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GLOBAL VALUE CHAINS IN AFRICA

Global value chains in Africa

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Global Value Chains in Africa

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Abstract: This paper provides evidence on the extent of Global Value Chain (GVC) participation by Africa as a region and for individual African countries. We find that Africa as a whole is heavily involved in GVCs, being more engaged in GVCs than many developing country regions as well as developed countries such as the USA. This overall finding hides the fact that much of Africa's participation in GVCs is in upstream production, with African firms providing primary inputs to firms in countries further down the value chain. The possibility of upgrading within GVCs in Africa is likely to be limited therefore, something which the current analysis suggests. Despite this, we observe a great deal of heterogeneity in terms of GVC participation and upgrading across African countries, with a number of African countries participating in GVCs to a relatively large extent.

JEL Classification: F15, F23

Keywords: Africa, Global Value Chains, Upgrading

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1. INTRODUCTION

Declines in transport and communication costs combined with reductions in policy barriers to trade and international investment have led to a rapid expansion in trade and capital flows in recent decades. This process of globalisation has further engendered a shift in the way that goods and services are produced. Production is increasingly organised within Global Value Chains (GVCs), whereby a lead firm typically located in the developed world relies upon a complex network of suppliers from across the globe. Suppliers may simply supply intermediate goods that are put together in the lead firm's home country, or may also put together the final good with the role of the lead firm limited to activities such as advertising, distribution and innovation. The expansion in world trade can be seen in Figure 1, which shows for the period 2000-2011 the value of world imports, with imports having increased year-on-year (except for 2009 following the economic crisis).[1] This figure further highlights the importance of intermediate goods in total trade, with intermediate goods making up 62% of world imports in 2000, rising to 65% in 2011.

Figure 1: Value of Imports by BEC Category, 2000-2011
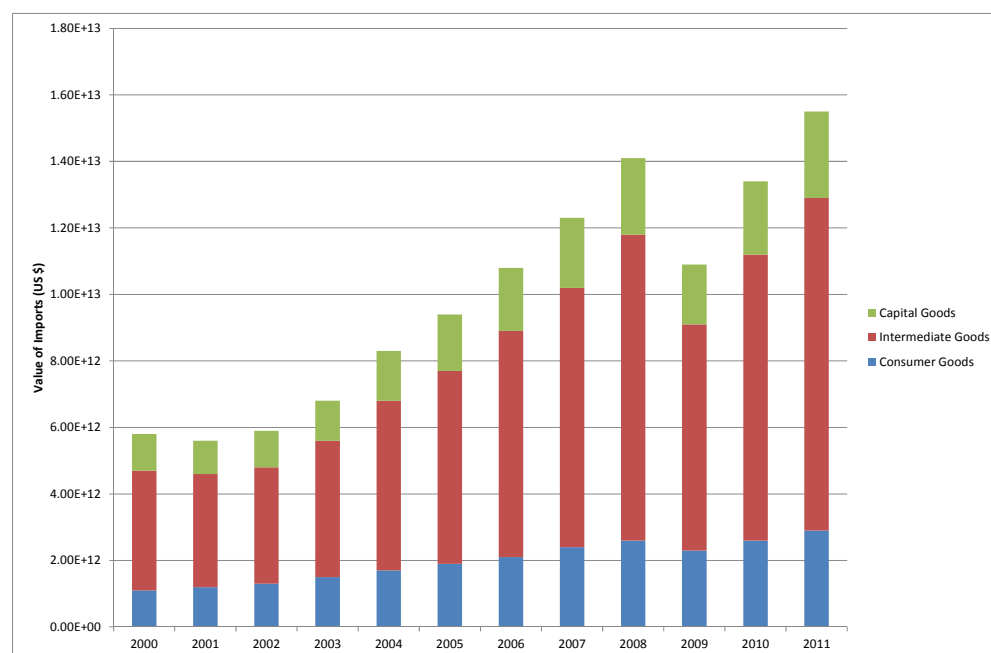
Source: UN COMTRADE

Much of the debate on the effects of GVCs, and offshoring more broadly, has been centred on the implications for developed countries, and for workers in developed countries in particular. A now large literature considers the impact of offshoring relatively inefficient parts of production,

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[1] Related to the role and impact of GVCs, a number of studies have documented that one of the main reasons for the large drop in world trade during the crisis was due to a large drop in trade in intermediates (see for example Levchenko and Lewis, 2009).

that are often low-skilled labour intensive, to developing countries with low wages and abundant supplies of low-skilled labour. This literature suggests that offshoring can help explain the increasing skill premium (e.g. Feenstra and Hanson, 1999) and the lower demand for labour (e.g. OECD, 2007) in developed countries, and can affect the vulnerability of workers by increasing the elasticity of labour demand (e.g. Senses, 2010). More recent work further suggests that offshoring may help explain the 'hollowing out of the middle' in terms of labour demand (e.g. Michaels et al, 2014) and that increased services offshoring can reduce manufacturing employment (e.g. Amiti and Wei, 2006; Winkler, 2009 and 2010). The literature looking at impacts in developing countries is much smaller, despite the fact that developing countries are important destinations for offshoring and are increasingly engaged in offshoring or outsourcing activities themselves.

There are various potential advantages of offshoring and engagement in GVCs for the developing world, and for Africa in particular. A potential advantage is that developing countries no longer need to create entire industries in order to industrialise and be competitive in world markets (Baldwin, 2012). Instead, firms in developing countries can provide specific skills or products to GVCs. It is further possible for low-wage countries to produce – or at least construct – high-quality manufactured goods. Through participation in GVCs, and the exposure to international markets and foreign competitors, the potential for technology transfer and spillover effects arises. Such effects can take a number of forms, for example by providing access to best practice management and business methods, through the use of high quality and high-tech intermediates, through developed country intellectual property and trademarks, through lead firm knowledge and technology sharing; through skills demand and upgrading, and through learning from customers. Such effects can impact upon local firms not engaged in GVCs as well as those that are involved in GVCs, with the development of a part of a GVC in a country potentially also leading to spin-off firms and industries.

While potentially offering up new and more rapid opportunities to develop, a concern for developing countries that become integrated into GVCs is that such countries become trapped in low value-added segments of the GVC, where there is little possibility for innovation or technology transfer.[2] As such, an important question is whether countries are able to upgrade within GVCs, which is usually taken to mean that countries – or firms within countries – are able to gain competitiveness in higher value-added processes and raise domestic labour productivity and skills. A further aspect related to upgrading that is relevant is whether GVC participation benefits the domestic society as a whole, through increased employment and wages, better living conditions, and economic security.

In this paper we examine the extent of GVC participation by African countries and provide a comparison of Africa's involvement in GVCs relative to other developed and developing regions. As such, the analysis is similar to other recent reports, such as that of UNCTAD (2013) and the African Economic Outlook (2014), which tend to show that GVCs are heavily

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[2] African Economic Outlook (2014) note that 61% of respondents to their country experts' survey indicated that being locked into low value-added stages of GVCs was the greatest threat from GVC participation.

concentrated in the regional blocs of East Asia, Europe and North America (Baldwin, 2012) and that Africa captures a small but growing share of trade in GVCs.[3] A starting point for this analysis is Figure 2 which shows the value of imports for nine different regions and indicates that Africa's imports are dwarfed by those from other developing regions in Asia and Latin America, as well as by the developed USA, EU and Japan. The figure also reveals however that between 2000 and 2010 imports in Africa have grown more rapidly (338%) from this low base than in any other region except transition countries (414%), which also began from a very low base. The share of intermediate imports in African countries (62%) didn't change between 2000 and 2010 however, with this share being below that in East Asia, Other Asia and Latin America in both periods, but above the values in the USA and the EU.

Figure 2: Value of Imports by Region and BEC Category 2000 and 2010
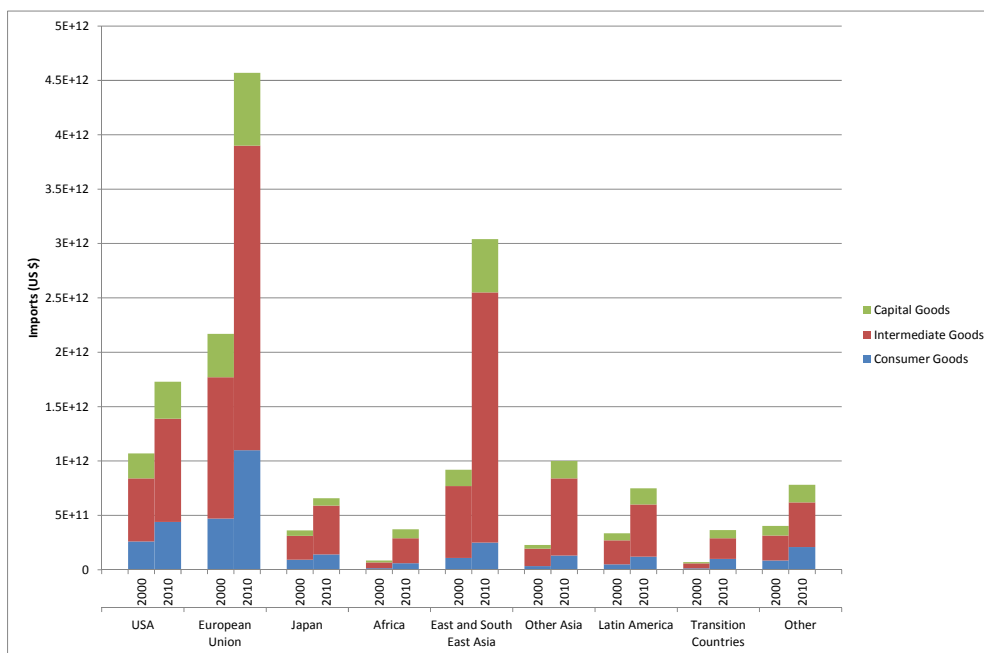
Source: UN COMTRADE

The current paper complements the existing studies on Africa's role in GVCs by further considering the extent of upgrading across African countries. To do this, we use detailed trade data to examine developments in the sophistication of exports, export unit values (capturing quality changes) and export market shares, further reporting information on product discovery (following Klinger and Lederman, 2006; Besedes and Prusa, 2006; and Cadot et al, 2011) as a measure of upgrading. Finally, we discuss the problems of linking GVCs to innovation in

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[3] African Economic Outlook (2014) for example states that Africa's share in global trade in value-added grew from 1.4% in 1995 to 2.2% in 2011, with UNCTAD (2013) showing that 85% of GVC trade takes place within the three regional blocs.

African countries, and provide descriptive evidence linking participation in GVCs to indicators of innovation at the firm-level in Africa.

We find that Africa is heavily involved in GVCs, being more engaged in GVCs than many developing country regions and developed countries such as the USA. This overall finding hides the fact that much of Africa's participation in GVCs is in upstream production, with firms in Africa providing primary products and simple manufactures to firms in countries further down the value chain. The expectation is that this kind of upstream production is likely to involve lower value-added activities, which unlike parts and components exports, for example, provide few opportunities for technology upgrading. Downstream participation in GVCs by Africa is found to be relatively low, and more importantly has shown little sign of increasing since 1995. Despite this, some African countries have been able to move into downstream production, with Mauritius, Botswana, Ethiopia, Kenya and Tanzania among other countries, reporting shares of downstream production in total GVC involvement of 50% or more in 2010.

The paper is split into three main parts: Section 2 discusses the measurement of GVC involvement and reports a number of results comparing Africa with other regions and comparing individual African countries in terms of GVC involvement; Section 3 discusses and reports information on a number of measures intended to capture upgrading within GVCs; and Section 4 tackles the difficult task of linking GVC participation to innovation. Finally, Section 5 concludes.

2. AFRICA'S INVOLVEMENT IN GLOBAL VALUE CHAINS

2.1. MEASURING GLOBAL VALUE CHAINS

For some time now researchers have considered appropriate ways to measure the extent of GVCs and of individual country's involvement in such chains, with the use of international Input-Output (IO) tables a common means of achieving this.[4] A country's exports (or final demand) can be split up into a component capturing domestically produced value-added and one capturing imported value-added that is incorporated into a country's exports (final demand). A complete analysis of GVCs will also account for the fact that a country's exports need not constitute final goods only, but may also be used as inputs into other country's production (and exports).

Hummels, Ishii and Yi (2001) (HIY) developed the concept of foreign value-added in trade, which refers to the foreign value-added embodied in a country's exports, with foreign value-added being expressed as a percentage of gross exports. As discussed by Koopman et al (2011, 2014), the original HIY measure was insufficient for a full analysis of GVCs. In particular, the original HIY measure required that imported intermediate inputs contain 100% foreign value-added, implying that a country cannot receive intermediate imports that embody its own value-

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[4] See Nomaler and Verspagen (2014) for a critique of the use of IO tables for measuring GVCs.

added. In addition, a country cannot import intermediate inputs, add value and then export the resulting good to be used as an intermediate input in another country's production of final goods. Koopman et al (2011) developed alternative indicators of GVC participation that allow one to split up the foreign and domestic value-added content of exports, with the foreign value-added share indicating the share of a country's exports that consist of inputs that have been produced in other countries and thus do not add to the GDP of the country of interest.[5] The approach of Koopman et al (2011) also allows one to calculate the share of a country's value-added exports embodied as intermediate inputs in other countries' exports, what Koopman et al (2011) refer to as 'indirect value-added exports'. Combined, these two measures provide a comprehensive description of GVC participation. The former indicates the extent to which a country's exports comprise value-added created abroad, and thus captures the extent of GVC participation for downstream firms and industries, with the latter capturing the contribution of the domestic sector to the exports of other countries, thus indicating the extent of GVC participation for relatively upstream sectors that themselves have relatively fewer inputs from either domestic or foreign sources.

The calculation of foreign value-added in trade requires a multi-region input-output (MRIO) table, which builds upon national IO tables by breaking down the use of products by origin. The rows in a MRIO table indicate the use of gross output from a particular industry in a particular country, and comprise two main components. The first is intermediate use, which provides information on intermediate use by both domestic industries and industries in other countries. The second is information on final demand, which is again split between demand for final goods from both domestic and foreign sources. The columns of the MRIO table provide information on the amounts of intermediates needed for the production of gross output. The column sum thus gives the sum of the domestic and foreign production of intermediates that are used in the production of output in a particular industry and country. Combining this sum with the sum of value-added generated in each industry and country gives the value of gross output. The information given by an MRIO table can be translated into standard IO matrix form by stacking all industries and countries, such that we have $(n \times i)$ rows and columns, with n being the number of countries and i the number of industries. Gross output can then be expressed as:

$$x = Z + y$$

$$x = Ax + y$$

$$(I - A)x = y$$

$$x = (I - A)^{-1}y = Ly$$

with x being gross output, Z intermediate demand, y final demand, I the identity matrix, A the technological coefficient matrix (i.e. the ratio of intermediate use to gross output by intermediate) and L the Leontief inverse. To calculate trade in value-added we additionally

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[5] See also Johnson and Noguera (2012), Foster-McGregor and Stehrer (2013) and Timmer et al (2014).

require a row vector, v, with each element representing the share of value-added per unit of output by country and industry, and a row vector, e, with each element reporting aggregate exports (i.e. sum of intermediate inputs exported abroad and exports of final goods) by country and industry. The trade in value-added matrix can then be written as:

$$\begin{pmatrix} T_v^{11} & \cdots & T_v^{1n} \\ \vdots & \ddots & \vdots \\ T_v^{n1} & \cdots & T_v^{nn} \end{pmatrix} = \begin{pmatrix} v^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & v^n \end{pmatrix} \begin{pmatrix} L^{11} & \cdots & L^{1n} \\ \vdots & \ddots & \vdots \\ L^{n1} & \cdots & L^{nn} \end{pmatrix} \begin{pmatrix} e^1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & e^n \end{pmatrix}$$

with v^n being an $i \times 1$ (diagonalised) row vector giving the value-added per unit of output for each industry in country n, L^{nn} being the $i \times i$ Leontief inverse for country n, and e^n being the $i \times 1$ (diagonalised) row vector of total exports for each industry in country n.[6] The first column of the trade in value-added matrix describes the value-added contained in the exports of country 1, and can be split into a domestic and foreign component. The term T_v^{11} gives the domestic value-added content of exports. The term T_v^{j1} ($j \neq 1$) gives the foreign value-added content of exports of country 1 generated by country j. Summing up these terms for all j, i.e. $\sum_{j=2}^{J} T_v^{j1}$, gives the total foreign value-added in the exports of country 1. The sum of the domestic and foreign value-added content of exports of country 1 is equal to total exports of country 1. Taking the ratios of T_v^{11} and $\sum_{j=2}^{J} T_v^{j1}$ to total exports then gives the share of exports of country 1 that are due to domestic (DVA) and foreign (FVA) value-added. An analogous interpretation holds for all other columns.

We can also use this trade in value-added matrix to obtain information on the domestic value-added that enters as an intermediate input in the value-added exported by other countries. This is found by looking at the rows, rather than the columns, of the T_v matrix. The term T_v^{12} for example, which can be written as $T_v^{12} = v^1 L^{12} e^2$, indicates the value of country 2's exports that depends on value-added from country 1. Summing along the row therefore (and excluding the diagonal term) provides an indicator of the value-added of a country that enters as an intermediate input into the value-added exported by all other countries. In the analysis below we again take this value as a ratio to total exports of a country, which we refer to as DVX. Finally, to capture the overall participation of countries and industries in GVCs we combine the FVA and DVX measures, by summing up the foreign value-added used in a country's own exports and the value-added supplied to other countries' exports, and taking the sum as a ratio to gross exports, i.e. $GVC = FVA + DVX$.

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[6] Some recent studies replace the export vector with the vector of final demand (see for example, Timmer et al (2014) and Los et al (2015)). Doing this changes the relative importance of some sectors in our analysis (e.g. mining and quarrying become relatively less important in the case of Africa), but doesn't affect the overall patterns found below. In Appendix C we briefly discuss the results when replacing the export vector with the final demand vector.

2.2. DATA

The data used to construct our indicators of GVC participation come from UNCTAD's Eora GVC database. The Eora dataset provides a MRIO table at the world level, with international IO tables reported for 187 countries over the period 1970-2011. The starting point in the construction of these data are national supply and use tables, or when not available national IO tables. These are then linked through international trade statistics. The database reports information on between 25 and 500 industries, depending on the country. In our analysis we use the 25 sector database over the period 1995-2010, using data in basic prices that reports consistent data at this level of aggregation for all 187 countries.[7] For more information on the construction of this dataset see Lenzen et al (2013).

2.3. DESCRIPTIVE EVIDENCE ON GVC PARTICIPATION BY AFRICA

2.3.1. Comparison of GVC Participation across Regions

In this sub-section we use the 25 sector Eora database to provide a comparison of GVC involvement of Africa as a whole with other regions, beginning in Figure 3 with data for 1995, 2000, 2005 and 2010 on overall participation in GVCs. A number of interesting facts emerge from this figure. The figure indicates that GVC participation has been increasing over time in most regions. The main exceptions to this are Central America and the Caribbean region where GVC participation has tended to decline somewhat. Overall however, GVC participation has increased, with the share of exports that are part of a multistage process increasing from around 41% in 1995 to just shy of 50% in 2010. That the advanced countries – and the EU in particular[8] – are heavily integrated in GVCs is hardly surprising, while the evidence of intensive GVC participation of East and South-East Asia and to a lesser extent Western Asia is also in line with expectations.

Turning to the situation in Africa we find that Africa has some of the highest rates of GVC participation, matching the levels found in Asia. In 1995, Africa's GVC participation was around the average for all regions (at around 41%). The growth rate of GVC participation between 1995 and 2010 in Africa has also been similar to that for all countries, with GVC participation increasing by 19.9% for Africa and 20.5% for all countries over the period 1995-2010. While this change in GVC participation was larger than that for developing countries as a whole (16.5%), it was lower than that for other developing regions, including South Asia (27%), West Asia (21%) and South America (21%), as well as the developed regions.

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[7] See Table A1 in the appendix for a list of the sectors.
[8] Note that we consider the individual countries of the particular region separately, meaning that the measures reported include intermediate flows between countries of the same region. This is likely to inflate the extent of GVC participation of the EU relative to other large single countries, such as the USA and Japan, for example.

Figure 3: GVC Participation by Region
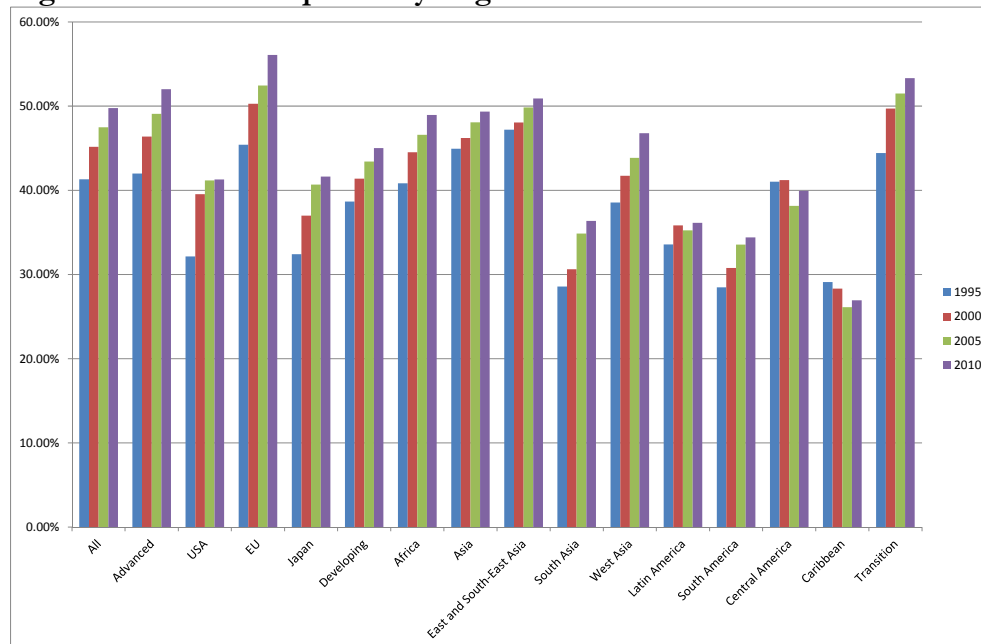
Notes: The GVC participation measure is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are the portion of a region's exports that are part of a multi-stage trade process. Exports of a region included intra-region exports. This is calculated as the sum of foreign value-added used in a country's own exports and the value-added supplied to other countries' exports taken as a ratio to gross exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Figures 4 and 5 split up total GVC participation into the foreign value-added component (FVA) and the value-added supplied to other countries' exports component (DVX). The FVA measure will tend to be higher if a country or sector is involved in downstream production, with imports from other countries feeding into that country's exports. Conversely, the DVX measure will tend to report higher numbers for countries and sectors involved in upstream production, with output and exports of that country feeding into the production and exports of downstream producers. Comparing these two measures thus provides evidence on where within a GVC a particular country or sector is. While upstream production is associated with the production of knowledge assets at the beginning of the production process, in a developing country context where rates of innovation are low it is more likely associated with the production of raw materials and other basic inputs to production, which may have little scope for upgrading (see Figure 14 below for evidence of this).

Figure 4 reports similar results to Figure 3, but for the FVA measure. The figure again points to the conclusion that GVC involvement has tended to rise over time for all countries, though the increase has been largely driven by the advanced countries. Overall, GVC participation according to this measure increased by around 20% between 1995 and 2010 with large increases occurring in advanced countries (Japan (92%), USA (41%), and to a lesser extent the EU (28%)). For developing countries as a whole there was little change in the FVA measure between 1995 and 2010, though relatively large increases were witnessed in South Asia (37%) and South America (18%). For most other developing regions a decline in FVA was observed between 1995 and

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2010, with the largest declines being observed for the Caribbean (by 29%) and Africa and Central America (both by 8%).

In terms of the levels of FVA, the initial values of the FVA measure were particularly large for East and South-East Asia, as well as Central America, the latter presumably due to interactions with the USA. In the case of Africa, the initial value of the FVA indicator was somewhat below the developing country average in 1995, being similar to values observed in West Asia and Transition countries, but higher than that in South Asia, and South America. The value of the FVA measure for Africa saw a decline between 1995 and 2000 however, with little change since. This outcome suggests that Africa – as well as most other developing regions – have struggled to become increasingly engaged in downstream production within GVCs.

Figure 4: FVA by Region
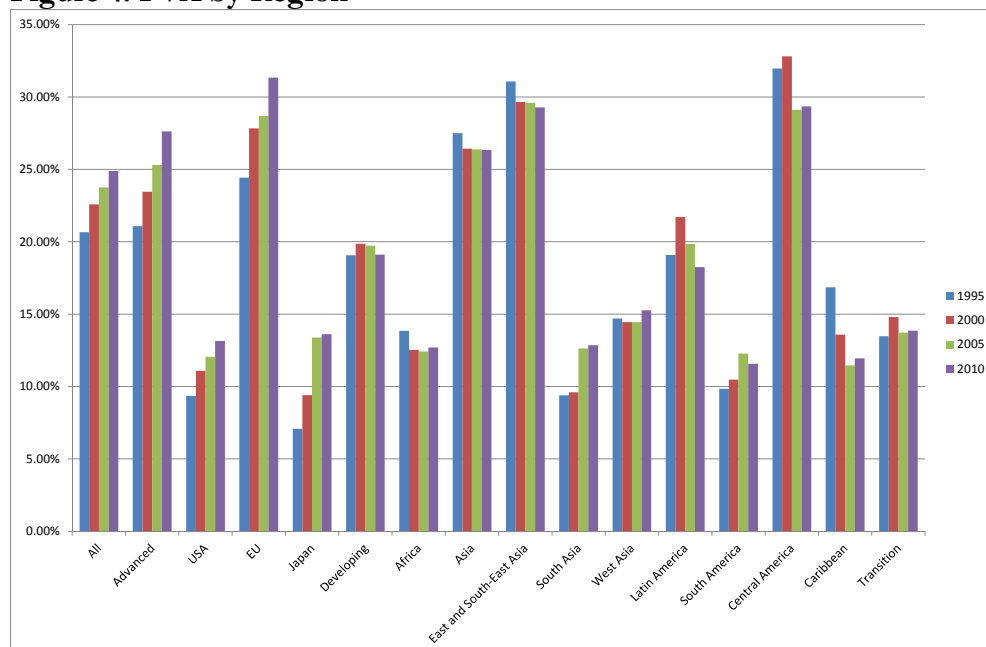
Notes: The FVA indicator is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are the ratio of foreign value-added used in a region's own exports to gross exports. Exports of a region include intra-region exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 5 reports similar figures for the DVX measure. The figure reveals that all regions observed an increase in the DVX measure between 1995 and 2010. In terms of the initial 1995 value of the DVX measure we observe that Africa had the second highest share at 27%. Africa also had the largest increase in the DVX measure between 1995 and 2010, with the DVX measure increasing by 34.4% between those two years. Large increases also occurred East and South East Asia (33.9%), West Asia (32%), and Transition Countries (27%). In general, increases were much larger for developing countries (32% on average) than for developed countries (21%).

The large and increasing values for the DVX variable combined with the relatively small and stagnant values for the FVA variable in the case of Africa further reinforces the view that Africa has struggled and continues to struggle in breaking into downstream production and that much of its involvement in GVCs is in upstream (natural resource and simple manufacturing) production. Indeed if we consider the share of total GVC participation that is due to the DVX measure we find that this has increased from a share of 66% in 1995 to 74% in 2010, suggesting that the importance of upstream production has increased over time in Africa.
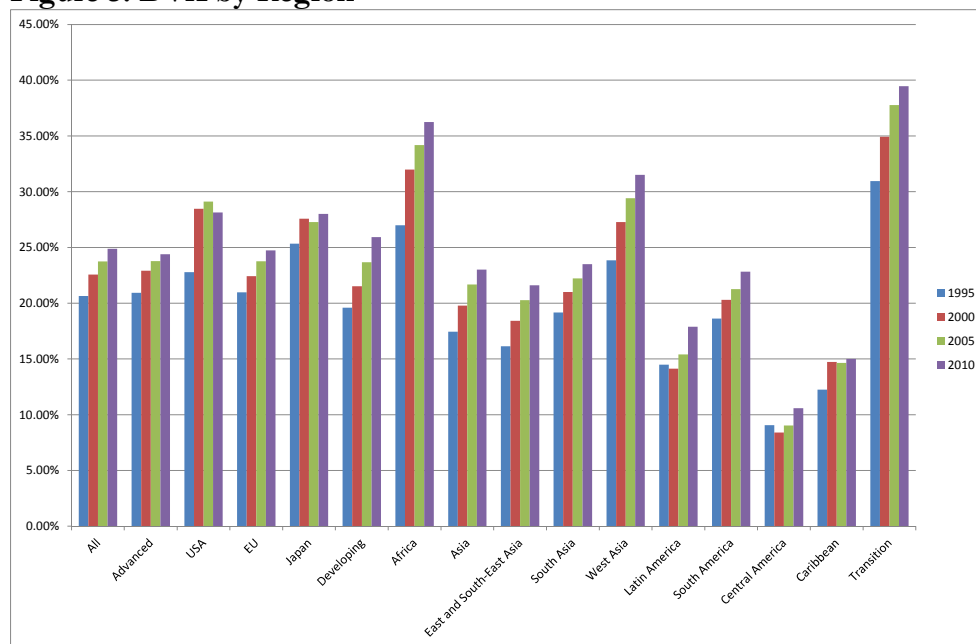
Figure 5: DVX by Region

Notes: The DVX indicator is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are the ratio of the value-added supplied to other regions' exports to gross exports. Exports include intra-region exports.
Source: Calculations based on UNCTAD-Eora GVC Database

While the figures reported in figures 3-5 highlight the importance of GVCs in the case of Africa, by looking at the shares in total exports of foreign value-added and the value-added in other countries exports, the measures do not allow us to say anything about the actual volume of GVC trade. To shed some light on this, we report in figures 6 and 7 the value of foreign value-added and the value of exports of intermediates in value-added exports of other countries respectively for each of our regions and for the years 1995, 2000, 2005, and 2010. Both figures indicate that in terms of value Africa's role in GVCs is very small, making up just 1% of foreign value-added (in all years) and between 2% (1995) and 3.2% (2010) of exports of other countries' value-added exports. It should be borne in mind therefore that while the GVC ratios for Africa, reported above, tend to be relatively high, by considering the ratio of GVC involvement to total exports they may overemphasise Africa's involvement in GVCs.

Figure 6: Foreign Value-added by Region
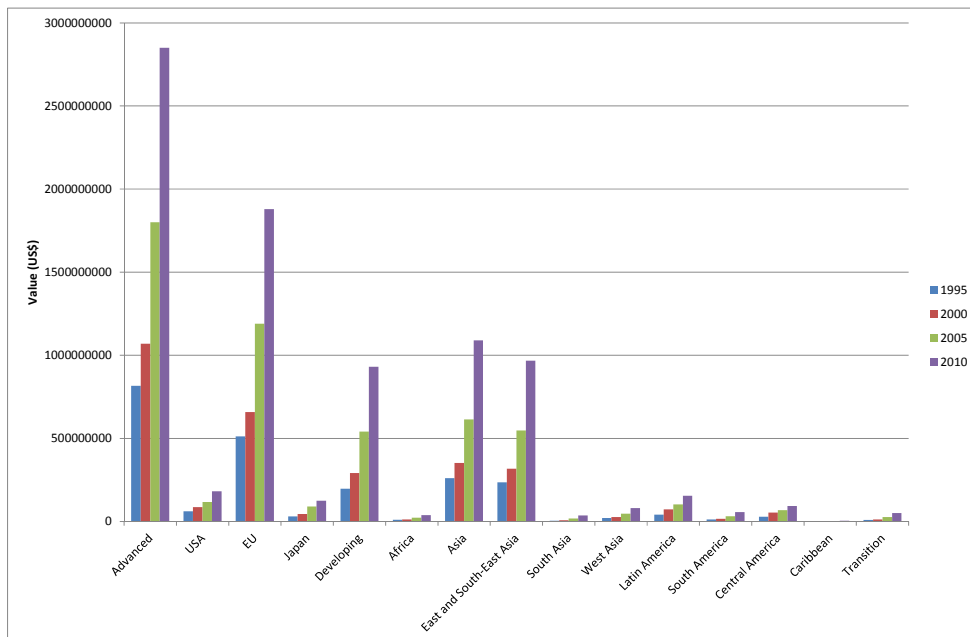
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 7: Value of Exports in Other Countries' Value-added Exports by Region
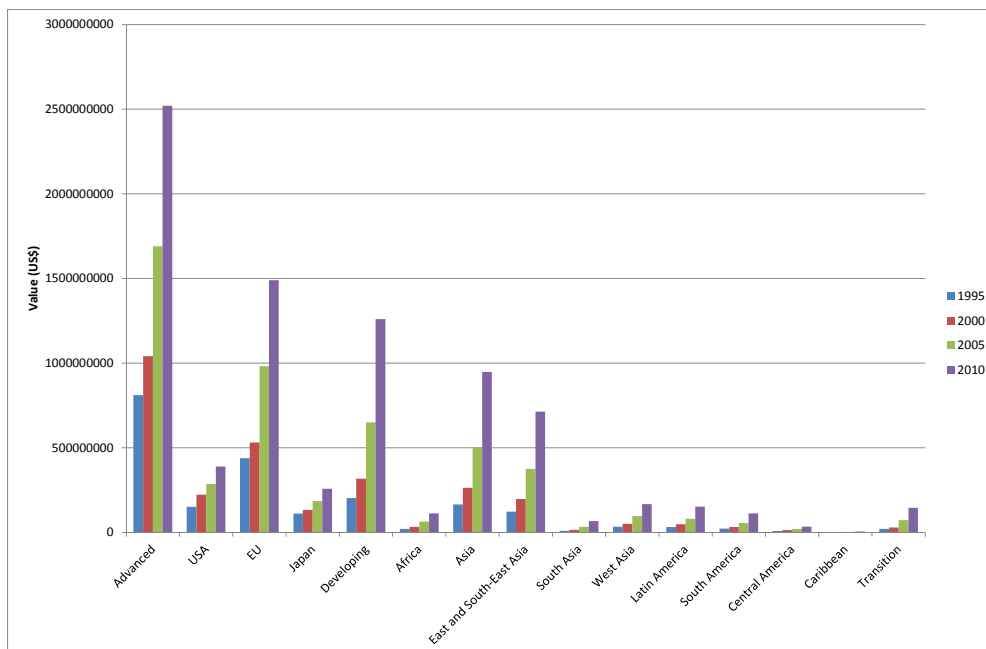
Source: Calculations based on UNCTAD-Eora GVC Database

2.3.2. Comparison of GVC Participation across African Countries

In this sub-section we undertake a similar exercise to above, but concentrate on individual African countries. Figures 8, 9 and 10 report for each of 49 African countries data on GVC,

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FVA and DVX respectively for the years 1995, 2000, 2005 and 2010. Figure 8 reveals a great deal of variation in GVC participation across African countries. Participation rates range from above 50% in 1995 for Sao Tome and Principe, Swaziland, Liberia, Algeria, Cape Verde, Botswana, and Guinea, to values around 25% for Cote d'Ivoire, Tanzania, Uganda, and Senegal. The period between 1995 and 2010 witnessed some interesting changes in the extent of GVC participation across Africa, with the tendency being for GVC participation to increase. Declines in GVC participation between 1995 and 2010 were observed in just a handful of countries (Liberia, Botswana, Eritrea, Angola, and Togo), with the decline being relatively large in Liberia (9%). The increases were particularly large in Democratic Republic of the Congo (20%), Guinea (17%), Libya (17%), and Mauritania (15%), amongst others.
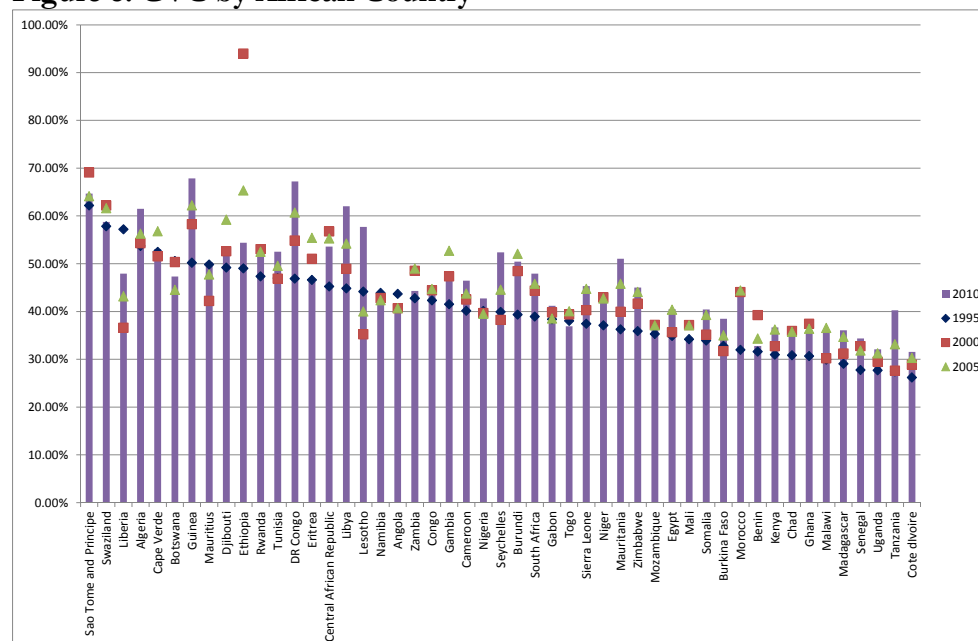
Figure 8: GVC by African Country

Notes: The GVC participation measure is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are for GVC participation, measured as the portion of a country's exports that is part of a multi-stage trade process. This is calculated as the sum of foreign value-added used in a country's own exports and the value-added supplied to other countries' exports taken as a ratio to gross exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Considering the FVA measure (Figure 9) we observe relatively low values of FVA for many countries in 1995. For 11 countries the FVA measure was at 10% or below in 1995 and was less than 40% for all countries except Swaziland, and Sao Tome and Principe. Between 1995 and 2010 we further witnessed declines in the FVA measure in a number of countries. In particular, we observe declines in this ratio for 22 of the 49 countries, with the declines being around 10% in Eritrea and Angola. Relatively large increases in the FVA ratio were observed in a small number of countries however, with increases of over 10 percentage points being observed in Lesotho, Tanzania and the Seychelles.

Turning to the DVX measure in Figure 10 we again find a great deal of heterogeneity in initial values of the DVX ratio, ranging from around 10% in Swaziland to around 43% in Guinea and Algeria. Changes in the DVX ratio between 1995 and 2010 tended to be positive however (the exceptions being Uganda, Botswana, Mauritius, Lesotho and Liberia). Increases of 10 percentage points or more were observed in a number of countries, namely, Libya, DR Congo, Guinea, Mauritania, Zimbabwe, and Morocco.

Figure 9: FVA by African Country
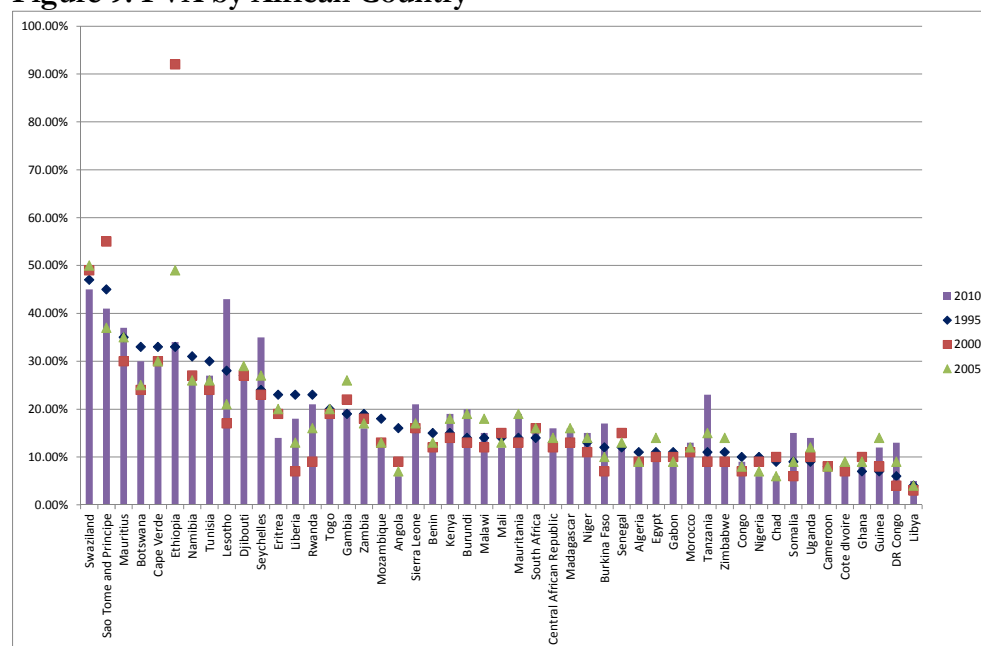

Notes: The FVA indicator is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are for the FVA index, measured as the ratio of foreign value-added used in a country's own exports to gross exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 10: DVX by African Country
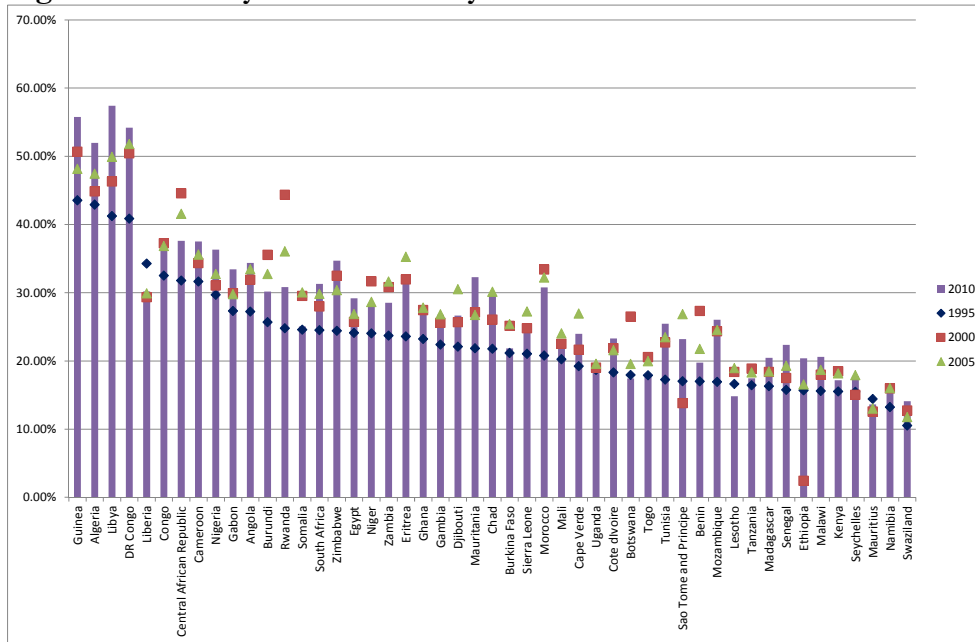
Notes: The DVX indicator is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are for the DVX index, measured as the ratio of the value-added supplied to other countries' exports to gross exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 11: FVA and DVX Share of GVC Participation by African Country in 2010
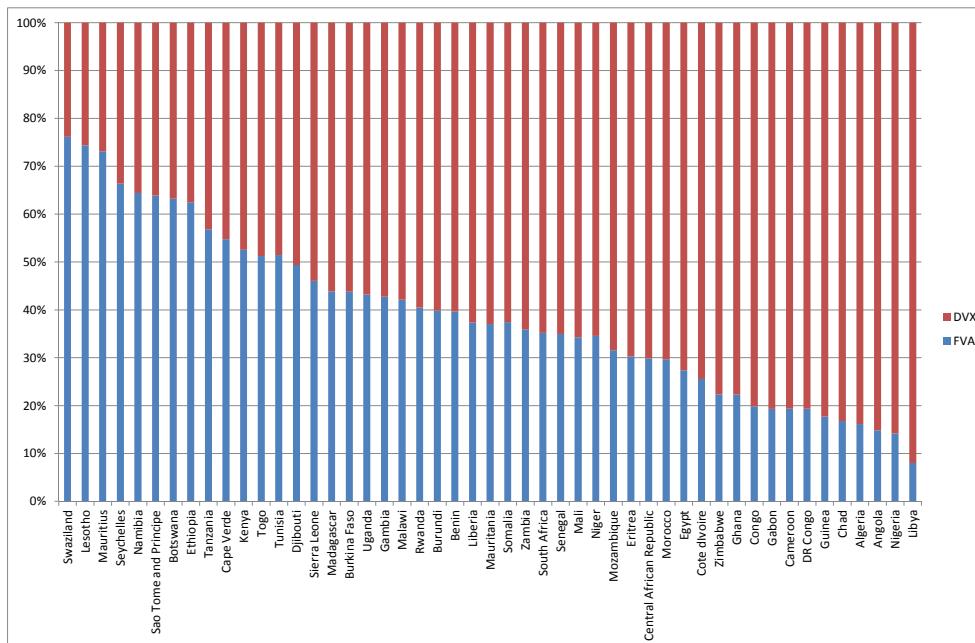
Source: Calculations based on UNCTAD-Eora GVC Database

Combined Figures 9 and 10 again point to the fact that, to the extent that they are engaged in GVCs, the majority of African countries are specialised in upstream production. There are exceptions however. These can be seen more clearly in Figure 11, which reports the shares of

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FVA and DVX in total GVC participation by African country in 2010. The figure indicates that in three countries (Swaziland, Lesotho and Mauritius) the share of FVA in overall GVC participation is above 70%. This suggests that a large proportion of the GVC involvement of these countries is in downstream production. For a further 10 countries this ratio is above 0.5, indicating that more than 50% of their GVC participation arises due to foreign value-added being incorporated in to their exports, and therefore an indicator of downstream production. In 15 countries, the share of DVX in total GVC participation is 70% or above, with the share being above 50% in a further 21 countries. In these countries the largest share of GVC participation arises because of their exports being incorporated into the exports of other countries. This indicates that these countries are relatively highly specialised in upstream production within GVCs.

Once again however, it needs to be remembered that the measures of GVCs constructed do not take into account the overall value of GVC trade. Figures 12 and 13 therefore report the value of foreign value-added and the value of intermediate exports in the value-added exports of other countries for each of the 49 African countries in our sample respectively for the years 1995, 2000, 2005 and 2010. For the vast majority of African countries we see that the values of both foreign value-added and the value of intermediate exports in other countries' value-added exports are very small, and are dwarfed by the values in South Africa. This is particularly the case for many of the countries that are ranked highly according to the ratios discussed above (e.g. Sao Tome and Principe, Swaziland, Liberia, and Cape Verde). There are however a number of other countries that report relatively high values in figures 12 and 13, including Algeria, Angola, Egypt, Libya, Kenya, Mauritius, Morocco, Nigeria, and Tunisia.

Figure 12: Foreign Value-added by African Country
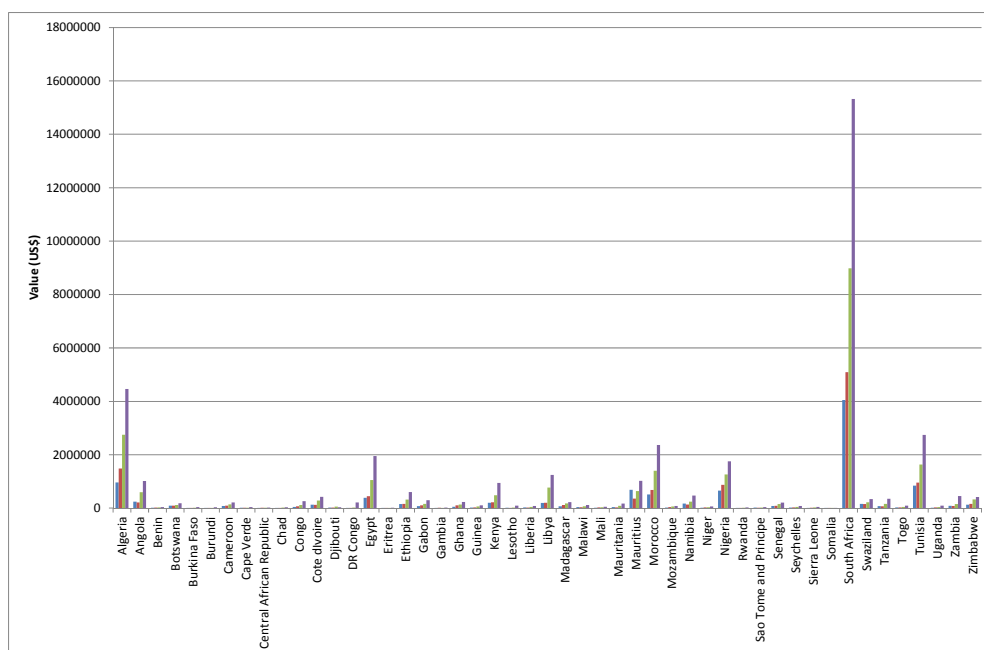

Source: Calculations based on UNCTAD-Eora GVC Database

Figure 13: Value of Exports in Other Countries' Value-added Exports by African Country
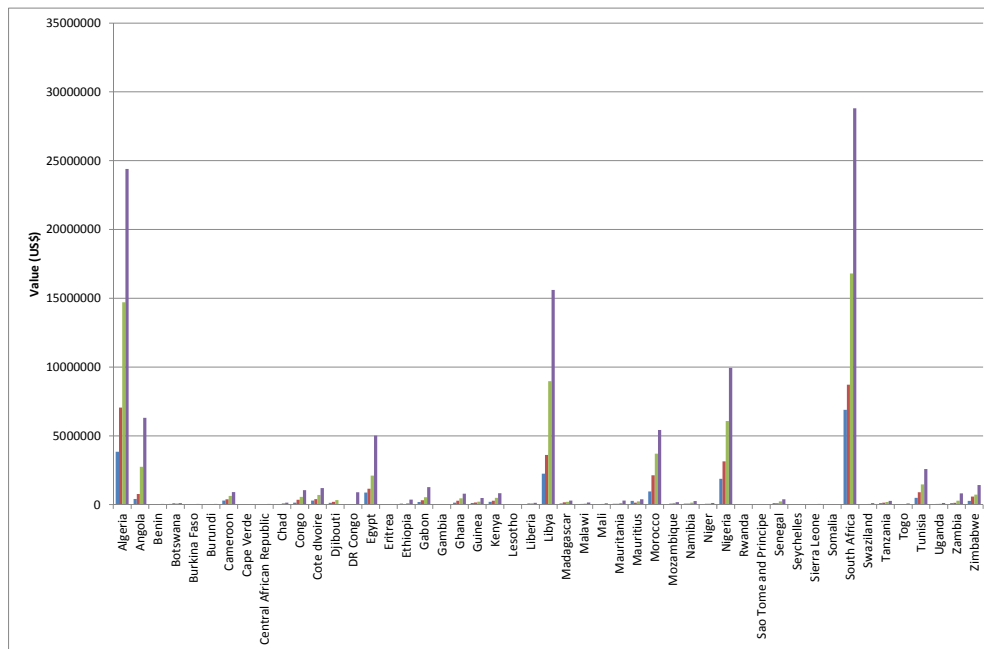
Source: Calculations based on UNCTAD-Eora GVC Database

Overall, the results for African countries suggest that (to the extent that they are engaged in trade in intermediates) many of them participate strongly in GVCs. At the same time, the majority of their participation is in upstream production. Such upstream production involves natural resource production and extraction as well as simple manufactures, where the possibility of upgrading is likely to be poor. To see this more clearly we report in Figure 14 the share of intermediate exports by BEC category. The data for this figure are taken from the UN COMTRADE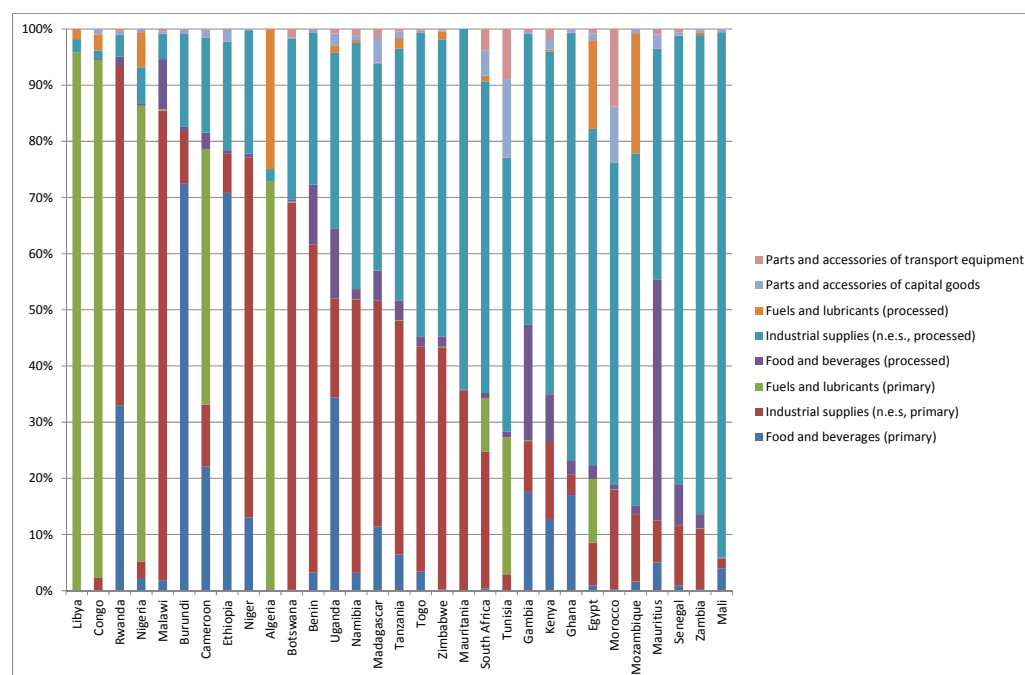 database (see section 3.2 and Table A2 in the Appendix for more details), which reports data for 31 African countries in 2010. The countries are sorted in descending order by the share of intermediate exports that involve primary products (i.e. primary food and beverages, primary industrial supplies and primary fuels and lubricants). The figure reveals that in 15 of the 31 countries, primary exports make up more than 50% of their total intermediate exports, with 23 countries having a primary share above 25%. Many of the countries with the highest shares of primary products are involved in the export of primary fuels and lubricants (i.e. Libya, Congo, Nigeria, Cameroon and Algeria). Rwanda, Malawi, Botswana and Benin amongst others have large shares of industrial supplies in total intermediate exports, with primary food and beverages exports being relatively large in Rwanda, Ethiopia, Uganda, and in particular Burundi. In terms of the non-primary intermediate exports, processed food and beverages are relatively important in Gambia and Mauritius, while processed fuels and lubricants have a relatively large share in Algeria, Egypt and Mozambique. Processed industrial supplies tend to make up the lion's share of (non-primary) intermediate exports in most countries however. This is a rather broad category that includes in addition to manufacturing goods, agricultural products and by-products, crude materials (such as rubber), textiles, cork and wood products, and leather products amongst

others. Many of these exports are likely to involve relatively simple manufacturing therefore. Perhaps the most telling observation from Figure 10 is that parts and accessories of capital goods and of transport equipment make up very small shares of total intermediate exports, with these shares being less than 10% for all but two countries (the average value being under 3% for all countries and just 1.6% when excluding Tunisia and Morocco). The two exceptions are Tunisia and Morocco, which report shares of these two categories of 22.9% and 23.7% respectively.[9] In the case of Morocco the share of intermediate exports accounted by parts and accessories of transport equipment is 13.8%, with that of capital goods being 9.9%. The relatively large share for transport equipment reflects the role of Morocco as a hub for automobile production. This is also true to an extent for Tunisia, though in this case the share of intermediate exports accounted for by transport equipment (8.9%) is lower than that for capital goods (13.9%).

Figure 14: Shares of Intermediate Exports by BEC Category in 2010

Source: UN COMTRADE

2.3.3. The Sectoral Dimension of Global Value Chain Involvement

Obtaining an understanding of the sectors in which countries are specialised within GVCs is an important step. For some African countries, there is evidence that they have been able to integrate downstream in the production network. Here the possibilities of upgrading are potentially stronger, though it is again important to understand the sectoral specialisation of their involvement in downstream production. Mauritius and Lesotho, for example, have well developed Export Processing Zones (EPZs) specialised in the production of textiles and apparel, which may limit the possibility of upgrading.

In what follows, we examine in more detail the sectoral specialisation of Africa's involvement in GVCs. In particular, we calculate the sectoral contributions to the measures of GVC participation described above for both regions and for the set of African countries. The sum across the sectors when considering the different regions therefore will be equal to the value of total GVC participation reported in Table 3. For purposes of presentation we begin by aggregating the 25 sectors into five categories (Primary; Low-Tech Manufacturing; High-Tech Manufacturing; Low-Tech Services; and High-Tech Services).[10] Using this split we then consider the contribution of each of these aggregated sectors to involvement in GVCs as measured by the GVC, FVA and DVX measures described above. Figures 15-17 report this breakdown for 2010.

Figure 15 reveals that there is a fairly even split in terms of the sectoral contributions to GVC participation for Africa, with the primary sector having a share of 26%, the two services categories around 20% each and the two manufacturing categories around 17% each. For most other regions however, the high-tech sectors contribute much more to overall GVC participation than for Africa. High-tech sectors contribute, on average, 58% of GVC participation in all countries, with the numbers being larger for developed countries (62%) as well as Central America (69%). Asia has a contribution of high-tech sectors to GVC that is around the average for all countries, though contributions in South and Western Asia lag behind those for East and South East Asia. The contribution of high-tech sectors to overall GVC participation in Africa is similar to those found in South Asia, Western Asia, the Caribbean, and Transition countries. The contribution of manufacturing to GVC participation in Africa (33%) trails behind all other regions, with the average for all countries being 66%, and with Western Asia and the Caribbean being the only other regions with shares below 40%. The share of services (41%) and primary sectors (26%) in GVC participation for Africa tend to be well above the average for all regions (26% and 8% respectively).

Results when considering the sectoral contributions to FVA (Figure 16) are even more pronounced. The contribution of high tech sectors to FVA in Africa (34%) are well below the average for all countries (66%), with only the Caribbean and Transition countries reporting comparable numbers. While manufacturing makes a much bigger contribution to FVA in Africa than it did for GVC (60%), this is still considerably smaller than the average for all countries (88%) and is the smallest of all regions (with the Caribbean having a share of 62% and Transition

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[10] See Table A1 in the appendix for more information on how industries are categorised.

countries 73%). The contribution of primary sectors to FVA in Africa (27%) however, is much larger than that for all other regions, with an average for all countries of just 3%, and Transition and South American countries having the next largest contribution of primary sectors at just 15%. Considering the contributions to DVX (Figure 17) we again find relatively small contributions of high-tech sectors (38% versus the overall average of 50%) and relatively large shares of primary sectors (25% versus an overall average of 13%). The contribution of manufacturing sectors to DVX are however more similar to other regions, with a value of 37% in Africa and 44% for all regions.

Figure 15: GVC Participation of Regions by Sector Category, 2010
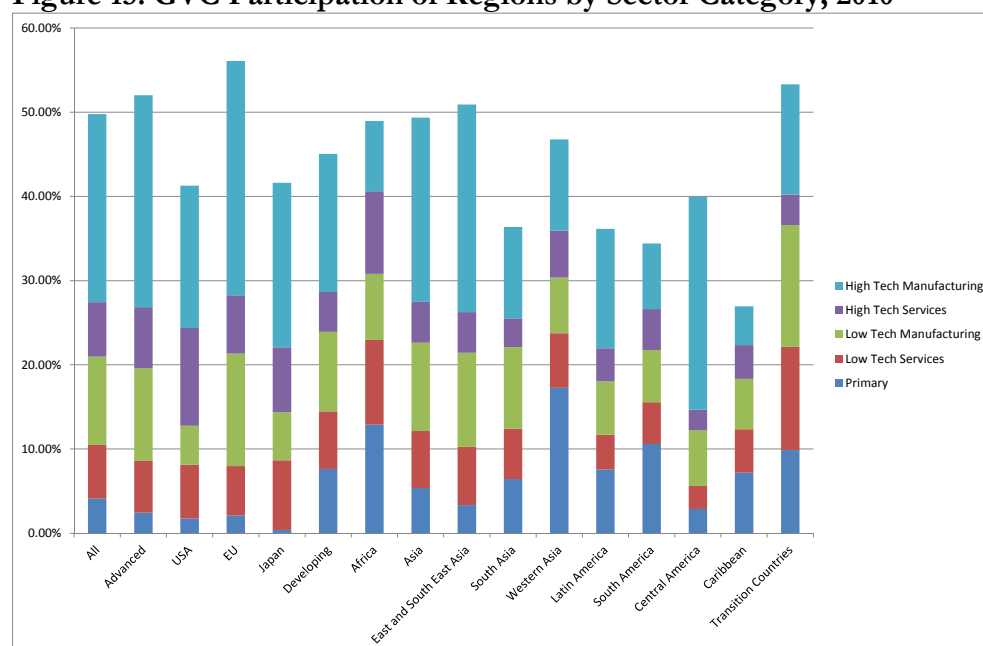
Notes: The GVC participation measure is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are the portion of a region's exports that are part of a multi-stage trade process. Exports of a region included intra-region exports. This is calculated as the sum of foreign value-added used in a country's own exports and the value-added supplied to other countries' exports taken as a ratio to gross exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 16: FVA Participation of Regions by Sector Category, 2010
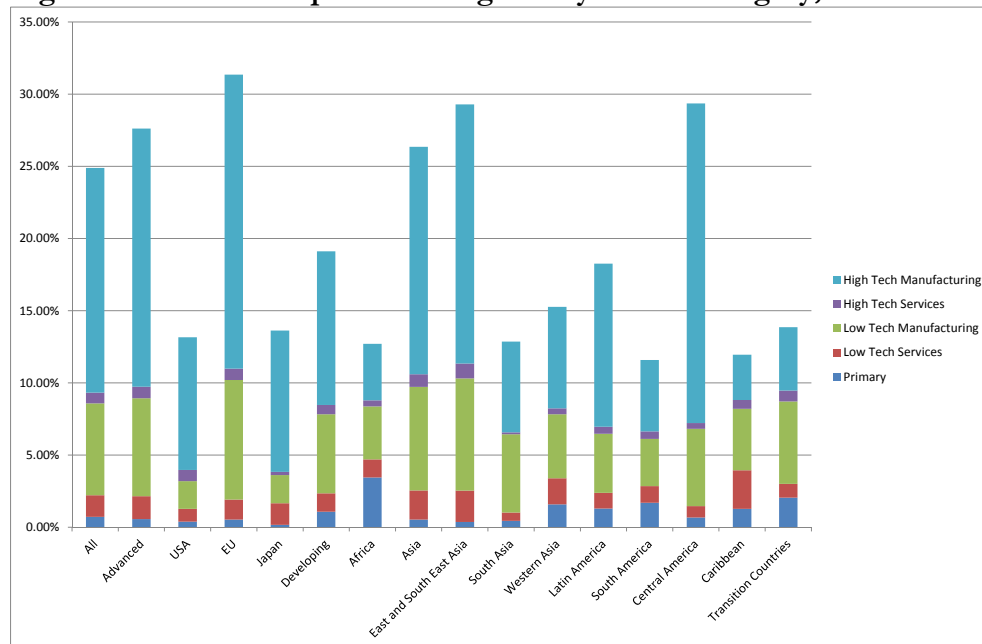
Notes: The FVA indicator is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are the ratio of foreign value-added used in a region's own exports to gross exports. Exports of a region include intra-region exports.
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 17: DVX Participation of Regions by Sector Category, 2010

Notes: The DVX indicator is constructed using the 25 sector version of the UNCTAD-Eora GVC database. Figures reported are the ratio of the value-added supplied to other regions' exports to gross exports. Exports include intra-region exports.
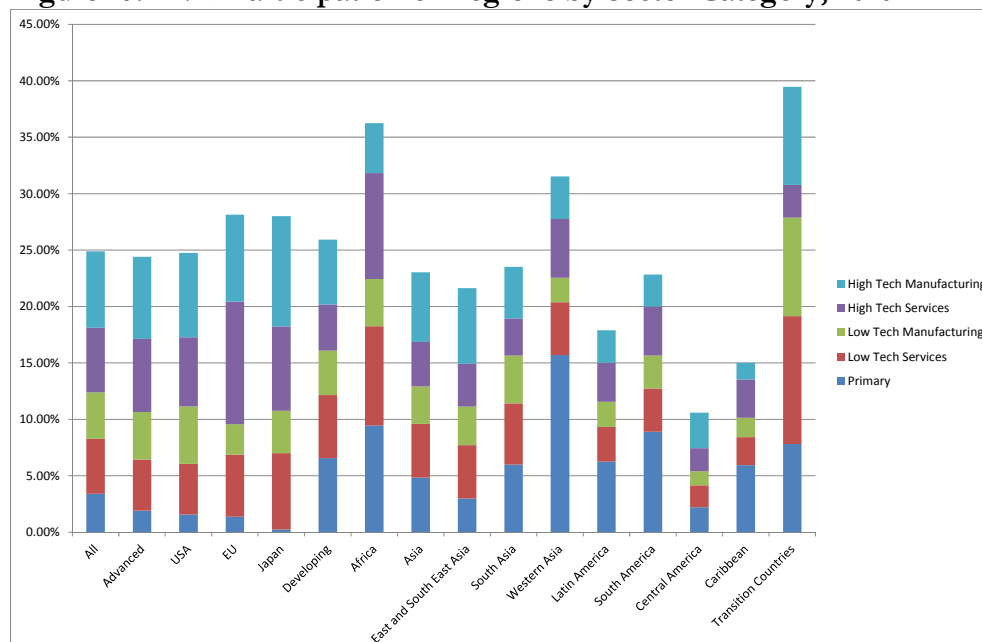Source: Calculations based on UNCTAD-Eora GVC Database

Figures 18-20 report the changes in GVC, FVA and DVX between 1995 and 2010 respectively, with the contributions of the five aggregated sectors also shown. The picture that emerges for Africa when looking at Figure 18 is that the increase in GVC participation has tended to occur in services (both low- and high-tech) and in primary sectors. The slight increase in the contribution of high-tech manufacturing is offset by a similar reduction in low-tech manufacturing. Overall however, roughly 50% of the increase in GVC participation in Africa has occurred through high-tech sectors. This contribution tends to be lower than that observed in developed regions, but compares favourably with most of the other developing regions. Contributions of high-tech manufacturing to GVC increases in Africa lag behind developed countries, as well as South Asia, South America and Transition countries.

The decline in the low-tech manufacturing contribution to GVC participation in Africa was driven by changes in its contribution to FVA (Figure 19), suggesting that Africa moved out of downstream GVC involvement in low-tech manufacturing. The relatively large increases and decreases in GVC participation due to high-tech manufacturing in other regions also tended to occur largely through FVA. The results on FVA have the further implication that the increased participation of Africa in GVCs through low- and high-tech services occurred largely through the DVX measure, which is confirmed by Figure 20. This suggests that much of Africa's increased GVC participation has been due to African services firms' involvement in upstream production.

Figure 18: Change in GVC, 1995-2010
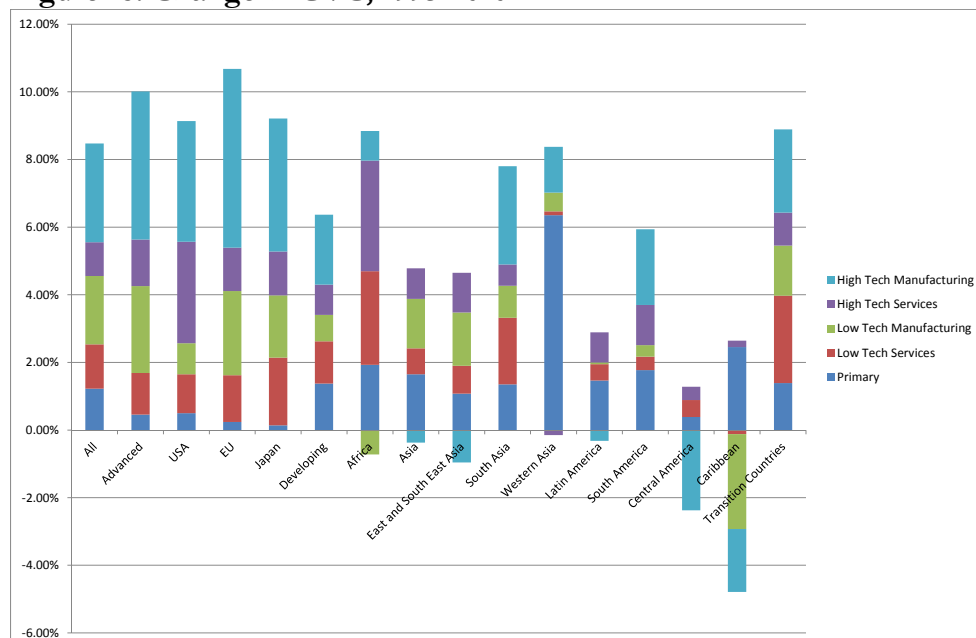
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 19: Change in FVA, 1995-2010
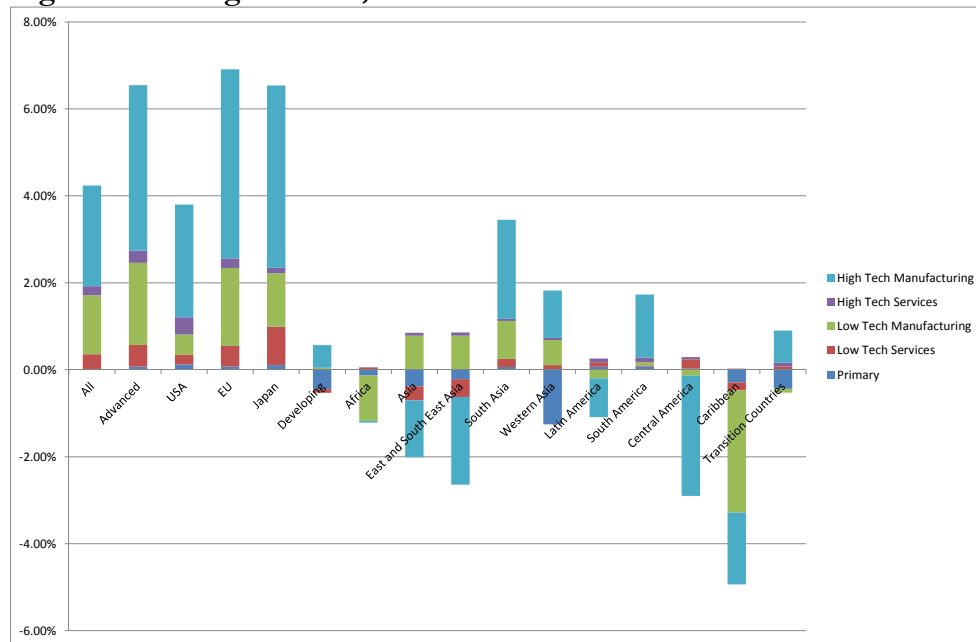
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 20: Change in DVX, 1995-2010
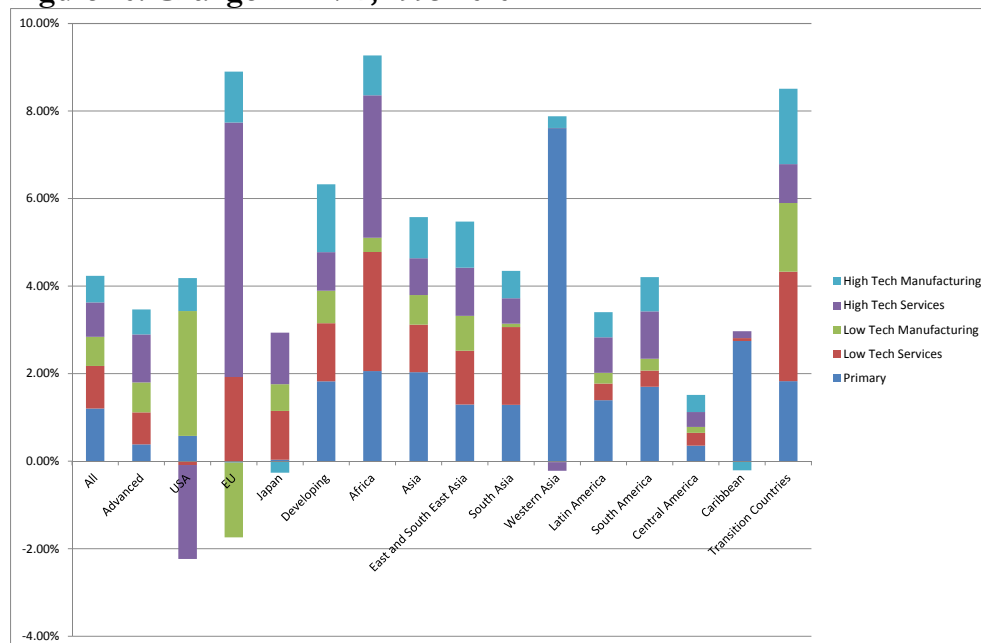
Source: Calculations based on UNCTAD-Eora GVC Database

Concentrating on the African region further, we report in Figure 21 the contribution of each of the 25 sectors to GVC participation in Africa for 1995, along with the change in the contributions between 1995 and 2010. Figures 22 and 23 then report similar figures for FVA and DVX respectively. Figure 21 shows that Mining and Quarrying, and Financial Intermediation make up the majority of GVC participation in Africa, with these two sectors also showing

relatively large increases between 1995 and 2010. Petroleum and Chemicals, Metal Products, Electrical Machinery, and Transport also contribute significantly to the value of GVC. When considering our measure of downstream GVC involvement (i.e. FVA) in Figure 22 we find somewhat different results. Financial Intermediation no longer makes an important contribution, though Mining and Quarrying continues to be important, along with Petroleum and Chemicals, Textiles and Apparel, Metal Products, and Electrical Machinery. The other notable observation from Figure 22 is that there have been few positive changes in the contributions of the different sectors to FVA over time, reaffirming earlier results that Africa has had difficulty in integrating into downstream production. Results for DVX (Figure 23) are largely similar to those for GVC, with Mining and Quarrying, and Financial Intermediation dominating. Significant contributions are again made by Petroleum and Chemicals, Metal Products, Electrical Machinery, and Transport, with Wholesale Trade, and Electricity, Gas and Water also reporting significant contributions.

Figure 21: Sectoral Contribution to GVC for Africa
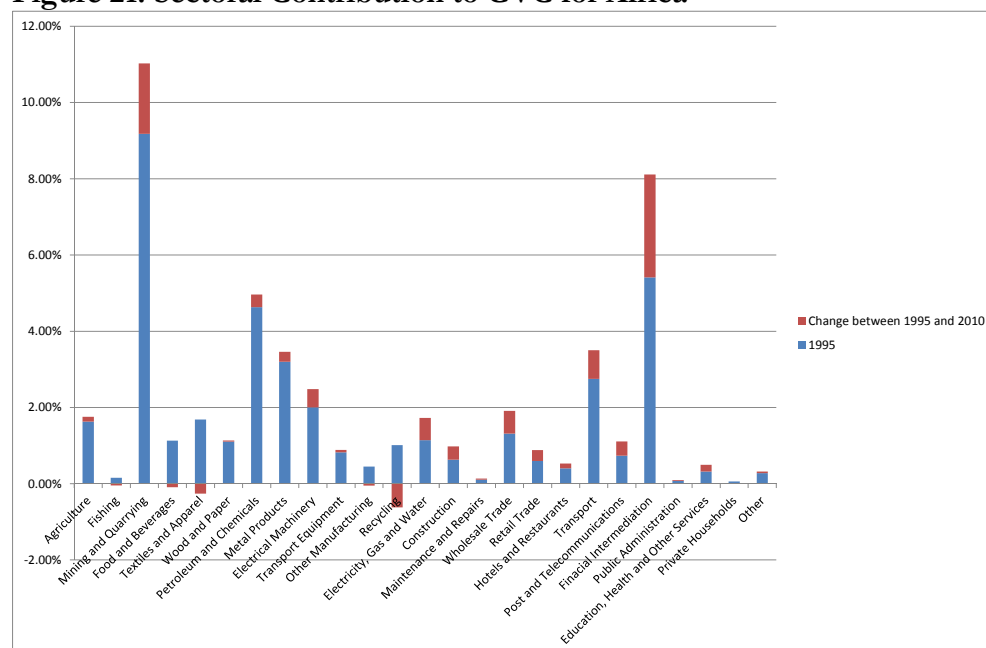
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 22: Sectoral Contribution to FVA for Africa
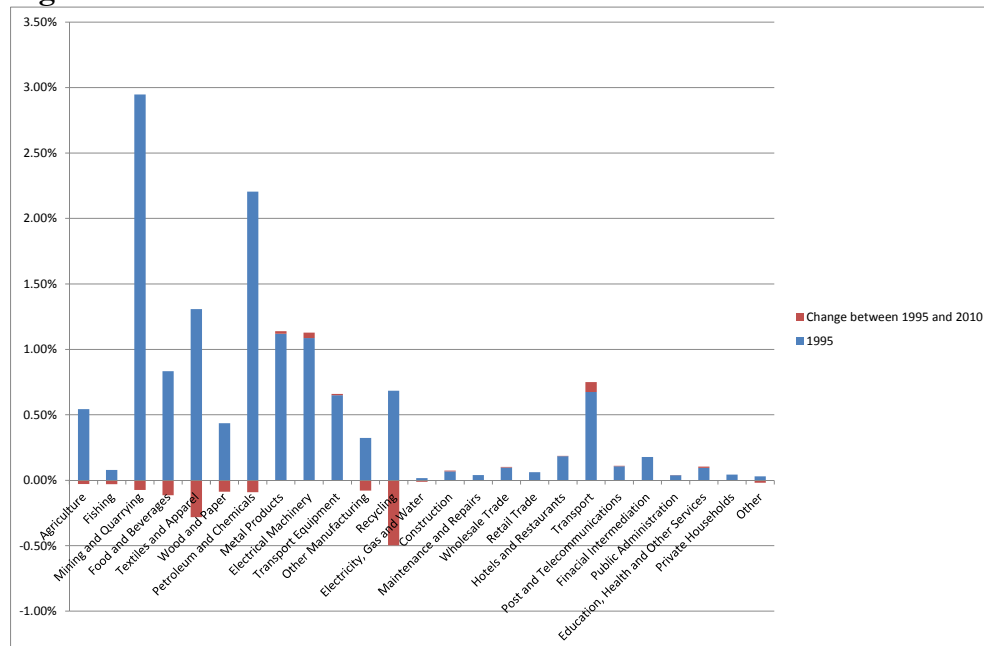
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 23: Sectoral Contribution to DVX for Africa
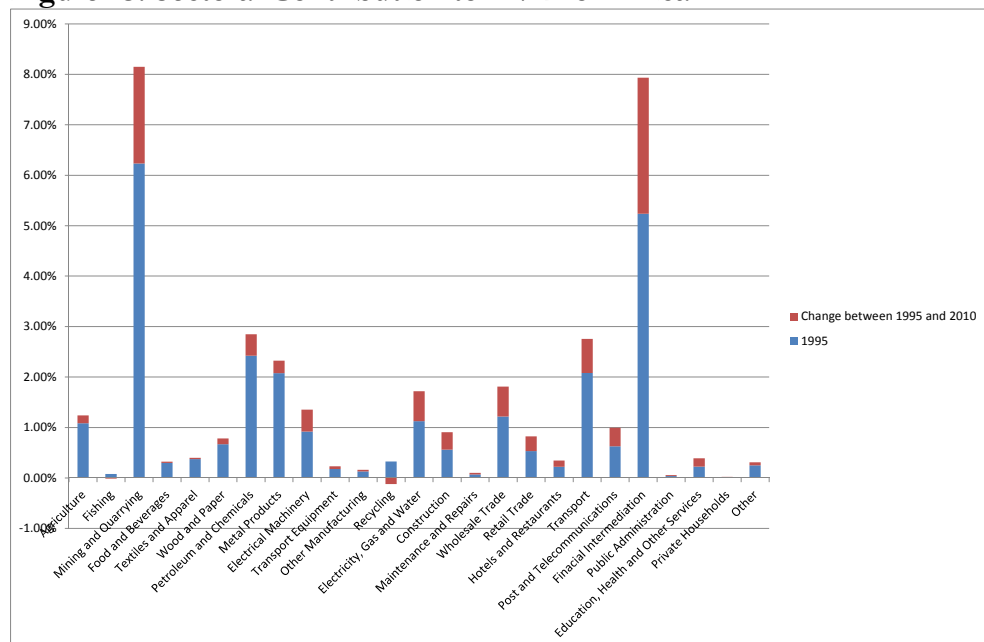
Source: Calculations based on UNCTAD-Eora GVC Database

While the results to date suggest that Africa is heavily involved in GVCs, with results in figures 21-23 suggesting that certain sectors are particularly important, the measures used do not take account of the actual volume of trade. To provide some insight into this, we report in Figure 24 the value of exports by sector in 1995 and 2010 (left-hand axis) and the share of Africa in total world exports by sector in 1995 (on the right-hand axis), with Figure 25 reporting the share of

domestic and foreign value-added in exports in 2010 by sector. Figure 24 shows that in 1995 the value of exports in most sectors was relatively low, with Africa making up just 2.8% of world exports across all sectors on average in 1995 (ranging from 0.3% in Electrical Machinery and in Transport Equipment to 9.1% in Mining and Quarrying, and 11.3% for Private Households). Despite the figures above indicating a relatively high degree of GVC participation of Africa in a number of sectors therefore, it should be kept in mind that the actual value of GVC production and trade that Africa is involved in is relatively small and dwarfed by other regions. This is particularly the case for some sectors that reported relatively high rates of FVA or DVX, such as Transport Equipment, Metal Products, and Electrical Machinery. At the same time, we observe that many sectors have experienced relatively rapid growth in exports over the period 1995-2010[11], with Mining and Quarrying showing the largest absolute increase. Many of the sectors that have shown the largest increases in exports are also those for which GVCs have increased the most, examples being Transport Equipment, Petroleum and Chemicals and Metal Products in the case of FVA, as well as Textiles and Apparel and Transport amongst others. Figure 25 confirms that the vast majority of value-added in all sectors is domestic value-added, with significant foreign value-added only observed in a small number of sectors, most notably Mining and Quarrying and Petroleum and Chemicals.

Table 24: Value of Exports by Sector for Africa in 1995 and 2010
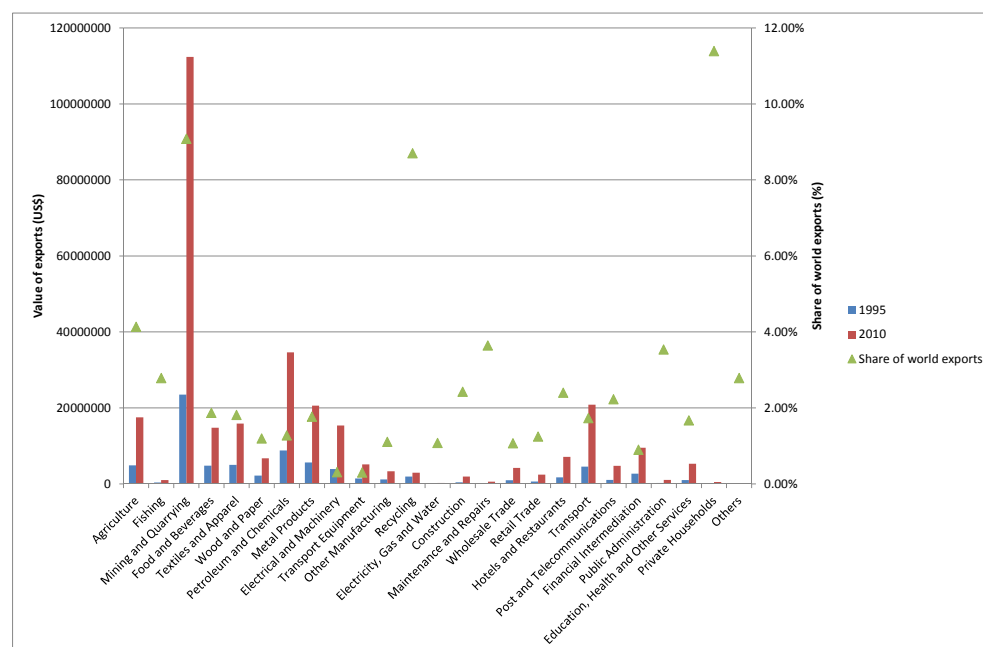
Source: Calculations based on UNCTAD-Eora GVC Database

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[11] Note that the export data are in current prices.

Table 25: Share of Foreign and Domestic Value-added in African Exports by Sector, 2010
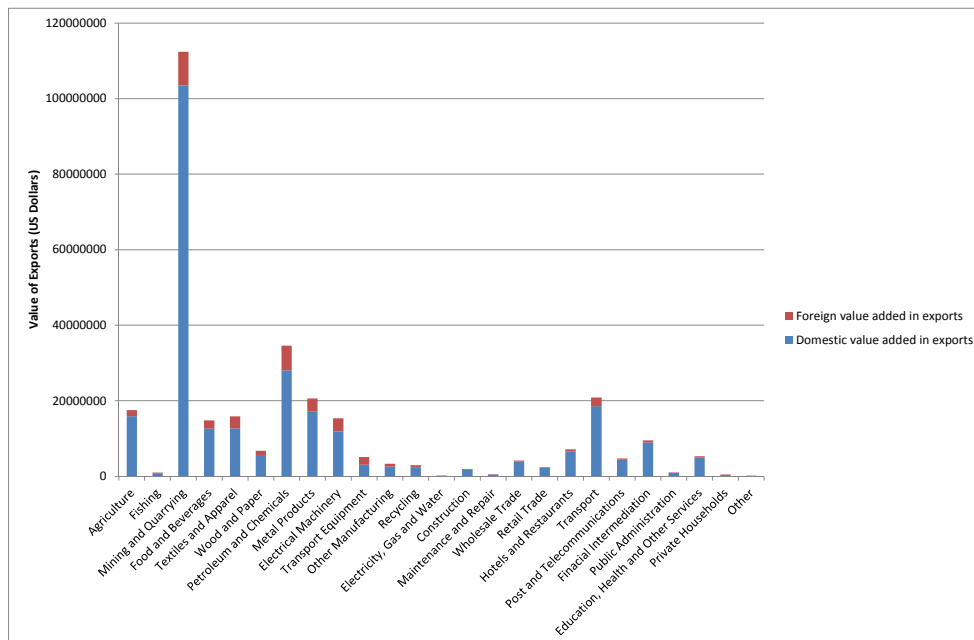
Source: Calculations based on UNCTAD-Eora GVC Database

For Africa as a whole we further report in Figure 26 a split of total GVC into sectoral contributions and into the contribution of FVA and DVX within each sectoral contribution for 2010. The figure shows that the contribution of DVX dominates the contribution of FVA to the sectoral contribution of GVC across most sectors. The contribution of FVA is above 50% in a small number of sectors however, namely Food and Beverages, Textiles and Apparel, Transport Equipment, Other Manufacturing, and Private Households.

Figure 26: Shares of FVA and DVX in GVC by Sector, 2010
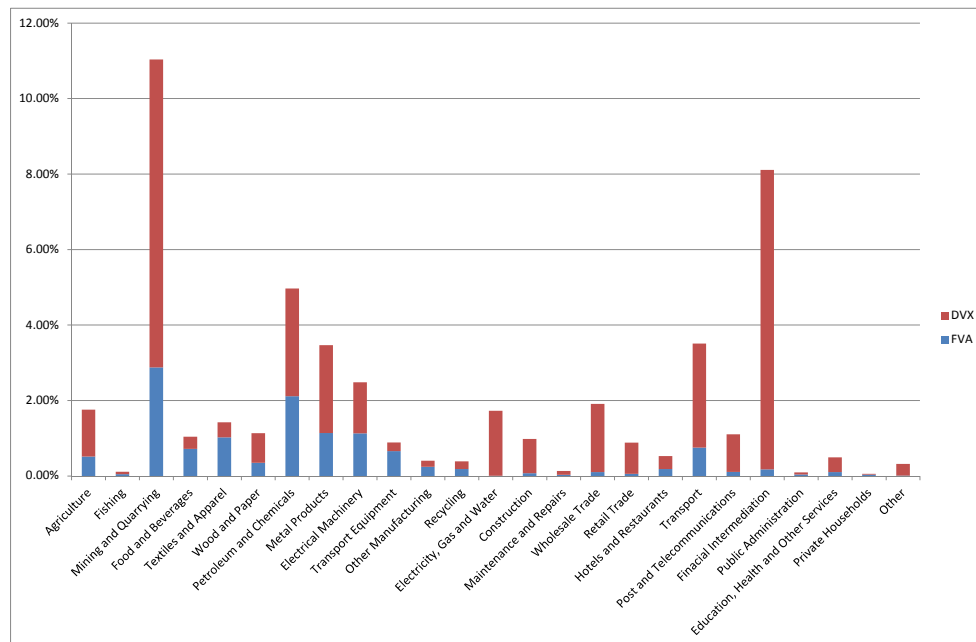
Source: Calculations based on UNCTAD-Eora GVC Database

In order to present results for individual African countries we again aggregate the 29 sectors into the five categories used above and breakdown the overall values of FVA and DVX into the contribution of these five sector categories. Figure 27 reports the contribution of each of these five sector types to total FVA for each African country in 2010, with Figure 28 reporting the change in FVA between 1995 and 2010 and the sectoral contributions to these changes. Figure 27 indicates that high-tech sectors tend to make relatively small contributions to FVA (the average across countries being 16%), with high-tech services contributing around 6% and high-tech manufacturing around 18% of total FVA across countries. The major exceptions to these general results include Chad, Djibouti, Ethiopia, Gambia and Mali in the case of high-tech services (where the contribution is over 10% of the total) and Algeria, Egypt, Morocco, Namibia, Niger, Swaziland and Tunisia in the case of high-tech manufacturing (where high-tech manufacturing comprises more than 30% of total FVA). The share of high-tech sectors in FVA in is particularly low for Angola and Gabon, with a share of less than 10%. The primary share of FVA is around 30% on average, though with a great deal of dispersion around this average. A number of countries have shares of primary sectors in FVA of around 50% or more, including Algeria, Angola, Gabon, Libya and Nigeria, with others (Botswana, Lesotho, Mauritius, Niger, the Seychelles, and Swaziland) having shares below 5%. On average, low-tech manufacturing makes up the greatest share of FVA involvement in Africa at 41%, with low-tech services having an average contribution of 13%. Low-tech manufacturing is particularly relevant in Ghana, Madagascar, Mauritius, Senegal, Tanzania, and Zambia with shares above 50%, while the share of low-tech services is above 50% in Burundi, Chad, and Eritrea.

Figure 28 indicates that when increases in FVA occur, they are not usually driven by high-tech sectors (possible exceptions being Kenya, Mauritius, Morocco, and Niger). Low-tech services are often found to be relevant in explaining the increases in FVA over time, with low-tech manufacturing being important in a number of cases (Lesotho, Madagascar, Seychelles and Tanzania). Low-tech manufacturing makes up a large share of the declines in FVA over time for a number of countries (Benin, Botswana, Eritrea, Mozambique, Rwanda, and Zambia amongst many others), with primary products being important in some countries (Angola, Benin, Gabon, Liberia, Niger, Nigeria) and high-tech manufacturing in a smaller number of cases (Namibia, Swaziland). The contribution of services to FVA declines tends to be minimal (exceptions being Angola and Eritrea, where low-tech services made a significant contribution to the decline in FVA).

Figure 27: Share of FVA by Sector Type for African Countries, 2010
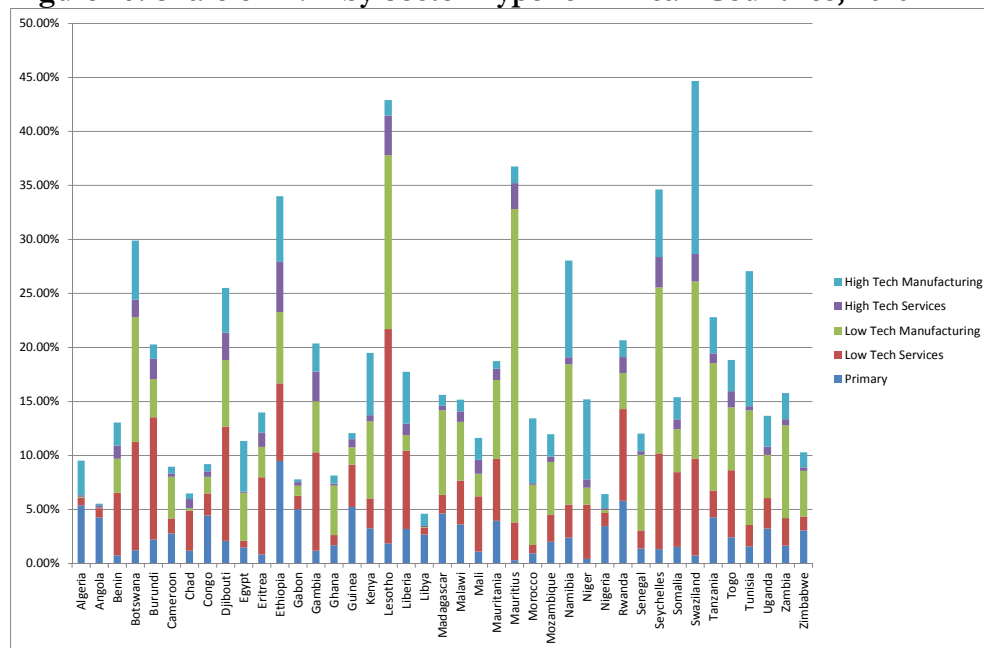
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 28: Change in the Share of FVA by Sector Type for African Countries
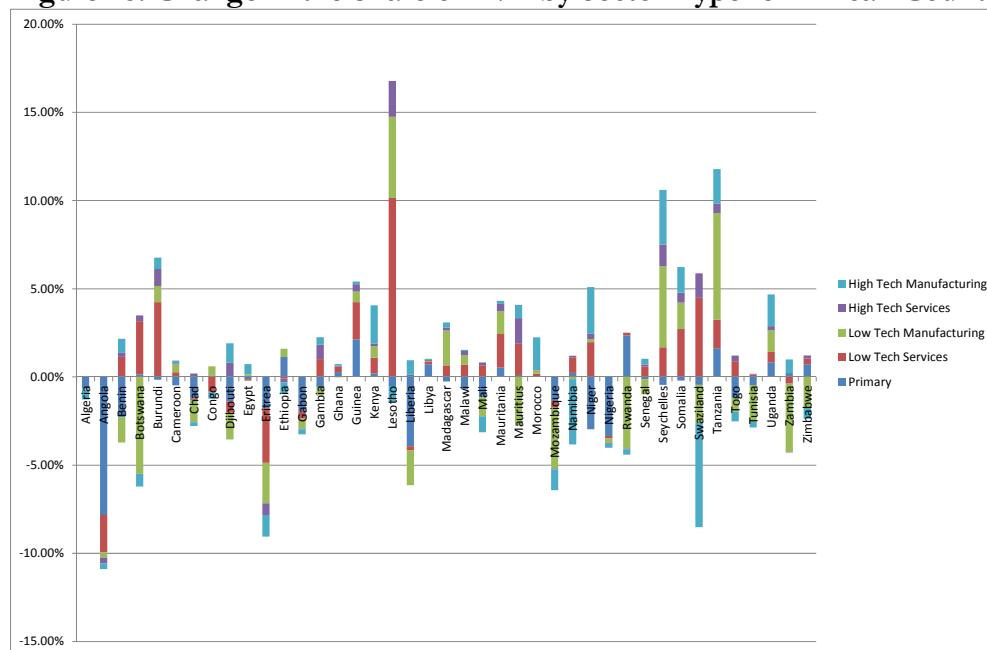
Source: Calculations based on UNCTAD-Eora GVC Database

Figures 29 and 30 report similar data to that in Figures 27 and 28, but for DVX rather than FVA. In terms of the share of DVX by sector in 2010, we observe much greater similarity across countries in terms of the contributions of the different sectors. Primary sectors tend to make up between 20% and 30% of DVX (25% on average), being somewhat larger for Guinea, Kenya, Malawi, Mauritania, Nigeria, and Togo, and somewhat lower for Botswana, Djibouti, Liberia, Mauritius, Seychelles, Tunisia and Uganda. Low-tech and High-tech manufacturing account for respectively 10% and 9.5% of DVX on average, with significantly larger contributions of low-tech manufacturing found in Ghana, Mauritius, Senegal, and Zambia, and significantly larger contributions of high-tech manufacturing found in Egypt, Morocco, Niger, and Tunisia. This implies that, on average, the major contribution to DVX comes from low-tech (28%) and high-tech (27.5%) services. Low-tech services are found to be particularly important in the cases of Djibouti, Eritrea, Ethiopia, Gambia, and the Seychelles, with high-tech sectors being particularly relevant in Angola, Djibouti, Libya, and Lesotho.

As we have already seen, changes in DVX between 1995 and 2010 tend to be positive, with one or two exceptions (Figure 30). In most countries where positive changes are observed, low- and high-tech services tend to account for the largest proportion of the change in DVX. The primary sectors make up a relatively large share of the changes in DVX in a number of countries, including the Gambia, Mauritania, Nigeria, and Somalia. Manufacturing generally contributes much less to the increase in DVX over time, though low-tech manufacturing makes up a sizeable portion of the increase in DVX for Cameroon and Mozambique, and high-tech manufacturing for Liberia, Morocco, Niger and Tunisia.

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Foreign Direct Investment as a Source of GVC Participation – The Case of Morocco

Foreign Direct Investment (FDI) is seen by many as a prime means of a country engaging in GVCs. GVCs are usually coordinated by Transnational Corporations (TNCs), with cross-border trade of inputs and outputs taking place within their network of affiliates, contractual partners and arm's-length suppliers (UNCTAD, 2013). Countries that have a higher presence of FDI therefore are likely to have a higher level of participation in GVCs, and may help generate spillovers to other domestic firms as well as through spin-offs.

Moran (2014) discusses the role of FDI in the development of value chains within Morocco, an example of an African country involved in relatively downstream GVCs (see main text), and the factors that have encouraged FDI inflows. For many years, FDI inflows were around 1% of GDP and tended to be concentrated in low-skill, low-technology, low value-added sectors. These flows rose in the 2000s to around 4% of GDP over the period 2003-2007. A number of factors have been important in encouraging FDI inflows. Despite the Arab Spring in the region, Morocco has remained politically and economically relatively stable, while macroeconomic conditions have generally been favourable. Morocco has also looked to strengthen its Investment Promotion activities, with a special mandate to seek out sophisticated investors. Efforts have also been made to upgrade the country's infrastructure, for example through the renovation and expansion of port facilities in Tangiers. Such factors have encouraged Renault to set up production facilities in Morocco, taking advantage of the proximity of Morocco to major markets in Spain, Portugal and Italy. On the negative side, Morocco has restrictive labour market regulatory structures. There is no distinction between laying off and firing workers in Moroccan labour law, with a six month notice period and relatively large severance package in effect (equal to 85 weeks of salary on average). These labour market regulations are cited as a disincentive for investors to set up operations in Morocco, as well as hindering Moroccan firms from moving into the supply chains of foreign companies that do invest.

The study of Moran also emphasises the role of good fortune in a country embedding itself in downstream production within GVCs. Morocco has developed a significant aerospace cluster around Casablanca, which arose due to the efforts of Seddik Belyamani, who was Boeing's executive president for worldwide sales in Seattle (an outcome which also emphasises the potential importance of a country's diaspora in developing GVC capabilities, and in particular a subset of influential diaspora). Creating a joint venture between Boeing and Royal Air Maroc, Belyamani and his counterpart in Royal Air Maroc, outsourced the production of parts to Morocco. In order to develop and cement its place in the GVC of this sector, an Institute for Aeronautical Training was set up to ensure an adequate supply of well-trained employees. By 2013, Morocco's aerospace exports exceeded $900 million.

Moran, T.H., 2013. Foreign investment and supply chains in emerging markets: Recurring problems and demonstrated solutions. Working Paper no. 14/12, Peterson Institute for International Economics, Washington: DC.

Figure 29: Share of DVX by Sector Type for African Countries, 2010
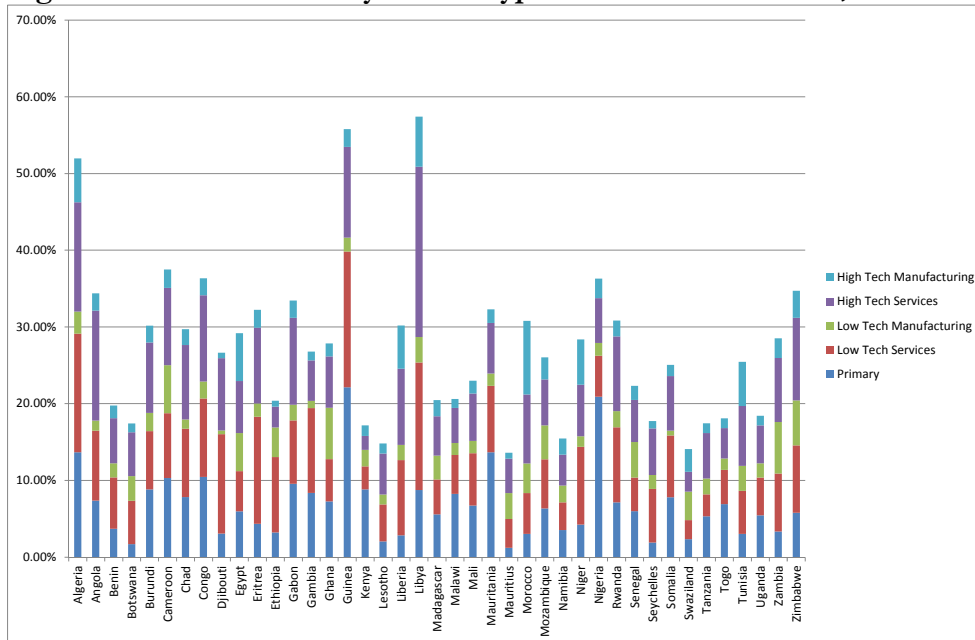
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 30: Change in DVX by Sector Type for African Countries
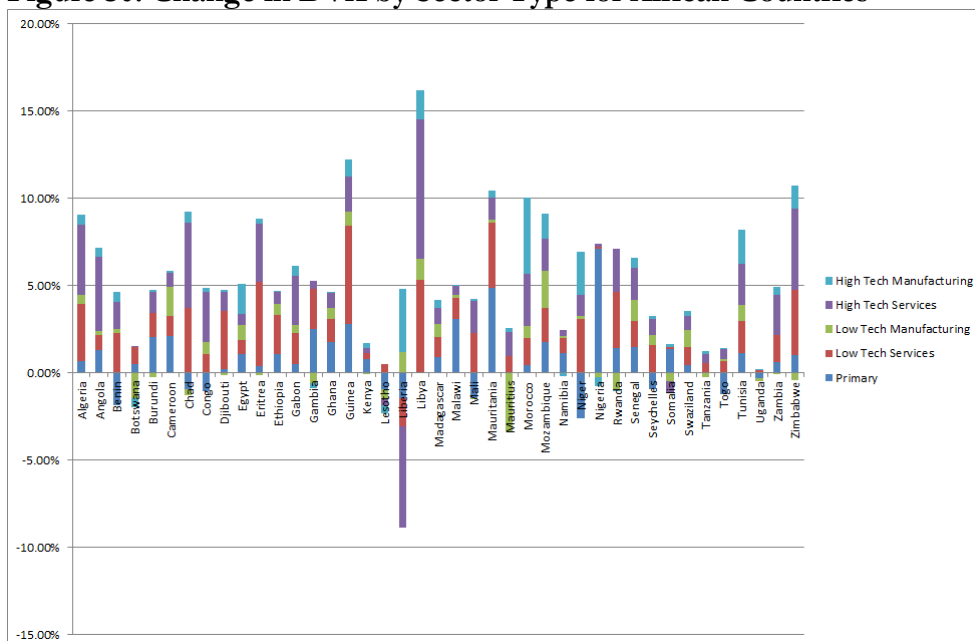
Source: Calculations based on UNCTAD-Eora GVC Database

2.3.4. The Regional Dimension of Global Value Chain Involvement

In addition to the sectoral dimension of GVC participation, it is also relevant to consider the regional dimension, examining which countries and regions share a common GVC. If African countries are able to engage in GVCs with advanced countries and regions the possibility of

knowledge and technology spillovers that can assist with technological upgrading is potentially greater, whereas if Africa's involvement in GVCs revolves around a set of firms from Africa or other developing countries the extent of such diffusion may be limited.

Figures 31-33 report the 2010 values of GVC, FVA and DVX respectively, but split up the overall values into the contributions of different regions. In the case of FVA and Africa for example, we split up Africa's share of foreign value-added in total exports into the region of origin of the foreign value-added. In the case of DVX and Africa we split up Africa's domestic value-added of intermediates inputs in the value-added of exports of other countries (in total exports of Africa) into the shares of Africa's domestic value-added going to each of our nine regions. The figures reveal that the EU contributes a great deal to overall GVC participation of other regions, particularly for the EU itself, but also for transition countries and notably Africa. East and South Asia are relatively important in the values of GVCs for Asian countries in general, while the USA is the major contributor to GVC participation for Central America and the Caribbean. Such results are suggestive of the continuing importance of geographical proximity for trade more generally, and for GVC participation in particular. Africa generally contributes very little to the overall GVC participation rates of regions, including for Africa itself. The contribution of other African countries to GVC participation in Africa in 2010 was just 5%, with the share of Europe (58%) dominating. The only other region to contribute significantly to African GVC participation was East and South-East Asia (15%). A similar pattern is observed when considering the FVA measure (Figure 28), though there is a slightly higher contribution of Africa to FVA for other African countries (10%) and a slightly lower contribution from the EU (45%). Results for the DVX measure (Figure 29) also tend to report a similar pattern, with DVX following a geographical pattern to a large extent. One thing to note from Figure 33 is that East and South-East Asia tends to contribute significantly across most regions, confirming the role of this region as a region heavily involved in final assembly (i.e. other regions provide a relatively large share of their domestic value-added through intermediates to the exports of East and South East Asia).

Figures 34-36 consider the developments in GVC, FVA and DVX participation by region over the period 1995-2010, with the contribution of each region to these changes highlighted. In the case of overall GVC participation (Figure 34) we see that the positive changes in GVC participation across regions are driven by the contributions of the EU and East and South-East Asia. What is also interesting in this figure is the negative contribution of the USA to changes in GVC participation across most regions, and particularly Latin America, with negative contributions of Japan also found across many regions. The EU and East and South-East Asia comprise the vast majority of the change in GVC participation for Africa, with these two regions making up 91% of the change (54% and 37% respectively). When we consider the change in FVA between 1995 and 2010 (Figure 35) we observe some interesting changes. While East and South-East Asia continue to make up a relatively large share of the positive changes in FVA across regions, the EU plays a much smaller role than for the change in GVC, often making a negative contribution. This is true for the case of Africa, where the EU makes a negative contribution to the change, leading to an overall negative change despite the positive

contribution of East and South-East Asia. This result implies that EU value-added in the exports of Africa has declined over time, perhaps suggesting that Africa is playing a relatively smaller role in assembly using EU intermediates. This may be the result of a switch by European firms to final production assembly elsewhere, most notably in other – perhaps new – EU members. That some of this decline has been offset by East and South-East Asia is suggestive of the role of firms in this region switching final assembly towards Africa. When considering the change in the DVX measure (Figure 36) we find results similar to those for the change in GVC, with the EU and East and South-East Asia dominating the positive changes in DVX over time. This is true for Africa, with the EU dominating the positive changes in DVX for this region. Such a result suggests that African value-added is increasingly embodied in the final exports of the EU (and to a lesser extent East and South-East Asia).

Figure 31: GVC Participation in 2010 Split up by Region
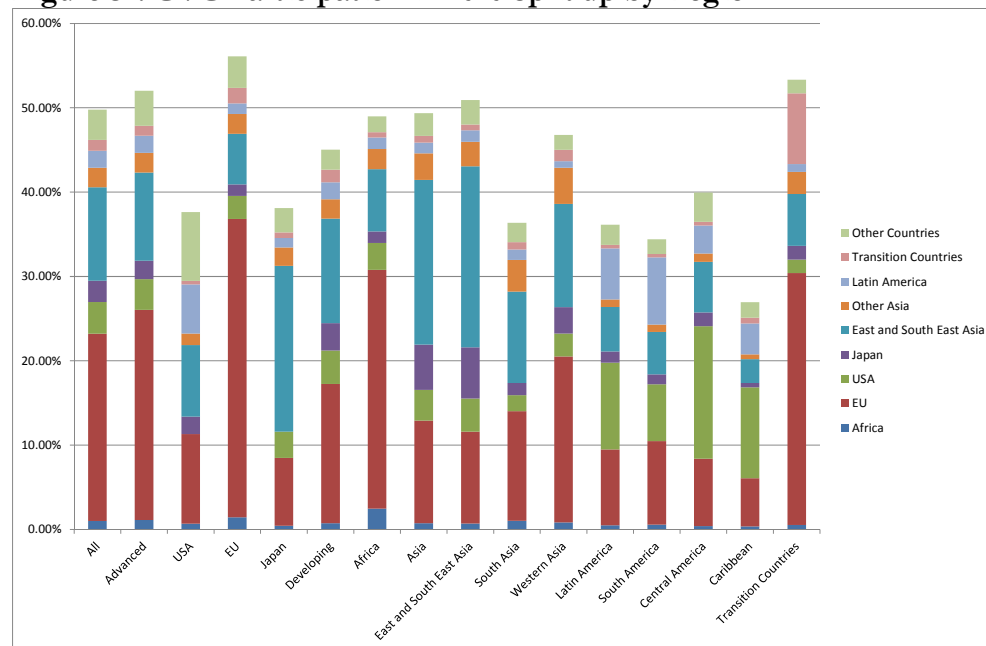
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 32: FVA Participation in 2010 Split up by Region
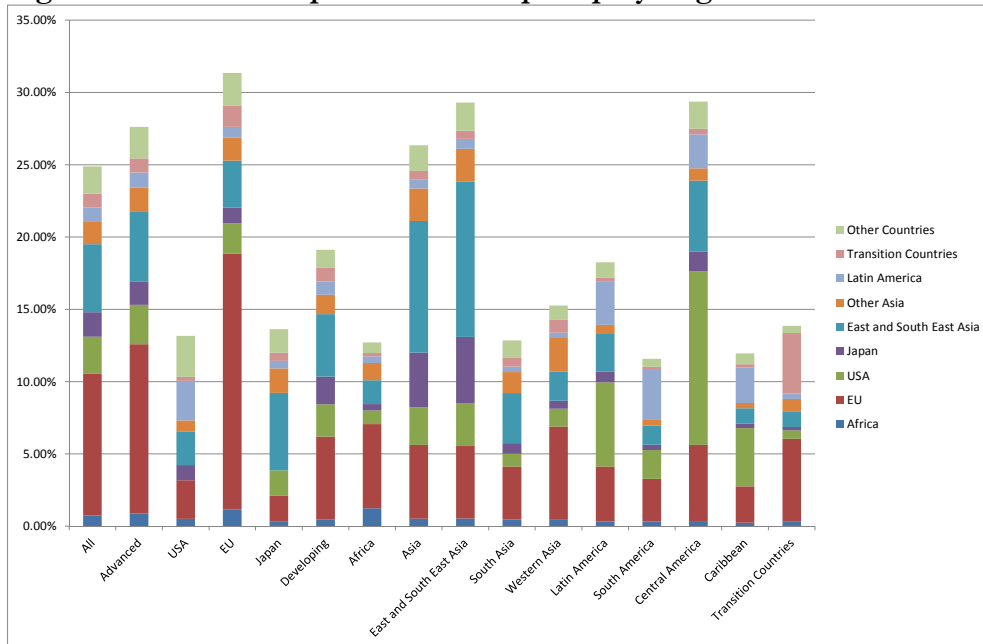
Source: Calculations based on UNCTAD-Eora GVC Database

Figure 33: DVX Participation in 2010 Split up by Region

Source: Calculations based on UNCTAD-Eora GVC Database

Figure 34: Change in GVC Participation, 1995-2010, Split up by Region

Source: Calculations based on UNCTAD-Eora GVC Database

Figure 35: Change in FVA Participation, 1995-2010, Split up by Region

Source: Calculations based on UNCTAD-Eora GVC Database

Figure 36: Change in DVX Participation, 1995-2010, Split up by Region

Source: Calculations based on UNCTAD-Eora GVC Database

To shed more light on the case of Africa we further report a breakdown of FVA and DVX by region for each African country (figures 37 and 38 respectively). Figure 37 indicates that while other African countries are not important contributors to FVA for Africa as a whole, there are numerous exceptions. Other African countries contribute more than 50% of FVA in the case of Botswana, Malawi, Mozambique, Namibia, Swaziland, Zambia, and Zimbabwe. Interestingly, these countries are situated in southern Africa, relatively distant from the EU that tends to contribute the greatest share to FVA across Africa. In other countries, the contribution of African countries to FVA is much lower, contributing less than 6% of FVA in Algeria, Egypt, Morocco, Nigeria, South Africa, and Tunisia. The simple (unweighted) average contribution of East and South East Asia across African countries is 12.5%, but again there are wide disparities across countries, with contributions being above 20% in Lesotho (42%), Madagascar (24%) and Mauritius (26%).

Turning to the DVX measure (Figure 38) we see the dominant role of the EU in the values of DVX for African countries. The unweighted average contribution of the EU to DVX across African countries is 47%, with shares above 75% being observed in Algeria, Cameroon, Cote d'Ivoire, Libya and Tunisia, and shares below 25% being observed in Cape Verde, Republic of the Congo, Djibouti, Eritrea, and Somalia. The contribution of Africa to the values of DVX for African countries is generally small, though again, there are a number of exceptions, with Malawi, Mozambique, Namibia, Togo, Zambia, and Zimbabwe reporting contributions of 15% or more. East and South-East Asia and Transition countries are the only other regions to make a significant contribution to DVX in African countries, with East and South-East Asia making contributions of 25% or more in the Republic of the Congo, Gabon, Morocco, Niger, Swaziland,

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and Zambia, and Transition countries in Burundi, Cape Verde, Chad, Djibouti, Eritrea, Lesotho, Senegal, and Sierra Leone.

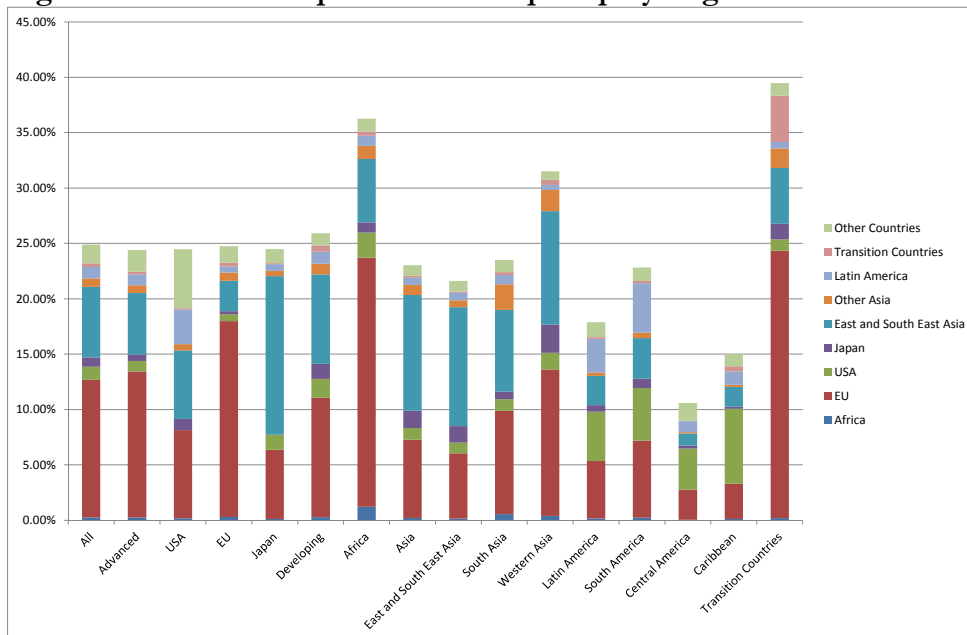**Figure 37: FVA by African Country in 2010, Split by Region**

Source: Calculations based on UNCTAD-Eora GVC Database

Figure 38: DVX by African Country in 2010, Split by Region

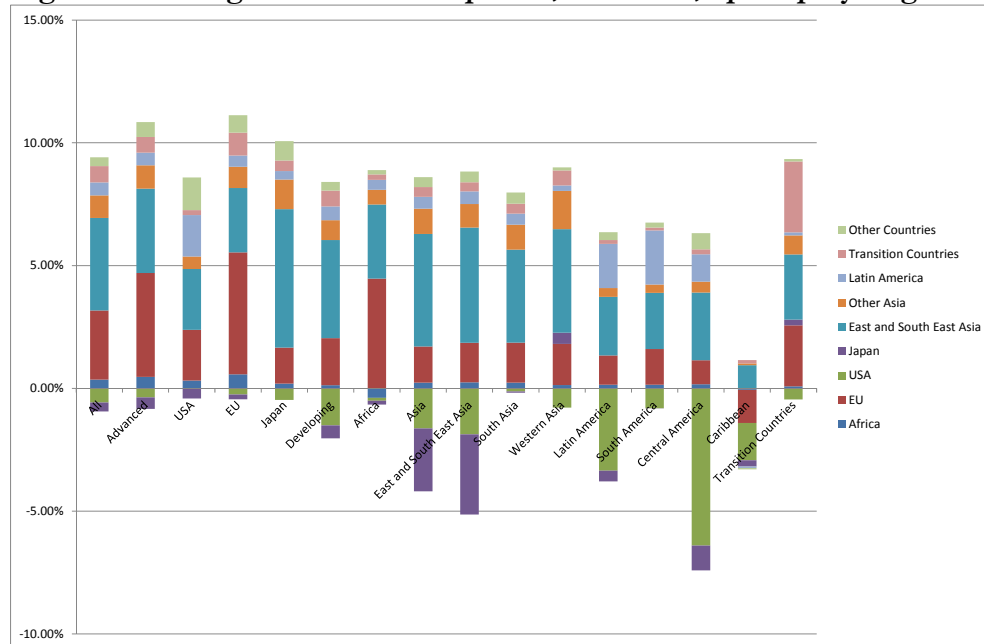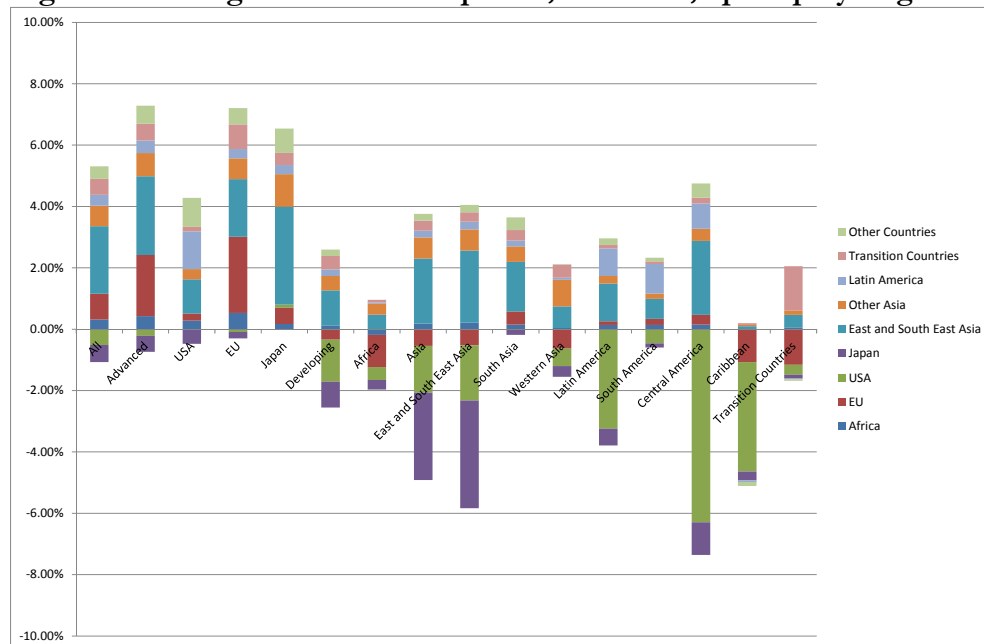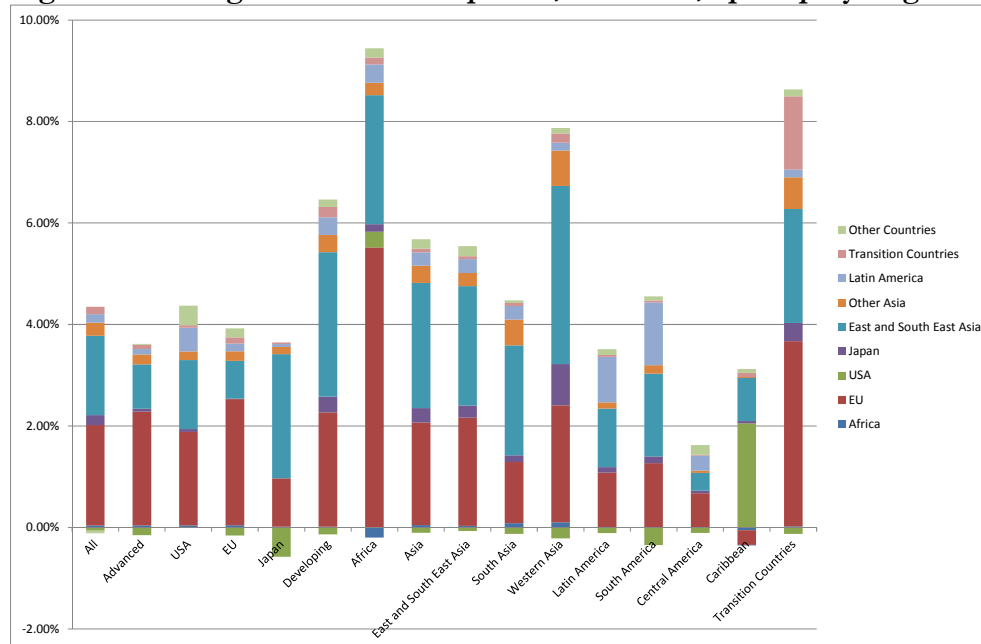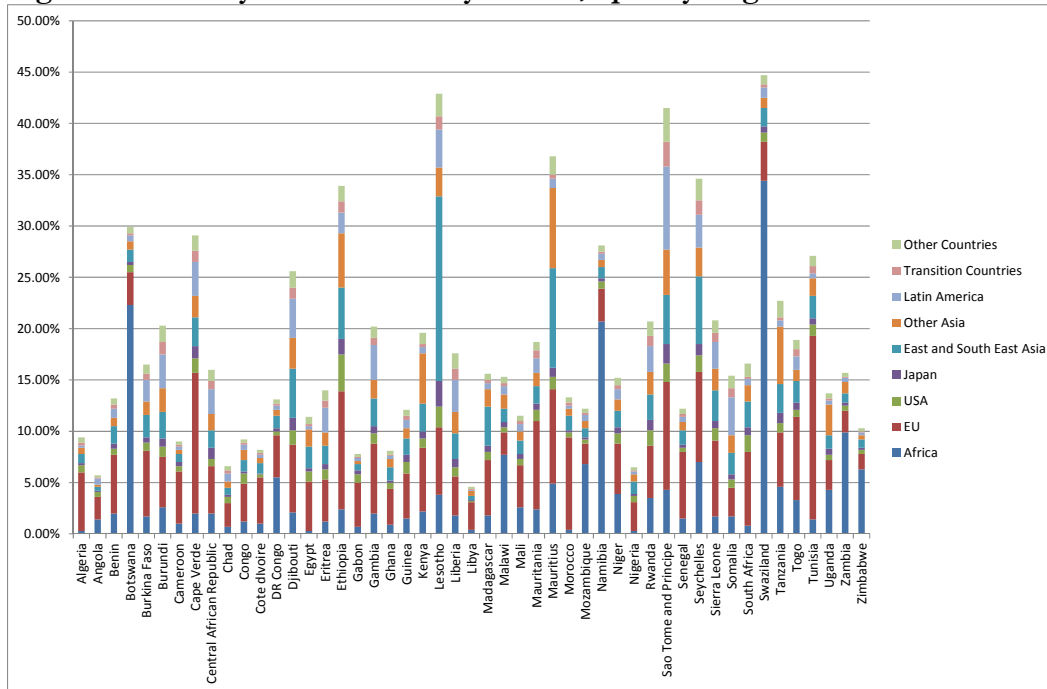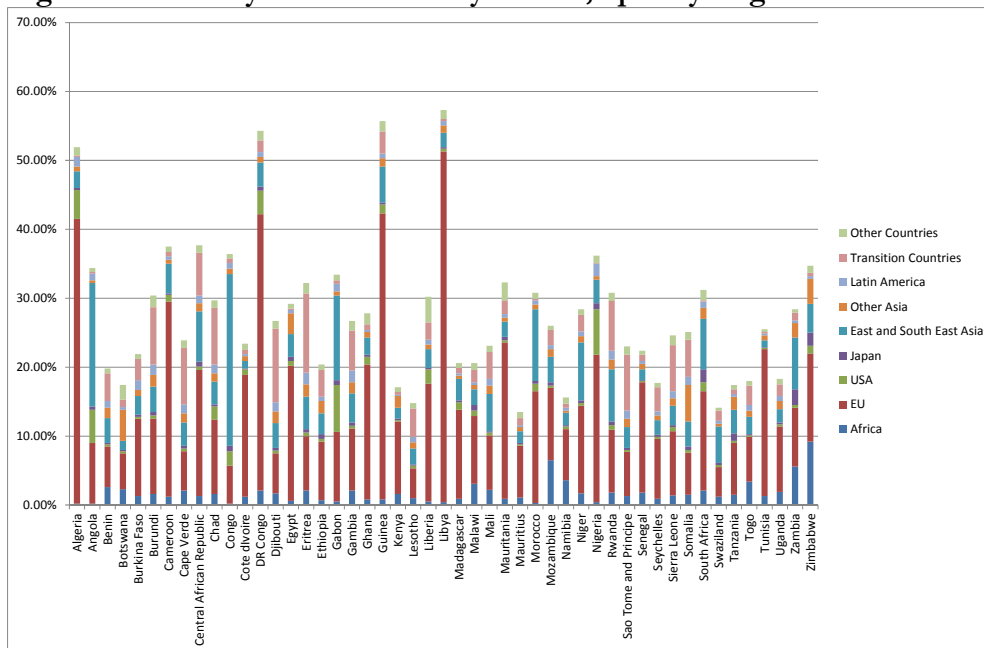Source: Calculations based on UNCTAD-Eora GVC Database

Finally in this subsection, Figure 39 reports for Africa as a whole the share of GVC participation by partner region that is due to FVA and DVX. The figure reveals that in most cases, and for the EU, East and South East Asia and the USA in particular, DVX makes up the vast majority of total GVC participation. GVC participation with these regions therefore largely involves upstream production by African countries, with the provision of raw materials for producers in these relatively advanced regions being the major role of African countries in GVCs. Only in the case of Africa and Other Asia does FVA make up more than a 50% share of total GVC participation.

Figure 39: Shares of FVA and DVX in GVC by Region, 2010
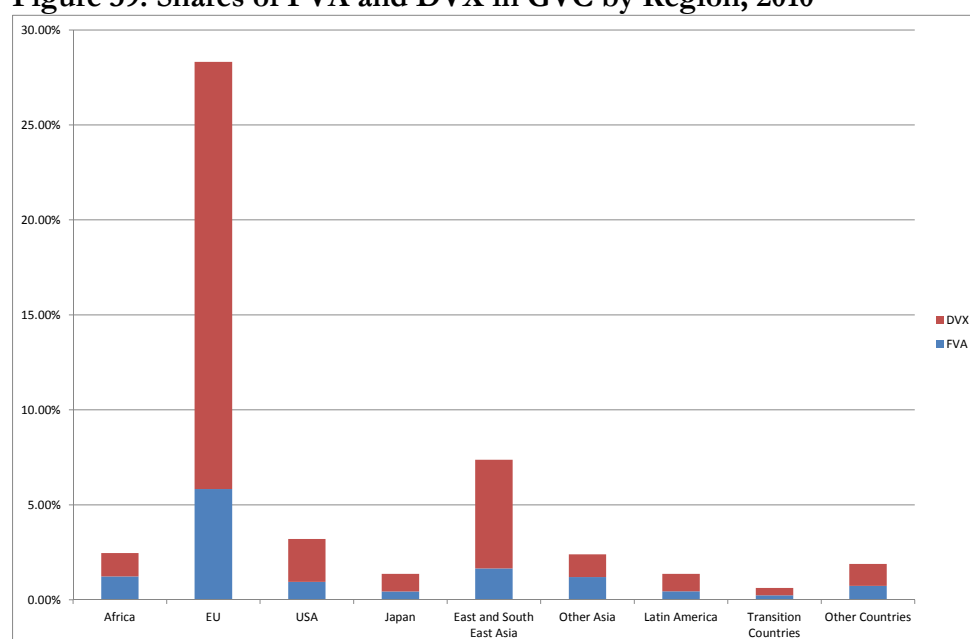
Source: Calculations based on UNCTAD-Eora GVC Database

2.3.5. Summary

This section has presented comparative evidence of the importance of GVCs for Africa as a region, as well as evidence on the extent of GVCs for individual African countries. To summarise the major results from this section, we can state that:

(i)   Africa as a region is heavily involved in GVCs, and more so than many other developing regions. This hides the fact that much of the GVC involvement of Africa is in upstream production, and involves in particular, the supply of primary goods into production of final goods in other regions and countries. Downstream involvement in GVCs is relatively small, and has shown little sign of improving in the last 15 years.

(ii)   There is a great deal of heterogeneity in GVC involvement across African countries, with a number of relatively successful countries that are heavily involved in GVCs,

and with a relatively large share of their involvement being in downstream GVCs. It needs to be borne in mind however that the measures of GVC involvement considered may overemphasise the importance of GVC involvement, since they do not account for the actual volume of exports, which is shown to be relatively low for African countries.

(iii) Manufacturing and high-tech sectors more generally are not usually a major contributor to GVC participation in African countries. While manufacturing tends to play a larger role in downstream involvement in GVCs, the primary sector still accounts for the largest part of downstream GVC involvement across African countries. Changes over time in GVC participation tend to be driven by primary and services sectors, with high-tech services being particularly relevant for many African countries. Much of the change in GVC participation over time is driven by upstream production, with evidence to suggest that low-tech manufacturing has become less important in downstream production for a number of African countries.

(iv) Intra-African GVCs are not particularly important for most African countries, with a number of exceptions in southern Africa that are more distant from other regions. The EU tends to be the biggest GVC partner for Africa, with some evidence to suggest that the contributions of East and South-East Asia, and Transition countries are increasing.

3. UPGRADING IN GLOBAL VALUE CHAINS

The analysis above has indicated that Africa participates intensively in GVCs, but that its participation tends to be largely upstream, with participation often limited to primary production where the possibilities for upgrading and spillovers may be lower. In this section we report information on a number of measures that look to capture the presence of upgrading in GVCs in African countries. Definitions and types of upgrading within GVCs vary, with Gibbon and Ponte (2005) arguing that upgrading involves producers moving up the value chain by shifting to more rewarding functional positions or by making products that have more value-added invested in them. Four types of upgrading are often distinguished (Humphrey, 2004), the four types being: (i) process upgrading, which involves increased productivity in existing activities within a GVC; (ii) product upgrading, which is the movement into higher value-added products within a GVC; (iii) functional upgrading, which involves the movement into more technologically sophisticated or more integrated aspects of a production process; and (iv) inter-sectoral or chain upgrading, which involves a movement into higher value-added supply chains. The measurement of these different aspects of upgrading is not straightforward, with most evidence coming from case studies. In our analysis we construct three alternative indicators, intended to capture one or more aspects of upgrading within GVCs. We begin by adopting the approach of Bernhardt and Milberg (2011) who capture upgrading by considering changes in export unit values and export market shares, before considering information on the sophistication of exports and product discovery.

3.1. METHODOLOGY

3.1.1.   Unit Value Ratios and Market Shares

To capture the extent of upgrading in GVCs we begin by following an approach suggested by Bernhardt and Milberg (2011). They use detailed trade data to capture economic upgrading, by plotting the change in export unit values between two time periods against the change in export market share between two time periods by sector for a large sample of countries. Export unit values, as elsewhere in the literature (e.g. Li and Song, 2011), are used to capture the quality of exports, with higher quality exports being associated with technological upgrading. As discussed by Bernhardt and Milberg (2011) increased competitiveness is usually associated with lower costs and therefore lower unit values. Upgrading then rests upon higher export unit values *and* maintained international competitiveness. Export market shares are therefore used as an indicator of cost competitiveness. Bernhardt and Milberg (2011) thus define economic upgrading as having taken place if the following two dimensions exhibit positive values:

1. The dynamics of international competitiveness of a certain sector, measured by the percentage change in world market shares between the beginning and the end of a decade.

2. The dynamics of product value, measured by the percentage change of unit values between the beginning and the end of a decade.

Bernhardt and Milberg (2011) complement the concept of economic upgrading with the concept of social upgrading. They define social upgrading as a process of improvement in the entitlements and rights of workers as social actors that improves the quality of their employment. Given limited data availability on aspects of rights of workers and labour standards, Bernhardt and Milberg (2011) define social upgrading to have occurred if there is a positive value along the following two dimensions:

1. The percentage change in the number of employees in a given sector over a decade.

2. The percentage change in the sectoral wage level – i.e. the annual wage per worker – over a decade.

In our analysis, we consider both economic and social upgrading across different sectors for the set of regions used above and for the sample of individual African countries. We further consider overall upgrading as a combination of social upgrading and economic upgrading, for which we compare the (unweighted) mean of the two economic dimensions with the (unweighted) mean of the two social dimensions.

We begin by calculating the change in unit value ratios at the 5-digit level of SITC Rev.3 and then aggregate to the sector- and country-level by taking the average across sectors for each

country (using export values as weights).[12] To avoid yearly fluctuations in the trade data and to reduce the impact of outliers we calculate the percentage change in unit value ratios between two three-year periods. In particular, we make a comparison between unit value ratios for the periods 2000-2002 and 2007-2009. Using a similar approach we calculate the change in the world export market share of each African country between each of these time periods. The dimensions of social upgrading are calculated at the sector level using combinations of 2-digit ISIC data on employment and wages. Region-level aggregates are calculated using the weighted mean of country-level results and using nominal GDP (in constant US Dollar) as weights. To lower the influence of extreme values at the beginning and end of the decade, we use the median of three consecutive years. In other words, we report the percentage change between the median of the first three years and the median of the last three years. If the value of the first year of the decade is missing, then we use the median of the second to fourth year instead.[13]

3.1.2. The "Quality" of Diversification: Sophistication

We complement the analysis further by considering a country's export structure which might also be important from a growth perspective. Hausmann et al (2007) argue that what a country produces and exports may be an important determinant of growth. There are a number of economic arguments as to why this may be the case, such as learning-by-doing, which may be more rapid for some products than for others. Baldwin (2011) criticises this approach arguing that it does not take the global value chain importance into account. For a country however it is still important to 'climb-up the ladder' by shifting workers to higher productivity jobs and to benefit from learning-by-doing effects in the longer run, even though these might still be at the lower end of the global supply chain (see Stehrer and Wörz, 2009).

Lall (2000) emphasises the relevance of the technological composition of a country's export basket for industrial development. Having an export structure with a higher technological intensity offers better prospects for future growth, because high-technology products tend to grow faster in trade due to higher income elasticity, creation of new demand, faster substitution of older products, greater potential for further learning, and larger spillover effects. Having an export structure with a lower technological intensity implies facing slowly-growing markets, limited learning potential, smaller scope for technological upgrading, and fewer spillover effects. These countries provide greater openness to entry by competitors, which might in fact stimulate temporary rapid trade growth, but this will not create *sustained* growth. After the advantage of low technology is exploited, it becomes essential to move into activities with higher technological intensity.

Although Lall's concept of technology levels serves well for many purposes, it is a rather static concept and it is only defined for relatively aggregated product groups. Also, it might not capture all aspects of a product that eventually determine its success in global markets. For example, a

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[12] For consistency we aggregate up to the level of the Eora sectors used in Section 2.
[13] Bernhardt and Milberg (2011) use the mean of three years for the same reason. We used the median instead due to its higher robustness to individual outliers.

certain product might involve a low-technology production process but requires complex logistics to be successful in global markets. To capture all such direct and indirect aspects of products in a simple way, Hausmann et al (2007) and Lall, Weiss and Zhang (2006) propose the concept of "product sophistication". Their central idea is to measure product sophistication by inspecting which products are exported by which countries and then classify a certain product as more sophisticated if its exporters have a high income per capita. Being exported by high-income countries implies that the production process of that industry exhibit characteristics that enable high-wage producers to compete in world markets. These characteristics include, inter alia, technology, infrastructure, natural resource availability, marketing and value chain management. Of particular interest to us are changes in this index for African countries, which will provide evidence of a move towards products that are exported by richer and more advanced countries.

Formally, the sophistication index of a product is calculated by averaging the GDP per capita of those countries that export this product weighted by the exporters' revealed comparative advantage in that product. The revealed comparative advantage of a product or industry i of country n is defined as the share of its exports in the country's total exports, $x_{i,n}/x_n$, relative to the share world exports of industry i in world total exports, $x_{i,w}/x_w$, hence

$$RCA_{i,n} = \frac{x_{i,n}/x_n}{x_{i,w}/x_w} \tag{1}$$

It follows that the sophistication index of product/industry i, is defined as

$$PRODY_i = \sum_n \left(RCA_{i,n} GDPperCap_n\right) \bigg/ \sum_n \left(RCA_{i,n}\right) \tag{2}$$

In addition to this product level sophistication measure, Hausmann et al (2007) introduce a country level sophistication measure in the form of a weighted average of all product level sophistication levels, where the weights are the products' value shares in the country's total exports[14]:

$$EXPY_n = \sum_i \left(\frac{x_{i,n}}{x_n} PRODY_i\right) \tag{3}$$

For the calculation of $EXPY$ in (3), Hausmann et al (2007) use the average $PRODY$ of three fixed years, namely those with the largest number of observations. One disadvantage of this approach, as discussed by McCann (2007), is that it fails to take account of changes in global trade patterns over time. More specifically, the $EXPY$ in (3) captures how the composition of products has changed over time, while disregarding any change of the $PRODY$ of products over time. McCann (2007) thus proposes to use each year's $PRODY$ values to calculate the same year's $EXPY$ values. This alternative measure, however, is likely to exhibit a tendency to grow over time by construction, because all $PRODY$ values grow with GDP per capita growth if

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[14] Note that dividing by the sum of weights equals dividing by 1, hence the denominator is omitted.

export portfolios do not change drastically. In this regard, interpreting an individual country's *EXPY* time series is not straightforward. In our analysis, we use the average of *PRODY* over the years 2008-2010.

3.1.3. Product Discovery

It is important to distinguish between whether diversification takes place within existing sectors or by introducing new sectors that have not been exported before and are discovered to be profitable. The term "discovery" in this context was used by Hausmann and Rodrik (2003) to denote the production of a new good that does not necessarily stem from innovation but from entrepreneurial copying from abroad. This notion is particularly relevant in the context of developing countries, as entering new export lines within a given trade data nomenclature does not involve genuine innovation in the sense of creating a totally new product, because the nomenclature consists of known products. Hence, to start exporting in previously inactive product lines implies exporting a product that is probably already exported by another country. Still, such discoveries involve entrepreneurial risk and capabilities. In the context of GVCs, a movement into new product lines can indicate product, functional or intersectoral upgrading, though it should be borne in mind that discovery as defined below can occur in any sector and need not involve the discovery (or export) of more technologically advanced products.

Several definitions of what constitutes a "discovery" have been suggested in the literature. We construct a "conservative" version that is similar to the one in Klinger and Lederman (2006), a "liberal" version that corresponds to the analysis of export spells by Besedes and Prusa (2006), and a "moderate" version as in Cadot et al (2011). The difference between these versions lies in the intensity and the length of the time window under consideration, with certain trade-offs between a short and a long time window. To illustrate these trade-offs, consider that a country exports a certain good only in the years t and $t + 2$, but does not export that good in the year $t + 1$. On the one hand, if the notion of "discovery" should include short-term entrepreneurial trial and error, then such a situation corresponds to two discoveries. Also, depending on the aggregation level of export data, it is unknown to the researcher whether two exactly identical products got exported or two products that are different but similar. In the latter, more realistic case, two distinct entrepreneurial actions took place, providing further justification for defining them as two separate discoveries. On the other hand, if the notion of "discovery" should describe a successful long-term development of an export line, it is more meaningful to consider only goods that are exported above a certain threshold for several consecutive years.

Aside from this conceptual trade-off, the quality of data should also be considered. If there is a gap in exports of a particular product line of just one year – like in the above example – then it is possible that this gap is due to non-reporting instead of non-exporting. The choice of export length therefore also corresponds to the choice of sensitivity against misreporting. As will be discussed in the data section further below, we treat missing entries as not-reported positive values only if the country has not reported any exports in a given year, otherwise we treat missing entries as zero exports.

For the conservative version, the number of product discoveries in a given country in the 2000s is defined as:

$$Disc^{2000s} = \sum_i \begin{cases} 1 \text{ if } x_i \geq US\$ \ 10.000 \text{ if } t = 2009, 2008, 2007 \wedge \ x_i = 0 \text{ in } t = 2000 \\ 0 \text{ otherwise} \end{cases} \quad (4)$$

For the liberal version, a product discovery occurs if a product line is active in a given year but inactive in the preceding year. The number of product discoveries by country and year is thus defined as:

$$Disc^t = \sum_i \begin{cases} 1 \text{ if } x_i > 0 \text{ in t } \wedge \ x_i = 0 \text{ in } t-1 \\ 0 \text{ otherwise} \end{cases} \quad (5)$$

The moderate or intermediate version was introduced by Cadot et al (2011), who argue that a product discovery occurs if a country's product line was not active in the two preceding years but active in the two following years, which corresponds to a five-year window. The number of product discoveries is thus defined as:

$$Disc^t = \sum_i \begin{cases} 1 \text{ if } x_i > 0 \text{ in } t, t+1 \ \wedge \ x_i = 0 \text{ in } t-1, t-2 \\ 0 \text{ otherwise} \end{cases} \quad (6)$$

3.2. DATA

Export data are obtained from the UN COMTRADE database at the 5-digit level of the SITC Revision 3 classification. Information on the use of goods is added by applying the 5-digit SITC-BEC-conversion table together with BEC groups of capital goods, intermediate goods and consumption goods (see appendix).[15] Similarly, sectoral aggregates are calculated by applying the 5-digit SITC-ISIC-conversion table and further aggregating by Eora sectors.

The COMTRADE database contains a significant number of missing values on the product level, which are often likely to represent an export value of zero.[16] If a country has reported any exports in a certain year, then all missing values of that country and year are therefore replaced by zero values. If, however, a country has not reported any exports in a certain year, then these missing values are rather likely due to non-reporting than to non-exporting. Our treatment of such non-reported values depends on the specific analysis. For measures of discovery events, the relevant information is whether a product was exported or not. We therefore maximise the number of useable observations by replacing these cases of missing values with linear

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[15] Conversion tables between SITC and ISIC only exist for the 5-digit level of SITC, which is our justification for using this level of disaggregation. If a 4-digit product does not have any 5-digit sub-division, we create an artificial 5-digit product with the same content.

[16] Cadot et al (2007:6) state that UN COMTRADE "does not always report inactive export lines as zero lines, as national customs often omit those lines."

interpolations from preceding and subsequent years.[17] For all other measures, i.e. sophistication and economic upgrading, however, the particular level of exports matters a lot, and using interpolated data would thus affect the results by construction. We therefore abstain from any interpolation in the calculation of these measures these cases, and restrict the analysis to years for which reported data is available.

Data on GDP are obtained from the World Bank's World Development Indicators using constant 2000 US dollars, while the indicators of employment and wages are from UNIDO's Industrial Development Statistics (INDSTAT4), which provides data on employment and wages according to the International Standard Industrial Classification (ISIC) system.

3.3. RESULTS

This section is split into four subsections. Section 3.3.1 reports results of the economic and social upgrading measures for geographical regions and for individual African countries; Section 3.3.2 reports results from the export sophistication measures; Section 3.3.3 presents the results on product discovery; and Section 3.3.4 summarises the results on the different indicators of upgrading.

3.3.1. Economic and Social Upgrading

Economic and Social Upgrading by Region

Figure 40 reports for each of 13 sectors for which trade data are available from UN COMTRADE the changes in market shares and unit values for each of the regions used in Section 2.3 during the 2000s, thus capturing economic upgrading.[18] The initial thing to notice from this figure is that there is little evidence of product downgrading (indicated by being in the lower left quadrant) for any region. Only in the case of Japan in Education, Health and Other Services is there any evidence of product downgrading. There are also very few cases of regions being in the indeterminate case of having positive market share changes and negative unit value changes, with the USA in Education, Health and Other Services being one such case. There are numerous cases of the alternative indeterminate case of positive unit value changes and negative market share changes, with the USA, Japan (and Advanced Countries more generally) and the Caribbean often found to be in the upper left quadrant. For most regions and most sectors however, economic upgrading according to this measure is the norm.

Across the different sectors we tend to see evidence of economic upgrading in Africa. Percentage changes in the two aspects of economic upgrading tend to be relatively large across a

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[17] For example, Slovenia did not report any trade data in the year 1994, but it did so in the years 1993 and 1995. Product line 72834 was positive in 1993 and 1995, hence we used a linear interpolation for the year 1994. Note that if that product line was zero in 1993 and 1995, this procedure would adequately insert a zero. Also note that we only interpolated, never extrapolated.

[18] Note that country coverage is generally not as complete when using the COMTRADE data when compared with the Eora data. It should also be borne in mind that export data are reported in current US Dollars.

broad range of sectors, being particularly large in Electrical and Machinery; Transport; and Other Manufacturing.

Figure 40: Economic Upgrading by Region, 2000s

Economic upgrading by region, 2000s
Petroleum and Chemicals

Economic upgrading by region, 2000s
Metal Products

Economic upgrading by region, 2000s
Electrical and Machinery

Economic upgrading by region, 2000s
Transport Equipment

Economic upgrading by region, 2000s
Other Manufacturing

Economic upgrading by region, 2000s
Electricity, Gas and Water

49

Economic upgrading by region, 2000s
Education, Health and Other Services

Figure 41 reports results for social upgrading for a smaller sample of eight sectors for which UNIDO's INDSTAT4 reports data.[19] The figure again reveals little evidence of downgrading, along the social dimension in this case, nor any indeterminate cases of increased employment but lower wages. There are a number of cases however of increased wages combined with reduced employment, with this being the norm in transition countries, and often the case in the EU and advanced countries overall. We find evidence of social upgrading for Africa in six of the eight sectors (Food and Beverages; Petroleum and Chemicals; Metal Products; Electrical and Machinery; Transport Equipment; and Other Manufacturing), though where evidence of social upgrading is found for Africa its extent tends to be lower than for other regions for which upgrading is also found. In general, the change in wages tends to dominate the change in employment for Africa, with the one slight exception being transport equipment.

Figure 41: Social Upgrading by Region, 2000s

Social upgrading by region, 2000s
Food and Beverages

Social upgrading by region, 2000s
Textiles and Apparel

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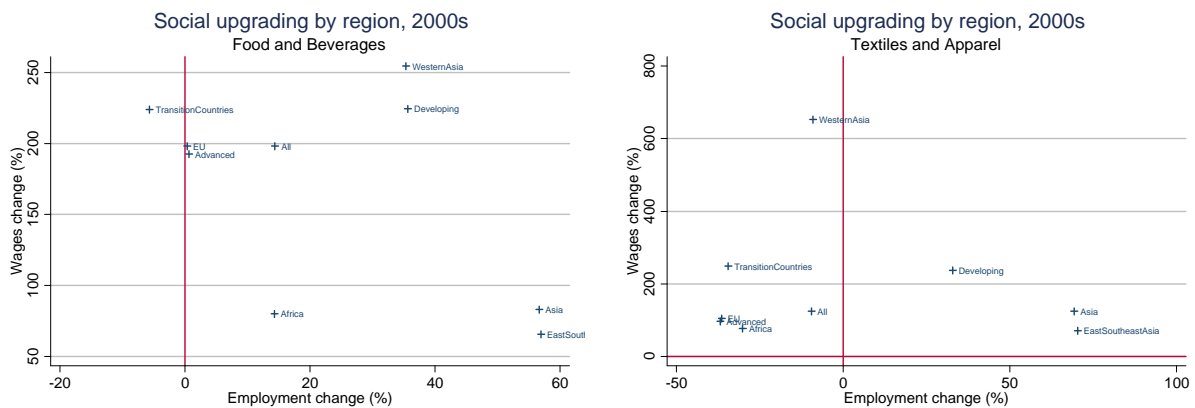
[19] Country samples are again considerably smaller than those available from the Eora dataset, and indeed the COMTRADE database.

Social upgrading by region, 2000s
Wood and paper

Social upgrading by region, 2000s
Petroleum and Chemicals

Social upgrading by region, 2000s
Metal Products

Social upgrading by region, 2000s
Electrical and Machinery

Social upgrading by region, 2000s
Transport Equipment

Social upgrading by region, 2000s
Other Manufacturing
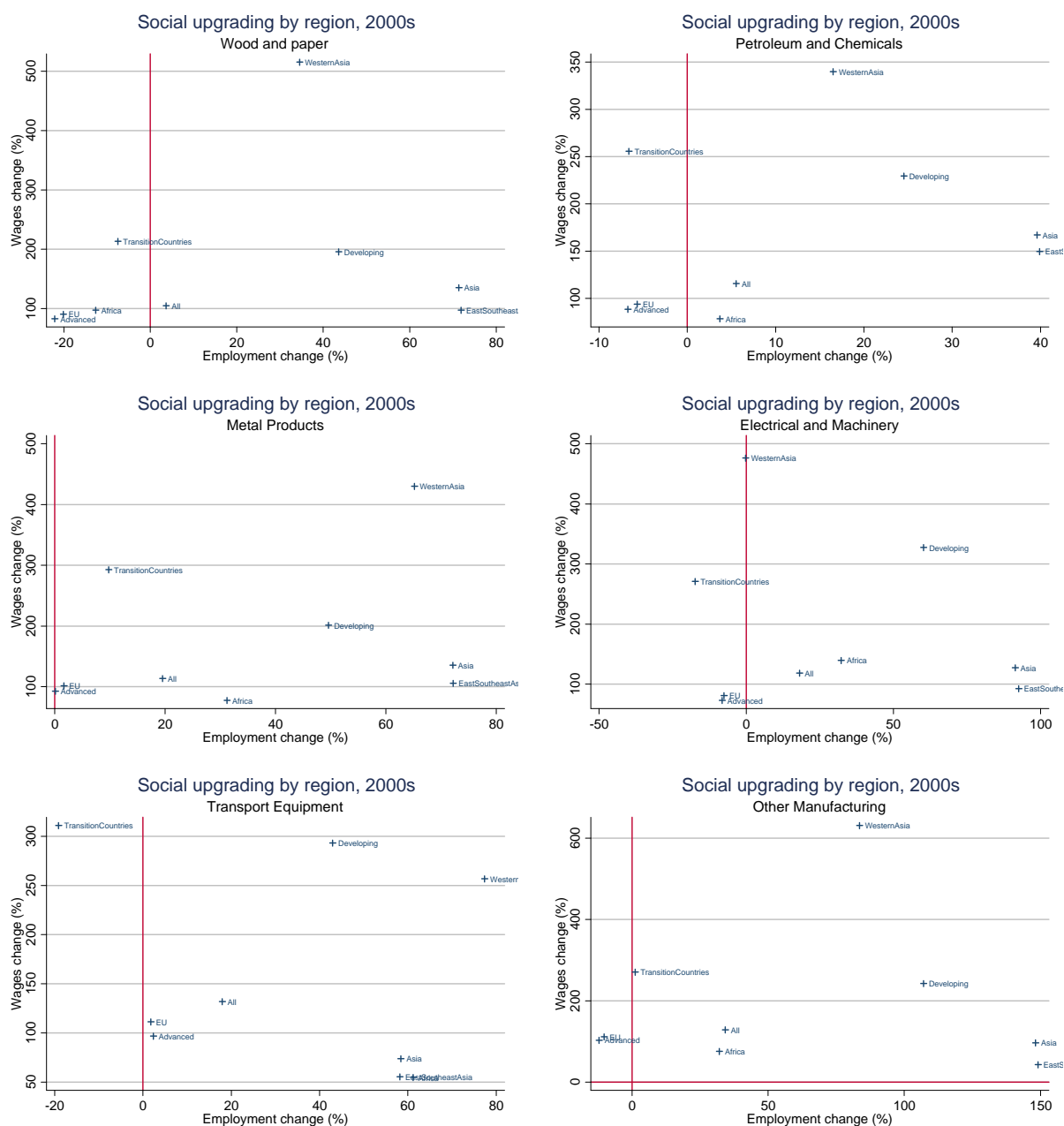
Economic and Social Upgrading by African Country

Figure 42 reports the extent of economic upgrading during the 2000s across the 13 sectors for individual African countries. Due to issues of data availability we only have detailed trade data for around 20 African countries (depending on the sector). The first thing to note from Figure 42 is that there is little evidence of economic downgrading across the different sectors. Despite this general statement there are individual occurrences of downgrading, for example, the Gambia in Agriculture, Burundi in Fishing, Ethiopia in Mining and Quarrying, Niger in Food and Beverages, Algeria in Textiles and Apparel, and Zambia in Wood and Paper. Evidence of economic upgrading tends to be a common outcome across all sectors, with Fishing, Mining and Quarrying, and Electricity, Gas and Water (where data are scarce) being the major exceptions. In

the indeterminate cases (upper-left and lower-right quadrants) we find across sectors that countries tend to be concentrated in the upper-left quadrants, indicating that they have been able to increase the unit values of their exported products, but at the expense of a declining market share. Only in a few cases do we observe increased market share and reduced unit values, examples being Uganda in Fishing, Malawi in Mining and Quarrying, Benin in Transport Equipment, and Malawi, Namibia and Uganda in Education, Health and Other Services.

Figure 42: Economic Upgrading by African Country, 2000s
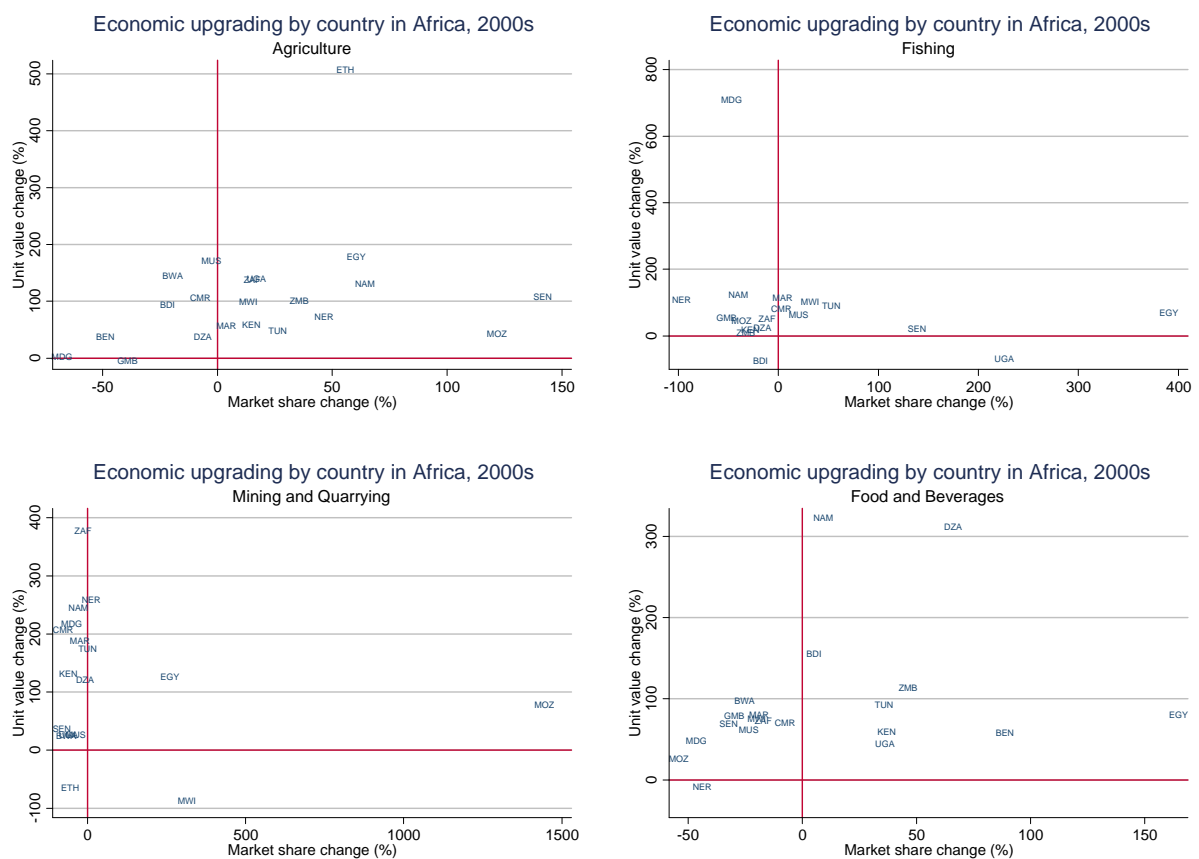
Note: Zambia with a unit value change of 6,363% and market share change of 307% is dropped from this figure

Note: Ethiopia with a unit value change of 2,215% and a market share change of 12% is dropped from this figure
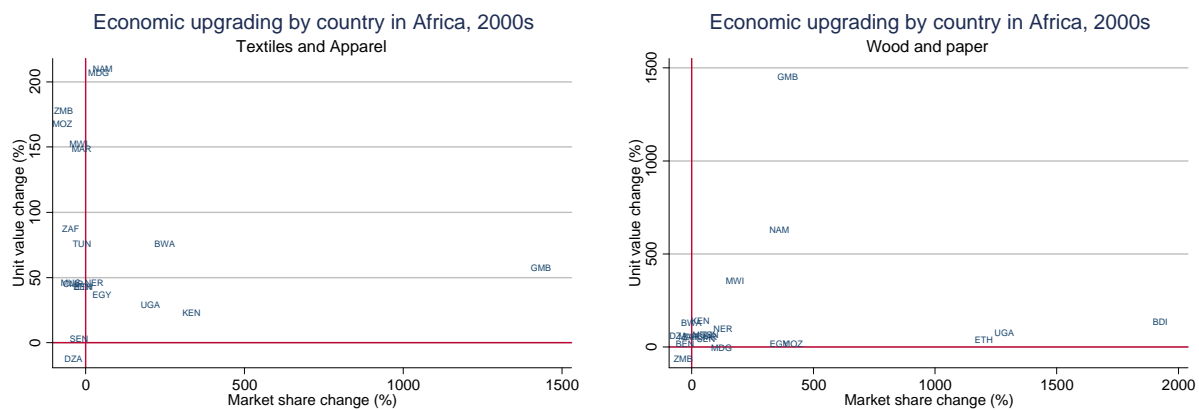
Note: Burundi with a market share change of 8,967% and no

52

information on the unit value change is dropped from this figure

Economic upgrading by country in Africa, 2000s
Petroleum and Chemicals

Economic upgrading by country in Africa, 2000s
Metal Products
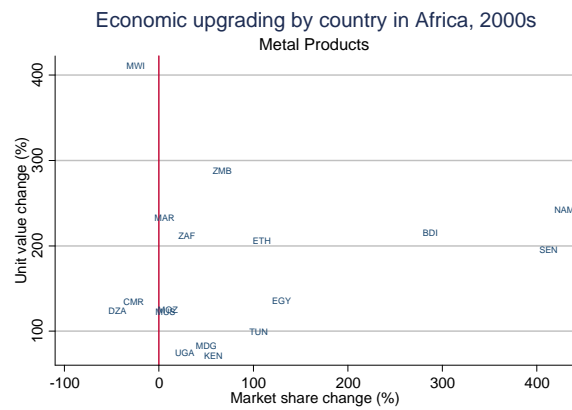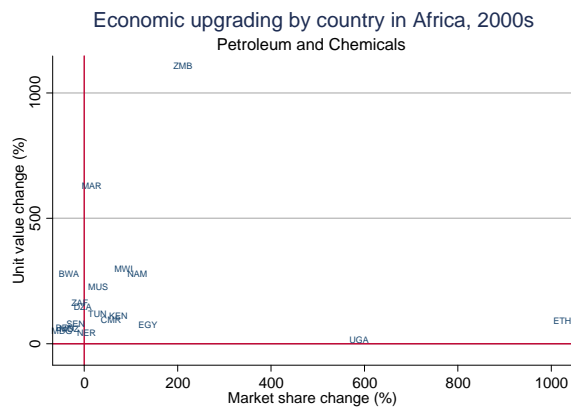
Note: Botswana with a market share change of 96% and a unit value change of 6,515%, and Niger with a market share change of 1,703% and a unit value change of 139% are dropped from this figure

Economic upgrading by country in Africa, 2000s
Electrical and Machinery
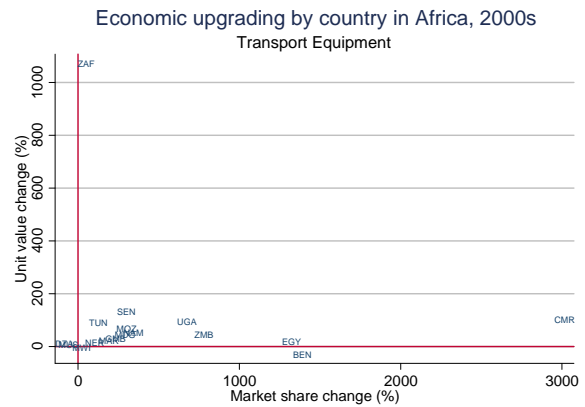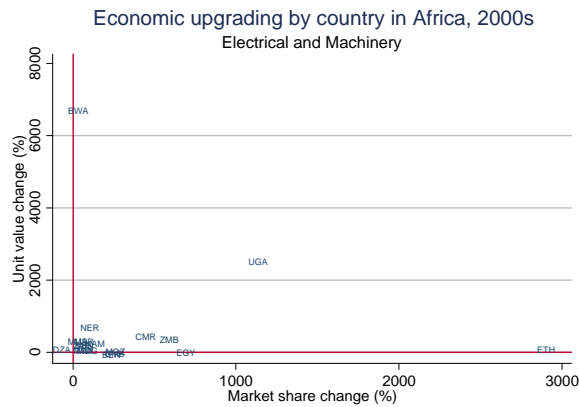
Note: Burundi with a market share change of 6,537% and a unit value change of 689%, and Kenya with a market share change of 258% and a unit value change of 17,347% are dropped from this figure

Economic upgrading by country in Africa, 2000s
Transport Equipment

Note: Botswana with a market share change of 58% and a unit value change of 11,788%, Kenya with a market share change of 184% and a unit value change of 10,965%, Ethiopia with a market share change of 23,805% and no information on the unit value change, and Burundi with a market share change of 13,694% and no information on the unit value change are dropped from this figure

Economic upgrading by country in Africa, 2000s
Other Manufacturing
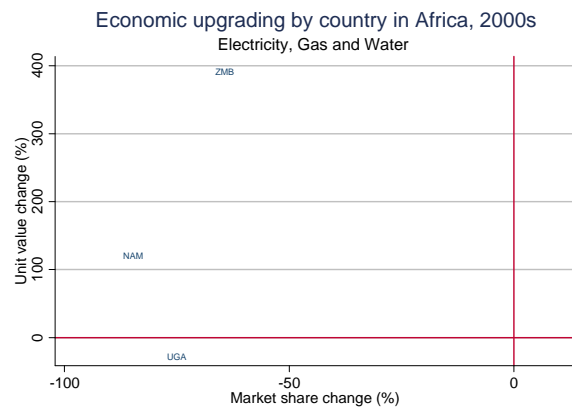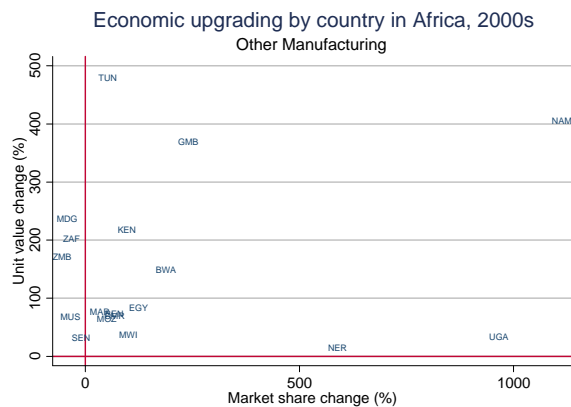
Note: Algeria with a market share change of 86% and a unit value change of 2,089%, Ethiopia with a market share change of 5,227% and a unit value change of 415%, and Burundi with a market share change of 18,961% no information on the unit value change are dropped from this figure

Economic upgrading by country in Africa, 2000s
Electricity, Gas and Water

Note: Kenya with a market share change of 104,289% and no information on the unit value change, and South Africa with a market share change of 30,411% and a unit value change of 582% are dropped from this figure

53

Economic upgrading by country in Africa, 2000s
Education, Health and Other Services
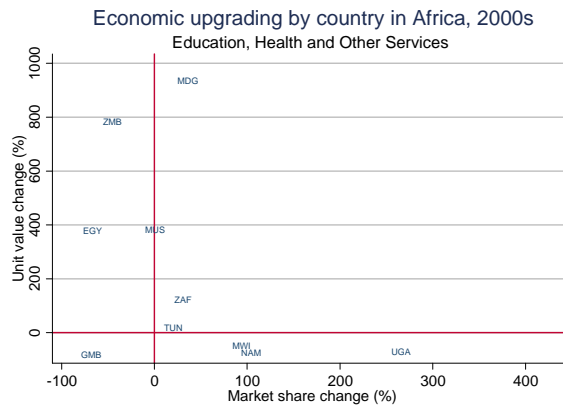
Note: Ethiopia with a market share change of 8,699% and no unit value change is dropped from this figure

Data on employment and wages for individual African countries from UNIDO's INDSTAT is scarcer still. Despite this, Figure 43 reports evidence for social upgrading for the handful of countries for which we have data. The figure indicates that there tends to be no evidence of social downgrading, with social upgrading tending to be the norm (the exception being Eritrea in Metal Products and Electrical and Machinery where social downgrading is found to occur). In some sectors (for example, Textiles and Apparel, and to some extent Petroleum and Chemicals) we observe in a majority of countries that real wages have risen at the cost of reduced employment. Only in the case of Lesotho in Petroleum and Chemicals, do we observe increased employment combined with lower real wages.

Figure 43: Social Upgrading by African Country, 2000s

Social upgrading by country in Africa, 2000s
Wood and paper

Social upgrading by country in Africa, 2000s
Petroleum and Chemicals

Social upgrading by country in Africa, 2000s
Metal Products

Social upgrading by country in Africa, 2000s
Electrical and Machinery

Social upgrading by country in Africa, 2000s
Transport Equipment

Social upgrading by country in Africa, 2000s
Other Manufacturing

Case Study Evidence on GVCs and Social Upgrading in Africa

A good deal of case study evidence has amassed examining the impact of GVCs on economic and social upgrading. Rossi (2013) for example considers the impact of GVC participation on social upgrading in the case of the Moroccan garment industry. She is interested in two categories of social upgrading, both of which are related to the attainment of rights and decent working conditions for workers. The first are measurable standards and include factors such as wages, physical wellbeing (e.g. health and safety, working environment, and working hours), and employment security (e.g. contract type, and social protection). The second are enabling rights, which are less easy to measure, and include factors such as the freedom of association, collective bargaining, the right to freely choose employment, non-discrimination, and voice.

Rossi links three types of economic upgrading within GVCs to the measures of social upgrading. The types of economic upgrading are: (i) process upgrading that increases the efficiency of the production process; (ii) product upgrading that involves a change in the type of product produced; and (iii) functional upgrading, which involves a change in the mix of activities performed by the firm. It is this latter form that involves a move to a more technologically advanced chain, considered the key step in moving towards higher value-added activities. In the case of garment production functional upgrading is considered to be a move from assembly to 'full package' production

Morocco has become an important garment supplier to the EU, with 89.3% of garment production in Morocco aimed at the export market (and 90% of this to the EU) over the period 2003-2007, and with garment exports comprising 23.2% of manufacturing exports. In 2011, there were around 1,600 garment manufacturers in Morocco, employing around 175,000 workers, many of whom were women and young unskilled workers. Garment producers in Morocco have become increasingly engaged in the fast fashion segment of the market, which is characterised by a high responsiveness to the latest fashion trends and customer demands, relatively high quality, and low cost. As discussed by Rossi, this shift adds additional pressure on suppliers in terms of flexibility, low cost, short lead times, and high quality and productivity.

One of the main results of Rossi's study was that economic upgrading, particularly in the fast fashion sector, led to the emergence of parallel workforces within the same factory. Regular workers tended to be higher skilled and usually senior workers that had been in the factory for some time, and tended to ensure the quality and stability of production, while irregular workers tended to be younger and low-skilled, with a role of acting as a buffer for uncertainty in production. This outcome of a dual labour force is not uncommon in the GVC literature, and it usually linked to the exploitation of cheap labour and to the increased vulnerability and insecurity of certain categories of workers (e.g. women, migrant and contract workers). Rossi further finds that the extent of social upgrading differs between these two groups of workers.

Process upgrading was found to be widespread across the different firms, often achieved through production rationalisation, improved work organisation, and higher labour productivity. Process upgrading was further found to have an important impact on social upgrading through overtime, with excessive working hours being reduced, and through improved health and safety standards. At the same time, process upgrading was sometimes associated with reduced employment, an outcome that impacted upon the low-skilled workers in particular, that were dismissed in favour of fewer workers able to adapt to different production functions.

Product upgrading generally took two forms: (i) a shift to producing a wide range of products at short notice; and (ii) a shift towards highly specialised production for the high-end luxury brands. This latter form of product upgrading can lead to increased wages, as well as additional positive benefits if the new products require new skills and technologies. This was not a general outcome however, with many firms starting to supply for luxury brands, but not observing any changes in terms of skill or social upgrading.

Finally, in terms of functional upgrading all firms were engaged in some form of 'full package' sub-contracting, with those that were most successful enjoying higher profit margins and able to hold off competition from lower-cost neighbouring countries. Functional upgrading requires a higher level of skills in the labour force, and hence an investment in training and payment of higher wages to qualified workers. At the same time, the complexity of the services offered, along with the required speed and flexibility of production pose additional problems and lead to fluctuations in workforce according to order status. It is these problems that lead to the development of a dual workforce, with the regular workers being permanently hired and which have higher skills able to provide high quality products and take on new tasks when needed, and lower skilled younger workers employed on worse terms as irregular workers. These latter workers are found to be discriminated against with regard to wages, benefits, hours of work and general work conditions.

Functional upgrading has a mixed impact on social upgrading as it leads to different treatment for regular and irregular workers, with respect to contracting arrangements, wage payments and enforcement of correct recording of overtime

hours. Functional upgrading also impacts on other measurable conditions for these two groups, with irregular workers not benefitting from any training and not having opportunities for skill upgrading. This had further knock-on effects with such workers not having access to wage bonuses and not building up the experience to allow them to bargain more effectively in their current or another factory, leading to little hope of obtaining regular employment. In terms of enabling rights, regular workers gain a higher degree of respect within factories and are engaged in a constructive dialogue with management. Irregular workers however are often subject to discrimination because their work is not considered equally important. Irregular workers tend not to have a voice and many complain of harsh treatment by their supervisors

Ross, A., 2013. Does economic upgrading lead to social upgrading in global production networks? Evidence from Morocco. *World Development*, 46, 223-233.

3.3.2. The Sophistication of Exports

Figure 44 shows the expected – and indeed implied – outcome that the values of EXPY are higher for more developed and richer regions than for the lesser developed poorer regions. Africa had the second lowest (ahead of the Caribbean) value of EXPY in 1995 reflecting the fact that it is heavily specialised in exports that are not exported by richer regions. Africa has shown a dramatic increase in EXPY however, with the value increasing by around 50% between 1995 and 2000. While much of this increase is due to data being available for additional African countries in 2000 (see Figure 41 below), there was a general tendency for EXPY to increase for those countries for which data was available in 1995, suggesting that this increase is also due to a movement towards more sophisticated exports, or more precisely towards exports that are more intensively exported by richer countries. In 2000, the value of EXPY in Africa had risen to such an extent that it matched the values in South Asia, remaining somewhat below the values in South America and Transition countries. Since 2000 however there has been a slight decrease in the value of EXPY for Africa, while the value in South Asia has continued to grow relatively rapidly. Despite similar stalls in the development of EXPY in South America and Transition countries, the value of EXPY in Africa continued to be the lowest of all regions.

Figure 44: EXPY by Region
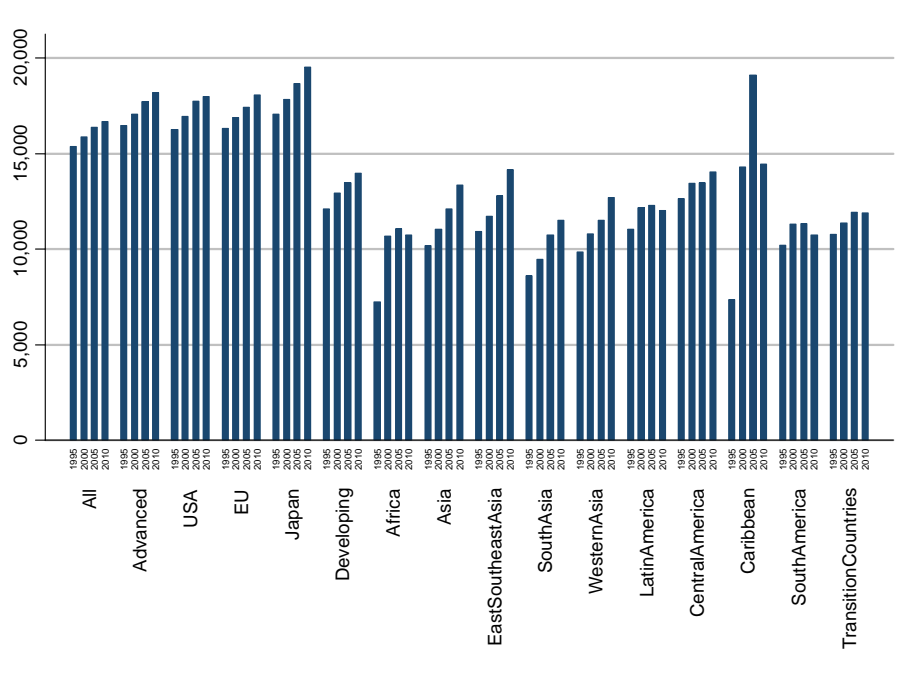
Considering results by African country (Figure 45), we find relatively large values (10,000 or above) of EXPY for Algeria, Egypt, Libya, Nigeria, South Africa and Tunisia in 2010. The value of EXPY is below 5,000 in a number of countries however, including Benin, Burkina Faso, Burundi, Ethiopia, Gambia, Ghana, Malawi, Mali, Mauritius, Mauritania, Niger, Rwanda, and Zimbabwe. Of perhaps more interest than the levels are the changes in the values of EXPY. For some countries we observe steady increases in the value of EXPY over time. For Madagascar, Malawi, and Tunisia, for example, we observe increases in EXPY from 1995 to 2000 and from 2000 to 2010. In 16 other countries we observe increases from 2000 to 2010, with little change observed in another three countries. The increases are relatively large for Benin, Madagascar, Senegal and Tunisia. We observe a number of negative changes in EXPY between 2000 and 2010 however. In particular, there are nine countries for which EXPY declines, with the declines being particularly pronounced in Mauritania, Sudan and Zimbabwe.

Overall therefore, the results from the export sophistication measure provide mixed results. While developments for Africa as a whole have tended to be positive, Africa remains the region with the lowest values of this export sophistication index. Within Africa there have been a number of relative successes in terms of export sophistication development (examples being Benin, Madagascar, Mauritius and Tunisia), but a significant number of cases where export sophistication has regressed (the most notable examples being Mauritania, Sudan and Zimbabwe).

Figure 45: EXPY by African Country
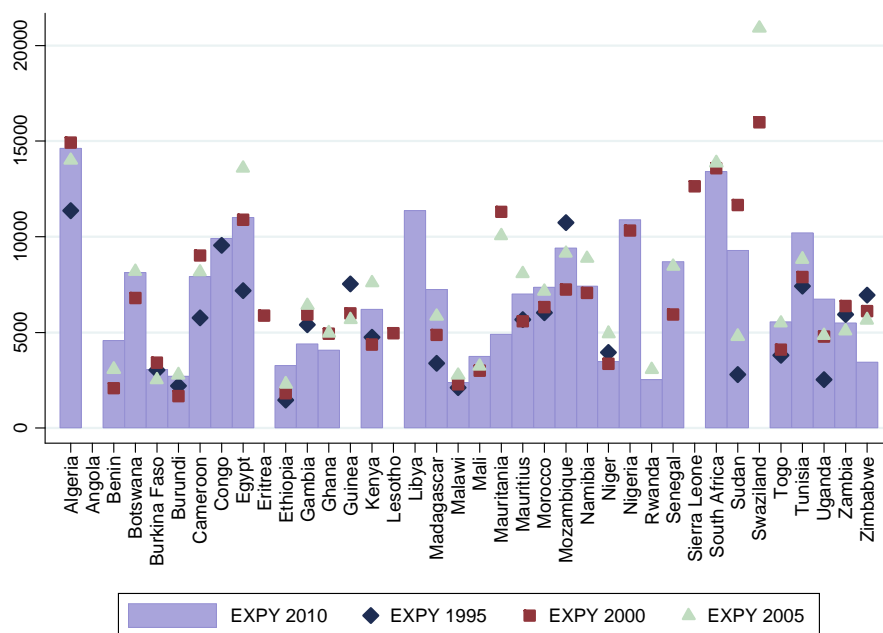
3.3.3. Product Discovery

In this section we report results on the indicators of product discovery described above. In the main text we concentrate on the conservative measure of product discovery, with results from the liberal and intermediate cases relegated to Appendix B. Figure 46 reports results for the conservative measure of product discovery (see equations (4) and (5) above). Concentrating on the 2000s for which the trade data is more complete, we see a great deal of heterogeneity in product discovery. Rates tend to be relatively low for advanced regions, particularly the US. South and West Asia have the highest rates, followed by South and Central America. Africa has a rate of product discovery that is slightly below the average for developing countries, at a rate similar to transition countries. Figure 47 then splits up the information on product discovery by BEC code. Results for the USA stand out, with all product discoveries in the 2000s found to be in intermediate goods. Shares of intermediate goods in product discovery tend to be relatively high for advanced countries in general, with shares for Africa being somewhat lower than for developing countries as a whole. In the 2000s, consumption goods tended to make up a large share of product discovery in Africa, relative to other regions.

Figure 46: Product Discovery by Region, 2000s (Conservative Measure)
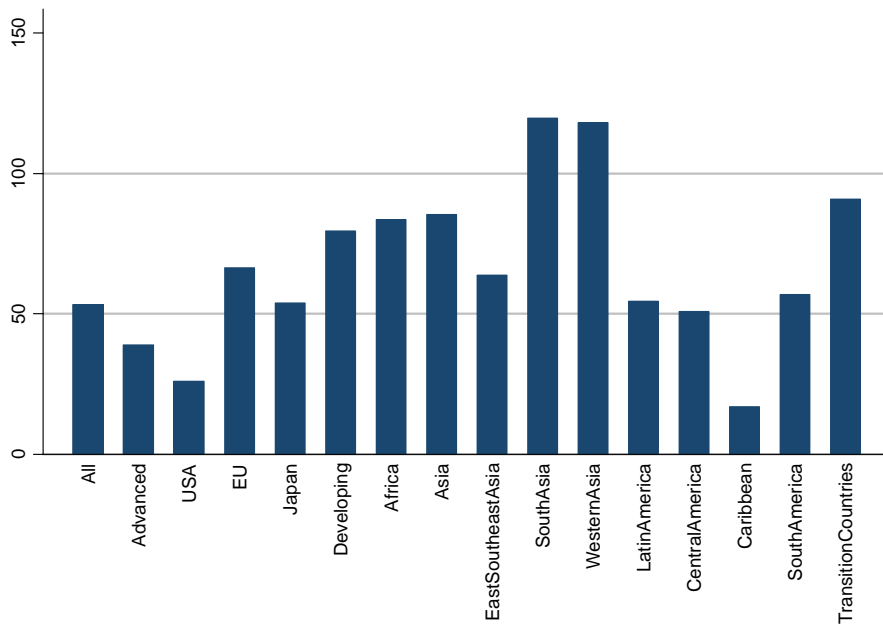
Figure 47: Types of Product Discovery by Region, 2000s (Conservative Measure)
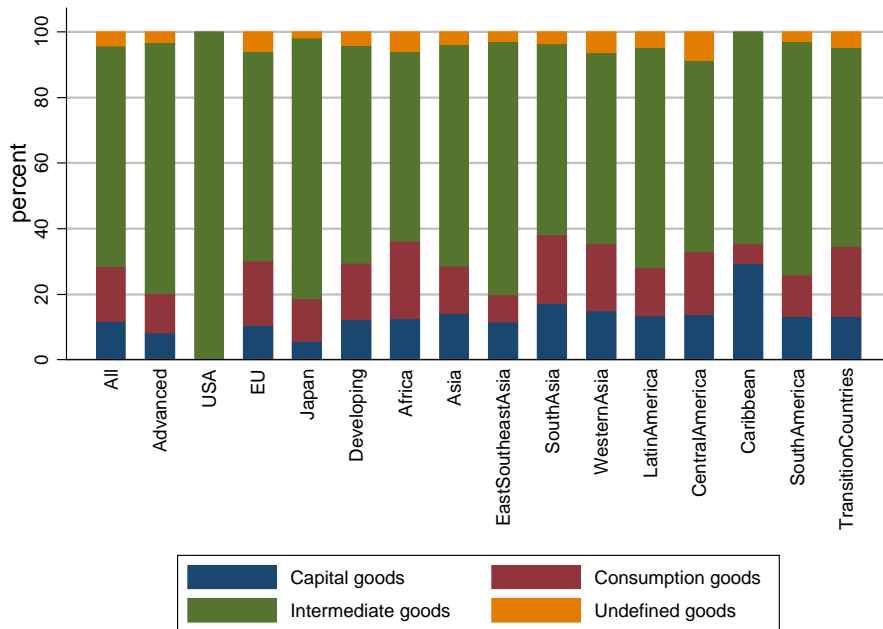
Figure 48: Product Discovery by African Country, 2000s (Conservative Measure)
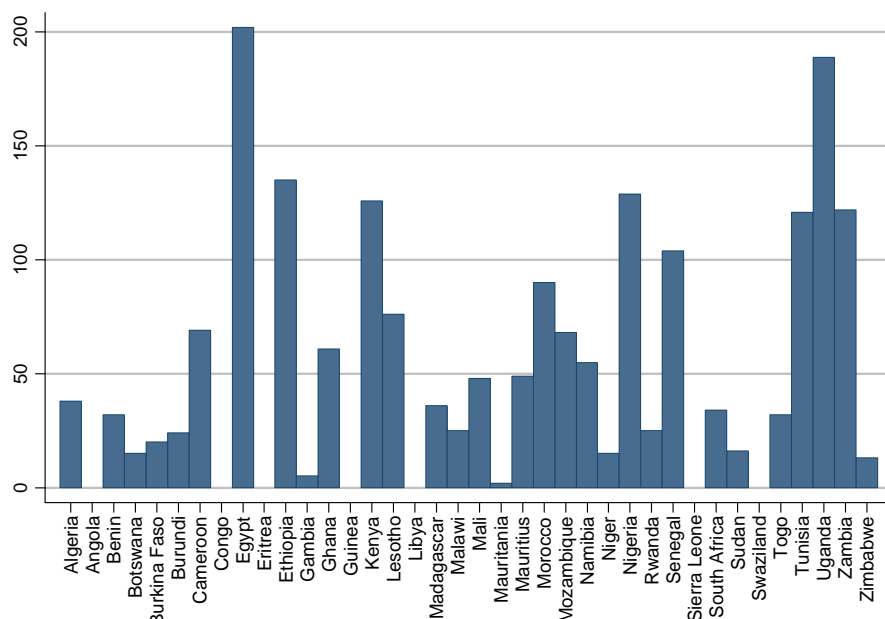
Considering individual African countries (Figure 48), we find the highest rates of product discovery in Egypt, Uganda, Tunisia, Eritrea, Kenya and Nigeria, with Zambia, Senegal and Morocco also reporting above average (for Africa) rates of product discovery. Figure 49 reports information on the share of product discovery by product type for the 2000s. Intermediates are found to make up the greatest share of product discovery across most countries, with the shares being particularly high for the Gambia, Mauritania, South Africa and Zimbabwe amongst others. Shares of intermediates are much lower (less than 50%) in other countries such as Burundi, Ethiopia, Lesotho, Madagascar and Togo. Consumption goods discoveries tend to be relatively important in countries such as Burkina Faso, Togo, Ethiopia and Niger, with capital goods discoveries being relatively important in Burundi, Kenya and Madagascar.

Figure 49: Product Discovery by African Country, 2000s (Conservative Measure)
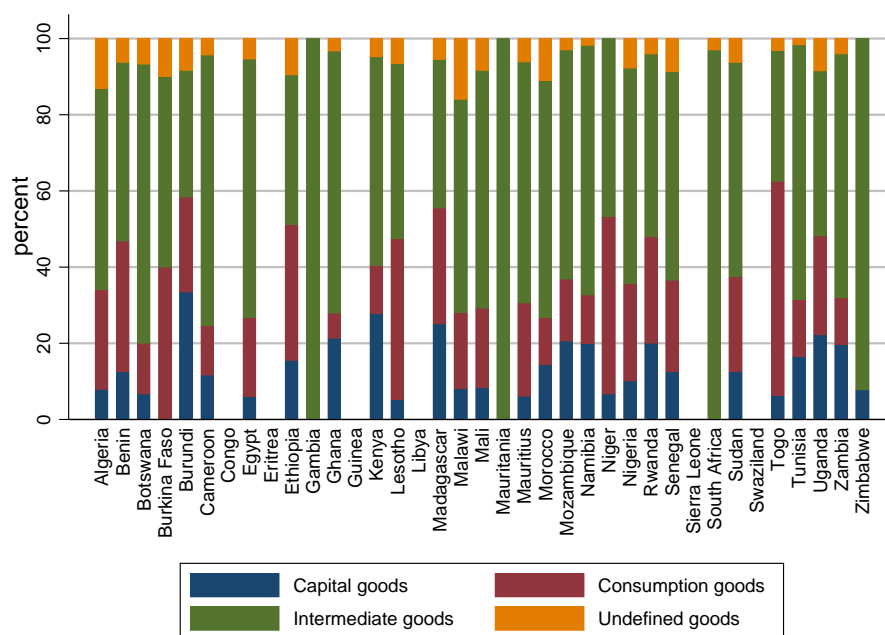
3.3.4. Summary

This section has presented results from a number of alternative indicators that are intended to capture upgrading. Given the variety of measures considered and the sectoral nature of some of these measures, it is both difficult to compare results across the different measures or draw firm conclusions on the existence of upgrading for specific African countries. Summarising however, the results in this section suggest the following:

(i) Despite a great deal of cross-country heterogeneity there is little evidence of economic downgrading at the sectoral level using the approach of Bernhardt and Milberg (2011), with economic upgrading tending to be prevalent. Where economic upgrading is not present we tend to observe increased unit value ratios combined with reduced market shares, suggesting that increased prices result in a loss of competitiveness (possibly implying that increased prices are not the result of improved quality).

(ii) Similar results hold for social upgrading, with social upgrading being the more normal outcome. While a small number of cases of social downgrading are present, a lack of social upgrading more usually arises as a combination of increased wages but reduced employment.

(iii) Levels of export sophistication do not reach the levels in advanced countries for any country in Africa, though levels reported for a number of African countries are around the average for the sample of developing countries (e.g. Algeria and South Africa). The majority of African countries however, report values of export sophistication that are somewhat below the developing country average (of around 14,000), with values being below 5,000 for 12 of the 32

countries for which data are available. The change in export sophistication has also tended to grow relatively slowly for most countries between 2000 and 2010, with declines in export sophistication observed in 11 of 29 countries for which data are available in both years.

(iv) Product discovery is found to be above the average for developing countries in a number of African countries (Egypt and Uganda being the most prominent examples). For the majority of countries however, rates of product discovery are somewhat below the developing country average, being less than 50 (compared to an average for developing countries of around 80) in 16 of 31 countries for which we have data.

(v) Overall the results suggest that a minority of African countries have been able to upgrade according to a number of the indicators of upgrading considered (prominent examples including Egypt, Nigeria and Tunisia). Despite some evidence of upgrading across particular dimensions however, for most African countries we observe that the extent of upgrading tends to be lower than that for the average developing country.

4. GLOBAL VALUE CHAINS AND INNOVATION IN AFRICA

Identifying a role for GVC involvement on innovation and technology production is a difficult task even in the case of developed countries. A number of existing studies attempt this however in a developed country context, examples including Görg and Hanley (2011) for Ireland, Cusmano et al (2008) for Italy, Bloom et al. (2011) for 12 advanced countries and Arvantis and Loukis (2012) for Switzerland and Greece. Studies on offshoring and innovation outside of developed countries are scarcer, though a number of studies examine the relationship between importing and innovative activities (examples including Goldberg et al (2010) for India, and Gorodnichenko et al (2010), Correa et al (2010) and Crino (2012) for a set of emerging economies). Fritsch and Görg (2013) also concentrate on firms from a set of 20 emerging economies, but use questions from the survey more directly related to the concept of offshoring. They find that the effect of offshoring is positive and significantly larger than the effect of domestic outsourcing on R&D spending.

In a developing country context – and in Africa in particular – this task is even more difficult given the paucity of available data, particularly at the sectoral level where much of the analysis of GVCs takes place. A common proxy variable is a measure of R&D expenditure, considered to be the major input into innovative activities. While there are some data reported on R&D expenditures for African countries (UNESCO for example reports data on R&D as a percentage of GDP for a large sample of countries, including some from Africa), data at the sectoral level is severely limited. In 2010, the first African Innovation Outlook was published, which reports a number of relevant indicators of innovation for African countries based on survey data. While a step forward, this publication only splits R&D spending into business, government, higher education and private non-profit institutions, with no industry split reported. A second popular proxy for innovation and technological output are patent counts, with concordances now available to provide a mapping from the technology classes that patents are reported in to

common industry classifications (see for example Lybbert and Zolas, 2012). Again however, while simple aggregate patent counts are available for many African countries from a number of sources (e.g. the World Intellectual Property Organisation, WIPO), data is sparse for African countries at the technology class level.

Given the lack of sectoral data on R&D and patenting, along with the perceived weaknesses of these proxies, increasingly researchers are turning to (firm-level) innovation surveys to answer questions related to innovation and other aspects of firm behaviour and performance. These surveys have a number of advantages, in that they allow for a more accurate description of actual (product and process) innovations. In an African context a number of surveys (e.g. World Bank Enterprise Surveys, UNIDO's Africa Investor Survey) ask questions on whether firms have introduced new products or processes and other innovation related questions. Unfortunately, in the case of African countries the questions on innovation are often not asked, and even when they are sample sizes are often too small to do any meaningful analysis at the sectoral level. A further issue for the current paper is that the questions on innovation are often not related to relevant questions on the importance and role of GVCs for the firms being surveyed, particularly in Africa. Fritsch and Görg (2013) use information on whether firms have outsourced products or services in the past three years and on the share of foreign material inputs in total material inputs for their sample of emerging economies using the Business Environment and Enterprise Performance Survey (BEEPs) dataset. These questions have rarely been asked in an African context. Moreover, there is a lack of firm-level panel data for African countries, the presence of which could help reduce problems of endogeneity and allow studies to address issues of causality between innovation and GVCs in addition to simple correlation.[20] A useful step in understanding the relationship between innovation and GVCs in a developing country context – and in particular in Africa – will be to develop existing firm-level surveys into panel datasets that provide information on a firm's innovation profile and activities and its internationalisation strategies, something achieved in the recent EFIGE database of European firms for example.

To provide some information on the relationship between GVCs and innovation in an African context, we use UNIDO's Africa Investor Survey 2010, which covers around 5,000 domestic and foreign-owned firms in 19 African countries. Note however that only around 2,200 firms responded to the innovation questions from this sample of 5,000 firms. Note further that we only have data on the innovation question for just 29 services firms (from a total sample of over 2,000!). In our analysis therefore we pool observations from the 19 different countries, and do not attempt to make any sectoral breakdown other than for broad aggregates such as manufacturing and services. To capture innovation using this dataset we consider responses to the questions asking whether the firm had introduced a new product or process innovation in the last three years. There is no direct question on offshoring or GVCs, so we are forced to rely on responses to the question of whether the firm imported any of its inputs in the last financial year, also reporting information on whether the firm exported any of its output in the last financial year.

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[20] While there exist two-period panel datasets for a handful of African countries in the set of World Bank enterprise surveys, they do not ask the questions on the introduction of new products/processes or the R&D questions in both years.

Table 1 reports for all 19 countries the average response to the question of whether firms introduced new product or process innovations in the last three years for all firms, and for importers and exporters separately. Results are reported for manufacturing firms, services firms, agriculture and mining firms, and electricity, water and construction firms separately. The table indicates that around 32% of firms that responded to the innovation question introduced new products in the last three years. These figures are somewhat larger for importers (36%) and in particular for exporters (47%). A lower percentage introduced new processes (22%), with the figures for importers again being slightly higher (25%) and those for exporters higher still (32%). For manufacturing firms only the averages are generally higher, though the pattern is similar with averages for importers being somewhat larger than for all firms and those for exporters being the largest. Results for services are somewhat different. Averages in the case of services are generally lower, with the values being highest for importers, with exporters having an average that is lower than for all firms. It should be borne in mind that averages for services firms are based upon a particularly small sample. In the case of agriculture and mining we find that around 20% of firms introduced new products and 16% new processes, with importers and particularly exporters tending to have higher rates of product and to a lesser extent process innovation. Finally, for electricity, water and construction rates of product and process innovation are relatively low (10-12%), with generally little difference for importing and exporting firms.

To consider whether these differences are significant we report in tables 2 and 3 results of mean comparison tests, with Table 2 reporting results for importers versus non-importers and Table 1 exporters versus non-exporters.[21] To allow for the fact that some sectors are more likely to innovate than others we first demean the new product and process variables by ISIC two-digit sector before conducting the mean comparison tests. The mean values reported in tables 2 and 3 are therefore the mean values by type of firm after the sector demeaning has taken place. Results in Table 2 indicate that there are significant differences in the propensity to introduce product and process innovations for all firms and for manufacturing firms, with this difference favouring importers. No significant differences are found for the other sectors, neither for product nor process innovations, though the average values tend to be higher for importers than for non-importers. In the case of exporters versus non-exporters we find in Table 3 that there is a significant difference in the propensity to introduce product innovations for all firms and for all sectors except electricity, water and construction, with this difference favouring exporters. In the case of process innovations we observe significant differences in the case of all and manufacturing firms only.

While not implying causality, the results from these latter three tables suggest, in the case of manufacturing firms at least, that importing and exporting firms are more likely to introduce

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[21] We repeated this exercise using the World Bank Enterprise Surveys for a sample of eight African countries (Central African Republic, Ethiopia, Ghana, Kenya, Rwanda, Uganda, Zambia and Zimbabwe). Given differences in the questionnaires – in particular related to sector – we did not distinguish between or demean by sector. Results indicate that there are no significant differences in the average propensity to introduce new products between exporters and non-exporters, but that there are significant differences between exporters and non-exporters with respect to undertaking R&D. Results also indicate a significant difference in the propensity to undertake R&D and introduce new products between firms that use inputs of a foreign origin in production and those that don't. Results are thus quite similar to those using the UNIDO survey data.

product and process innovations. While the results only relate to the distinction between firms that are involved in international transactions and those that are not, in the case of importers we may think of the observed differences as being related to GVCs, since the question is interested in imports of (intermediate) inputs. In the case of exporters, this category also includes exporters of final goods, which may not be related to GVCs.

Table 1: Descriptive Statistics for New Product and Process Innovations

	Obs.	All Firms	Obs.	Importers	Obs.	Exporters
Full Sample						
Product	2166	0.319	1093	0.364	494	0.466
Process	2159	0.222	1088	0.250	489	0.323
Manufacturing Firms						
Product	1813	0.350	929	0.400	426	0.493
Process	1804	0.242	923	0.271	421	0.347
Services Firms						
Product	29	0.207	14	0.214	24	0.125
Process	29	0.069	14	0.071	24	0.042
Agriculture and Mining						
Product	123	0.203	50	0.260	52	0.288
Process	124	0.161	50	0.180	52	0.192
Electricity, Water and Construction						
Product	201	0.124	100	0.100	190	0.121
Process	202	0.104	101	0.119	191	0.105

Notes: Obs. refers to the number of observations. This table reports the mean values of the response to the question of whether firms introduced new product or process innovations in the last three years (1 = yes; 0 = no).

Table 2: Mean Comparison Tests for Importers versus Non-Importers

| | Mean | | | |
	Importers	Non-Importers	t-statistic	p-value
All Firms				
Product	0.034	-0.035	-3.552	0.000***
Process	0.025	-0.025	-2.846	0.004***
Manufacturing Firms				
Product	0.040	-0.042	-3.717	0.000***
Process	0.027	-0.028	-2.712	0.007***
Services Firms				
Product	-0.021	0.020	0.324	0.748
Process	0.036	-0.033	-1.415	0.168
Agriculture and Mining				
Product	0.061	-0.042	-1.440	0.152
Process	0.012	-0.008	-0.309	0.758
Electricity, Water and Construction				
Product	-0.025	0.025	1.072	0.285
Process	0.014	-0.014	-0.670	0.503

Notes: This table reports the mean values of the response to the question of whether firms introduced new product or process innovations in the last three years for all firms and for importers (demeaned by sector), along with the t-statistic of a test of significant differences in the two means and associated p-value.

Table 3: Mean Comparison Tests for Exporter versus Non-Exporters

| | Mean | | | |
	Exporters	Non-Exporters	t-statistic	p-value
All Firms				
Product	0.126	-0.037	-7.129	0.000***
Process	0.093	-0.027	-5.759	0.000***
Manufacturing Firms				
Product	0.133	-0.041	-6.744	0.000***
Process	0.105	-0.032	-5.842	0.000***
Services Firms				
Product	0.240	-0.050	-1.815	0.081*
Process	0.000	0.000	0.000	1.000
Agriculture and Mining				
Product	0.079	-0.058	-1.938	0.055*
Process	0.028	-0.020	-0.724	0.470
Electricity, Water and Construction				
Product	0.043	-0.003	-0.448	0.655
Process	-0.017	0.001	0.186	0.853

Notes: This table reports the mean values of the response to the question of whether firms introduced new product or process innovations in the last three years for all firms and for exporters (demeaned by sector), along with the t-statistic of a test of significant differences in the two means and associated p-value.

5. CONCLUSION

Production increasingly takes place within Global Value Chains. For Africa there are potential benefits from this related to the fact that African countries no longer have to build up an entire industry in order to be competitive in international markets. Instead, it is possible to identify particular stages of a GVC within a sector and use policy in an effort to get a foothold in these stages of production. The major risk of such an approach is that African countries become stuck in low value-added stages of production where the opportunities for upgrading and technology diffusion are limited. This paper considers the extent of GVC participation by African countries and considers whether there is any evidence of upgrading or lock-in for African countries.

The descriptive analysis in the paper indicates a number of important facts. According to popular measures of GVC participation we observe that Africa is heavily involved in GVCs. This conclusion hides a number of other considerations however. Africa's participation in GVCs is currently largely limited to upstage production. While upstage production may involve high value-added activities, such as innovation and the production of knowledge assets, in the case of

developing countries – and Africa in particular – upstream production is associated with low value-added primary production, where possibilities for learning and upgrading are likely to be more limited. Exports of primary products dominate the intermediate exports of most African countries, with potential implications for upgrading. There are cases where individual African countries have been able to position themselves downstream within GVCs. The indicators of GVC participation used are based upon shares of imported and exported value-added in total exports and thus neglect the size of such flows however. It remains the case that Africa as a whole trades relatively little compared with other regions, with trade in intermediate goods in particular being low relative to other regions. The implication of this is that the ratios of GVC participation may overstate the importance of GVCs for Africa.

In terms of the evidence in favour of upgrading, levels of export sophistication and product discovery that are intended to capture the extent of upgrading within GVCs tend to be lower for Africa than for other developing regions, suggesting that the performance of African countries in terms of upgrading has been weaker than in other regions. Despite this, developments in these indicators over time suggest that progress in terms of upgrading has been made across a broad range of African countries. Moreover, results suggest that countries in Africa have been able to export their products at higher prices while maintaining market shares, suggesting economic upgrading along this dimension.

The analysis in the paper further indicates that participation in GVCs across African countries is highly heterogeneous. While the overall evidence tends to suggest that for Africa as a whole GVC participation and the extent of upgrading tends to be limited (and limited to upstream production in particular), there are a number of relatively successful cases where GVC involvement is greater. Some African countries have been able to move into downstream production within GVCs, acting as assembly hubs for motor vehicles and other manufacturing output. In addition to reporting higher downstream GVC activity, these countries also report relatively large exports of parts and components and some of the highest shares of exports of high-tech products. The possibility for knowledge and technology spillovers and for upgrading across all dimensions mentioned in the text would appear to be larger for these countries.

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APPENDIX A: DATA DESCRIPTION

Table A1: Eora Sectors

Sector Number	Short Name	Type
1	Agriculture	Primary
2	Fishing	Primary
3	Mining and Quarrying	Primary
4	Food and Beverages	Low-Tech Manufacturing
5	Textiles and Apparel	Low-Tech Manufacturing
6	Wood and Paper	Low-Tech Manufacturing
7	Petroleum and Chemicals	High-Tech Manufacturing
8	Metal Products	Low-Tech Manufacturing
9	Electrical and Machinery	High-Tech Manufacturing
10	Transport Equipment	High-Tech Manufacturing
11	Other Manufacturing	Low-Tech Manufacturing
12	Recycling	Low-Tech Manufacturing
13	Electricity, Gas and Water	Low-Tech Services
14	Construction	Low-Tech Services
15	Maintenance and Repairs	Low-Tech Services
16	Wholesale Trade	Low-Tech Services
17	Retail Trade	Low-Tech Services
18	Hotels and Restaurants	Low-Tech Services
19	Transport	Low-Tech Services
20	Post and Telecommunications	High-Tech Services
21	Financial Intermediation	High-Tech Services
22	Public Administration	High-Tech Services
23	Education, Health and Other Services	High-Tech Services
24	Private Households	Low-Tech Services
25	Others	Low-Tech Services

Table A2: Classification of BEC by Usage

BEC	Categories
Capital goods	41* Capital goods (except transport equipment)
	521* Transport equipment, industrial
Intermediate goods	111* Food and beverages, primary, mainly for industry
	121* Food and beverages, processed, mainly for industry
	21* Industrial supplies not elsewhere specified, primary
	22* Industrial supplies not elsewhere specified, processed
	31* Fuels and lubricants, primary
	322* Fuels and lubricants, processed (other than motor spirit)
	42* Parts and accessories of capital goods (except transport equipment)
	53* Parts and accessories of transport equipment
Consumption goods	112* Food and beverages, primary, mainly for household consumption
	122* Food and beverages, processed, mainly for household consumption
	522* Transport equipment, non-industrial
	61* Consumer goods not elsewhere specified, durable
	62* Consumer goods not elsewhere specified, semi-durable
	63* Consumer goods not elsewhere specified, non-durable

Country Coverage

| Developed Countries	African Countries	East and South-East Asia	Central America	South America
Australia	Algeria	Brunei	Costa Rica	Argentina
Austria	Angola	Cambodia	Nicaragua	Bolivia
Belgium	Benin	Indonesia	Panama	Brazil
Canada	Botswana	Laos	Belize	Chile
Cyprus	Burkina Faso	Malaysia	El Salvador	Colombia
Czech Republic	Burundi	Myanmar	Honduras	Guyana
Estonia	Cameroon	Philippines	Guatemala	Suriname
Finland	Cape Verde	Singapore	Mexico	Uruguay
France	Central African Republic	Thailand		Paraguay
Germany	Chad	Viet Nam		Peru
Greece	Congo	China		Ecuador
Hong Kong	Cote d'Ivoire	Hong Kong		Venezuela
Iceland	Democratic Republic of the	Macao		
Ireland	Congo	North Korea		
Israel	Djibouti	Mongolia		
Italy	Egypt	South Korea		
Japan	Eritrea	Taiwan		
Latvia	Ethiopia			
Luxembourg	Gabon	**South Asia**	**Caribbean**	**Transition Countries**
Malta	Gambia	Afghanistan	Antigua	Albania
Netherlands	Ghana	Bangladesh	Aruba	Belarus
Norway	Guinea	Bhutan	Bahamas	Croatia
New Zealand	Kenya	India	Barbados	Kazakhstan
Portugal	Lesotho	Maldives	Bermuda	Kyrgyzstan
San Marino	Liberia	Nepal	Cayman Islands	Moldova
Singapore	Libya	Pakistan	Cuba	Russia
Slovakia	Malawi	Sri Lanka	British Virgin Islands	Tajikistan
Slovenia	Madagascar		Jamaica	Turkmenistan,
South Korea	Mali		Trinidad and Tobago	Ukraine
Spain	Mauritania		Dominican Republic	Uzbekistan,
Sweden	Mauritius	**Western Asia**	Haiti	Bosnia and Herzegovina
Switzerland	Morocco	Armenia	Netherlands Antilles	Serbia
Taiwan	Mozambique	Azerbaijan		Montenegro
United Kingdom	Namibia	Bahrain		Former USSR
USA	Niger	Georgia		TFYR Macedonia
	Nigeria	Iraq		
	Rwanda	Israel		
	Sao Tome and Principe	Jordan		
	Senegal	Kuwait		
	Sierra Leone	Lebanon		
	Somalia	Oman		
	South Africa	Qatar		
	Swaziland	Saudi Arabia		
	Tanzania	Syria		
	Togo	Turkey		
	Tunisia	United Arab Emirates		
	Uganda	Yemen		
	Zambia	Iran		
	Zimbabwe	Gaza Strip		

APPENDIX B: ADDITIONAL RESULTS ON PRODUCT DISCOVERY

Alternative Measures of Product Discovery

Results for product discovery are quite sensitive to the measure used. Results using the liberal measure (Figure A1) report much higher values for Africa, for transition countries and in particular for the Caribbean which reported the lowest values according to the conservative measure. Results using the moderate measure (Figure A2) are similar to those using the liberal measure, with Africa ranked second in terms of product discovery rates behind transition countries, with West and South Asia also reporting relatively high rates.

Figure A1: Product Discovery by Region, 2000s (Liberal Measure)
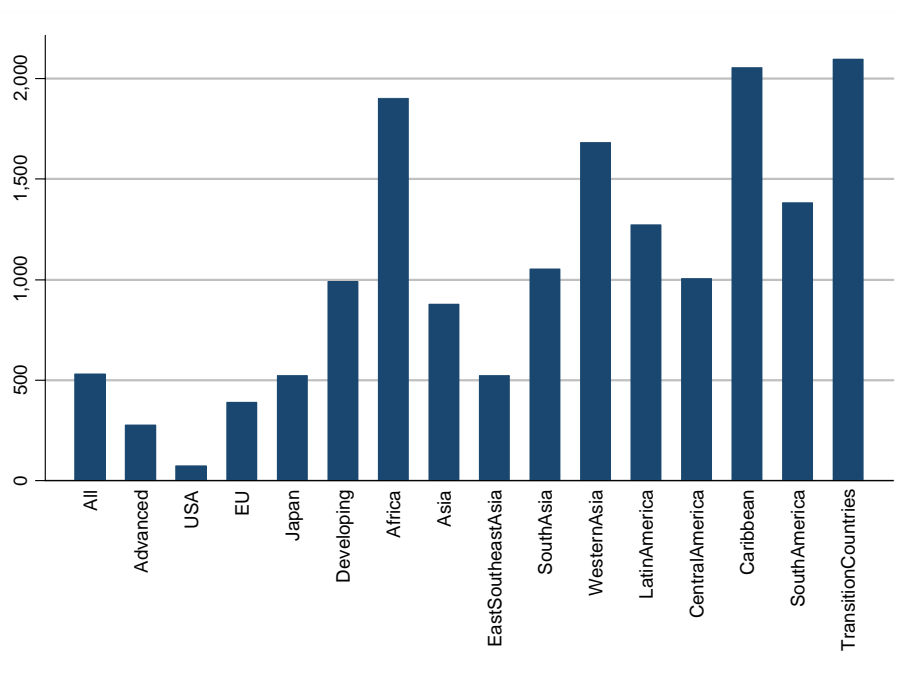
Figure A2: Product Discovery by Region, 2000s (Moderate Measure)
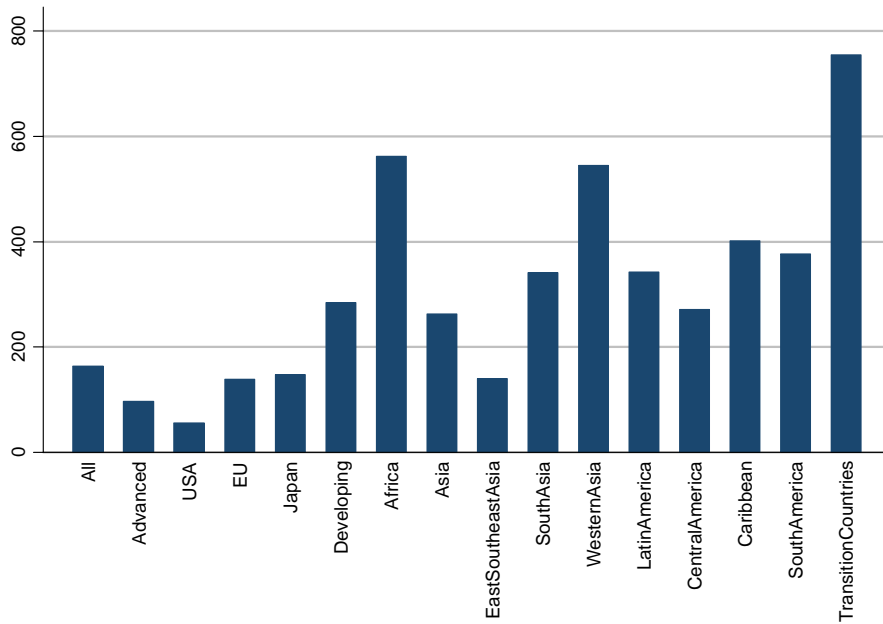
At the level of the individual African country using the liberal measure leads to a number of changes when compared with the conservative measure, with Mozambique and Ghana joining Egypt, Uganda and Zambia with the highest rates of product discovery. These results are repeated using the moderate measure of product discovery (Figure A4).
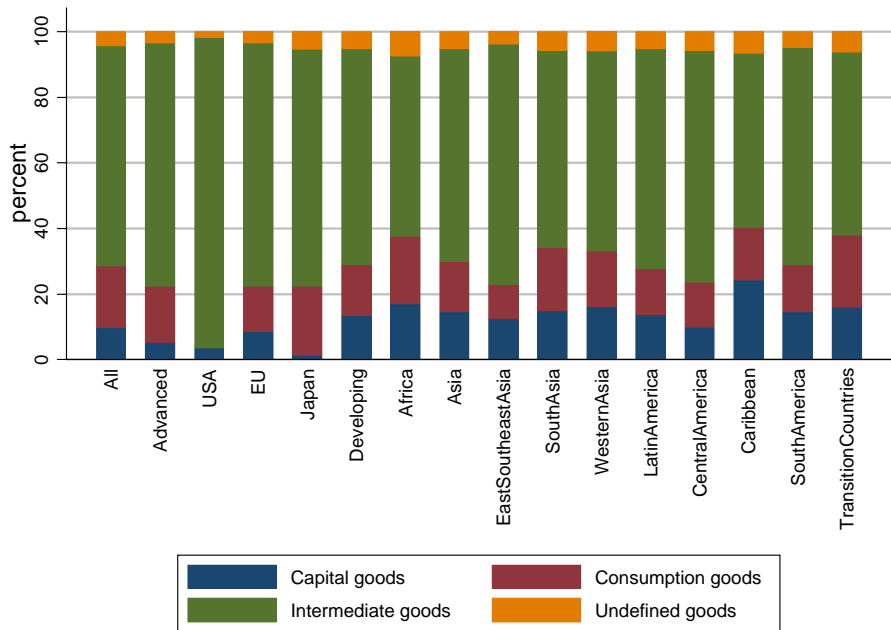
Figure A3: Product Discovery by African Country, 2000s (Liberal Measure)
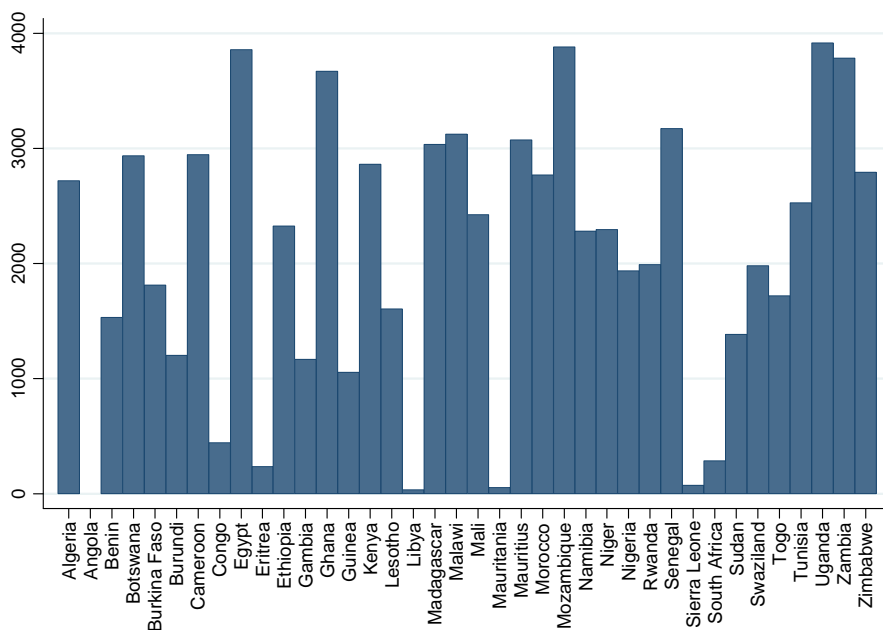
Figure A4: Product Discovery by African Country, 2000s (Moderate Measure)
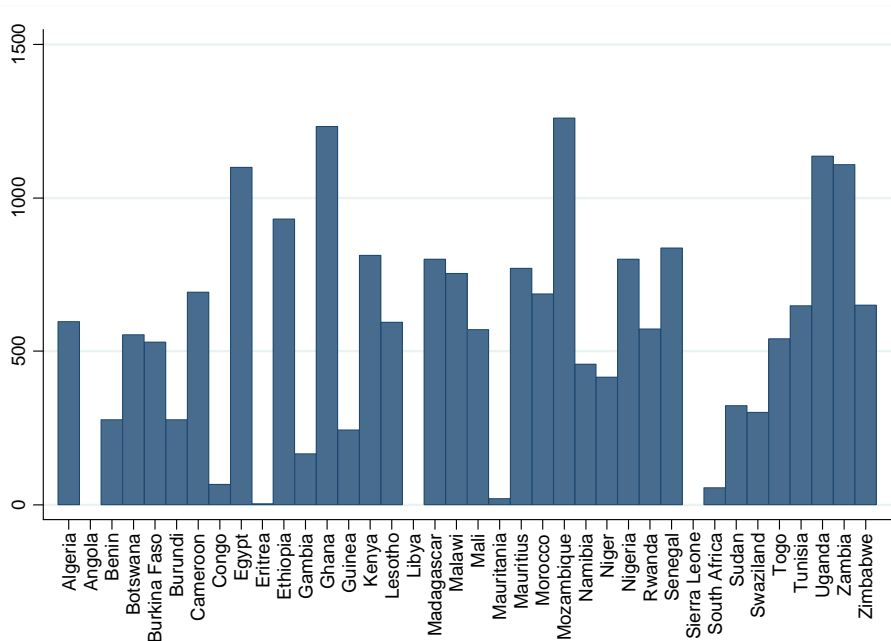
Types of Product Discovery

Finally, we report in Figures A5 and A6 the results of splitting up product discovery by BEC code for individual regions using the liberal and moderate measures respectively, and in Figures A7 and A8 similar results for the 2000s for individual African countries. Figures A5 and A6 confirm earlier results indicating that Africa has a relatively low share of product discovery in intermediate goods, and a relatively large share in consumption goods.

Figure A5: Types of Product Discovery by Region, 2000s (Liberal Measure)
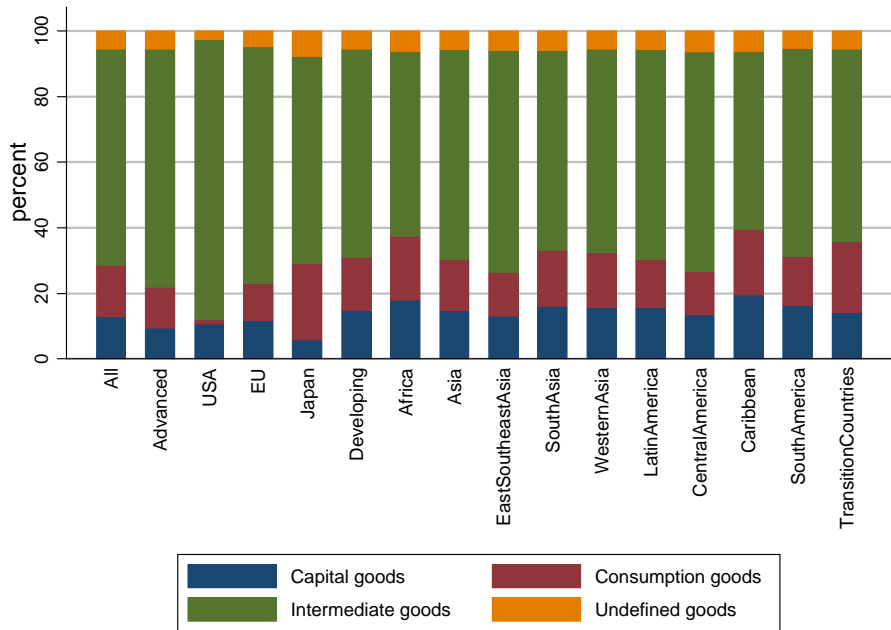
Figure A6: Types of Product Discovery by Region, 2000s (Moderate Measure)

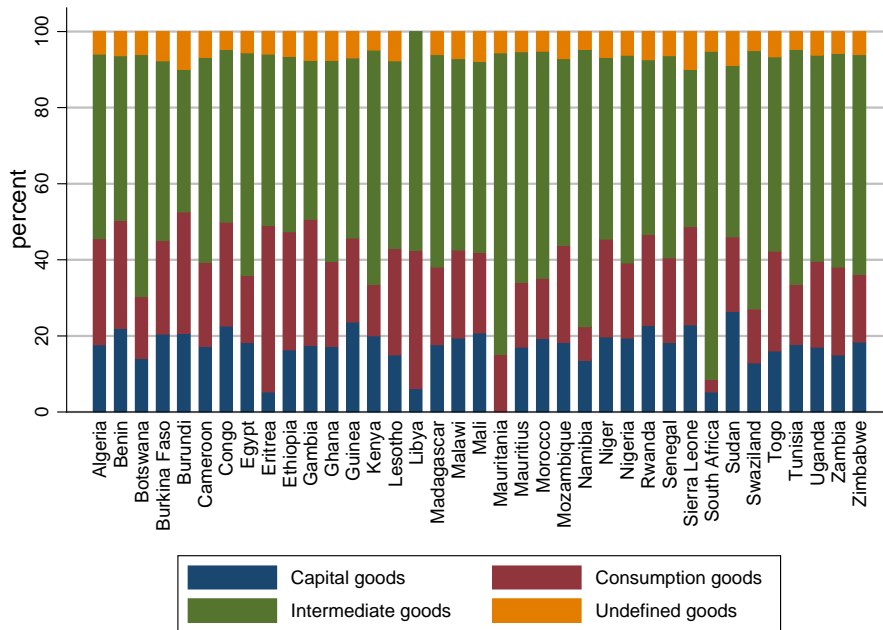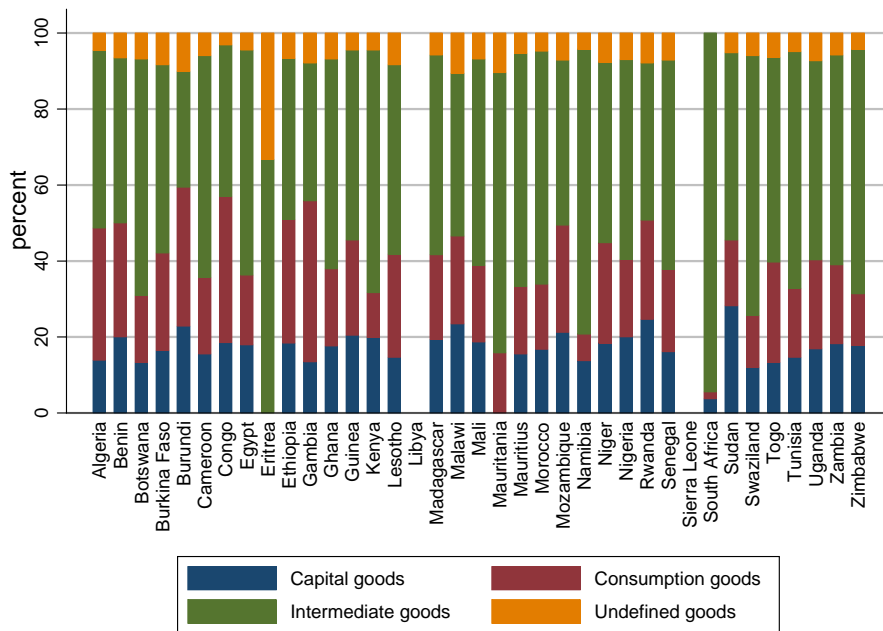**Figure A7: Product Discovery by African Country, 2000s (Liberal Measure)**

Figure A8: Product Discovery by African Country, 2000s (Moderate Measure)

**APPENDIX C: RESULTS USING ALTERNATIVE INDICATOR OF GVCS**

Timmer et al (2014) and Los et al (2015) propose an alternative indicator of GVC participation to describe the international fragmentation of specific value chains. The method is quite similar to that described above (i.e. Koopman et al, 2011) but replaces the export vector with the final output vector. A value chain of final products, **g**, is identified by the last stage of production, with the vector of value-added created in each of the SN country-industries involved in a value chain being given by:

$$\mathbf{g} = \mathbf{v}(\mathbf{I} - \mathbf{A})^{-1}\mathbf{F}$$

where S denotes industries, N denotes countries, **v** is a diagonalised vector of value-added over gross output ratios, $(\mathbf{I} - \mathbf{A})^{-1}$ is the Leontief inverse, and **F** is the diagonalised final output vector that determines which value chain is considered. In our analysis, **F** consists of: (i) Household final consumption; (ii) Non-profit institutions serving households; (iii) Government final consumption; Gross fixed capital formation; (iv) Changes in inventories; (v) Acquisitions less disposals of valuables.

Los et al (2015) then decompose the value-added of a final product (i.e. value chain) into value-added contributions in any country in the world. In particular, they split the value into a domestic and a foreign component, but also by region. Timmer et al (2014) take an alternative approach and in turn replace the value-added to gross output ratio vector with the ratio to gross output of value-added by capital and by labour to split up the contributions into the capital and labour components, again further splitting into a domestic and foreign component. In our analysis, we consider any aspect of value-added not due to labour to be due to capital. As such, the value-added of labour is given by the Compensation of Employees, while the value-added of capital is given by: (i) Taxes on production; (ii) Subsidies on production; (iii) Net operating surplus; (iv) Net mixed income; and (v) Consumption of fixed capital.

**Figure A9: Value of Value Chain in 2010 by Region**
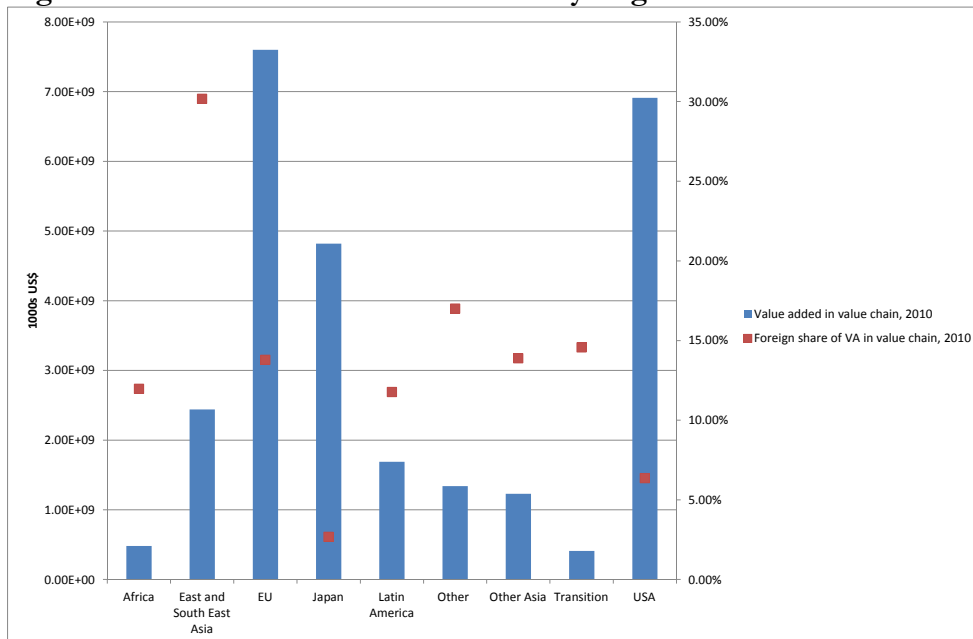
Source: Calculations based on UNCTAD-Eora GVC Database

Figure A9 reports the average value-added of the value chain across countries and sectors within each of nine regions in 2010. Africa as a region has a relatively small average value-added in value chains, being larger than Transition countries only. Values are, as expected, considerably higher in the EU, the USA and Japan, as well as East and South-East Asia, Other Asia and Latin America. Figure A9 also reports the average foreign value-added share by region for 2010. Here we observe that Africa has a higher foreign value-added share than both Japan and the USA, with a share similar to that in Latin America. Shares in Africa are somewhat smaller than values found in the EU, Other Asia, and Transition countries, and considerably lower than the share in East and South-East Asia. Overall, the pattern of outcomes in Figure A9 corresponds quite closely with that in the main text, with the major exception being that the USA has a relatively larger involvement in GVCs when measured using final demand rather than exports.

For each aggregated region and each sector, Figure A10 reports the foreign value-added share in final demand in 1995 and 2011. The figure indicates that there has been a tendency for the foreign value-added shares of final demand to increase over time in all regions. The exception to this is the case of Japan, where we see the vast majority of observations below the 45 degree line, indicating a declining share of foreign value-added. In the case of Africa there has been a strong tendency for fragmentation to increase. The fitted line of a regression of 1995 and 2010 shares for Africa reveals a coefficient of around 1.32, indicating that foreign value-added shares increased by around 32% over 15 years.

Figure A10: Foreign Value-added Shares in Output of Final Goods (1995 and 2011)
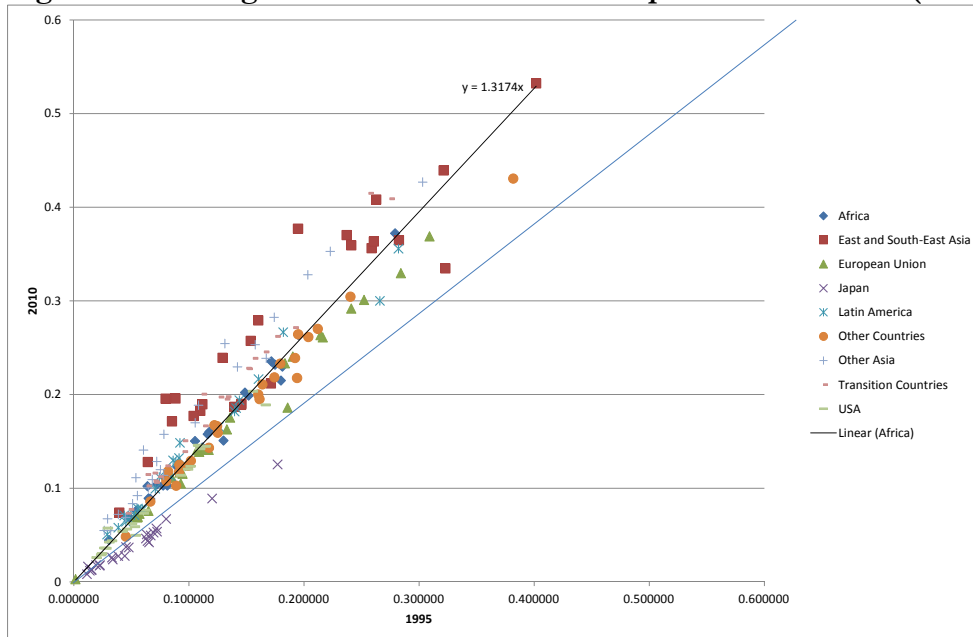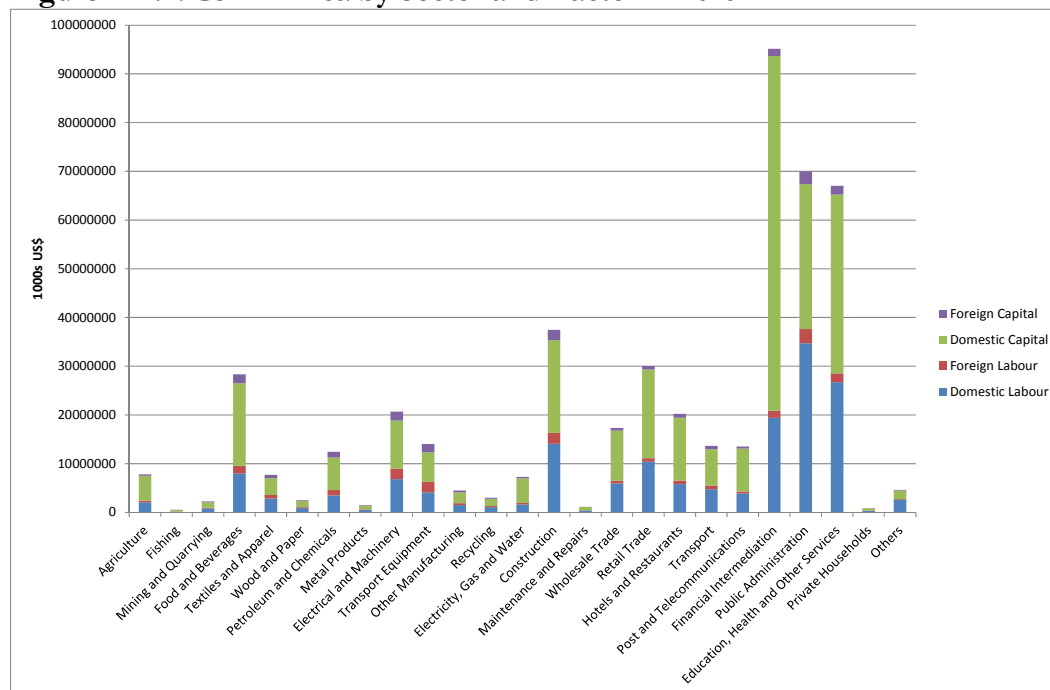

Source: Calculations based on UNCTAD-Eora GVC Database

Figure A11 reports the values of value-added in value chains by sector for Africa as a whole in 2010, further split into domestic and foreign, and capital and labour contributions. The first thing to note from this figure is that the use of the final demand vector in place of the gross export vector has a big influence on the values of GVCs reported, with Mining and Quarrying becoming relatively unimportant and Construction, Retail Trade, Food and Beverages, amongst others becoming relatively more important. The other thing to note is that the foreign value-added contribution tends to be relatively small. This is confirmed by Table A3, which reports the foreign value-added shares by sector for 1995 and 2010. The minimum share in 2010 was 4.4% in Financial Intermediation, with the maximum being 37% in Transport Equipment. The unweighted average was around 15%, which is not dissimilar to the value of the downstream measure of GVCs for Africa found using the Koopman et al (2011) approach in the main text.

Figure A12 considers the changes in value-added in value chains over time for Africa. The figure shows that the value-added in value chains declined over time for 13 of the 25 sectors in Africa, with the declines being particularly large in Mining and Quarrying; Financial Intermediation; Public Administration; and Education, Health and Other Services. Where declines have occurred they tend to be due to declines in the value-added contributions of domestic labour and capital, with increases in foreign capital and labour tending to be the norm. The exception to this is the case of Mining and Quarrying where declines in foreign labour and capital were also observed. Given these changes, it is unsurprising to find (from Table A3) that the foreign value-added shares increased between 1995 and 2010 for all sectors, with the (unweighted) average increase being 3.8 percentage points. While the largest (smallest) percentage point changes occurred for Transport Equipment (Financial Intermediation) with changes of 9.3 (1.4) percentage points, the largest percentage changes in foreign value-added were in Wholesale Trade (59%).
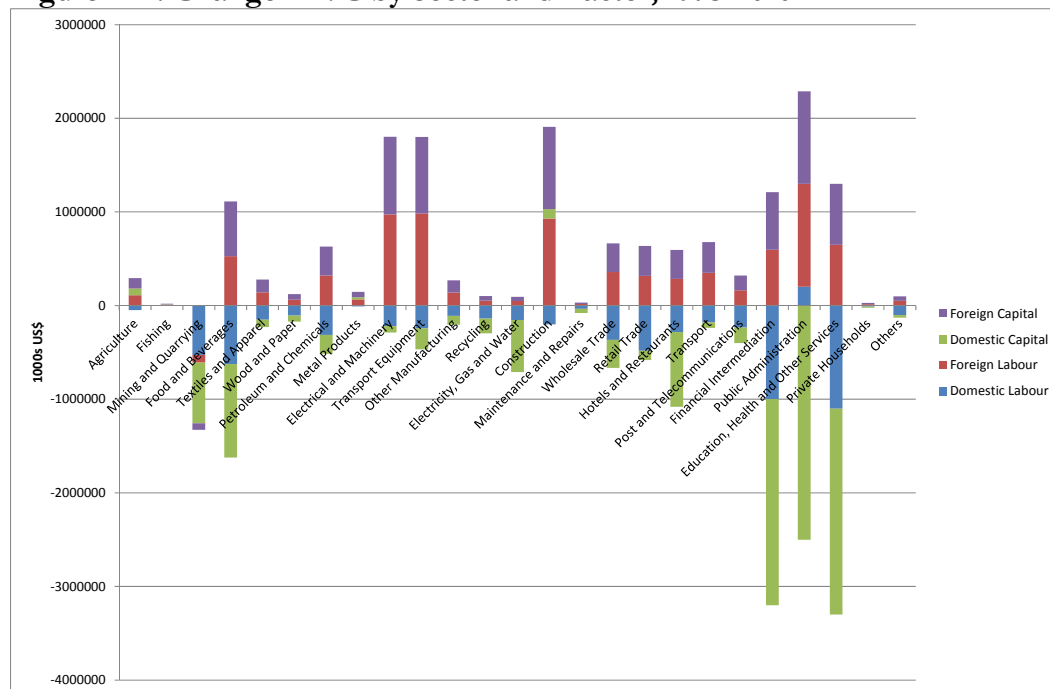
Figure A11: VCs in Africa by Sector and Factor in 2010

Source: Calculations based on UNCTAD-Eora GVC Database

Figure A12: Change in VC by Sector and Factor, 1995-2010

Source: Calculations based on UNCTAD-Eora GVC Database

**Table A3: Foreign Value-added Shares in Final Demand by Sector in Africa**

Sector	Foreign Value-added Share	Final Demand

	1995	2010	Change 1995-2010	in 2010
Agriculture	0.077582	0.10268	0.02510	25400000
Fishing	0.117223	0.14174	0.02452	1758070
Mining and Quarrying	0.130159	0.15071	0.02055	2878204
Food and Beverages	0.117838	0.16013	0.04229	88200000
Textiles and Apparel	0.180005	0.21475	0.03475	24600000
Wood and Paper	0.148770	0.20205	0.05328	7533286
Petroleum and Chemicals	0.181208	0.22973	0.04852	39000000
Metal Products	0.171669	0.23541	0.06374	4993287
Electrical and Machinery	0.195233	0.26317	0.06794	72100000
Transport Equipment	0.279230	0.37202	0.09279	49100000
Other Manufacturing	0.174754	0.23174	0.05699	14400000
Recycling	0.151991	0.19883	0.04684	7643386
Electricity, Gas and Water	0.081264	0.10277	0.02151	23600000
Construction	0.116409	0.15762	0.04121	132000000
Maintenance and Repairs	0.089845	0.12253	0.03268	3800767
Wholesale Trade	0.064007	0.10203	0.03802	59500000
Retail Trade	0.048061	0.06919	0.02113	101000000
Hotels and Restaurants	0.072468	0.10403	0.03156	70400000
Transport	0.105409	0.15022	0.04481	49400000
Post and Telecommunications	0.065027	0.08915	0.02412	44500000
Financial Intermediation	0.030755	0.04441	0.01366	318000000
Public Administration	0.080177	0.11035	0.03017	226000000
Education, Health and Other Services	0.054245	0.07593	0.02168	225000000
Private Households	0.111758	0.14348	0.03172	3023271
Others	0.066455	0.08840	0.02195	18100000

Notes: values of final demand are in 1000s of US dollars.

Considering the value of foreign value-added across sectors in Africa (Figure A13) we observe that FVA tends to be relatively large in Public Administration, as well as a number of other sectors including Construction; Electrical Machinery; and Transport Equipment. Splitting FVA into the labour and capital contributions, we find that contributions tend to be split fairly evenly between the two sources of value-added. The labour contribution ranges from a low of 47 to a high of 55%, with an (unweighted) average of 50.7%.

**Figure A13: FVA by Sector and Factor in 2010**
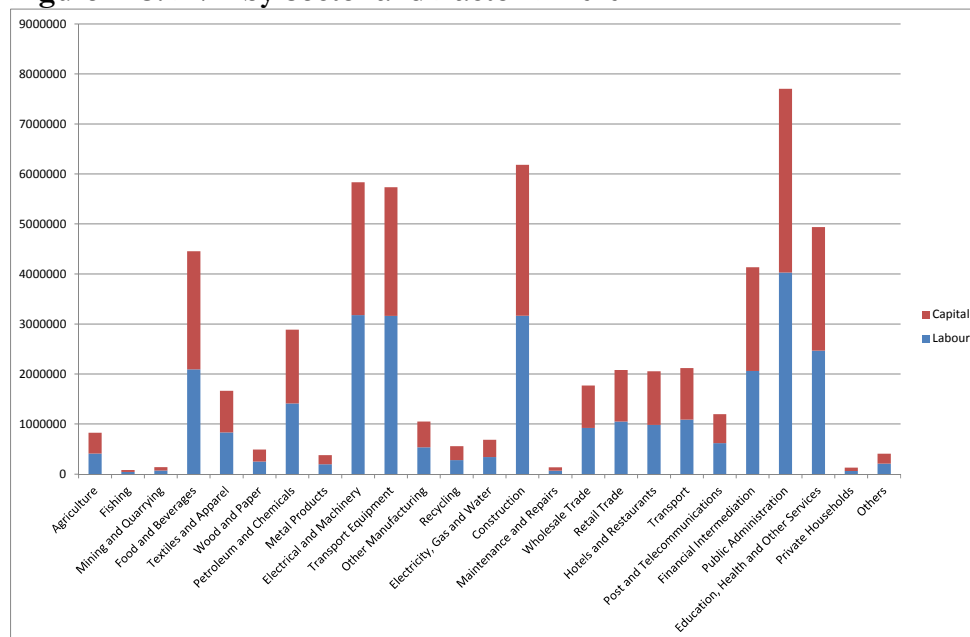
Source: Calculations based on UNCTAD-Eora GVC Database

Figure A14 reports the value of the value chain for each African country, obtained by summing the domestic and foreign value-added across the 25 sectors for each African country. The first thing to note from this figure is that the value of the value chain is relatively small for the vast majority of countries, reflecting their relatively small size. This further confirms the statement made in the main report that using the Koopman et al (2011) approach of taking values of GVC participation relative to total exports may overinflate the importance of GVCs for Africa. Countries such as Swaziland and Sao Tome and Principe, amongst many others, that report relatively large values for GVC participation using the Koopman et al (2011) approach have some of the smallest values for value chains when using the current approach and not scaling by exports. Relatively speaking, value chains are important for a number of countries using this approach, including South Africa, Egypt, Algeria, Nigeria, Morocco and Libya.

The share of FVA in the value chain tends to be relatively small (again, around 15%), being below 10% in a number of cases (and lowest for Somalia at just 2.8%) (see also Figure A15). The largest value for FVA is reported in Ethiopia, with a share of 41.8%, with shares of 30% or more also reported in Angola, Sao Tome and Principe, and Swaziland. Results in Figure A15 suggest that the split between labour and capital in terms of FVA tends to be fairly even across African countries. Indeed, the (unweighted) average contribution of labour is 50%, with the values ranging from 46.7% to 55.0%.

Figure A14: VCs by African Country, 2010
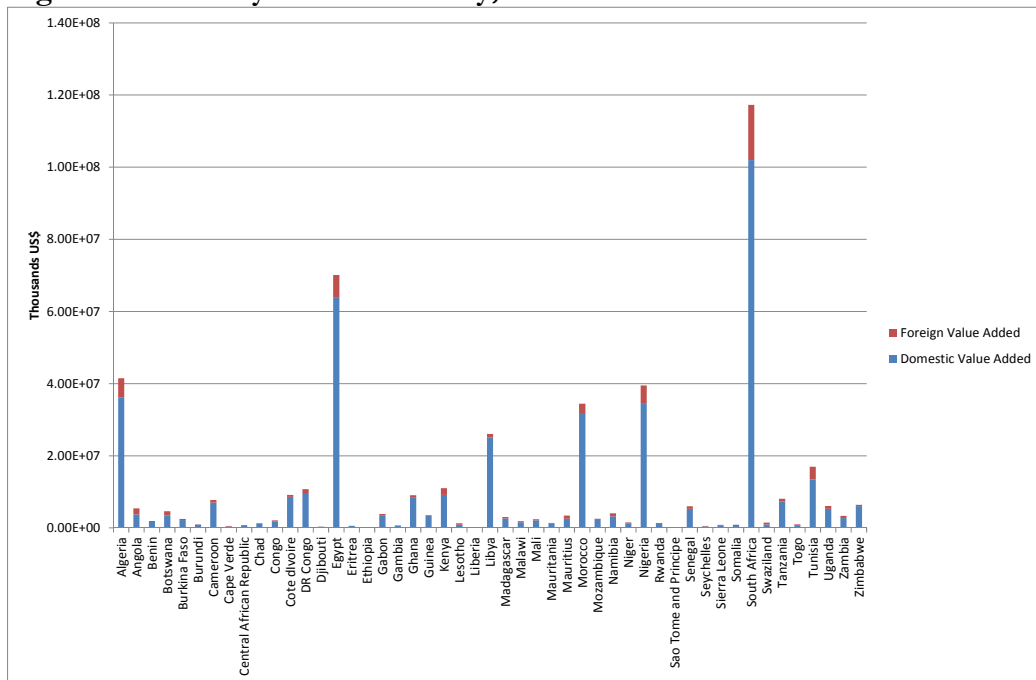
Source: Calculations based on UNCTAD-Eora GVC Database

**Figure A15: Breakdown of the Value of VC by African Country, 2010**
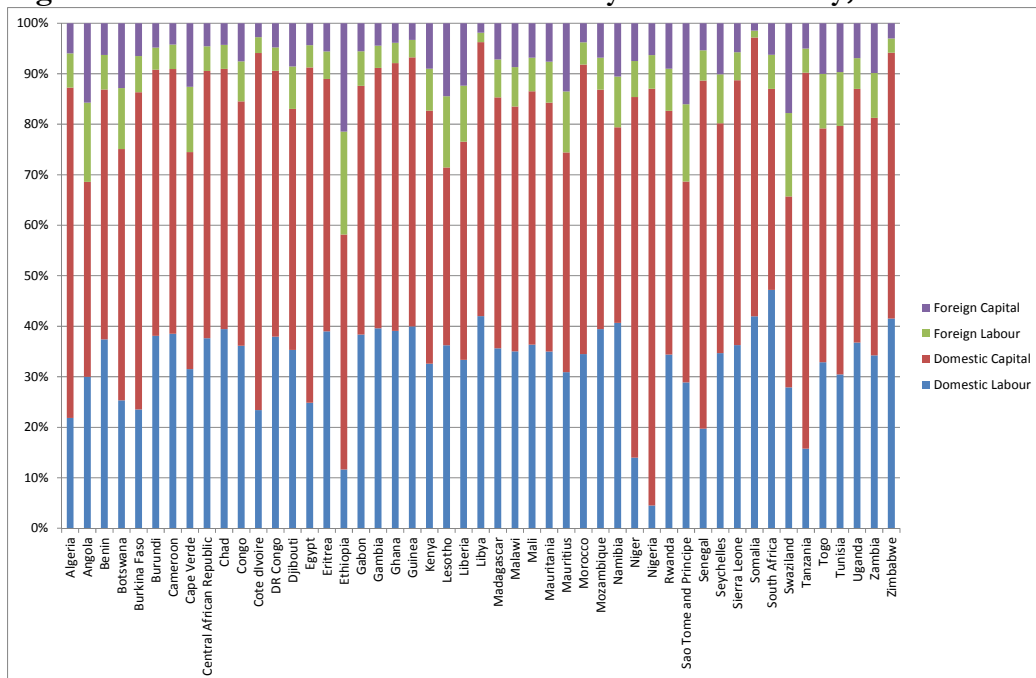
Source: Calculations based on UNCTAD-Eora GVC Database

Finally, we consider the regional breakdown of value chain involvement for Africa. Figure A16 reports the average values of foreign value-added by sector for Africa as a whole, but split by region of origin. The EU dominates as a source of FVA across most sectors, with an average

value of 49% across all sectors (and a minimum of 35% for Maintenance and Repairs and 58% for Transport Equipment). Other African countries make up 10% of an African country's foreign value-added on average (a low of 5% for Others and a high of 15% for Hotels and Restaurants), with East and South-East Asia contributing 8.9% (a high of 13.5% for Textiles and Apparel), the USA 8.4% (a high of 15% for Wholesale Trade) and Japan 8.2% (a high of 18.2% for Wholesale Trade).

Figure A16: Regional Breakdown of FVA in 2010
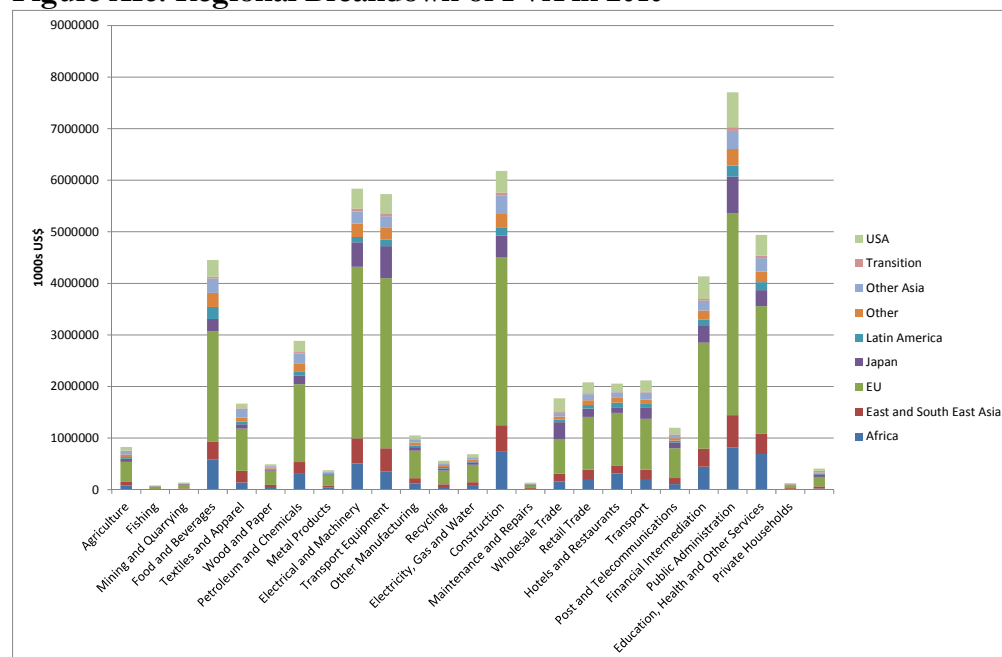
Source: Calculations based on UNCTAD-Eora GVC Database

Summary:

- The average value of a value chain in Africa is dwarfed by that of most other regions.
- Foreign value-added within African value chains makes up between 10% and 15% of the overall value of the value chain, a share that is not dissimilar from many other regions and higher than that in the USA and Japan.
- Foreign value-added shares in African value chains have risen over time, increasing by around 30% between 1995 and 2010.
- Value chains in Africa tend to be relatively large (on average) in a number of services sectors (e.g. public administration, financial intermediation, and education, health and other services), as well as food and beverages, and construction.
- The value-added in value chains in African declined in about half of sectors between 1995 and 2010, with these declines driven by declines in the domestic component of value-added.

- The average value of a value chain in most African countries is relatively small, with exceptions being South Africa, Egypt, Algeria, Nigeria, Morocco and Libya.
- The EU is the dominant source of foreign value-added across Africa as a whole.

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