.

$$\text{Firm Backward GVC} = \begin{cases} 1, & \text{if the firm exports directly or indirectly} \\ & \text{and directly import inputs and supplies} \\ 0, & \text{otherwise} \end{cases} \quad (4)$$

The WBES covers about 127 countries, including 46 African countries, though its span is shorter and not collected annually.⁵ This data is directly collected from firms, business owners and top managers in the Manufacturing and the Services sectors. The standard Enterprise Survey topics include firm characteristics, gender participation, access to finance, annual sales, costs of inputs/labour, workforce composition, bribery, licensing, infrastructure, trade, crime, competition, capacity

utilization, land and permits, taxation, informality, business-government relations, innovation and technology, and performance measures. The sampling methodology for Enterprise Surveys is stratified random sampling, where the strata are based on firm size. The key limitations are that, first, since most firms are small and medium-sized in most economies, WBES' oversample large firms and exporters since they play a more vital role in job creation.⁶ Second, the data is not also purposely designed to study GVCs and firms are only asked whether they engaged in import and export activities but not the trading values. Therefore, it is not well suited to study the level of participation of firms.

GVC firm definition using the Kenyan customs is also based on whether a firm both imports and exports intermediate products, except here we observe only direct trade.⁷ This is because firms that both import and export intermediate goods also participate more in GVCs (World Bank, 2019). Due to data limitations, we can only construct firm-level backward GVC measures for Kenya. We also use customs data for country-level analysis for both Kenya and Uganda (as Uganda does not have firm-identifiers). In that case, GVC trade is simply intermediate goods imports.

The data contains actual customs transactions records from the Customs Services Department of the Kenya Revenue Authority (KRA) for each exporter and importer by product (at 8-digit HS level), destination/origin, date of export/import, and value of export/import.⁸ The data ranges from January 2008 to December 2020. Traders are identified by their tax ID. We merge the imports and exports data using firm identifiers at an annual level. The main drawback is that we do not observe the domestic activities of the trading firms, and cannot analyse any other characteristics such as size, ownership, etc., in relation to their international trade activities. In addition, this type of data is still relatively scarce and that makes comparisons across countries challenging; but this allows for comparison across data for the purposes of this paper.⁹

3. GVC trends and comparisons

Continental and sub-continental comparisons

In this section, we compare the GVC participation of Africa using different data sets. That includes the share of GVC firms in Africa comparing within and across regions, backward and forward GVC participation.

Figure 1 (from panel 'a' to panel 'd') shows broad GVC participation as a share of exports, comparing Africa to other regions using the UNCTAD-Eora data. Africa's GVC participation as a share of export is between 50% and 60%, comparable with Asia and higher than South America. However, backward GVCs represent 40% of the export while the forward GVCs only account for 15%. Africa's forward GVC participation is higher than any other continent in the world, consistent with the structure of countries endowed with natural resources.¹⁰ On the other hand, Africa's backward participation is the lowest. Although the backward GVC participation of Africa, Asia (Figure 1b) and South America (Figure 1d) is lower than the forward GVC participation, the level of backward GVC participation for Asia is more than twice that of Africa and about the same level as South America. Countries that are accumulating abundant capital may engage in more backward GVC activities, as the capital resources help to transform raw materials and intermediate products into final goods. The results are, therefore, not strange; for example, Foster-McGregor et al. (2015) show that Africa has a good GVC engagement, and mainly in the upstream industries.

Figure 1 (from panel 'e' to panel 'h') makes a similar comparison for backward GVC across continents using trends of GVC firms in the continents as a share of total firms surveyed in each country. The figures are shown as four-year averages due to variation in the country-year sample pairs across countries for the WBES, to reduce the volatility of the data for inclusion or exclusion of a particular country. Note also that it is not necessarily the same pair of firms that are surveyed each year. Although this makes for a less accurate comparison, as firms are the ones that trade and produce the output ultimately in I-O tables, we can expect some consistency, especially when the data is aggregated. Indeed the share of backward GVC firms is lowest in Africa and highest in Europe, based on observations in Figure 1 (from panel 'a' to panel 'd').¹¹ However, it is worth noting that the share of GVC firms for Africa is actually higher than that for Asia, in contrast to the UNCTAD-Eora indicators. This signals the first evidence of some of the inconsistencies that may exist between the macro and micro

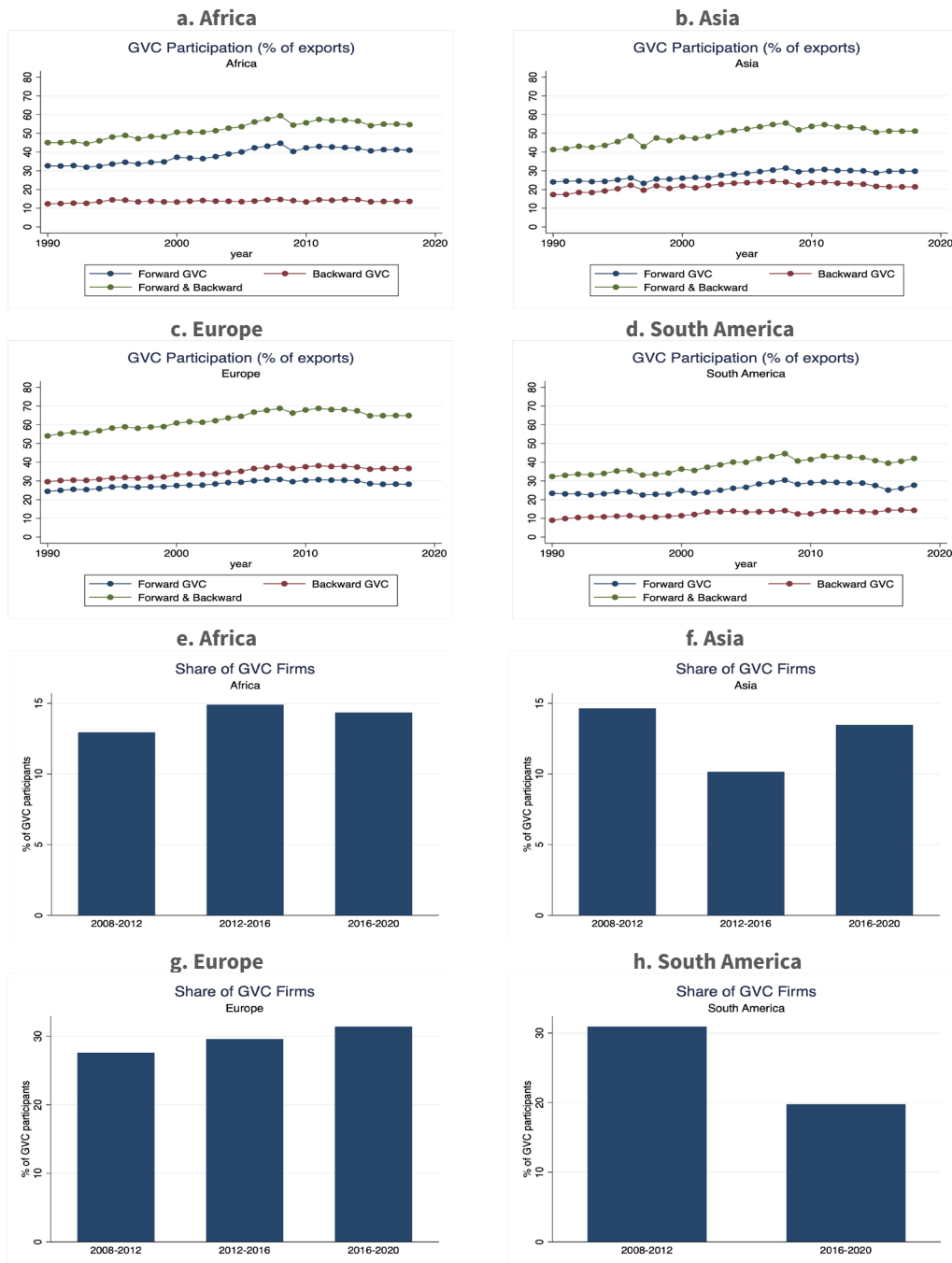
data. Notably, the continental comparisons seem to be consistent for Europe but less so for Africa, Asia, and South America.

Figure A1 (in the appendix) compares across sub-continental regions using the UNCTAD-Eora data. The key differences are in the contribution to overall GVC participation. While the results for the sub-African regions are all consistent with the Africa level GVC results, it is not the case for Asia and Europe, where continental results mask the differences within. Western and Middle Africa's backward participation had been on the decline, relatively stagnant for North and Eastern Africa, and increasing for Southern African countries. Southern, Eastern and North Africa outperform the other African regions in backward GVCs levels. Figure A2 (in the appendix) shows the share of backward GVC firms in the sub-continent based on WBES data. Notably, there are consistencies with the UNCTAD-Eora data in that the share of GVC firms in Northern and Southern Africa is slightly higher than for Middle Africa, Western Africa, and South Asia. Interestingly, the share of GVC firms for South-East Asia is lower than Southern Africa and East Africa, and around the same levels as Middle, West and North Africa. Again, this may highlight contrasting messages. The firm-level data seems to suggest that Africa's backward GVC participation may be performing better than the country-level indicators are picking up. Although the WBES over-sample large firms and exporters, this is a challenge across the board (not Africa alone), thus may not necessarily explain the positive bias for Africa.¹²

Intra-Africa comparisons

We first compare three RECS in Africa with themselves and with the Association of Southeast Asian Nations (ASEAN). Notably, the backward GVC participation of SADC (Figure A3 panel 'a') and EAC-Intergovernmental Authority on Development (IGAD) (Figure A3 panel 'c') are relatively higher than that of the Economic Community of West African States (ECOWAS) (Figure A3 panel 'b'). The participation of RECs in GVC trade is increasing—along the forward than the backward GVC activities—but still below the participation level observed in other regions such as ASEAN (de Melo & Twum, 2021). These observations are consistent with those of the share of GVC firms, with share of GVC firms (backward participation) highest in EAC, then SADC then ECOWAS (Figure A3 panels 'e', 'f', and 'g'). EAC and SADC are at par or higher than the Africa average. Interestingly, the share of GVC firms in ASEAN is lower than the three African RECs, contrary to the much higher GVC participation. The downward trend for ASEAN and upward trends for EAC are also observed in both sets of data.

Figure 1: Continental GVC comparisons

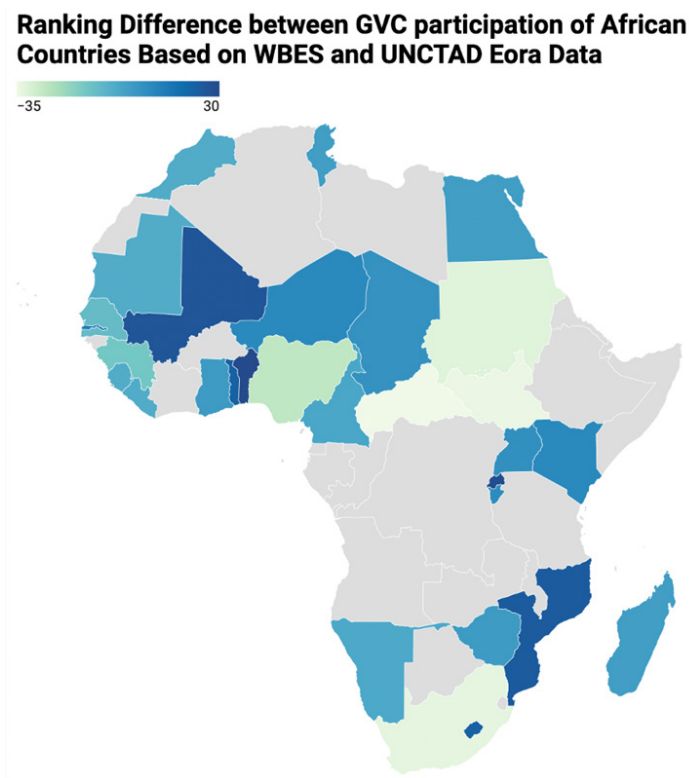


Notes: UNCTAD-Eora results are weighted by trade values of the respective countries. The y-axis does not start from zero to make the figures more visible. WBES depict backward GVCs as in Equation 4.

Source: Authors' own calculations from UNCTAD-Eora GVC database (panel 'a' to panel 'd') and WBES (e to h).

Figure 2 ranks GVC participation of African countries using WBES and UNCTAD-Eora data and present the difference in ranks between the two using a choropleth map. We ranked the average GVC participation of countries using the two data sets for comparable time frame (2008–2018).¹³ We use the two different rankings to create another variable that captures the differences between rankings of a single country across the two data sets. As Figure 2 shows, the GVC participation of countries measured using the two data sets sometimes vary significantly. We also assess the country-level GVC participation, focusing on two countries for which we have customs, WBES, and Eora data, namely Uganda and Kenya, in order to compare across these three data sets. Figure 3 panel 'a' and panel 'b' show that GVC trade has been decreasing in Uganda in recent years and Kenya's backward GVC participation is relatively higher than Uganda's. We find that the firm-level data is consistent (Figure 3 panel 'c' and panel 'd'), i.e., the share of GVC firms is higher in Kenya compared to Uganda, with nearly twice as many GVC firms in Kenya. Comparatively, the backward participation is not twice as high for Kenya as it is in Uganda. That is, Kenya's GVC participation, as measured by WBES data, seems to be higher than as measured by Eora data.

Figure 2: Difference in ranks using WBES and UNCTAD-Eora



Notes: The figure is constructed in two steps. First, we ranked the average GVC participation for African countries using WBES and UNCTAD-Eora data from 2008 to 2018. Second, we calculated the differences of ranks using the two data sets and plot them (Rank WBES–Rank Eora). The darker the colour the higher WBES ranks a country compared to UNCTAD-Eora. The grey area represents countries that we couldn't find data on both Eora and WBES during the specified period. Source: Authors' own calculations.

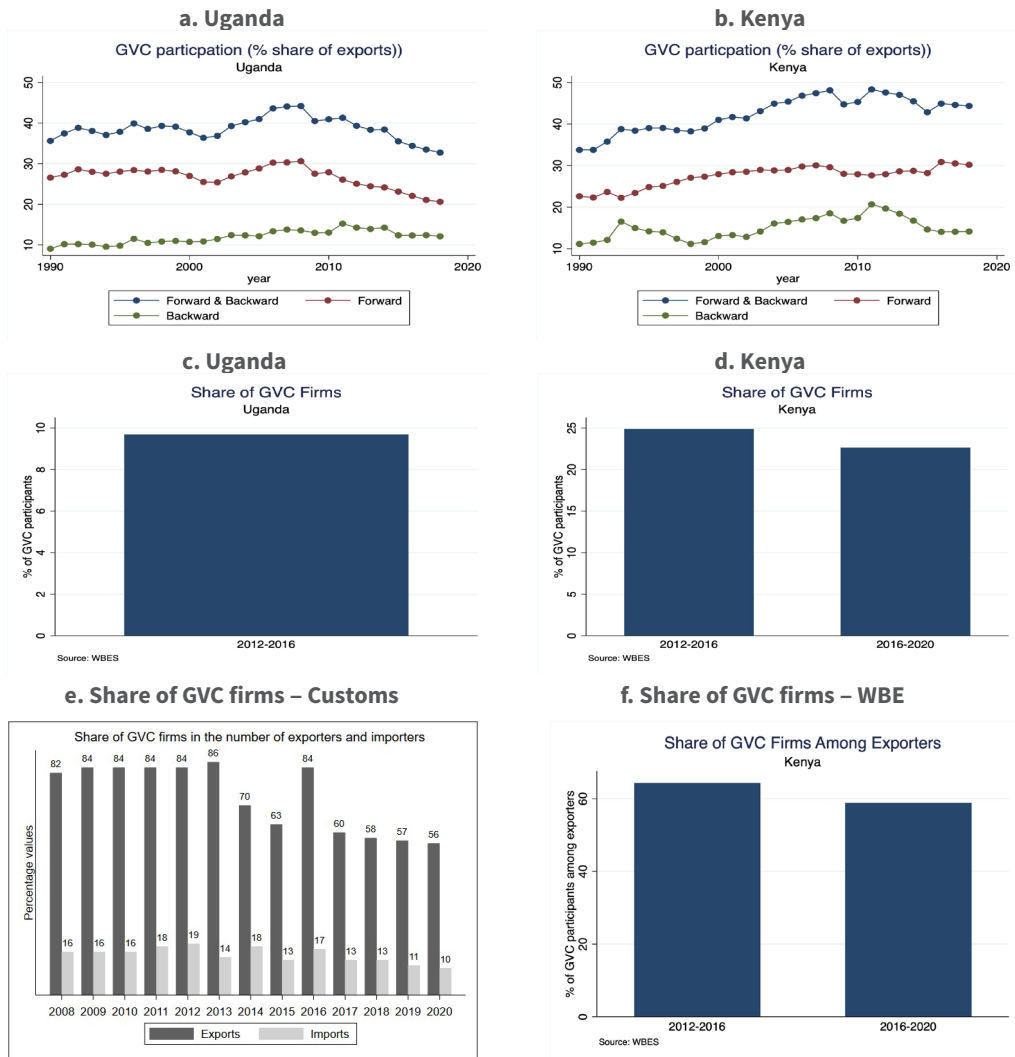
Using the customs data, Kenya's GVC firms (those that both import and export) made up about 15% of trading firms in the 2016–2020 period (Table A1 in the appendix). This is slightly lower than WBES that had at around 23% in the same period. As Kenya is the only country for which firm-level customs data is available, we are not able to compare across countries. Since customs data only includes trading firms, we show GVC firms as a share of exports and importers in Kenya (Figure 3 panel 'e'), and as a share of exporters in the WBES (Figure 3 panel 'f'). This makes it more comparable. Indeed, the share of firms is almost identical at around 60% of exporters in both data sets. This signals that firm-level data may be the best data to use for analysing GVCs in Africa. For aggregate analysis, these data may be aggregated up as displayed in this analysis.

Firm-Characteristics comparisons

We next take a closer look, to the extent possible, at some firm characteristic of GVC firms in Africa compared to other regions and within Africa. The paper uses WBES to conduct this analysis and later zooms in on Kenya which is the only country for which firm-level customs data is available, to compare with WBES. Figure 4 shows that GVC firms consistently have a larger share of exports compared to non-GVC firms. This is the case for within-Africa comparisons too.¹⁴ This is consistent with what is expected among GVC firms. GVC firms are also more likely to be foreign-owned in Europe and South America, but not necessarily in Africa and Asia (Figure 5). The majority of foreign-owned firms are non-GVC compared to GVC, although the gap has narrowed. Given that GVC firms are more likely to export this may mean that Africa may need to attract the right kind of foreign direct investment (FDI) that is export-oriented.

Similarly, GVC firms dominate trade in Kenya and are more likely to export. Although they are less than 20% of trading firms, they make up to between 56% and 86% (going by the period 2008–2020) of exporting firms in Kenya (Figure 3 panel e). They also dominate exports and imports by value, over 77%, and most of them sell intermediate goods. Those values have been declining, however, in recent years, but remain dominant nonetheless. GVC firms also trade with a larger number of countries and trade a larger number of products (see Table A1 in the appendix for 4-5 year averages, and Table A2 in the appendix for annual trends from 2008 to 2020). GVCs from Kenya mainly export to Africa (over 30%) followed by Europe and Asia. GVC importers are mainly from Asia—account for about 40% of sales followed by Europe, sub-Saharan Africa, and the Middle East and North Africa (MENA) region.

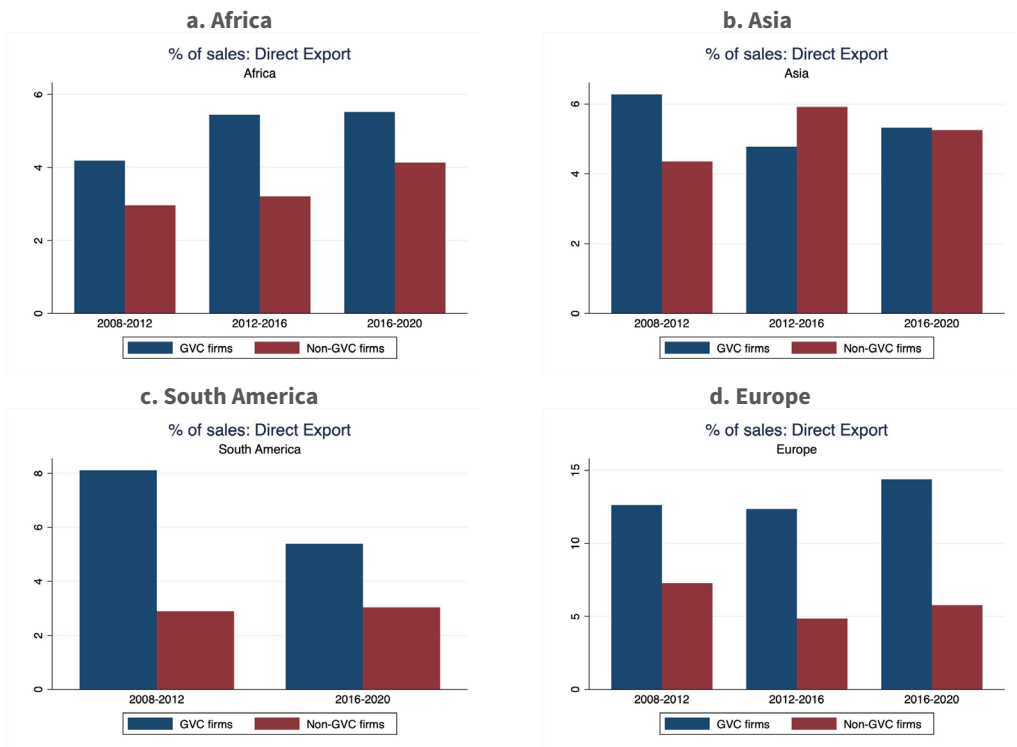
Figure 3: Country-level comparisons



Note: The y-axis in (a) and (b) do not start from zero to make the figures more visible. WBES depict backward GVCs as in Equation 4.

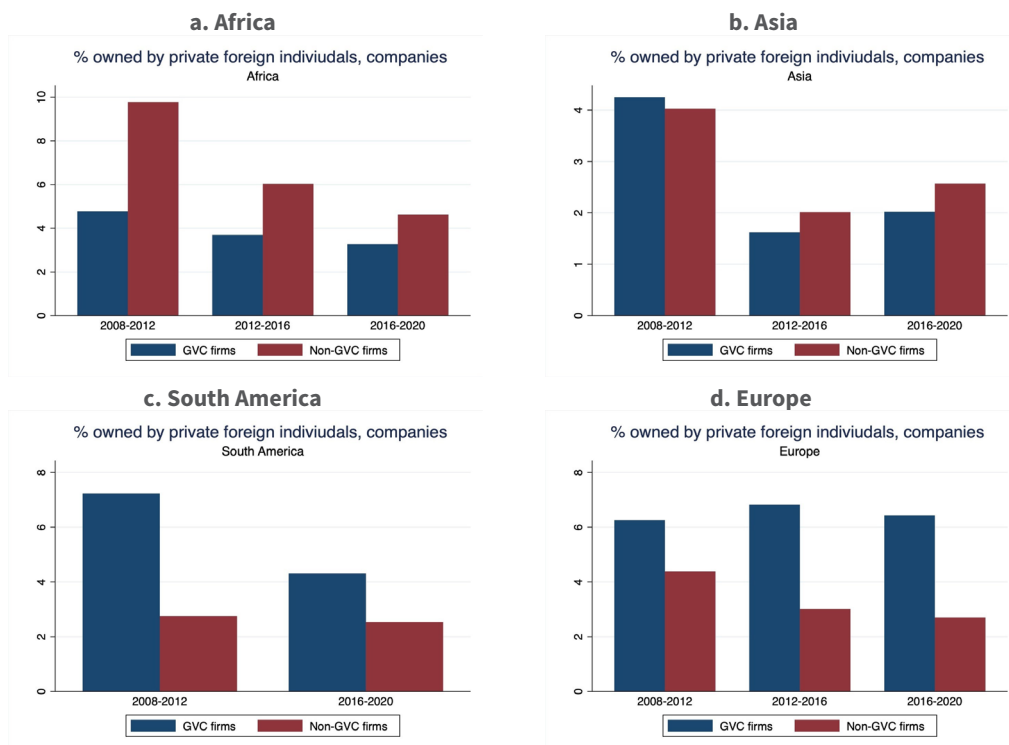
Source: Authors' own calculations from UNCTAD-Eora GVC database (a, b), WBES (c, d, f – Uganda was only sampled in 2013) and Kenya customs data (e).

Figure 4: Share of exports of GVC firms from across continents



Source: Authors' own calculations from WBES data.

Figure 5: Foreign ownership of GVC firms from across continents



Source: Authors' own calculations from WBES data.

4. Empirical strategy

Theoretical framework

According to the 2020 World Development Report (WDR), the major factors that determine global value chains participation could be broadly classified into four categories.

The first factors are endowments: labour, land, and capital. The role of endowment in international trade is well known and clearly depicted in the Heckscher–Ohlin model and there are several empirical works confirming this¹⁵, by extension explaining GVC trade and the positioning of countries in GVCs. On labour, the availability of cheap and low-skilled workers is also associated with a higher level of backward GVC activities in the assembly, electronics, and manufacturing sectors. On land, the availability of land is associated with forward GVC as it is well suited for agricultural activities and mining, which are located in the upstream section of the value chain (Antràs, 2020). On capital, the presence of foreign firms is also another important determinant of GVC participation. The presence of foreign firms increases productivity and GVC engagement through knowledge spillover and local supply chains Amendolagine et al. (2019). This approach was central to Lesotho's and recently Ethiopia's successful entrance into the apparel GVC (World Bank, 2019). In our regression, we include the share of high-skilled workers to GDP, total natural resource rent to GDP, and capital to GDP ratio to capture the role of endowments in determining Africa's GVC participation.

The second factor that determines a country's GVC participation is market size. This is analogous with the gravity trade theory. Specifically, larger countries have a larger industrial capacity, they tend to attract a larger set of contiguous stages and reduce the use of imported inputs relative to domestically sourced inputs in their exports. This implies countries with larger domestic manufacturing industries will have relatively smaller backward GVC participation. We capture market size using value-added manufacturing data from UNIDO.¹⁶

Geography is the third factor that determines GVC participation. The role of geography is well documented in traditional and modern trade theories (e.g., gravity model and EK model). Globalized production implies intermediate products will cross borders multiple times during the production process. Hence, the role of transport costs could be even stronger in the case of GVC (Diakantoni et al., 2017).¹⁷ Notably, distance to major regional and global value chain hubs will be critical for the success

of firms engaged in GVC (Fernandes et al., 2020). For example, African countries which are close to Europe, such as Morocco, will find it easier to engage in the automotive sector GVC than others. We capture geography by summing the linear distance of each country from three major GVC hubs, namely, the USA, China, and Germany.

The fourth factor is the role of institutions. Institutions play an important role in determining the successful participation of firms in GVC (Dollar & Kidder, 2017). Poor institutional quality entails weak contract enforcement, which is a significant deterrent to traditional trade flows, and GVCs are particularly sensitive to the quality of contractual institutions. Poor institutional quality is also linked to poor records on safeguarding property rights. Foreign investors will not take economically viable risks if corruption and political instability persist. We capture institutional quality using the political instability index from the World Bank governance indices.

Empirical models

Multi-country level analysis

Relying on this framework, we start the analysis with the UNCTAD-Eora and WBES databases. The dependent variables are defined from Equation 1 to Equation 4. We first run Equation 5, which is a cross-section analysis.

$$GVC_{c(t+1)} = \beta_1 + \beta_2 \text{Endowment}_{ct} + \beta_3 \text{Market Size}_{ct} + \beta_4 \text{Geography}_{ct} + \beta_5 \text{Institution}_{ct} + FE_d + \varepsilon_{ct} \quad (5)$$

In Equation 5, c stands for country, t stands for decade, and ε represent the orthogonal error term. In this equation we use WBES data and Eora data. Following Fernandes et al. (2020), we estimate the impact of country decadal averages of the determinants on country decadal average GVC participation using the least squares between effects (LS-BE). The decade fixed effects are included to take care of technological shocks or the other global shocks such as financial crisis that affect everyone. We use the latest available year of the survey data available for each country and explanatory variables are included for the last decade of the latest year in the survey (e.g., if latest survey year is 2015, the explanatory variables are 2000–2009).¹⁸ There are three dependent variable used with the EORA data: backward, forward, and overall GVC participation (backward + forward).¹⁹

For WBES, the dependent variable is the share of GVC firms in a country for the multi-country analysis. For single country analysis (e.g., Kenya alone) the dependent variables is a dummy variable if the firm is a GVC firm. This is because in the single-country analysis, the variations stems from the firms (i.e., if we use the share of GVC firms, we will have just one observation since it is cross-section), while for the multi-country analysis, we have the country variation hence using the shares. To make a

comparison with the rest of the world, we replicated the exercises for all countries in the database and created interaction terms for countries located in Africa (interacted with a dummy variable which takes a value of 1 if the country is in Africa, 0 otherwise). The interaction terms show how much the considered factor is more or less relevant compared to the rest of the world.

Single country-level analysis

Equation 6 corresponds to the customs-data analysis which we carry out at the country-level using both Kenya and Uganda in which case we do not use the firm variation which is unavailable in the Ugandan data. This is estimated separately for each country.

$$GVC_{cgpt} = \beta_1 + \beta_2 Endowment_{ct} + \beta_3 Market_Size_{ct} + \beta_4 Geography_{ct} + \beta_5 Institution_{ct} + \delta_p + \gamma_g + \theta_t + \varepsilon_{icgpt} \quad (6)$$

The dependent variable, GVC_{cgpt} , is a natural logarithm of the values of intermediate import flows of product (p) with country (c) and partners (g) over time in years (t) (see Equation 6 for more details). δ_p is the product fixed effect to account for endogeneity that arises from product characteristics. γ_g is the partner fixed effects to account for partner-specific characteristics. θ_t is the year fixed effect; while ε_{icgpt} is the error term. As before, each country's endowment, market size, geography, and institutions are included in the model.

Within-country firm-level analysis

The dependent variable is a dummy variable capturing the GVC participation of firms as defined in Equation 4 for WBES. For firm-level, customs data is a dummy as to whether a firm is a GVC (simultaneously exports and imports intermediate goods) or non-GVC (an exclusive exporter or importer). For the customs-level and WBES regressions, we use a probit model to capture any non-linear effects and also to ensure the predicted probabilities will remain within zero and one. Table A2 (in the appendix) shows the descriptive statistics for the customs data of Kenya.

Following literature on firm-level determinants of GVC (see Urata & Baek, 2020; Lu et al., 2018), we use the survey responses for the WBES regressions, since unlike the previous sets of specifications we are using firm-level variation for these within-country regressions. As such, the following are used as explanatory variables instead: a share of foreign ownership (FDI), the share of low-skilled workers (Skill), how much firms consider political instability²⁰ as a hurdle for their operation, and the number of competitors they have in the economy (for a measure of market). Following WDR 2020, all of the independent variables are normalized with mean and standard deviation.²¹

Endogeneity

There are possible endogeneity concerns to estimate the regression specification given in the econometric specification. Both the GVC participation of countries and the explanatory variables listed in the specification could be affected by other factors simultaneously. For example, there could be regional and global financial and economic shocks, fiscal and monetary policy shifts, etc. We have undertaken two different types of approaches to address this challenge. First, we have estimated the model using lagged explanatory variables when using EORA data for the regression exploiting the between variations across countries. In this case, the dependent variable is the average value of the latest decade per country, while the explanatory variable is average values from the past decade. This is following Fernandes et al. (2020), which argues that, "the GVC participation and some determinants change very slowly within countries from year to year. Decadal averages of GVC participation and determinants exhibit more meaningful variation than year-to-year observations and they may wash out measurement issues in GVC participation due to errors in input-output tables." The explanatory variables are lagged to handle reverse causality, following World Bank (2019).

Explanatory variables

Our selection of variables is consistent with the suggestion of the WDR 2020 WDR on global value chains. The explanatory variables are broadly classified into four groups: endowments, market size, geography, and institutions. Table 1 provides the detailed definitions of the explanatory variables used in all models; Table A4 (in the appendix) shows the correlation across the variables for Eora and WBES; and Table A3 (in the appendix) gives the summary statistics for customs firm-level data.

Endowments are represented by natural resource rent in GDP, the ratio of the number of high-skilled workers GDP, FDI inflow, and land size. Market size is defined as manufacturing value-added, which shows the size of the domestic market. Geography is represented by the sum of distances to major GVC hubs. This is calculated as the sum of distances to the USA, China, and Germany. Institution is represented by the political stability index from the World Bank's Worldwide Governance Indicators (WGI). These explanatory variables are valid for all macro-level regressions. We also explored how these factors affect GVC participation using different data sources while focusing only on a single country. As there are quite few rounds of surveys in WBES, we rely on firm-level variations to measure the effect of the suggested determinants. In such cases, it was necessary to capture these factors using proxy variables available in the firm-level WBES data. Accordingly, FDI inflow is proxied by the share of foreign ownership, low-skill labour is proxied by the share of low-skilled workers among all workers, capital is proxied by the cost of investment, the market size is proxied by the number of competitors, and political stability is proxied by firms' perception of stability in the survey

Table 1: Definition of explanatory variables

| Variable | Definition | Source | Divided By Real GDP |
|---------------------|--|----------------------------------|---------------------|
| Land | Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases, the definition of inland water bodies includes major rivers and lakes. | World Bank | |
| Capital | Capital stock at constant 2017 national prices (in mil. 2017 US\$) to real GDP. | PWT & World Bank | Yes |
| Rent | Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. | World Bank WDI | Yes |
| Distance | The sum distances to major GVC hubs, namely, USA, China and Germany. | CEPII | No |
| Skill | The number of high-skilled workers as the share of real GDP | ILOstat & World Bank | Yes |
| Political Stability | Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. | World Bank Governance Indicators | No |
| Market Size | Manufacturing value-added (MVA) of an economy is the total estimate of net-output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate consumption. | UNIDO | |
| FDI In-flow | Foreign direct investment refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. | World Bank WDI | Yes |

Data on GDP, land size, FDI flow, and the share of resource rent to GDP are extracted from the World Bank's databank. The United Nations Industrial Development Organization's (UNIDO) manufacturing value-added data is used to capture market size. Labour and skill related information is extracted from the International Labour Organization (ILO) statistics. The capital to GDP ratio is from Penn World Table version 10.

5. Results

Macro-level empirical results

The macro-level empirical analysis focuses on county-level data. Table 2 shows the determinants of GVC participation based on the econometric specification provided in Equation 5 for African countries only.²² The first column shows results for backward GVC participation based on Eora data. Political stability is positively correlated with the backward GVC participation of African countries. The second column shows similar regression results on forward GVC participation. Capital and market size are positively correlated with forward GVC participation. On the contrary, both the distance from GVC hubs and political stability are negatively correlated with forward GVC participation of African countries.

Mining requires bulky transportation, so the negative relationship between distance and forward GVC is not surprising. Unfortunately, countries don't choose to change their distance from major GVC hubs. Nevertheless, they can invest and improve their logistic sector to counterbalance the effect of distance and reap the benefit of GVC (Luo & Xu, 2018). The result on political stability wasn't expected; however, this result could be due to the fact Africa's forward GVC participation is dominated by oil and mineral exporting countries that are prone to political instability.²³ The results from column (1) and column (2) sometimes contradict with each other, highlighting that different factors could be responsible for the forward and backward GVC participation.

Column (3) combines both forward and backward GVC to capture the overall involvement of countries over the value chain. The results show a positive correlation between African countries that had higher FDI inflow in the past decade and their overall GVC participation in the next decade. We also find capital and market size are positively correlated with GVC participation in line with WDR 2020. On the contrary, the share of high-skilled workers and land are negatively correlated with overall GVC participation. This is against our expectation and theoretical predictions. Distance from GVC hubs and political stability don't show statistically significant relationship with overall GVC participation of African countries²⁴ partly due to opposing effects of these factors on the backward and forward GVC participation.

Column 4 utilized the latest WBES by country, comparable to the Eora results presented in column (1). The dependent variable is the share of GVC firms from the latest survey of WBES. WBES data is transformed into country-level data by

constructing mean values of the latest survey for each country. The explanatory variables are exactly the same as the ones used in the first three columns²⁵. The results based on WBES are largely statistically insignificant with one exception and important similarity with the result from Eora data: there is a positive relationship between political stability and backward GVC participation of African countries in both data sets. This highlights how much institutions are relevant in promoting Africa's future engagements in global values chain activities.

Table 3 presents the results using both Eora and WBES, comparing Africa and other regions. The first three columns present Eora data results for forward, backward, and overall GVC participation, respectively, while the fourth column shows the results using WBES. The main interesting finding is the positive association between political stability and backward GVC trade, with this being more relevant for African countries than others. Column (2) shows results for forward GVC participation. The result shows natural resource rent and market size are positively correlated with forward GVC participation, and more so in Africa for the latter. Distance from GVC hubs is negatively correlated with forward GVC participation, and the association is stronger in Africa. The rest are not statistically significant.

The results in column (3) show that FDI, natural resource rent, and market size are positively correlated with the overall GVC trade of African countries, more than those in other regions. These results are more in line with the theoretical predictions and results from WDR 2020. Distance negatively correlates with overall GVC participation of countries, but there is no different association for Africa. We also don't detect any differential effect of political stability on overall GVC participation of African countries despite finding such results when we focus on backward and forward GVC participation separately. This highlights the need to study the determinants of forward and backward GVC participation separately.

Column (4) is based on WBES. The most consistent result between the results based on Eora and WBES in Table 3 is the positive correlation between political stability and backward GVC participation. The association is higher in the case of Africa.

When using both types of data sets, the main finding is that, both the improvement in political stability and proximity to major regional hubs are more relevant for African countries in improving backward GVC participation at the country-level. Political stability is consistent with the results using only the African countries sample in Table 2.

Comparing results from the three data: Macro- and micro-level results

Our study deployed multiple data sets and studied if the conclusions from different sources on determinants of GVC participation are similar. Particularly, we examined GVC participation using Eora, WBES, and customs-level data for Kenya and Uganda for which all three sets of data are available.

Table 2: Regression results using Eora and WBES data for Africa: Country-level

| | (Eora) | | (WBES) | |
|---------------------|------------------------|-----------------------|-----------------------|--------------------|
| | (1) | (2) | (3) | (4) |
| | Backward-GVC | Forward-GVC | GVC | GVC |
| FDI | -0.0401 (0.0247) | 0.00580 (0.0137) | 0.191*** (0.0458) | -1.010 (1.045) |
| Rent | 0.0184 (0.0457) | 0.0110 (0.0217) | 0.151* (0.0785) | 1.174 (1.261) |
| Land | -0.118*** (0.0353) | 0.0281 (0.0189) | -0.111* (0.0599) | -1.217 (1.311) |
| Capital | -0.0540 (0.0585) | 0.0604* (0.0314) | 0.536*** (0.123) | 1.945 (2.857) |
| Skill | -0.120* (0.0717) | -0.0243 (0.0346) | -0.636*** (0.0984) | 2.723 (2.522) |
| Market Size | -0.0949*** (0.0246) | 0.0427*** (0.0141) | 0.606*** (0.0498) | -0.0307 (1.383) |
| Distance | 0.158 (0.215) | -0.341*** (0.120) | -0.0803 (0.327) | -4.525 (6.810) |
| Political Stability | 0.221*** (0.0514) | -0.153*** (0.0270) | -0.118 (0.101) | 4.621* (2.348) |
| Constant | -2.439 (2.707) | 4.010** (1.614) | -5.625 (4.398) | 133.0 (120.0) |
| Decade FE | YES | YES | YES | NO |
| N | 91 | 91 | 91 | 31 |
| No. of Countries | 34 | 34 | 34 | 31 |
| Adj. R ² | 0.519 | 0.559 | 0.901 | 0.001 |

Notes: Following the WDR 2020 and Equation 5, the dependent variable from columns (1)-(3) decadal average of GVC participation using Eora data from 1990 to 2019 and column (4) is the share of GVC firms from the latest survey of WBES per country. The explanatory variables for Eora are averages values from the previous decade from 1980 to 2019 in all the specifications. For WBES, this lag number of years is different depending on the latest year of the survey, e.g., the regressions in the first three columns uses the least squares between effects (LS-BE) estimator. The results exploit the cross-sectional variations between countries. Column (4) depends on WBES data that is transformed into country-level data by constructing mean values of the latest survey for each country. We couldn't adopt the decade-level regression because the WBES isn't collected consistently across years. Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Determinants of GVC participation - UNCTAD-Eora and WBES data: Comparing Africa to other regions

| | (Eora) | | | (WBES) |
|------------------------------|------------------------|------------------------|-----------------------|----------------------|
| | (1) Backward GVC | (2) Forward GVC | (3) Total GVC | (4) Backward GVC |
| Africa | -10.85*** (3.004) | 0.467 (1.733) | -6.349 (4.679) | 48.59 (115.3) |
| FDI | 0.0855*** (0.0227) | -0.00105 (0.0123) | 0.247*** (0.0371) | -1.422 (1.292) |
| FDI x Africa | -0.0135 (0.0246) | -0.00641 (0.0128) | 0.162*** (0.0440) | -1.381* (0.756) |
| Rent | -0.0942*** (0.0183) | 0.0623*** (0.00966) | 0.0927*** (0.0282) | 0.843 (0.724) |
| Rent x Africa | 0.0288 (0.0449) | 0.00873 (0.0204) | 0.128* (0.0770) | 0.768 (1.164) |
| Market Size | -0.0666*** (0.0232) | 0.0371*** (0.0112) | 0.687*** (0.0329) | 1.450 (0.986) |
| Market Size x Africa | -0.115*** (0.0219) | 0.0476*** (0.0133) | 0.635*** (0.0466) | 0.115 (1.201) |
| Land | -0.0318 (0.0237) | 0.0104 (0.0155) | -0.174*** (0.0420) | -2.032* (1.034) |
| Land x Africa | -0.136*** (0.0351) | 0.0237 (0.0181) | -0.0666 (0.0565) | -1.205 (1.151) |
| Capital | 0.340*** (0.115) | -0.0355 (0.0352) | -0.0284 (0.0785) | 2.115 (1.599) |
| Capital x Africa | -0.0952 (0.0661) | 0.0414 (0.0298) | 0.654*** (0.107) | 2.115 (2.638) |
| Skill | 0.0755 (0.0708) | -0.0451 (0.0299) | 0.170** (0.0800) | -3.072* (1.800) |
| Skill x Africa | -0.149** (0.0704) | -0.0222 (0.0317) | -0.585*** (0.0957) | 2.551 (2.196) |
| Distance | -0.205* (0.107) | -0.504*** (0.0547) | -0.426*** (0.159) | -13.73*** (4.322) |
| Distance x Africa | 0.134 (0.215) | -0.388*** (0.119) | 0.0386 (0.328) | -5.026 (5.579) |
| Political Stability | 0.279*** (0.0459) | -0.0148 (0.0231) | 0.334*** (0.0577) | 4.486*** (1.332) |
| Political Stability x Africa | 0.223*** (0.0459) | -0.161*** (0.0257) | -0.117 (0.0964) | 4.565** (2.110) |
| Constant | 7.532*** (1.045) | 3.851*** (0.637) | 2.118 (1.584) | 88.21** (42.11) |
| Decade FE | YES | YES | YES | NO |
| N | 372 | 372 | 372 | 110 |
| No. of Countries | 134 | 134 | 134 | 110 |
| Adj. R ² | 0.434 | 0.445 | 0.930 | 0.439 |

Notes: Following the WDR 2020 and Equation 5, the dependent variable from columns (1)-(3) decadal average of GVC participation using Eora data and column (4) is the share of GVC firms from the latest survey of WBES. The explanatory variables are averages values from the previous decade. The regressions in the first three columns uses the least squares between effects (LS-BE) estimator. The results exploit the cross-sectional variations between countries. Column (4) depends on WBES data that is transformed into country-level data by construction mean values of the latest survey for each country. We couldn't adopt the decade-level regression because the WBES isn't collected consistently across years. Robust standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4 shows results from the World Bank Enterprise Survey pooled data and Eora data for Kenya and Uganda. Column (1) and column (5), which rely on WBES data, reveal that, when the share of foreign ownership increases by one standard deviation, the probability of backward GVC participation increases by 15% and 6% in Kenya and Uganda, respectively.²⁶ Moreover, an increase in capital is positively associated with backward GVC participation both in Kenya and Uganda, though the association is weaker than FDI.

Column (2) also presents results for firm-level customs data from Kenya. The result reveals that, when inflows of FDI increases by one standard deviation, the probability of GVC firms rises by 0.6%, but a one standard deviation rise in capital reduces that by 4.7%. The results from Eora data differ between Kenya and Uganda (column 3 and column 6, respectively). There is no statistically significant relationship between the FDI inflow and Kenya's backward GVC participation, but it has a positive relationship in the case of Uganda. In the case of country-level customs data, a one standard deviation increase in FDI inflow increases backward GVC participation by 0.08 and 3.2 standard deviations in Kenya (column 4) and Uganda (column 7), respectively.

The overall conclusion from the three data sets is that, FDI inflow is positively associated with backward GVC participation of these African countries, both at the firm-level and country-level of analysis. The rest of the results are not consistent across all three databases. However, the share of low-skilled labour is positively correlated with backward GVC participation when we use country-level customs data for both countries (column 4 and column 7), but not consistent with the other sets of data (WBES, firm-level customs, and Eora). A similar trend of no effect or mixed effects is observed for the rest of the variables as well.

Table 4: Determinants of backward GVC participation in Kenya and Uganda using UNCTAD-Eora, WBES, and customs-level data

| | Kenya | | | | Uganda | | |
|---------------------|---------------------|---------------------|--------------------|-----------------------|----------------------|---------------------|-----------------------|
| | WBES (1) | Cust. (Firm) (2) | EORA (3) | Cust. Country (4) | WBES (5) | EoRA (6) | Custom (7) |
| FDI | 0.531*** (0.093) | 0.027*** (0.010) | 0.878 (1.18) | 0.087*** (0.014) | 0.539*** (0.130) | 1.598*** (6.40) | 3.217*** (0.412) |
| Skill | 0.204** (0.080) | -0.032 (0.103) | 1.207 (1.92) | 0.629*** (0.090) | -0.161 (-0.140) | -0.566** (-3.08) | 3.458*** (0.527) |
| Capital | 0.011** (0.040) | -0.220** (0.090) | -0.590 (-0.59) | 0.092 (0.105) | 0.353*** (0.045) | 0.00419 (0.01) | -7.709*** (0.594) |
| Market | -0.002 (0.002) | -0.086 (0.137) | -1.158 (-1.00) | -1.043*** (0.144) | | -0.338 (-0.91) | 0.927** (0.364) |
| Political stability | 0.052 (0.081) | -0.072 (0.062) | -3.363 (-1.35) | 0.288*** (0.085) | -0.347*** (0.162) | -1.092 (-1.98) | -0.050 (0.614) |
| Constant | 0.580*** (0.122) | 3.516 (2.296) | 11.39*** (4.31) | 25.339*** (2.276) | -1.89*** (0.270) | 10.78*** (17.76) | -5.091 (14.486) |
| Year FE | YES | | YES | YES | | YES | YES |
| Partner country FE | | YES | | YES | | | YES |
| Product FE | | YES | | YES | | | YES |
| N | 314 | 1,688,102 | 29 | 370,781 | 149 | 27 | 117,350 |

Notes: The dependent variable in all cases refers to backward GVC participation. For Eora data, it is FVA in export; for WBES data, it is a dummy if the firm import intermediates and is an exporter; for firm-level customs data, it is a dummy as to whether a firm is a GVC (simultaneously exports and imports intermediate goods) or non-GVC (an exclusive exporter or importer); and for country-level customs data, it is the import of intermediate commodities (HS-6) digit level at bilateral level. Column (1) and column (5) uses the pooled WBES firm-level data from different years, column (2) uses firm-level data, while Column (3) and column (6) uses the country-level Eora data. Column (4) and column (7) used country-level customs-level data where partner-country fixed effects and product fixed effects were used. The variables for Eora data are already explained in variable description table. To ensure comparability across databases, we use related explanatory variables as much as possible. Accordingly, in the WBES data based results, FDI inflow is proxied by the share of foreign ownership; low-skill labour is proxied by the share of low-skilled workers among all workers; capital is proxied by the cost of investment; the market size is proxied by the number of competitors; and political stability is proxied by firms' perception of stability in the survey. We have included year and country fixed effects in WBES and Eora data, while the customs-level data uses year fixed effect only. WEBS (column 1 and column 5) and firm-level customs (column 2) are analysed as probit models, while other models are analysed as linear model. Robust standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1

6. Conclusions

This study comprehensively quantifies and compares GVC participation of African countries' and regional groupings using macro- and micro-based GVC measures. First, we conduct a comprehensive overview of GVCs in Africa at the continental, sub-regional, and country level, comparing with other continents, as well as comparing between regions within Africa. Second, as GVC levels at aggregate levels are ultimately the result of firm activity, we further attempt to dissect the aggregate trends using firm-level data. Finally, we follow the World Bank Development Report 2020 framework to conduct empirical analysis across a select set of samples and data, on GVC determinants and consistency in policy implications of results.

We contribute to the literature by systematically comparing Africa's GVC engagement using different data sources and improve on previous studies data challenges. We compare country-level GVC participation across three sets of data and conduct empirical analysis to understand the key determinants and possible inconsistencies, and how data on Africa can help improve the key messages from the literature. We contribute by constructing firm-level GVC measures for Africa. We add to this work by having these measures for nearly all countries in Africa and comparing across data for a select number of countries.

We find that aggregated data may mask GVC participation levels in Africa, and that country-level analyses as well as micro-level analyses provide more accurate picture. A common theme in the multi-country empirical results (using WBES and Eora) is the positive relationship between political stability and backward GVC participation of African countries. This highlights how much institutions are relevant in promoting Africa's future engagements in global value chain activities. Comparatively, improvement in political stability and proximity to major regional hubs are more relevant for African countries than other regions. When we focus on a single country (Uganda or Kenya) and compare GVCs in the same macroeconomic conditions and business climate across all the three data sets (WBES, EORA, and customs data) at a micro- and macro-level, the consistent result is that FDI is positively associated with backward GVC participation of these African countries, both at the firm-level and country-level of analysis. This consistency remains when FDI was measured in values and when proxied by foreign-ownership of firms in WBES data.

Although we were able to get the overall picture of GVC participation of African countries and firms, we also observed some inconsistent results across data sources,

especially in aggregate analysis, e.g., all African countries. That is partly due to a lack of carefully recorded, frequent, and harmonized data covering African countries' global and regional value chains. Moreover, some African countries are missing from popular GVC databases. Therefore, African countries, preferably the AfCFTA Secretariat, may consider establishing protocols and database that helps understand Africa's GVC participation more coherently to enable policy makers to make informed decisions. The protocols should standardized the way trade activities are registered and also assumption used in preparation of national input-output tables.

Notes

1. They constructed the Inter-Country Input–Output (ICIO) which is adopted by de Melo and Twum (2021).
2. For example, Van Biesebroeck and Mensah (2019) and Ge et al. (2020) which also used the world Bank Enterprise Survey.
3. Popular databases, such as OECD-TiVA and ADB-MRIO, only include South Africa, and group all other African countries in ‘the Rest of the World’ category. The only exception in this group of databases is the UNCATD-Eora database that includes a majority of African countries.
4. However, this requires several assumptions (see Casella et al., 2019). The number of industries varies from 26 to 500 depending on the country. The metadatabase is based on many sources, and it interpolates missing points to provide broad, consistent coverage.
5. The survey year by each country is available in Table A5 (in the appendix). To ensure data consistency, we focused on the period from 2008 to 2020.
6. See World Bank (2009) for more details on sampling of WBES.
7. These products are identified following the fifth revision of the Broad Economic Categories (BEC rev5).
8. Sourced from the Exporter Dynamics Database (EDD) by the World Bank; see Fernandes et al. (2016) for description. EDD has records for 58 countries, but data for only 11 countries is publicly available.
9. We compared aggregate exports and imports from our customs data with the official Government of Kenya statistics for the period of our study and the ratio was one, indicating reliability of customs data.
10. Foster-McGregor et al. (2015) show that, in 15 of the 31 African countries in their sample, primary exports make up more than 50 of their total intermediate exports, with 23 countries having a primary share above 25.

11. The trend of Europe is similar to that of North America, and the trend of South America is similar to Oceania. These results are omitted for brevity, but can be made available upon request.
12. Firm-level to country-level aggregation is based on the weights provided in the survey.
13. The UNCTAD-Eora and WBES don't measure GVC in the same way, or measure exactly the same thing. Nevertheless, we argue the rank comparison can still highlight some basic features.
14. These are available on request.
15. See Romalis (2004) for the summary of empirical evidences.
16. On firm-level basis, Antràs (2020) argues that size should be sufficiently high, both to be able to amortize the fixed costs associated with GVC participation, and also to be able to fulfil large-volume orders from comparably large importers in other countries.
17. Trade costs that are related with tariff and non-tariff barriers also increase costs.
18. Note that for WBES, this is not consistent due to inconsistency in years available. Thus, for all countries whose survey is available in the next decade, the lagged dependent variable is the last decade, regardless of which year in that decade the survey was. So 2015 and 2018 will both have previous decade values, the same as lags are defined as 1980–1989, 1990–1999, and so on).
19. Refer to Equation 3 to see how the values are computed.
20. To ensure comparability with the Worldwide Governance Indicators (WGI) political stability indicator, we multiplied the WBES normalized political instability variable by negative 1.
21. Standardized coefficients refer to how many standard deviations the dependent variable will change per standard deviation increase in the explanatory variable.
22. The reader should bear in mind that the explanatory variables are the decadal averages from the past decade for the rest of the discussion concerning Table 2 and Table 3.
23. Kuroiwa and Umezaki (2019) also find similar results using World Bank's Worldwide Governance Indicators (WGI).
24. However, when the decade fixed effects are removed, political stability has a positive relation with the overall GVC participation of African countries, while distance from GVC hubs has the opposite relation.
25. All regressions based on Eora and WBES in Table 2 exploit cross sectional variations across countries.
26. These are calculated marginal effects from the probit regression in Table 4. Marginal effects results for WEBS and firm-level customs data are in Table A10 (in the appendix).

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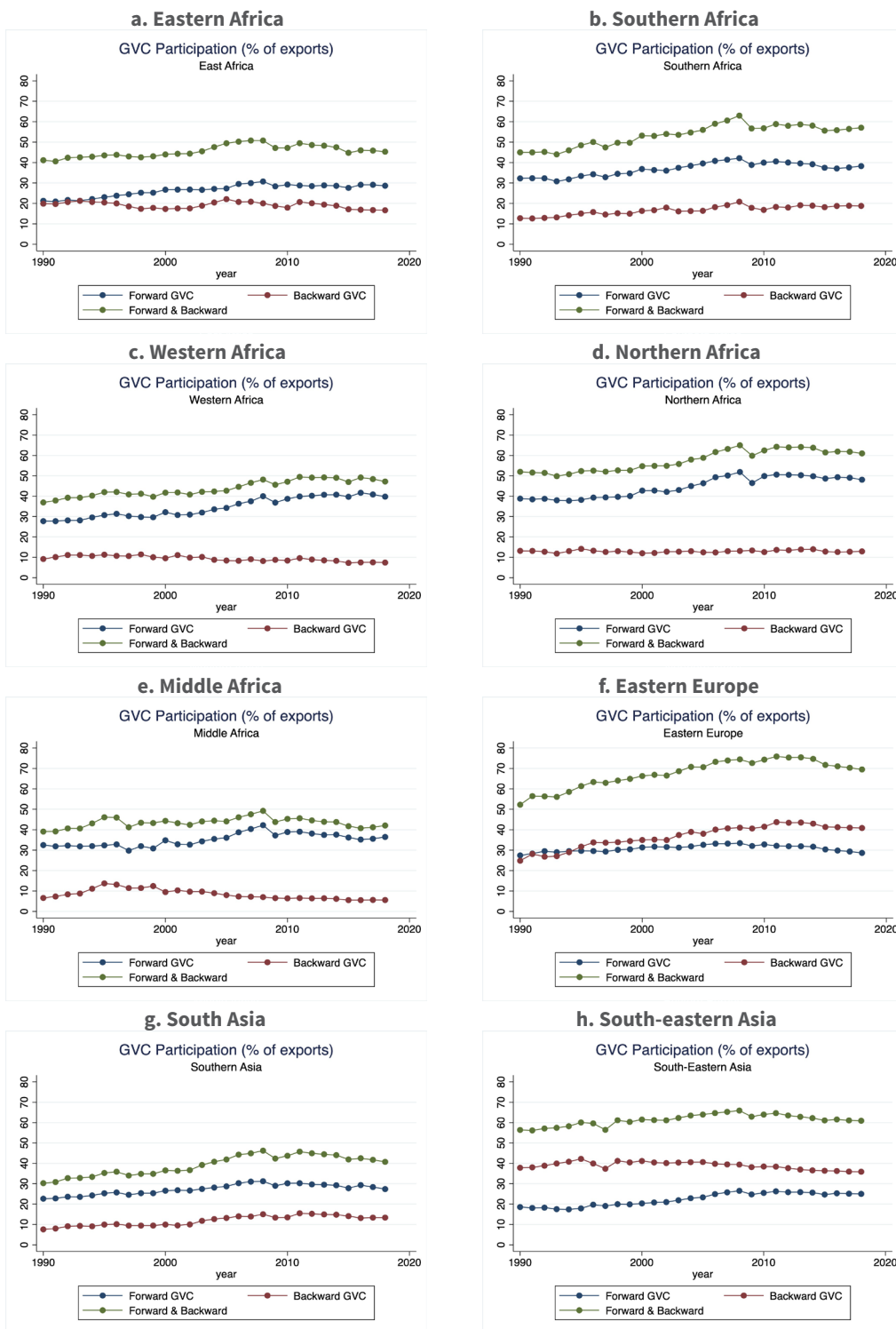
Appendix

Table A1: Kenyan trading firms, 4-5 year averages

| Period | 2008–2011 | 2012–2015 | 2016–2020 |
|--|------------------|------------------|------------------|
| <i>Number of firms by GVC status</i> | | | |
| GVC | 6549 | 6991 | 6183 |
| Non-GVC | 26160 | 30721 | 36930 |
| Total | 32708 | 37712 | 43113 |
| <i>Share of firms by GVC status (%)</i> | | | |
| GVC | 20.1 | 19.3 | 14.9 |
| Non-GVC | 79.9 | 80.7 | 85.1 |
| Total | 100 | 100 | 100 |
| <i>Average number of countries by GVC status</i> | | | |
| GVCs | 18 | 20 | 23 |
| Non-GVCs | 3 | 3 | 3 |
| All firms | 13 | 15 | 16 |
| <i>Average of products by GVC status (HS 8-digit)</i> | | | |
| GVCs | 116 | 139 | 166 |
| Non-GVCs | 34 | 37 | 49 |
| All firms | 93 | 109 | 122 |

Source: Authors' own calculations from Kenya customs data.

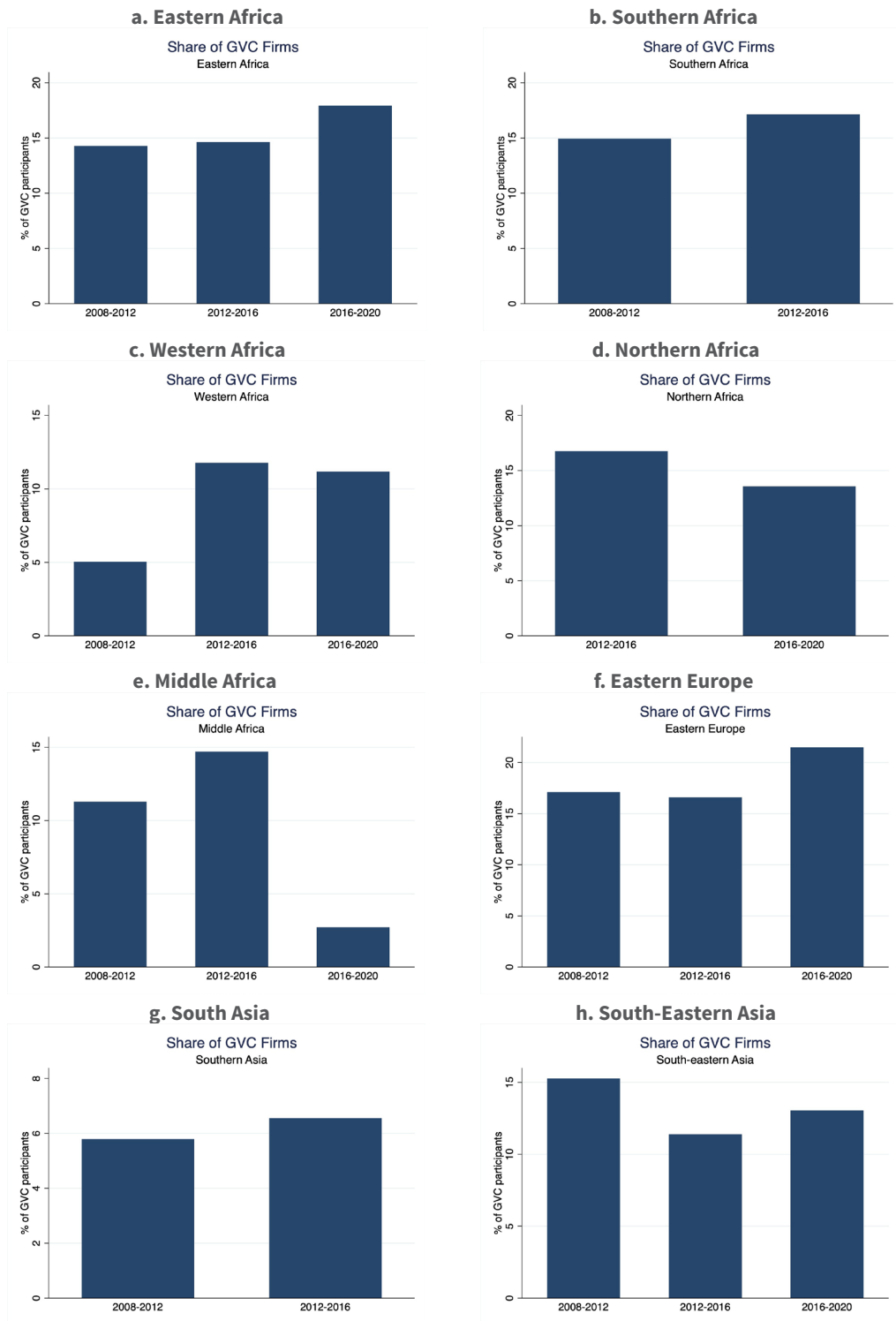
Figure A1: Sub-continental GVC comparisons



Note: The results are weighted by the trade value of the respective countries.

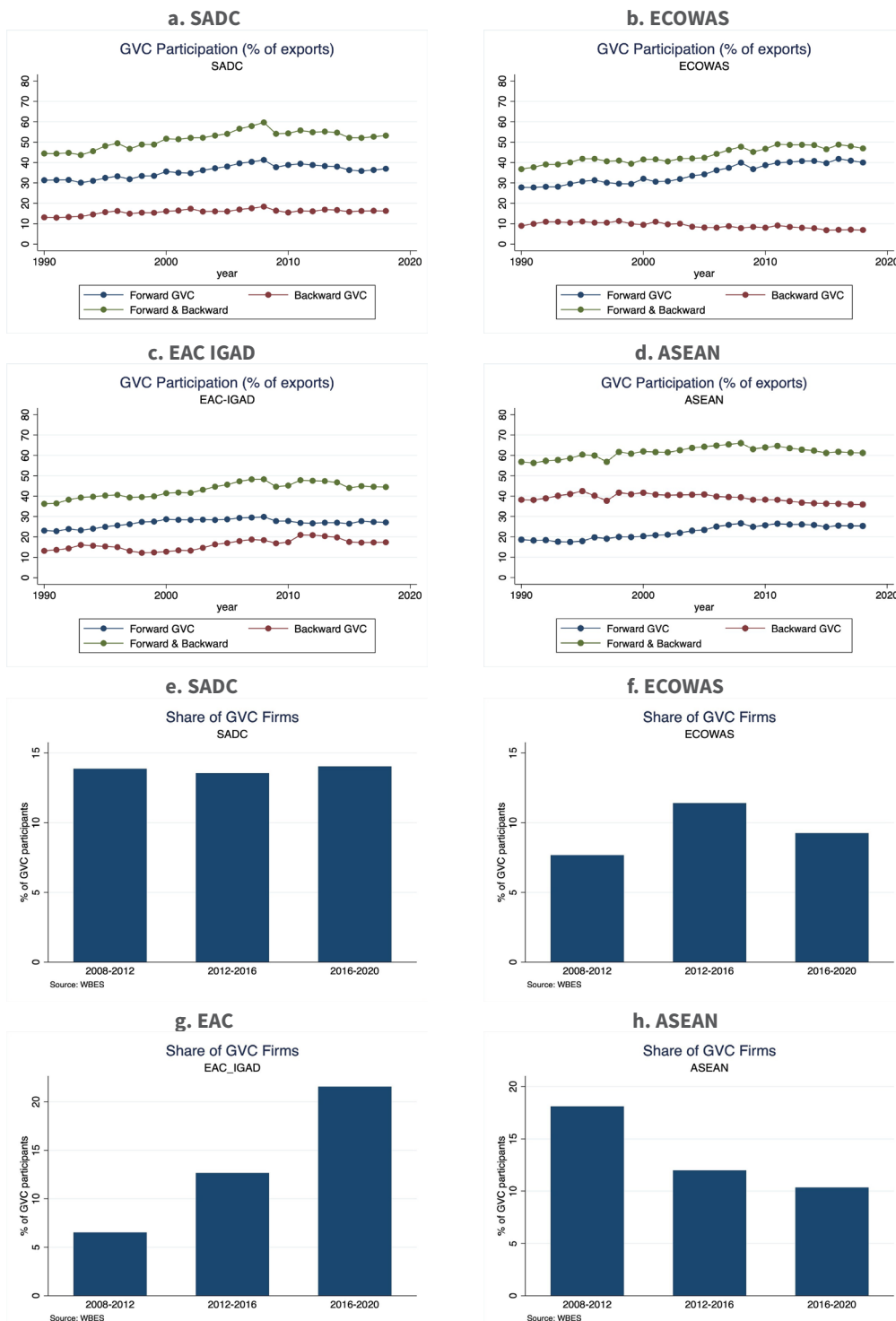
Source: Authors' own computations from EORA GVC database.

Figure A2: Sub-continental comparisons



Source: Authors' own calculations from WBES.

Figure A3: REC GVC participation



Note: UNCTAD-Eora results are weighted by trade values of the respective countries. The y-axis does not start from zero to make the figures more visible. WBES depict backward GVCs as in Equation 4.
 Source: Authors' own calculations from UNCTAD-Eora GVC database (a to d) and WBES (e to h).

Table A2: Kenyan trading firms, annual trends from 2008 to 2020

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Number of firms by categories | | | | | | | | | | | | | |
| Importer-only | 22,680 | 25,233 | 28,936 | 22,516 | 21,658 | 34,729 | 20,174 | 36,801 | 22,081 | 32,041 | 32,584 | 38,154 | 40,510 |
| Exporter-only | 1,371 | 1,251 | 1,286 | 1,365 | 1,305 | 1,226 | 2,861 | 4,131 | 1,159 | 4,108 | 4,445 | 4,756 | 4,814 |
| Two-way | 5,936 | 6,401 | 6,844 | 7,013 | 6,937 | 7,305 | 6,698 | 7,024 | 6,115 | 6,253 | 6,211 | 6,323 | 6,012 |
| All firms | 29,987 | 32,885 | 37,066 | 30,894 | 29,900 | 43,260 | 29,733 | 47,956 | 29,355 | 42,402 | 43,240 | 49,233 | 51,336 |
| Share of firms by categories (%) | | | | | | | | | | | | | |
| Importer-only | 75.6 | 76.7 | 78.1 | 72.9 | 72.4 | 80.3 | 67.9 | 76.7 | 75.2 | 75.6 | 75.4 | 77.5 | 78.9 |
| Exporter-only | 4.6 | 3.8 | 3.5 | 4.4 | 4.4 | 2.8 | 9.6 | 8.6 | 3.9 | 9.7 | 10.3 | 9.7 | 9.4 |
| Two-way | 19.8 | 19.5 | 18.5 | 22.7 | 23.2 | 16.9 | 22.5 | 14.6 | 20.8 | 14.7 | 14.4 | 12.8 | 11.7 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Number of firms by GVC status | | | | | | | | | | | | | |
| GVC | 5,936 | 6,401 | 6,844 | 7,013 | 6,937 | 7,305 | 6,698 | 7,024 | 6,115 | 6,253 | 6,211 | 6,323 | 6,012 |
| Non-GVC | 24,051 | 26,484 | 30,222 | 23,881 | 22,963 | 35,955 | 23,035 | 40,932 | 23,240 | 36,149 | 37,029 | 42,910 | 45,324 |
| Total | 29,987 | 32,885 | 37,066 | 30,894 | 29,900 | 43,260 | 29,733 | 47,956 | 29,355 | 42,402 | 43,240 | 49,233 | 51,336 |

continued next page

Table A2 Continued

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|--|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Share of firms by GVC status (%) | | | | | | | | | | | | | |
| GVC | 19.8 | 19.5 | 18.5 | 22.7 | 23.2 | 16.9 | 22.5 | 14.6 | 20.8 | 14.7 | 14.4 | 12.8 | 11.7 |
| Non-GVC | 80.2 | 80.5 | 81.5 | 77.3 | 76.8 | 83.1 | 77.5 | 85.4 | 79.2 | 85.3 | 85.6 | 87.2 | 88.3 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Average number of countries per firm category | | | | | | | | | | | | | |
| GVCs | 17 | 17 | 18 | 19 | 19 | 21 | 20 | 21 | 20 | 20 | 21 | 27 | 28 |
| Non-GVCs | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| All firms | 13 | 13 | 14 | 14 | 15 | 15 | 16 | 15 | 16 | 14 | 14 | 18 | 18 |
| GVCs | 109 | 105 | 119 | 129 | 129 | 146 | 130 | 150 | 126 | 150 | 130 | 215 | 211 |
| Non-GVCs | 30 | 29 | 37 | 40 | 39 | 39 | 39 | 32 | 28 | 32 | 51 | 67 | 69 |
| All firms | 87 | 84 | 95 | 104 | 106 | 114 | 105 | 110 | 99 | 107 | 98 | 156 | 150 |

Source: Authors' own calculations from Kenya customs data.

Table A3: Summary statistics for customs data

| Variable | Obs. | Mean | Std. dev. | Min | Max |
|---------------------|-------------|-------------|------------------|------------|------------|
| Exports | 4,090,716 | 2.129 | 4.727 | 0.000 | 23.723 |
| Imports | 4,090,716 | 9.658 | 5.044 | 0.000 | 25.474 |
| FDI | 3,687,032 | 20.375 | 0.921 | 18.380 | 21.193 |
| Skill | 4,090,716 | 8.365 | 0.292 | 8.007 | 8.848 |
| Political stability | 4,090,716 | -1.213 | 0.117 | -1.430 | -1.000 |
| Capital | 3,687,032 | 12.839 | 0.270 | 12.271 | 13.200 |
| Rent | 3,687,032 | 2.686 | 0.818 | 1.052 | 3.713 |
| Market size | 3,687,032 | 22.470 | 0.164 | 22.191 | 22.697 |

Note: All variables are in natural logarithm except political stability.

Table A4: Correlation table for Eora and WBES data - African countries

| UNCTAD-Eora | GVC | Land | Distance | Market Size | Rent | FDI | Capital | Backward GVC | Forward GVC |
|--------------|------------|-------------|-----------------|--------------------|-------------|------------|----------------|--------------|-------------|
| GVC | 1 | | | | | | | | |
| Land | -0.0753 | 1 | | | | | | | |
| distgvc | -0.0267 | -0.2158 | 1 | | | | | | |
| Mktsize | 0.209 | 0.5311 | -0.201 | 1 | | | | | |
| Natural | -0.0719 | 0.3143 | -0.1145 | 0.1219 | 1 | | | | |
| FDI inflow | 0.0716 | 0.2311 | -0.0821 | 0.5509 | 0.0419 | 1 | | | |
| capital | 0.2804 | 0.153 | -0.0921 | -0.0017 | 0.1258 | -0.0566 | 1 | | |
| Backward GVC | 0.5603 | -0.4516 | 0.3161 | -0.2216 | -0.4496 | -0.1645 | 0.0914 | 1 | |
| Forward GVC | 0.2935 | 0.4504 | -0.3899 | 0.4523 | 0.4513 | 0.2572 | 0.158 | -0.6274 | 1 |
| WBES | | | | | | | | | |
| | GVC | Land | Distance | Market Size | Rent | FDI | Capital | | |
| GVC | 1 | | | | | | | | |
| Land | -0.3006 | 1 | | | | | | | |
| Distance | 0.0188 | -0.081 | 1 | | | | | | |
| Market Size | -0.1742 | 0.2834 | 0.0761 | 1 | | | | | |
| Rent | -0.2527 | 0.0261 | -0.0563 | -0.1037 | 1 | | | | |
| FDI | -0.2054 | 0.3755 | -0.1143 | 0.8911 | 0.0117 | 1 | | | |
| Capital | 0.0797 | 0.0667 | -0.1082 | 0.0661 | 0.0197 | 0.1018 | 1 | | |

Table A5: Survey year by country - WBES

| country | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Angola | | | 1 | | | | | | | | | | |
| Benin | | 1 | | | | | | | 1 | | | | |
| Botswana | | | 1 | | | | | | | | | | |
| Burkina Faso | | 1 | | | | | | | | | | | |
| Burundi | | | | | | | 1 | | | | | | |
| Cameroon | | 1 | | | | | | | 1 | | | | |
| Chad | | 1 | | | | | | | | | 1 | | |
| Cote d'Ivoire | | 1 | | | | | | | 1 | | | | |
| DRC | | | 1 | | | 1 | | | | | | | |
| Djibouti | | | | | | 1 | | | | | | | |
| Egypt | | | | | | 1 | | | 1 | | | | 1 |
| Eswatini | | | | | | | | | | | | | |
| Ethiopia | | | | 1 | | | | | | | | | |
| Gambia | | | | | | | | | | | 1 | | |
| Ghana | | | | | | 1 | | | | | | | |
| Guinea | | | | | | | | | 1 | | | | |
| Kenya | | | | | | 1 | | | | | 1 | | |
| Lesotho | | 1 | | | | | | | 1 | | | | |
| Liberia | | 1 | | | | | | | | 1 | | | |
| Madagascar | 1 | | | | | | | | | | | | |
| Malawi | | 1 | | | | | 1 | | | | | | |
| Mali | | 1 | | | | | | 1 | | | | | |

continued next page

Table A6: List of African countries with their respective sub-regions and RECS

| Continent | Sub-region | RECS | Country |
|------------------|-------------------|-------------|-----------------|
| Africa | Eastern Africa | EAC IGAD | Burundi |
| Africa | Eastern Africa | EAC IGAD | Djibouti |
| Africa | Eastern Africa | EAC IGAD | Ethiopia |
| Africa | Eastern Africa | EAC IGAD | Kenya |
| Africa | Eastern Africa | EAC IGAD | Rwanda |
| Africa | Eastern Africa | EAC IGAD | South Sudan |
| Africa | Eastern Africa | EAC IGAD | Tanzania |
| Africa | Eastern Africa | EAC IGAD | Uganda |
| Africa | Eastern Africa | SADC | Madagascar |
| Africa | Eastern Africa | SADC | Malawi |
| Africa | Eastern Africa | SADC | Mauritius |
| Africa | Eastern Africa | SADC | Mozambique |
| Africa | Eastern Africa | SADC | Zambia |
| Africa | Eastern Africa | SADC | Zimbabwe |
| Africa | Eastern Africa | | Eritrea |
| Africa | Middle Africa | SADC | Angola |
| Africa | Middle Africa | SADC | DRC |
| Africa | Middle Africa | | Cameroon |
| Africa | Middle Africa | | Chad |
| Africa | Middle Africa | | Congo |
| Africa | Middle Africa | | Gabon |
| Africa | Northern Africa | EAC IGAD | Sudan |
| Africa | Northern Africa | | Egypt |
| Africa | Northern Africa | | Morocco |
| Africa | Northern Africa | | Tunisia |
| Africa | Southern Africa | SADC | Botswana |
| Africa | Southern Africa | SADC | Eswatini |
| Africa | Southern Africa | SADC | Lesotho |
| Africa | Southern Africa | SADC | Namibia |
| Africa | Southern Africa | SADC | South Africa |
| Africa | Western Africa | ECOWAS | Benin |
| Africa | Western Africa | ECOWAS | Burkina Faso |
| Africa | Western Africa | ECOWAS | Cape Verde |
| Africa | Western Africa | ECOWAS | Co ˆte d'Ivoire |
| Africa | Western Africa | ECOWAS | Gambia |
| Africa | Western Africa | ECOWAS | Ghana |
| Africa | Western Africa | ECOWAS | Guinea |

continued next page

Table A6 Continued

| Continent | Sub-region | RECS | Country |
|------------------|-------------------|-------------|----------------|
| Africa | Western Africa | ECOWAS | Guinea Bissau |
| Africa | Western Africa | ECOWAS | Liberia |
| Africa | Western Africa | ECOWAS | Mali |
| Africa | Western Africa | ECOWAS | Niger |
| Africa | Western Africa | ECOWAS | Nigeria |
| Africa | Western Africa | ECOWAS | Senegal |
| Africa | Western Africa | ECOWAS | Sierra Leone |
| Africa | Western Africa | ECOWAS | Togo |
| Africa | Western Africa | ECOWAS | Mauritania |
| Africa | Western Africa | ECOWAS | Sierra Leone |

Table A7: List of Asian countries with their respective sub-regions and RECS

| Continent | Sub-region | RECS | Country |
|------------------|--------------------|-------------|----------------|
| Asia | Central Asia | | Kazakhstan |
| Asia | Central Asia | | Tajikistan |
| Asia | Central Asia | | Uzbekistan |
| Asia | Eastern Asia | ASEAN | Lao PDR |
| Asia | Eastern Asia | ASEAN | Vietnam |
| Asia | Eastern Asia | | China |
| Asia | Eastern Asia | | Mongolia |
| Asia | South-eastern Asia | ASEAN | Cambodia |
| Asia | South-eastern Asia | ASEAN | Indonesia |
| Asia | South-eastern Asia | ASEAN | Malaysia |
| Asia | South-eastern Asia | ASEAN | Myanmar |
| Asia | South-eastern Asia | ASEAN | Philippines |
| Asia | South-eastern Asia | ASEAN | Thailand |
| Asia | South-eastern Asia | | Timor-Leste |
| Asia | Southern Asia | | Afghanistan |
| Asia | Southern Asia | | Bangladesh |
| Asia | Southern Asia | | Bhutan |
| Asia | Southern Asia | | India |
| Asia | Southern Asia | | Nepal |
| Asia | Southern Asia | | Pakistan |
| Asia | Western Asia | | Armenia |
| Asia | Western Asia | | Azerbaijan |
| Asia | Western Asia | | Cyprus |
| Asia | Western Asia | | Georgia |

continued next page

Table A7 Continued

| Continent | Sub-region | RECS | Country |
|------------------|-------------------|-------------|----------------|
| Asia | Western Asia | | Iraq |
| Asia | Western Asia | | Israel |
| Asia | Western Asia | | Jordan |
| Asia | Western Asia | | Lebanon |
| Asia | Western Asia | | Turkey |
| Asia | Western Asia | | Yemen |

Table A8: List of European countries with their respective sub-regions and RECS

| Continent | Sub-region | RECS Country |
|------------------|-------------------|------------------------|
| Europe | Eastern Europe | Belarus |
| Europe | Eastern Europe | Bulgaria |
| Europe | Eastern Europe | Hungary |
| Europe | Eastern Europe | Poland |
| Europe | Eastern Europe | Romania |
| Europe | Eastern Europe | Ukraine |
| Europe | Northern Europe | Estonia |
| Europe | Northern Europe | Latvia |
| Europe | Northern Europe | Lithuania |
| Europe | Northern Europe | Sweden |
| Europe | Southern Europe | Albania |
| Europe | Southern Europe | Bosnia and Herzegovina |
| Europe | Southern Europe | Croatia |
| Europe | Southern Europe | Greece |
| Europe | Southern Europe | Italy |
| Europe | Southern Europe | Malta |
| Europe | Southern Europe | Montenegro |
| Europe | Southern Europe | North Macedonia |
| Europe | Southern Europe | Portugal |
| Europe | Southern Europe | Serbia |
| Europe | Southern Europe | Slovenia |
| Europe | Western Europe | Belgium |
| Europe | Western Europe | Luxembourg |

Table A9: List of North American, South American, and Oceanic countries with their respective sub-regions and RECS

| Continent | Sub-region | RECS Country |
|------------------|-------------------|---------------------|
| North America | Caribbean | Bahamas |
| North America | Caribbean | Barbados |
| North America | Caribbean | Dominica |
| North America | Caribbean | Grenada |
| North America | Caribbean | Jamaica |
| North America | Central America | Belize |
| North America | Central America | Guatemala |
| North America | Central America | Honduras |
| North America | Central America | Mexico |
| North America | Central America | Nicaragua |
| North America | Central America | Panama |
| Oceania | Melanesia | Fiji |
| Oceania | Melanesia | Solomon Islands |
| Oceania | Melanesia | Vanuatu |
| Oceania | Polynesia | Samoa |
| Oceania | Polynesia | Tonga |
| South America | South America | Argentina |
| South America | South America | Brazil |
| South America | South America | Chile |
| South America | South America | Colombia |
| South America | South America | Ecuador |
| South America | South America | Guyana |
| South America | South America | Paraguay |
| South America | South America | Peru |
| South America | South America | Suriname |
| South America | South America | Uruguay |

Table A10: Marginal effects for WEBS and firm-level customs data probit analysis

| | Kenya | | Uganda |
|---------------------|---------------------|---------------------|-----------------------|
| | WBES (1) | Custom (2) | WBES (3) |
| FDI | 0.156*** (0.023) | 0.006*** (0.002) | 0.066 *** (0.015) |
| Skill | 0.060** (0.023) | -0.007 (0.022) | -0.023 (0.016) |
| Capital | 0.003 (0.012) | -0.047** (0.019) | 0.040*** (0.007) |
| Market | -0.022 (0.023) | -0.018 (0.030) | |
| Political stability | 0.015 (0.023) | -0.015 (0.013) | -0.045 *** (0.210) |
| Year FE | YES | YES | YES |
| Partner country FE | | YES | |
| Product FE | | YES | |

Note: The dependent variable in all cases refers to backward GVC participation. For WBES it is a dummy if the firm import intermediates and is an exporter; for firm-level customs data is a dummy as to whether a firms is a GVC (simultaneously exports and imports intermediate goods) or non-GVC (an exclusive exporter or importer). Standard errors calculated in delta method in parentheses.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A11: Regression results using Eora data using contemporaneous regression

| | (1) Forward-GVC | (2) Backward-GVC | (3) GVC |
|---------------------|--------------------|---------------------|-------------|
| FDI inflow | -0.0323 | 0.152 | 0.120 |
| | (-0.37) | (1.01) | (0.85) |
| Rent | -0.159 | -0.670 | -0.829 |
| | (-0.46) | (-1.35) | (-1.48) |
| Market Size | -0.432 | -0.733 | -1.165 |
| | (-0.74) | (-0.61) | (-1.07) |
| Land | 4.348** | 3.629 | 7.977*** |
| | (2.12) | (1.56) | (3.19) |
| Capital | -4.983*** | 0.400 | -4.583* |
| | (-2.84) | (0.13) | (-1.65) |
| Political Stability | -0.949* | 1.517** | 0.568 |
| | (-1.86) | (2.25) | (1.05) |
| Skill | -23194704.3 | 1998919.2 | -21195791.7 |
| | (-0.84) | (0.05) | (-0.60) |
| Distance | -74.87*** | 2.638 | -72.23*** |
| | (-9.27) | (0.16) | (-4.58) |
| Constant | 779.2*** | 45.47 | 824.7*** |
| | (10.31) | (0.27) | (5.46) |
| Country FE | YES | YES | YES |
| Time FE | YES | YES | YES |
| N | 843 | 843 | 843 |

Notes: Table A11 summarizes the association between the presented variables and African countries' backward, forward, and overall GVC participation. The regression is limited to African countries only, and it follows Equation 7. Standard errors are reported in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

We also use a contemporaneous regression, but with multiple fixed effects to capture some of time varying and time invariant factors that could potentially bias our estimates. The specification is given in Equation 7; where; t refers to time, δ_t refers to time fixed effects, and γ_c refers to country fixed effects. The rest are explained in Equation 5. However, we should be cautious in interpreting the results as the fixed effects may not capture all potential endogeneity concerns.

$$GVC_{ct} = \beta_1 + \beta_2 \text{Endowment}_{ct} + \beta_3 \text{Market Size}_{ct} + \beta_4 \text{Geography}_{ct} + \beta_5 \text{Institution}_{ct} + \delta_t + \gamma_c + \varepsilon_{ct} \quad (7)$$



Mission

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