WP 2017-09
June 2017

Working Paper

Charles H. Dyson School of Applied Economics and Management
Cornell University, Ithaca, New York 14853-7801 USA

SUB-SAHARAN AFRICA'S MANUFACTURING SECTOR: BUILDING COMPLEXITY

Haroon Bhorat, Ravi Kanbur, Christopher Rooney and François Steenkamp

It is the Policy of Cornell University actively to support equality of educational and employment opportunity. No person shall be denied admission to any educational program or activity or be denied employment on the basis of any legally prohibited discrimination involving, but not limited to, such factors as race, color, creed, religion, national or ethnic origin, sex, age or handicap. The University is committed to the maintenance of affirmative action programs which will assure the continuation of such equality of opportunity.

Sub-Saharan Africa's Manufacturing Sector: Building Complexity[*]

Haroon Bhorat[1], Ravi Kanbur[2], Christopher Rooney[3] and François Steenkamp[4]

May, 2017

Abstract

As Africa's working age population continues to grow rapidly, the region needs to experience both economic growth and high levels of job creation before it can realize the demographic dividend. This paper uses economic complexity analytics to provide product-level insights into sub-Saharan Africa's development path in comparison with that of the Eastern and Southern Asian regions. Specific emphasis is placed on the evolution of the manufacturing sector within these regions. The analysis from this study shows a sub-Saharan African (SSA) productive structure that is disconnected and characterized by products with low levels of economic complexity. The study further shows that the productive structure in SSA is inherently characterized by lower levels of economic complexity, which informed the notion of limited productive capabilities. This stands in contrast to the East and South Asian productive structure, which is connected and complex. This result implies that while the sheer scale and diversity of the manufacturing sector in Asia allows for the generation of a large number and diversity of employment opportunities that of the African manufacturing sector is marginal in nature and points to limited employment opportunities.

Keywords: Manufacturing sector; economic complexity; employment opportunities, sub-Saharan Africa.

JEL Classification: J01, L60, N67

[*] This paper has also been disseminated as Bhorat, H., R. Kanbur, C. Rooney and F. Steenkamp (2017), Sub-Saharan Africa's Manufacturing Sector: Building Complexity, Working Paper Series N° 256, African Development Bank, Abidjan, Côte d'Ivoire.

[1] Development Policy Research Unit (DPRU); School of Economics; University of Cape Town; South Africa
[2] Cornell University; Ithaca; U.S.A.
[3] Development Policy Research Unit (DPRU); School of Economics; University of Cape Town; South Africa
[4] Development Policy Research Unit (DPRU); School of Economics; University of Cape Town; South Africa

1 Introduction

Prior to 2000, there was widespread pessimism regarding Africa's economic growth prospects. An over-reliance on mineral exports, civil war and chronic corruption had ruined many of Africa's economies, culminating in *The Economist* labelling it the 'hopeless continent' (The Economist, 2000). Since the turn of the millennium, however, the narrative has changed. Pessimism has changed to optimism, buoyed by the growth of an African middle class (Shimeles & Ncube, 2015) and increasing foreign direct investment, which reached $60 billion in 2013—five times its 2000 level (Diop et al. 2015).

The optimism, however, has been tempered by unemployment—especially among young people— that has accompanied the high levels of economic growth. Between 2000 and 2008, the African working age population (15 – 64 years) increased from 443 million to 550 million, but only 73 million jobs were created over the same period (OECD, 2012; Sparreboom & Albee, 2011). The youth only obtained 16 million or 22 percent of those jobs (Sparreboom & Albee, 2011). Indeed, the SSA youth unemployment rate only decreased by 1 percent over the past 20 years—from 13.4 percent (1991 – 2000) to 12.3 percent (2001 – 2012) (ILO, 2014). In effect, the high growth rates have not generated a sufficient quantum of jobs to match the expansion in the labour force. The challenge is further exacerbated by estimates which state that each year between 2015 and 2035, 500 000 people in sub-Saharan Africa (SSA) will turn 15 (Filmer & Fox, 2014).

In the context of a growing labour force, there has been debate over the prospects of Africa following the economic footsteps of East and South Asia, and pursuing a form of manufacturing-led structural transformation, and thereby creating jobs for a young and growing labour force (McMillan et al., 2014; Rodrik, 2014; Page, 2012). This paper adds to this debate, which has typically viewed manufacturing at the aggregate level, by providing a more granular product-level analysis of SSA's evolving manufacturing sector, with the Asian experience serving as a counterpoint. The analysis is aided by the tools of complexity analysis, specifically those derived from the Atlas of Economic Complexity (see Hausmann et al., 2014).

2. Sub-Saharan Africa's Demographic Dividend and Structural Transformation

Over the next century, sub-Saharan Africa (SSA) is predicted to account for the majority share of world population growth. The world population is expected to grow by 3.9 billion by 2100, of which 2.9 billion or 75 percent will be from SSA (see Table 1).[5] As a result, SSA's share of the world's population will increase from 14 to 35 percent. Africa's working age population will increase by 2 billion while many other continents will see their working age population shrink as a result of aging populations (Bhorat, Naidoo and Ewinyu, 2017).[6] Nearly 40 percent of the world's working age population is expected to reside in Africa by 2100 – up from 10 percent in 2015.

Table 1: World and Sub-Saharan African Population Projections, 2015 - 2100

	Total Population (Billion)			Working Age Population (Billion)		
	2015	2100	Change (%)	2015	2100	Change (%)
Sub-Saharan Africa	1.0	3.9	290	0.5	2.5	400
World	7.3	11.2	53	4.8	6.7	40
SSA Proportion (%)	13.7 %	34.8 %	-	10.4 %	37.3 %	-

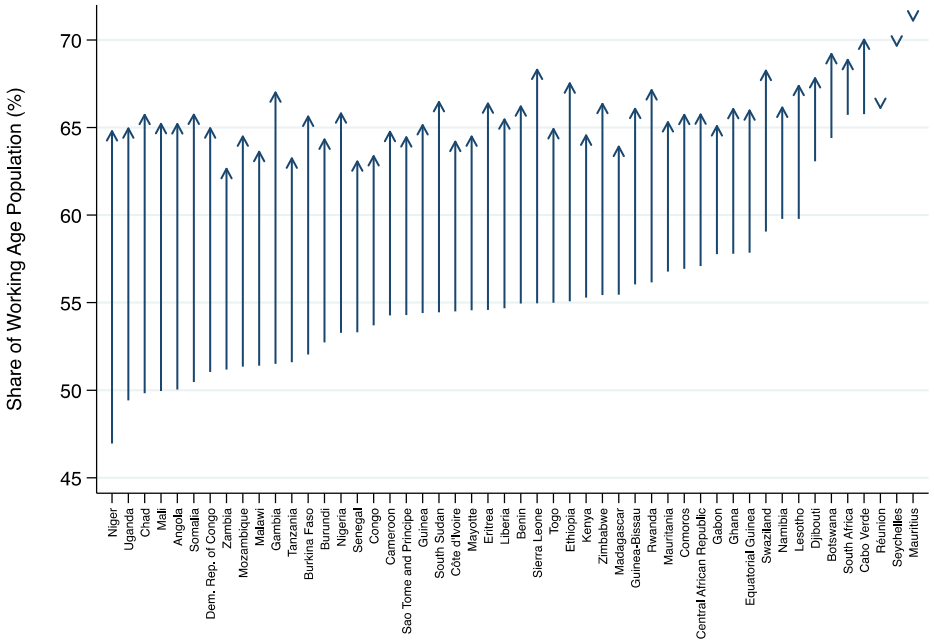
Source: Adapted from Drummond, Thakoor and Yu (2014) using the UN World Population database.

The predicted growth of Africa's population on aggregate and, importantly, the growth in the working age population, mask considerable country level heterogeneity across the continent. Figure 1 shows the degree to which SSA countries have completed their demographic transition. Specifically, we compare the share of the working age population in 2015 (the rectangular base of the arrow) to the predicted peak share of the working age population (the top point of the arrow) for each country.

Three countries (Mauritius, Seychelles and Réunion) have already hit the peak of their share of the working age population. In fact, between now and 2100, the proportion of the working age population in these three countries is expected to decline. Another group of five countries (Cabo Verde, South Africa, Botswana, Djibouti and Namibia) are relatively close to reaching their peak working age population. A third group of approximately 18 countries are expected to experience a rise in their working age population share of between 6 and 10 percentage points.

[5] All projections beyond 2015 use the UN Population Division's Medium Variant projections.
[6] Working age population is defined as individuals aged between 15 and 64 years.

Figure 1: Current and Peak Share of the Working Age Population in Sub-Saharan Africa, 2015-2100



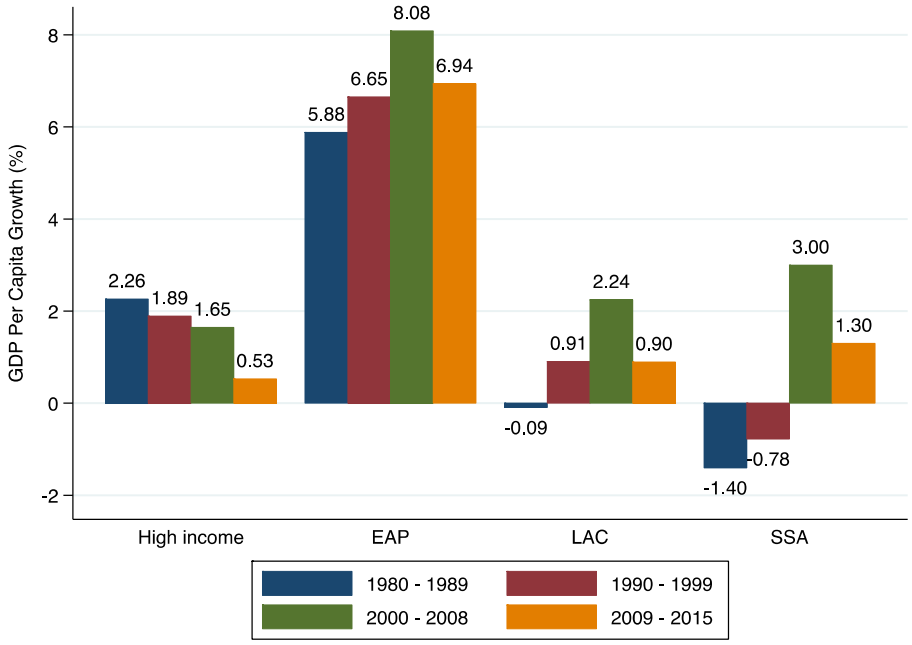
Source: Authors' calculations using the UN World Population Database.

Finally, a fourth group, comprising 24 countries, is expecting a rise in the working age population share of between 11 and 18 percentage points. This group includes Nigeria, Ethiopia, the Democratic Republic of the Congo, and Tanzania, four of the top six most populous countries in Africa. Indeed, just ten SSA countries will account for nearly 70 percent of the population growth in the region (see Appendix Figure 1). Nigeria will experience an increase of 570 million, accounting for nearly a fifth of all SSA population growth. The DRC will see its population increase by 311 million or 10.5 percent of all SSA growth. The third major population driver in the region, Tanzania, will experience a six-fold increase in the size of its population from 53 to 299 million.

The rapid growth of Africa's working age population presents both opportunities and risks. A growing labour force is an opportunity to increase the productive capacity of a country and thereby generate economic growth and raise living standards—together with the promise of a large and growing consumer market. In contrast, a failure to utilise the economic potential of new jobseekers through absorption in the labour market, will lead to rising unemployment and escalate the risk of social unrest. Ultimately, countries need to experience both economic growth and high levels of job creation to realize the dividend that comes with an expansion of the labour force.

The region has experienced economic growth over the past two and a half decades. This is depicted in Figure 2. In the 1980s and 1990s, sub-Saharan Africa's GDP per capita was falling. When compared with other developing county blocs—such as East Asia and Latin America and the Caribbean—it was the worst performing region by some distance. However, since 2000, it has out-performed, not only Latin America and the Caribbean, but high income countries as well. The recent global downturn—caused by the 2007/2008 financial crisis—has, however, raised questions about the sustainability of Africa's recent growth performance.

Figure 2: GDP Per Capita by Region, 1980-2015



Source: Authors' calculations using World Development Indicators (2017).
Notes: EAP: East Asia and Pacific (excluding high-income countries); LAC: Latin America and the Caribbean (excluding high-income countries); sub-Saharan Africa (excluding high-income countries). List of countries included in Appendix Table 1, Table 2, Table 3 and Table 4.

In particular, concerns have been raised about the lack of structural transformation— 'the reallocation of economic activity away from the least productive sectors of the economy to more productive ones' (OECD, 2013) —taking place across the region (Mcmillan & Rodrik, 2011; UNECA, 2014). Much of the growth has come from either large oil exporters (e.g. Nigeria) or countries that have experienced a large expansion of their services sector (e.g. Rwanda) (Rodrik, 2013).

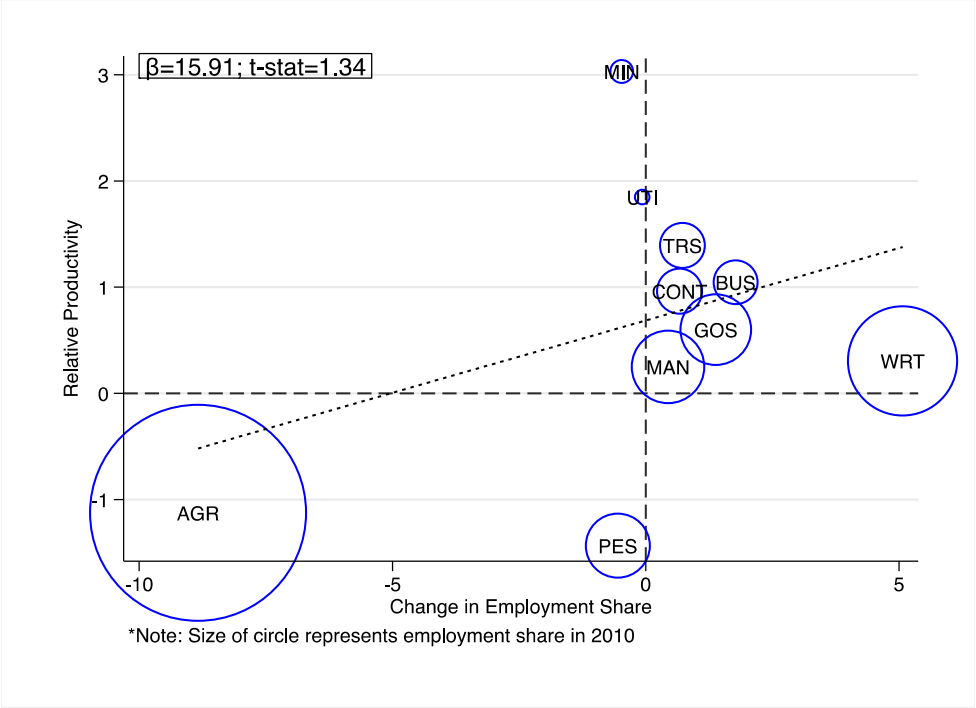
In Figure 3 below, we provide an overview of the degree of structural transformation in SSA between 1975 and 2010.[7] Figure 3 depicts this shift of employment across sectors varying in

[7] In

terms of productivity. This is done by plotting the productivity across ten sectors in 2010 against the change in employment within these sectors, over the period 1975 to 2010, for a sub-Saharan African regional aggregate. In essence, the graph is showing whether shifts in the structure of the economy, in terms of shifts in employment across sectors, have been toward productive or unproductive activities. A positively sloped fitted line is indicative of productivity-enhancing, and hence growth-inducing, structural change. Conversely, a negatively sloped fitted line is indicative of productivity-reducing, and hence growth-reducing, structural change.

Looking at Figure 3, there is evidence of growth inducing structural transformation in SSA over the period 1975 to 2010.[8] While remaining the largest employer, the low productivity agriculture sector has incurred the highest employment losses over the 35-year period.

Figure 3: Sectoral Productivity and Employment Changes in Africa, 1975-2010



Source: Own calculations using Groningen Growth and Development Centre 10-sector database (see Timmer et al.,2014).
Notes: 1. African countries included: Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, Tanzania and Zambia. 2. AGR = Agriculture; MIN = Mining; MAN = Manufacturing; UTI = Utilities; CONT = Construction; WRT = Trade Services; TRS = Transport Services; BUS = Business Services; GOS = Government Services; PES = Personal Services.

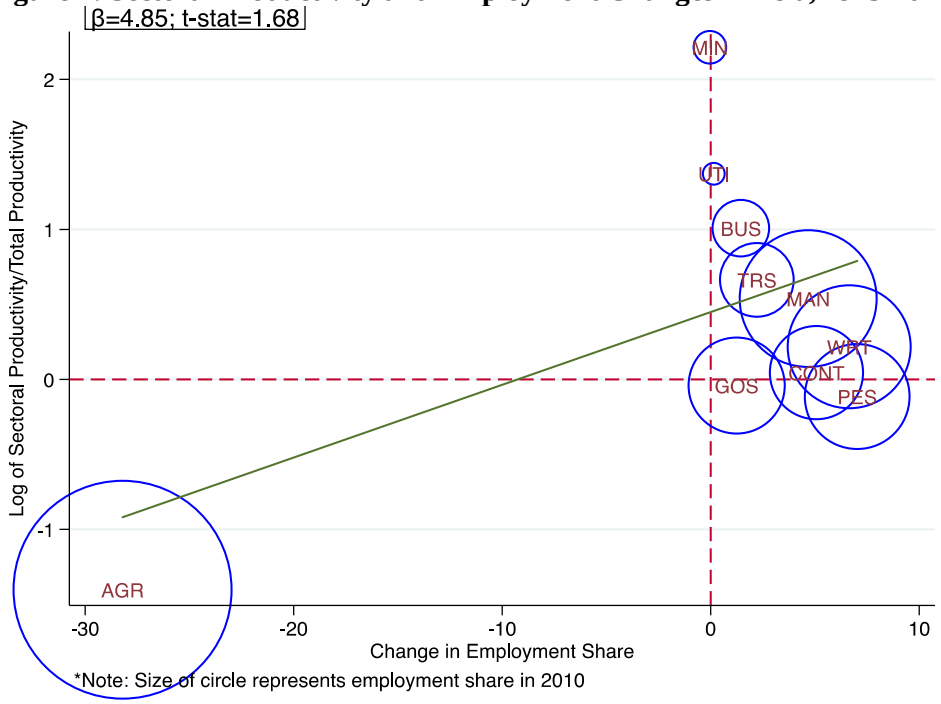
Employment levels in the high-productivity manufacturing sector have remained stagnant. The biggest beneficiaries of SSA's growth have evidently been services, with government,

Appendix Table 1, we report actual shares of employment for Africa and Asia between 1975 and 2010.
[8] It must be noted that the estimated regression line, measuring the relationship between productivity and changes in employment share by sector, is not statistically significant.

transport, business, and trade services increasing their share of employment over the period. Unfortunately, the most productive sectors (mining and utilities) have not recorded employment growth. This is indicative of the high level of capital intensity associated with these industries. Ultimately then, the African growth experience over the last 35 years can, in general, be characterised as being manifest in a growth in capital-intensive resource- and energy-based industries—which in turn have not generated a sufficient number of jobs. In turn, Africa's manufacturing sector has stagnated in output and employment terms. The latter has been in an environment of an unproductive agriculture sector and an employment-intensive, urban-based informal retail sector.

On the other hand, the East and South Asian regional aggregate (now known as the Asian regional aggregate) illustrates the more typical manufacturing-led pattern of structural transformation (see Figure 4 below). It is evident that employment has shifted from low productivity agricultural activities to higher productivity activities, particularly in manufacturing.

Figure 4: Sectoral Productivity and Employment Changes in Asia, 1975-2010



Source: Own calculations using Groningen Growth and Development Centre 10-sector database (see Timmer et al., 2014).

Notes: 1. Asian countries are comprised of East and South Asian countries, including: China, Hong Kong, India, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. 2. AGR = Agriculture; MIN = Mining; MAN = Manufacturing; UTI = Utilities; CONT = Construction; WRT = Trade Services; TRS = Transport Services; BUS = Business Services; GOS = Government Services; PES = Personal Services. 2. The estimated regression line, measuring the relationship between productivity and changes in employment share by sector, is not statistically significant.

In the aggregate, Asia has seen a dramatic decline in agricultural employment—approximately 30 percent. However, as in SSA, agriculture remains the dominant source of employment. Services, while showing employment growth, is minor compared to that of SSA, although it is off a bigger base. The most significant difference between SSA and Asia is driven by the differential outcomes in the manufacturing sector. Not only is manufacturing relatively more productive in Asia than in SSA, it has grown substantially between 1975 and 2010, and has the second largest share of employment (15.8%) after agriculture (40.1%).[9] This is consistent with the notion that manufacturing has been an engine of growth for the Asian region.

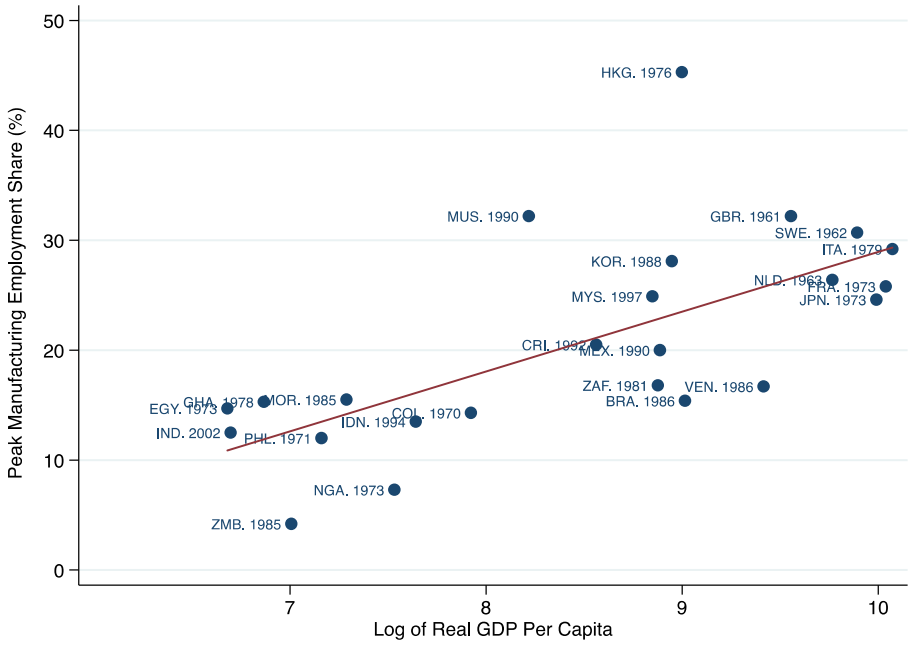
Comparing the SSA aggregate to the Asian aggregate, it is evident that both regions have experienced growth-inducing structural transformation over the period, but the nature of the transformation has been different. The Asian experience points to a shift from the low productivity agricultural sector to the high-productivity manufacturing sector. The SSA experience points to a shift from the low-productivity agricultural sector (although, to a lesser degree than in Asia) to services. In particular, a shift to wholesale and retail trade services, which is typically taking place within the informal sector. Therefore, in the context of a young and growing labour force in most countries in the SSA region, questions concerning where jobs are going to come from is front and centre in the policy debate.

Stagnation in the manufacturing sector is, however, not solely due to Africa-specific factors. Recent evidence indicates that it is becoming increasingly difficult to industrialize. Figure 5 indicates the income level peak manufacturing employment across various countries. The first wave of industrializers (notably, Great Britain, Sweden and Italy) witnessed peak manufacturing employment of about 30 percent of total employment. The next wave of industrialisation—mainly East Asian countries (e.g. South Korea)—saw peak manufacturing employment well below 30 percent. Finally, most Latin American and African countries began experiencing de-industrialisation when peak manufacturing employment was between 13 and 17 percent of total employment (e.g. Brazil; South Africa). Nigeria and Zambia both experienced deindustrialisation before manufacturing even reached 10 percent of total employment.

[9] In comparison, the employment share in manufacturing and agriculture in 2010 in SSA were 6.6 and 58.9 percent, respectively.

Rodrik (2014, 2016) attributes this phenomenon mainly to trade and globalisation. As part of their membership of the World Trade Organization, developing countries were forced to liberalise many of their markets. At the time, many African countries had nascent manufacturing sectors and thus, when exposed to world markets, became importers of manufactured goods. Secondly, the relative decline in prices of manufactured goods in industrialized countries threatened the economic viability of manufacturing sectors, especially in countries where the manufacturing sector was not well established. In contrast, Asian countries were not subject to the same trends because of their comparative advantage in manufacturing.

Figure 5: GDP per capital at Peak Manufacturing Levels, By Country



Source: Own calculations using Groningen Growth and Development Centre 10-sector database (see Timmer et al., 2014).

It is indisputable that it has become harder to industrialize. When developed countries and Asia industrialized, they did so under protectionist regimes, which allowed them to build a significant manufacturing base (Rodrik, 2016). In contrast, SSA has had to compete in the world market with established manufacturing exporters. In addition, Asian exporters have successfully penetrated the domestic markets of SSA countries, making it even more challenging for these countries to build a productive manufacturing sector. Regardless of these hurdles, however, manufacturing remains the best hope for SSA to generate a large number of good jobs and reduce the prospects of political and social instability.

McMillan et al. (2014), Rodrik (2016) and others, provide insight into the extent to which African countries can industrialize and thereby create manufacturing jobs in the face of a growing labour force. These analyses, however, have sought to examine the evolution of the manufacturing sector across countries at the aggregate level, focusing on the manufacturing sector as a homogenous entity. In the following analysis, we attempt to provide product-level insights into the evolution of the manufacturing sector in SSA, with the East and South Asian region as a counterpoint. The expansion of the manufacturing sector is not simply the expansion of a single aggregate entity but rather an evolution of heterogeneous productive activities within this aggregate. We go on to argue that an evolving manufacturing sector is one that shifts production toward increasingly sophisticated forms manufacturing activity requiring combinations of embedded knowledge and capabilities, thereby ultimately building economic complexity. The aim is to provide more nuance to the existing debate by providing a more granular method of analysis.

3. Employment, Manufacturing and Increasing Complexity

In this section, we use economic complexity analytics to provide product-level insights into sub-Saharan Africa's development path in comparison with that of the Eastern and Southern Asian regions. Specific emphasis is placed on the evolution of the manufacturing sector within these regions. The section starts by motivating for the link between a country's level of economic complexity and the relative strength of its manufacturing sector. This is followed by a product-level comparative analysis of the Asian and sub-Saharan African region's development trajectory with respect to their evolving manufacturing sectors. The East and South Asian region provides an example of a 'manufacturing success story', and thus acts as a useful counterpoint from which to compare the evolution of manufacturing in SSA. The section concludes by examining how the evolving manufacturing sectors across these regions act as a source of employment.

Conceptualizing Complexity and Connectedness

Economic Complexity

Hausmann et al. (2014) argue that the process of economic development involves the accumulation and mobilisation of productive knowledge, or capabilities. The amount of productive capabilities that a country is able to mobilize, is reflected in the diversity of firms

that it has, the diversity of occupations that these firms require, and the level of interactions between these networks of firms. These productive capabilities are described as non-tradable networks of collective know-how, such as logistics, finance, supply and knowledge networks (Hidalgo et al. 2009). The accumulation and mobilisation of these productive capabilities is embodied in the measure of *economic complexity*, developed by (Hidalgo et al. 2009).[10]

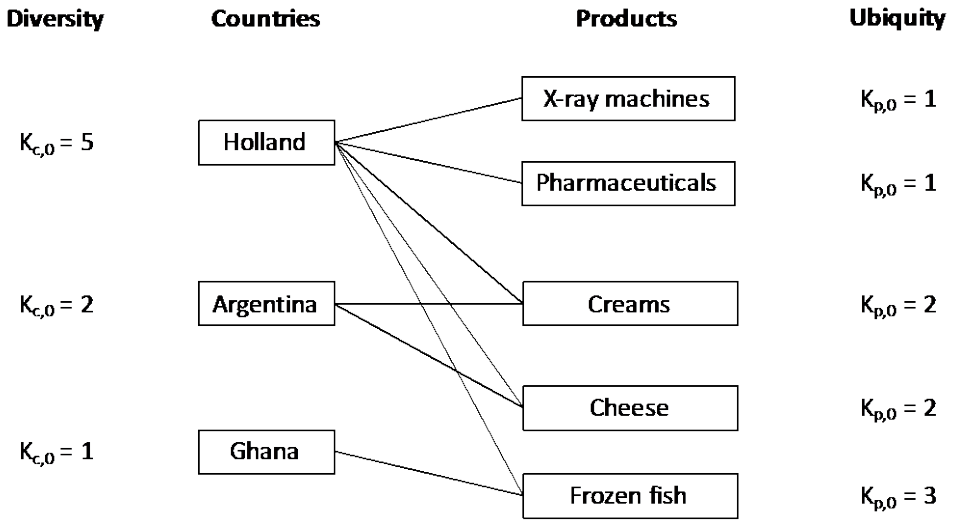
In order to measure the productive knowledge or capabilities embedded in an country, Hidalgo et al. (2009) use international trade data to examine what products countries make, and from this, to infer their productive capabilities. Two components inform the construction of a measure of *economic complexity* for a country: Firstly, countries with individuals and firms that possess more productive knowledge can produce a more diverse set of products. Secondly, products that require large amounts of productive knowledge are only produced in a few countries where this knowledge is available. Therefore, the more diverse a country's export portfolio and the less ubiquitous the products that comprise its export portfolio, the more productive knowledge embedded in its economy.

Figure 6 provides an illustrative example on how the dual measures of diversity and ubiquity are used in the measurement of economic and product complexity. One observes that Holland has the most diverse export basket (five products), while Ghana has the least diverse export basket (one product). This provides the first iteration of productive capabilities data, which suggest that Holland has more productive capabilities than Ghana. One also observes that Holland exports all five products, but interestingly, it exports the two least ubiquitous products (X-ray machines and pharmaceuticals), suggesting in part some form of specialized capability in the production and export of these goods. Holland also exports cream, cheese, and frozen fish, which are exported by Ghana and Argentina, and thus relatively more ubiquitous. This second iteration of information reinforces the first, and the combination of both the diversity and ubiquity measures, suggests that Holland has the most productive capabilities. The relative ubiquity of these products—cream, cheese and frozen fish—suggests that the productive capabilities embedded in them are common across the three countries. This is even truer in the case of frozen fish, which is produced in all three countries. However, only Holland can

[10] It is worth mentioning that a number of other researchers, such as Tacchella et al. (2012), have developed alternative methods for measuring economic and product complexity,. We employ the methodology outlined in the Atlas of Economic Complexity (http://atlas.cid.harvard.edu), developed by a team of researchers at the Centre of International Development (CID) at Harvard University.

produce X-ray machines and pharmaceuticals—suggesting that the productive capabilities embedded in these products are relatively more specialized and specific to Holland.

Figure 6: Example of Country-Product Network used in Method of Reflections



More formally, and informed by Hidalgo et al. (2009), using bilateral trade data - diversity and ubiquity are defined in the following equations:

$$Diversity = k_{c,0} = \sum_{p} M_{cp} \tag{1}$$

$$Ubiquity = k_{p,0} = \sum_{c} M_{cp} \tag{2}$$

Where M_{cp} is a matrix that is 1 if country c produces product p, and 0 otherwise. Diversity and ubiquity are measured by summing over the rows and columns of the matrix, respectively. Hidalgo et al. (2009) employ an iterative calculation, the Method of Reflections, to generate measures of complexity. Each iteration of the calculation corrects information from the previous iteration, until the process converges. In the case of countries, one calculates the average ubiquity of the products that each exports, the average diversity of the countries that make those products, and so forth. In the case of products, one calculates the average diversity of countries that export them, and the average ubiquity of the products that these countries make. Formally, this is expressed as:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_{p} M_{cp} \, . \, k_{p,N-1} \tag{3}$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_{c} M_{cp} \, . \, k_{c,N-1} \tag{4}$$

Therefore, diversity is used to correct for information carried by ubiquity, and ubiquity is used to correct for information carried by diversity. Furthermore, ubiquity can be further corrected by taking information from diversity that has already been corrected for by ubiquity, and so on. This mathematical process converges after a few iterations, and generates measures of complexity for countries, *economic complexity*, and measures of complexity for products, *product complexity*.[11] Formally, this is presented by manipulating equations (3) and (4) to arrive at:

$$k_{c,N} = \sum_{c\prime} \widetilde{M}_{cc\prime} \, k_{c\prime,N-2} \tag{5}$$

Where $\widetilde{M}_{cc\prime}$ corresponds to the eigen vector capturing the largest eigen value in the system. Eigen values represent the measure of economic complexity. More formally, this is represented as:

$$ECI = \frac{\vec{K} - < \vec{K} >}{stdev(\vec{K})} \tag{6}$$

In the equation, $<>$ and $stdev$ represent average and standard deviation, respectively. $\vec{K}$ represents the eigen vector of $\widetilde{M}_{cc\prime}$ associated with the second largest eigen value. This procedure allows for the generation of the measures of *economic complexity*, which measures the productive capabilities specific to each country, and *product complexity*, which measures the productive capabilities needed to produce a product.[12]

Connectedness

The connectedness of a country's productive structure, measured as the *opportunity value* index, using the Atlas of Economic Complexity measures (Hausmann et al., 2014), provides a value of the new 'nearby' productive opportunities associated with a country's current export

[11] We generate measures of economic and product complexity using trade data from the BACI database, made available by CEPII, and the Stata programme – *ecomplexity* – developed by Sebastian Bustos and Muhammed Yildirim (Bustos & Yildirim 2016).

[12] It is worth noting that a limitation of the complexity analytics described above is that the dataset only considers products and not services. This is concerning in the face of the rising share of services in international trade. The inclusion of services into the complexity analytics is constrained by the relative scarcity of services trade data.

structure. Higher *opportunity value* indices indicate more connected productive structures or productive structures comprising products that are relatively proximate to a large number of products that a country currently does not produce. In terms of capabilities, this means that the capabilities embedded in this connected productive structure are relatively proximate to those needed for products that are not currently produced. Conversely, the capabilities embedded in a less connected productive structure are relatively distant from those needed for products that are not currently produced.[13]

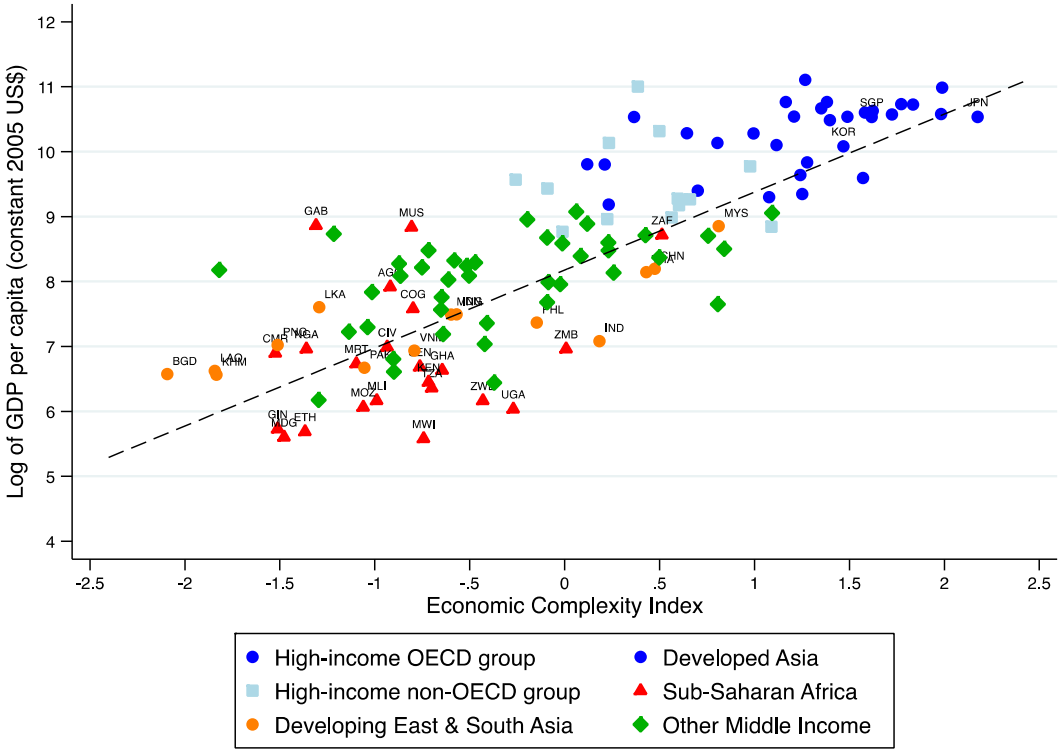
Hausmann et al. (2014) show that increasingly complex products, typically manufactured products, are connected and proximate to more products than less complex primary products that are distant and less connected. Put differently, the capabilities needed to produce manufactured products are relatively similar to those needed to produce other manufactured products. The implication being that if a country already has an established manufacturing sector, it is better positioned to expand and diversify this sector than a country with a marginal manufacturing sector.

Economic Complexity and Manufacturing

Hidalgo et al. (2009) show that *economic complexity* is correlated with a country's current level of income and that deviations from this relationship predict future economic growth. As such, Figure 7shows the relationship between *economic complexity* and GDP per capita across a sample of countries varying in terms of level of development and region. This indicates that the accumulation and mobilisation of productive capabilities is associated with higher levels of economic development.

[13] This concept is best depicted in the product space analytics developed by (Hidalgo et al., 2007). Although, we do not use this analytic technique in this paper, we do apply it in a previous paper (Bhorat et al., 2016).

Figure 7: Economic Complexity (ECI) and the Log of GDP per capita by analytical group, 2013



Source: Own calculations using trade data from BACI data (HS 6-digit revision 1992) and GDP per capita data from the World Development Indicators.
Note: 1. The sample of countries is reduced to those for which we estimate complexity measures.

For the purposes of this analysis, it is interesting to consider the positioning of sub-Saharan African countries (red triangle markers) relative to developing East and South Asian countries (orange circle markers) and developed East Asian countries (round blue markers with labels).[14] It is evident that sub-Saharan African countries are clustered in the south-west corner of the graph, and thus associated with lower levels of economic complexity and economic development. For the sample of sub-Saharan African countries, South Africa (see acronym ZAF in Figure 7) is an outlier with economic complexity level in line with other middle-income countries.

As with their levels of economic development, the economic complexity levels for the sample of Asian countries is spread across the distribution of countries. High-income Asian countries, such as Japan (JPN), South Korea (KOR), and Singapore (SGP), have high levels of productive capabilities. There are a number of Asian economies with low levels of economic complexity, similar or lower than the cluster of sub-Saharan African countries, but with higher levels of

[14] For a summary of economic complexity levels across the sample of countries located within these two regions, see Appendix Table 5.

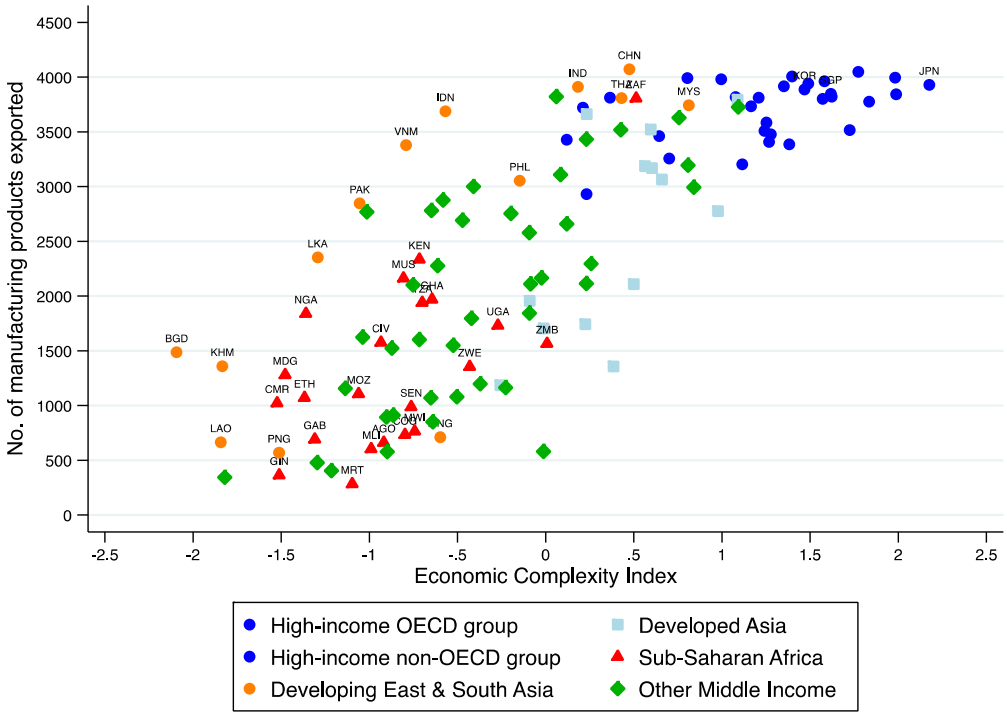
economic development (e.g. Sri Lanka (LKA); Papua New Guinea (PNG); Indonesia (IDN)). It may be that these Asian economies are better able to exploit their productive capabilities than their sub-Saharan African peers. We also observe a number of middle income Asian economies, such as China (CHN), India (IND), Malaysia (MYS), Philippines (PHL) and Thailand (THA), with relatively high levels of economic complexity.

Therefore, it is evident that our sample of Asian economies, with some variation, tends to be characterized by higher levels of productive knowledge (or capabilities) than their sub-Saharan African counterparts. This may explain the relative differences in the manufacturing sectors across countries located within these two regions. Economic growth and development is about the accumulation of capabilities that allows firms within a country to produce increasingly complex products. These increasingly complex products are typically manufactured products. We take this further by considering the link between economic complexity and manufacturing.

Figure 8 shows the relationship between a country's productive capabilities, measured as economic complexity, and the number of manufacturing products that it produces. Unsurprisingly, we first observe that countries with more productive capabilities produce a greater diversity of manufacturing products.[15] In addition, Figure 8 shows clearly that the sub-Saharan African countries (excluding South Africa) are clustered at low levels of economic complexity and produce a relatively low number of manufactured products.

[15] It is worth noting that the number of manufacturing products produced flattens out at higher levels of economic complexity and economic development. This is most likely a data construct since the classification system limits the upper bound of product diversity. The Harmonised System (HS) at the 6-digit level used to classify traded products is limited to 5018 products of which 4282 are manufacturing products.

Figure 8: Economic Complexity and Number of Manufactured Products Exported (HS6), 2013



Source: Authors' calculations using trade data from BACI data (HS 6-digit, revision 1992).
Notes: 1. The sample of countries is reduced to those for which we estimate complexity measures. 2. Determination of whether a manufactured product is exported by a country is not based on Revealed Comparative Advantage.

Second, the sample of Asian economies is spread across levels of economic complexity with varying numbers of manufacturing products. For example, Lao (LAO) and Papua New Guinea (PNG) have low levels of economic complexity and produce relatively few manufactured products. Conversely, India (IND), Thailand (THA), China (CHN), Malaysia (MYS), South Korea (KOR) and Japan (JPN) are increasingly complex and produce a greater diversity of manufactured products. On average, developing countries in East and South Asia produce 2545 different manufactured products at a standard deviation of 1329 (at the HS6 level). In comparison, sub-Saharan Africa countries produce, on average, 1357 different manufactured products at a standard deviation of 803 (at the HS6 level). Therefore, this is consistent with the Asian region, in comparison to sub-Saharan Africa, being comprised of countries with a greater range of complexity, translating then of course into a greater range of manufacturing products being produced. Therefore, the Asian region, relative to sub-Saharan Africa, is characterized by a greater heterogeneity in economic complexity, which corresponds with a greater cross-country range of manufacturing exports.

Third, we notice that in several instances, that for the same level of economic complexity, sub-Saharan African countries produce relatively less manufactured products than their Asian peers (for example, Sri Lanka (LKA) versus Nigeria (NGA) and Vietnam (VNM) versus Mauritius (MUS)).[16] This might be suggesting that, despite having similar levels of complexity, the capabilities embedded in the Asian economies, as revealed in their export baskets, are better aligned to manufacturing than the capabilities embedded in the sub-Saharan African economies.[17]

A final point worth considering is the extent to which there are regional spillovers of productive capabilities, and hence the shifting of production of manufactured products across the region. For example, surely it is easier for a country to develop manufacturing capabilities (e.g. Vietnam) if its neighbour (e.g. China) already has these productive capabilities (for example, firms shifting production across the border to take advantage of lower input prices). Conversely, in sub-Saharan Africa, there are fewer economies clustered within a sub-region, possessing strong manufacturing capabilities, thus further constraining the potential to drive growth through regional spillovers.

Therefore, we observe that relative to their East and South Asian counterparts, sub-Saharan African countries are typically characterized by lower amounts of productive capabilities, and this is reflected in less diverse and developed manufacturing sectors.

Evolving Development Paths and Manufacturing

In the previous section, we advanced the notion that countries with higher levels of economic complexity, and hence more productive capabilities, produce a more diverse set of manufactured products. In this section, we provide a comparative product-level analysis of the evolution of export structures for two regions, sub-Saharan Africa and Eastern and Southern Asia, for the period 1995 to 2013.[18] We provide a snapshot of these regions' respective

[16] The same pattern is evident when the sample of manufactured products is restricted to substantial exports in which a country's export of a product has a revealed comparative advantage.

[17] The economic complexity index does not provide any information on the various types of capabilities present in an economy. Therefore, based on their export baskets, two countries may have similar levels of economic complexity but the underlying capabilities needed to produce and export the products comprising their export baskets may vary. The pattern observed in Figure 8 may be due to the capabilities present in Asian economies being better aligned to producing manufacturing products.

[18] The proceeding analysis compares the evolving export structures of the Sub-Saharan African and Eastern and Southern Asian regions. For comparative purposes, export structures across countries within these regional groupings are aggregated into regional export structures. Sub-Saharan Africa comprises a sample of countries within the region, excluding South Africa, while the Asian regional aggregate comprises a sample of developing

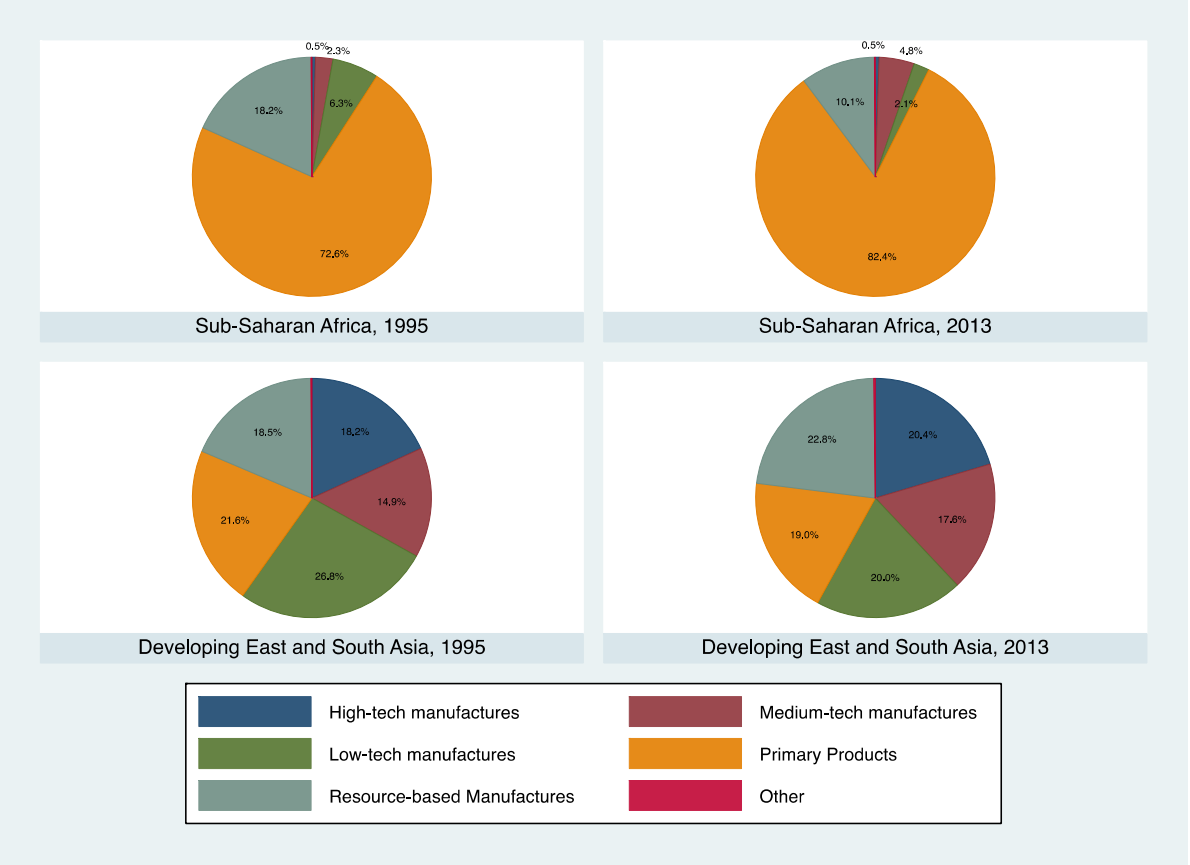
development paths, with a specific focus on the transformation of their manufacturing sectors. We examine these evolving export structures along two product-level dimensions: the complexity of the product, and the capital-intensity associated with the production of the product. This allows us to (a) examine the notion that structural transformation is the process of shifting to increasingly complex products, and (b) consider the employment effects associated with such process (which we discuss in the next sub-section).

We start by examining the changing composition of exports across these two regions over the period 1995 to 2013, as depicted in Figure 9.[19] Two key points emerge. First, the concentrated export structure centred on primary products for sub-Saharan African economies stands in contrast to the more diverse export structures of the East and South Asian economies. Primary products, which are characterized by low levels of complexity, constitute the bulk of the sub-Saharan African export basket (82.4 percent of total exports in 2013). In comparison, the export basket for developing East and South Asia is diversified across primary products (19 percent), resource-based manufactures (22.8 percent), low-tech manufactures (20 percent), medium-tech manufactures (17.6 percent) and high-tech manufactures (20.4 percent).

Eastern and Southern Asian countries, excluding China. The sample of countries across the regions is determined by which countries are included in the complexity analytics. For a list of countries included see Appendix Table 2.

[19] Export shares are categorised according to the Lall (2000) technology classification. This classification groups products into five main categories: primary products, resource-based manufactures, low-technology manufactures, medium-technology manufactures, and high-technology manufactures. Resource-based manufactures and low-technology manufactures tend to be more unskilled-labour and labour-intensive. Skilled-labour requirements rises with technology intensity. See Appendix Table 4 for a description of the Lall categories.

Figure 9: Export Shares by Region and Lall Classification, 1995-2013



Source: Own calculations using trade data from BACI data (HS 6-digit, revision 1992).
Notes: 1. The sub-Saharan aggregate excludes South Africa, while the Developing East and South Asia aggregate excludes China.

Second, while the sub-Saharan African export structure appears to have become increasingly concentrated in primary products, the export structures of the East and South Asian economies has shifted toward more technology-intensive manufactures. These technology-intensive manufactures are characterized by higher levels of complexity. The aggregate share of primary product exports in sub-Saharan Africa has thus increased by close to 10 percentage points, from 72.6 to 82.4 percent, over the period 1995 to 2013. The manufactured products exported by countries within this region are relatively low-complexity, resource-based manufactures, and this share has declined over the period. In the Asian case, the share of low-technology exports, although still significant, has dropped from 26.8 to 20 percent of total exports. However, in Asia there has been a shift toward more technology-intensive manufactures, with both high- and medium-technology manufactures experiencing increasing shares. In Asia then, there is a clear dominance of manufacturing products in the export basket, but more importantly, the composition of these manufactured exports is distinctly more diverse than that of sub-Saharan Africa.

Therefore, relating these regions' evolving export profile and structure to their economic growth performance over the period, the following is evident: First, the relatively high levels of economic growth in sub-Saharan Africa have been based disproportionately on higher primary product export volumes and not growing complexity.[20] Second, even when considering manufacturing in sub-Saharan Africa, the profile of products exported, are suggestive of a basket dominated by low-technology manufactures, manifest in lower levels of complexity. Third, Asian growth, by contrast, appears to be based on the development, of not only the development of a well-established manufacturing sector, but also of a sector that is shifting toward more technology-intensive manufactures, and hence more complex products. Therefore, whilst we reassert the view that Asian economic growth has been based on the growth and dominance in exported manufactured products, it is very clear with the evidence here, that this products basket is also based on an expanding share of more complex manufacturing exports.

We now shift the analysis to the product-level to derive a more nuanced perspective on the evolving productive structures of economies within these two regional aggregates. With the use of scatter plots, we show the product-level evolution of the productive structures of these regional aggregates within the 'product complexity and revealed physical capital intensity' space. This space is defined by a horizontal axis showing the level of product complexity for each manufacturing product and a vertical axis showing the revealed physical capital intensity for each manufacturing product.[21] Following Shirotori et al. (2010), the revealed physical capital intensity of product i is calculated as:

$$k_i = \sum_j \omega_i^j \frac{K^j}{L^j} \tag{7}$$

where K^j is country j's capital stock, L^j is its labour force, and ω_i^j is a weight given by

$$\omega_i^j = \frac{X_i^j / X^j}{\sum_j \left(X_i^j / X^j \right)} \tag{8}$$

[20] Presumably, the commodity price boom played a significant role in diverting resources toward natural resource extraction.

[21] We use the 4-digit level of the Harmonised System (HS), which translates into approximately 994 manufacturing products.

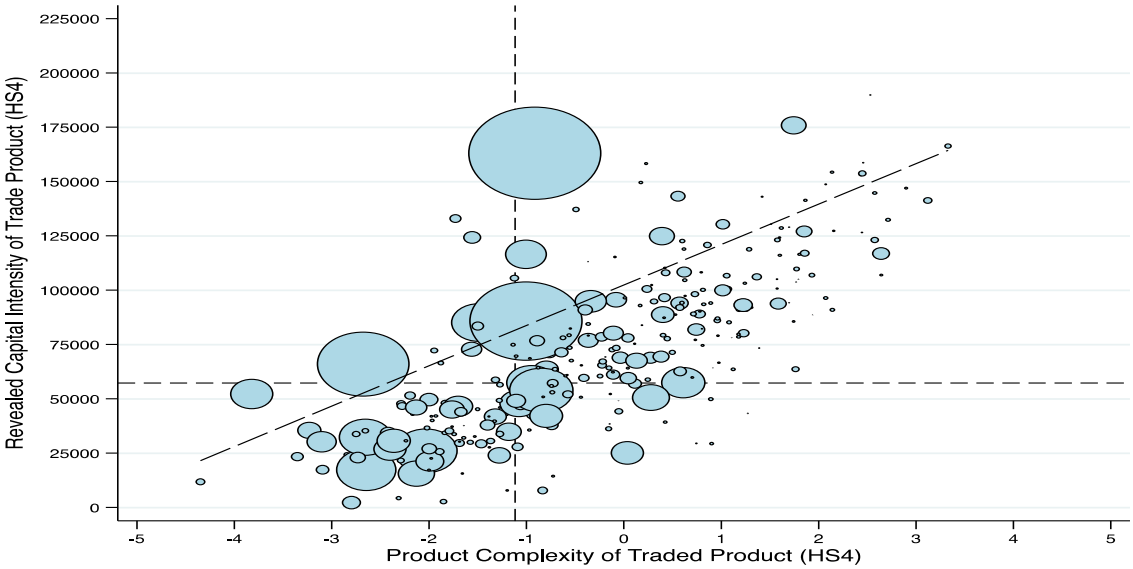
where X_i^j is country j's exports of product i, $X^j = \sum_i X_i^j$ is country j's aggregate exports and $\sum_j \left(X_i^j / X^j\right)$ is the sum of product shares across countries. The weights, ω_i^j, are revealed comparative advantage (RCA) indices that sum to unity. The measure is the weighted average of the capital abundance of the countries exporting product i, and simply means that a product exported by a country that is richly endowed in physical capital is supposed to be capital-intensive.

Our approach here is the following: Manufacturing products are categorized according to whether they are 'entries' into the regional export portfolio (i.e. products not exported in 1995 but exported in 2013) or whether they are 'continuing' exports (i.e. products exported in both 1995 and 2013). The former provides insight into the type of manufacturing products that countries within the regions are diversifying into, while the latter provides insight into the products that comprise the existing manufacturing sector across countries within these regions. Separate graphs are provided for each product grouping in each regional grouping. The dashed horizontal and vertical lines in each scatter plot represent the mean revealed physical capital intensity and the mean product complexity for products classified as low-technology manufactures falling within the fashion cluster of the Lall (2000) classification. We can think of this reference point being represented by the cluster of products associated with the clothing and textiles industry. These lines provide a reference point for the capital intensity and product complexity associated with these labour-intensive products.

It is expected that an evolving export structure associated with both higher income levels and higher levels of employment would evolve and be depicted as such: First, one would observe a large and dominant distribution of products in the south-west corner, which are characterized by low complexity and high levels of labour intensity. Examples of clusters of products here would be clothing, textile, and processed foods. Second, over time one should observe a shift toward the north-east area of the diagram into more complex products—thereby generating an economic pathway to higher levels of income. Such complex products would include, for example, electronics, machinery and chemicals. These graphics essentially then present the different stages of manufacturing export development over time, at the export product level in the complexity-capital intensity space.

Figure 10 presents the export structure pertaining to existing products, or products that are exported in 1995 and continue to be exported in 2013 from the sub-Saharan African region. Figure 11 depicts the export structure for the South and East Asian region.[22]

Figure 10: Evolution of Sub-Saharan Africa's Export Portfolio – Existing Products, 1995-2013



Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to manufacturing products.

The clustering of bubbles to the south-west of Figure 10 suggests that exports from sub-Saharan African countries typically possess low levels of product complexity. The cluster of products to the left of the dashed vertical line have complexity levels below the average complexity for clothing and textile products, showing that a large share of SSA manufacturing exports are characterized by low levels of complexity (i.e. products below the horizontal line such as, raw sugar; manganese ore, aluminium ore, precious metal ore, knit sweaters, palm oil, and knit t-shirts).[23] Existing manufacturing exports with complexity levels above the average for clothing and textiles (i.e. to the right of the dashed vertical line) are not job generators, and we see this most predominantly for the two products, refined petroleum and special purpose ships, depicted as the largest bubbles above the dashed horizontal line.

[22] It is worth noting that we exclude South Africa and China from the sub-Saharan and East and South Asian aggregates, respectively. The graphics do not change substantially.
[23] Products with the larger export shares (i.e. larger bubbles) are reported in brackets.

There are a number of existing exports clustered in the north-east of the graph that are associated with higher levels of product complexity and capital-intensity. However, the number of such products is limited and their share of trade is small. The graph points to a relatively underdeveloped manufacturing sector across the region.

Figure 10 provides insight into the path dependency of the SSA export basket. Hausmann et al. (2014) show that a country's existing export basket influences its subsequent diversification. Behind this is the notion that the more proximate the productive capabilities embodied in a country's existing export basket to the productive capabilities associated with products that it does not currently produce, the more easily it can shift to these products. Hausmann et al. (2014) also show that more complex products, typically manufacturing products, are more proximate (or connected) to other manufacturing products, and thus it is easier to shift to these other complex manufactured products if you already produce a number of complex manufactured products. The implication of the SSA export basket being concentrated in products characterized by low levels of complexity and low levels of connectedness, is that it is harder for countries within the region to diversify into more complex manufacturing products.

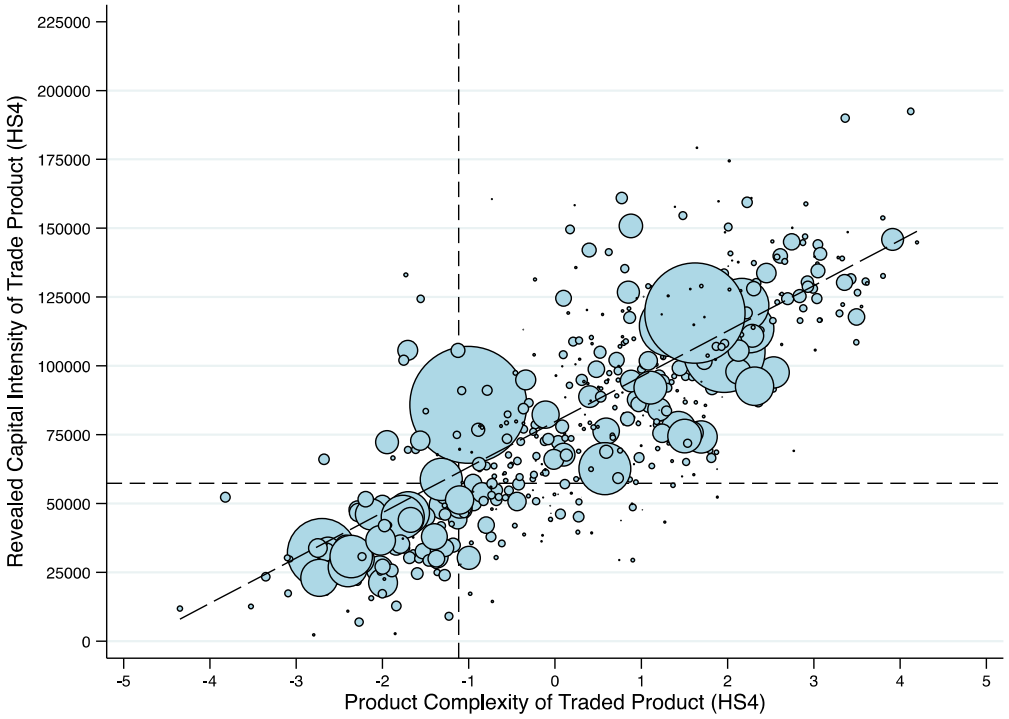
In contrast, the East and South Asian export structure, observed in Figure 11, points to an established and integrated manufacturing sector. The region's export structure is spread relatively evenly across the 'product complexity-revealed capital intensity' space. The Asian export structure provides a number of insights. First, there seems to be an integrated chain of products in the product complexity-revealed capital intensity space, which is suggestive (much in the spirit of the product space approach) of Asian economies taking advantage of proximate products and building capabilities in them fairly efficiently. Second, this is clearly not the case in SSA, where the product complexity-revealed capital intensity space is far more 'lumpy' and disjointed.

Third, the thick cluster of low complexity and low capital intensity products in the south-west corner (typically textile and clothing products such as, non-knit women's suits, non-knit men's suits, knit sweaters, leather footwear and knit t-shirts; non-retail pure cotton yarn), suggests consistent job creation in these established labour-intensive industries over time. This is in contrast with SSA where its cluster of products in the south-west corner is relatively small in

comparison and concentrated in resource-based manufactures such as raw sugar, manganese ore, aluminium ore, and precious metal ore.

Finally, the cluster of products in the north-east of the graph are relatively more complex and capital-intensive (for example, integrated circuits, computers, broadcasting equipment, telephones, office machine parts, semiconductor parts, rubber tires, video displays, air conditioners and cyclic hydrocarbons). The magnitude and diversity of these complex machinery, electronic and chemical products stands in contrast to the marginal nature of these types of complex products in the SSA export basket. This has implications on subsequent diversification, since complex products are associated with higher levels of connectedness. Thus by already producing these types of products, Asian countries are better placed to diversify into increasingly complex products (which we observe in Figure 13).

Figure 11: Evolution of East and South Asia's Export Portfolio – Existing Products, 1995-2013



Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to manufacturing products.

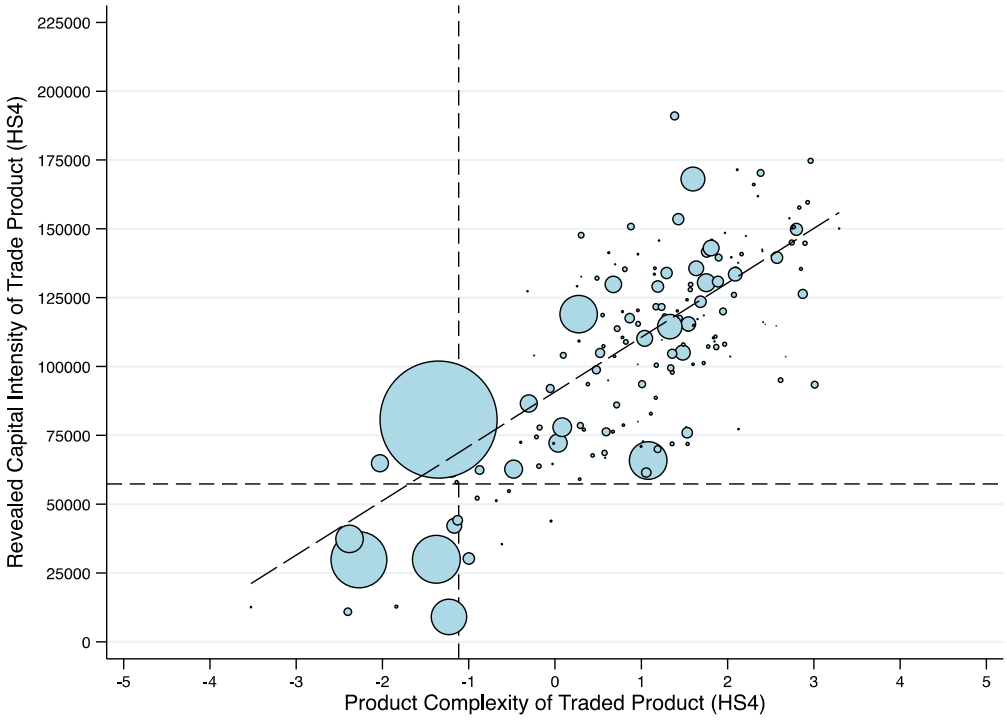
Focus is now shifted to the way in which export structures within these regions have evolved. Figure 12 depicts the manufacturing products to which sub-Saharan African countries have shifted their focus. Correspondingly, Figure 13 depicts the way in which the East and South Asian export portfolio has evolved over the period 1995 to 2013.

The pattern of entry into new manufacturing products in the sub-Saharan African region provides a number of insights. First, it seems that SSA is stuck in some sort of low complexity trap, associated with both low (copper ore, nickel mattes and titanium ore) and high (passenger and cargo ships) capital-intensity products.[24] Certainly, in terms of trade volumes, entry is concentrated in a handful of low complexity products. These entries to the south-west of the figure are concentrated in resource-based activities, which is unlike the light manufacturing activities in clothing and textiles, which drove employment growth in Asia

Second, although there is evidence of entry into relatively more complex manufactured products in the north-east corner of the graph (e.g. broadcasting equipment, saturated acyclic monocarboxylic acids, and construction vehicles), the share of exports accounted for by these products, and hence the scale, is relatively small. In particular, the scale of these entries is too small to become a platform for global expansion. The marginal nature of the entries into more complex products is in stark contrast to the East and South Asian experience (observed below) over the same period.

[24] It is important to note that we include resource-based manufacturing products and thus products such as copper ore and titanium ore appear in the sample of manufacturing products. We do provide the same scatter plots for the sample of manufacturing products being restricted to non-commodity based manufacturing products in Appendix Figures 2 -5.

Figure 12: Evolution of Sub-Saharan Africa's Export Portfolio – Entry into New Products in 2013



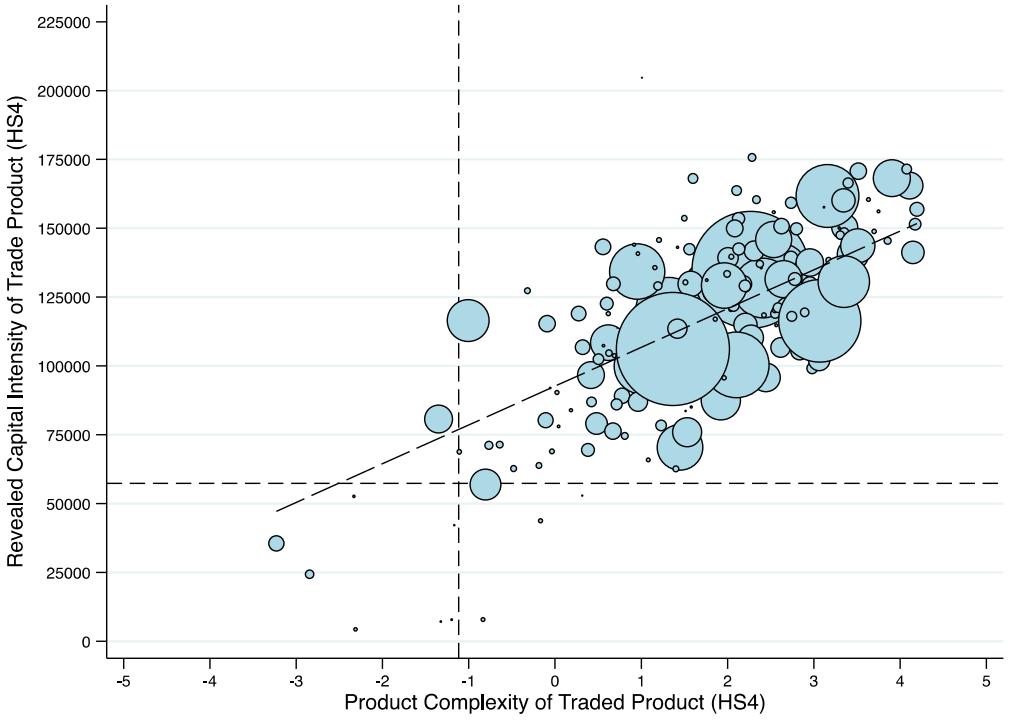
Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to manufacturing products.

It is clear that SSAs existing export basket, as depicted in Figure 10, which is associated with low levels of complexity and connectedness has impacted on its subsequent pattern of diversification. The productive capabilities embodied in its existing export structure are distant from those needed in order to successfully shift into relatively more complex manufacturing products. As such, one can deduce from this that SSA countries have not accumulated the necessary capabilities needed for this shift, and hence the relative stagnation of its manufacturing sector.

The East and South Asian pattern of entry and hence diversification, depicted in Figure 13, stands in stark contrast to that evident in sub-Saharan Africa. This region's evolving export structure is biased toward increasingly complex and capital-intensive products (for example, packaged medicaments, delivery trucks, vehicle parts, ethylene polymers, and industrial printers). This is consistent with Figure 9, which shows rising export shares in medium- and high-technology manufactured products that are typically more skill-, capital- and technology-

intensive. Furthermore, the magnitude of these entries is relatively large, thus indicating that these manufacturing industries have experienced scale economies. Furthermore, it is evident that there is a growth-inducing path dependency associated with the pattern of development evident in the Asian picture, which we discuss in more detail below

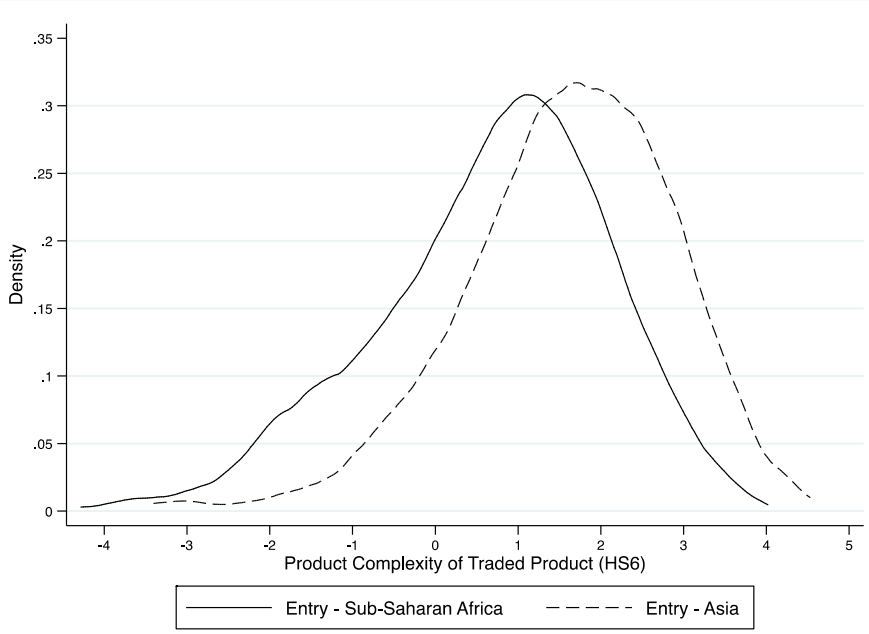
Figure 13: Evolution of East and South Asia's Export Portfolio – Entry into New Products in 2013



Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to manufacturing products.

The extent to which Asian firms have been able to shift into increasingly complex manufactured products is summarized in Figure 14. In this graph, we show the distribution of product entries according to the level of complexity associated with the new product. It is evident than, on average, diversification in the Asian region is characterized by entries into more complex products relative to the African region. This is visible in the distribution of entries for Asia being to the right of the distribution of entries for SSA.

Figure 14: Distribution of Entries by Region



Source: Authors' calculations using trade data from BACI data (HS 6-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 2. Trade flows restricted to manufacturing products.

A question worth considering is why Asian firms have been able to shift more easily into these increasingly complex manufactured products? Complexity analytics offers an explanation for this varying pattern of diversification across the two regions. In a recent working paper, Bhorat et al. (2016) use complexity analytics to explain manufacturing performance in Africa. Informed by Hidalgo et al. (2007), they argue that the process of structural transformation is a path dependent process, whereby countries accumulate productive capabilities and thereby shift production toward increasingly complex and proximate manufacturing products, based on the existing levels of capabilities. They find that the extent to which a country can diversify its export structure toward an increasing number of proximate manufactured products is dependent upon the connectedness of its initial productive structure. If the capability set exists, these products can be expanded into. The dynamic process of growing a new productive structure and hence export basket, revolves around upgrading a country's capability set over time.

This provides insight into what we observe in the scatter plots above. Asian economies are better able to enter new manufacturing product markets because the required capabilities are similar or close to those it currently possesses. For instance, if a firm in a country is able to assemble motor vehicles for the international market, a lot of the inputs needed to enter the international car parts market are already in place, such as logistics networks, supply networks,

port infrastructure, and the like. Hence, the shift into new complex product markets in the north-east corner of Figure 13. Conversely, sub-Saharan Africa's productive structure is concentrated in less complex resource-based products where the embedded capabilities are relatively distant from those needed to produce complex manufactured products. Hence, the sub-Saharan export structure remaining stagnant in the south-west corner of Figure 10 and Figure 12.

Therefore, the preceding analysis provides the following key points: First, the East and South Asian export structure and profile are more diverse and, consequently, more complex than its sub-Saharan African counterpart. In the Asian case, we observe a greater number of existing products and new products associated with higher levels of economic complexity in the north-east quadrant. In addition, the sheer scale of exports in these relatively complex products suggests established and integrated manufacturing sectors in Asia. In the SSA case, existing products as well as new products are typically located in the low complexity south-west quadrant. In addition, the share of exports is concentrated in a few of these products, this suggesting a less diverse export basket. Second, and importantly, not only have East and South Asian firms found it easier to shift into increasingly complex manufactured products than their sub-Saharan African counterparts, but the magnitude of this diversification has been substantial. It is clear that the integrated structure of the Asian export basket points to the productive capabilities embedded in its existing export basket being relatively proximate to those needed in order to shift into more complex manufactured products. As such, we observed a substantial shift into complex manufacturing products over the period. The relatively disconnected and patchy export basket for SSA, pointed to the productive capabilities embedded in its existing export basket being distant from those needed to successfully shift into more complex manufacturing products.

Employment and Manufacturing

In light of the above discussion on the development trajectories pertaining to each of these regions, we now provide a discussion on how these evolving productive structures relate to employment. The manufacturing sector in the Asian region, particularly the East Asian region, has been a major source of employment for the countries that comprise this region. It is hoped that sub-Saharan African countries undergo similar manufacturing-led economic growth and are thus able to employ a young and growing labour force.

Implicitly, we have argued that growing a manufacturing sector, and hence generating manufacturing jobs, is about shifting toward a greater multitude of complex manufacturing activities and thereby building complexity within an economy. Therefore, to conclude, we consider the link between economic complexity and employment across the two regions over time. Table 2 shows the aggregate levels of employment in manufacturing, as well as the mean economic complexity score for the two regions in 1995 and 2010. This allows one to observe trends in manufacturing employment growth in relation to economic complexity growth. A simple elasticity measure is included, where the percentage change in manufacturing employment in response to a percentage change in economic complexity is shown.

Table 2: Economic Complexity and Employment

Region	Total Employment in Manufacturing (Thousands)			Economic Complexity			Elasticity
	1995	2010	Δ	1995	2010	Δ	
South-East Asia	61 059	78 291	17 232	-0.06	0.28	0.34	0.05
Sub-Saharan Africa	4 023	9 221	5 198	-1.05	-0.92	0.13	10.42

Source: Authors' calculations using Groningen Growth and Development Centre 10-sector database (see Timmer et al., 2014) and BACI data (HS 6-digit, revision 1992) to create economic complexity measure.
Notes: 1. South-East Asian countries include: India, Indonesia, Malaysia, Philippines and Thailand. Sub-Saharan African countries include: Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, Tanzania and Zambia. 2. Elasticity is measured as follows: $\frac{\%\Delta\ Manufacturing\ Jobs}{\%\Delta\ ECI\ Score}$

The employment data evident in Table 2 in conjunction with the export data analysis above, indicates the sheer scale of the manufacturing sector in the East and South Asian regions and hence it being a major source of employment. The manufacturing sector provided 61 million jobs in 1995 and this grew by 17 million to 78 million jobs in 2010. In comparison, the manufacturing sector in SSA is substantially smaller, providing 4 million jobs in 1995, but notably more than doubling to 9 million in 2010. Simply put, our data illustrates that the manufacturing sector in Asia is larger and more diverse than its sub-Saharan African counterpart, and is thus able to employ more workers. The Asian manufacturing sector is spread more evenly across products varying in complexity and capital-intensity, and hence offers more employment opportunities for a greater range of workers across the manufacturing spectrum. The African manufacturing sector, in contrast, is relatively small and concentrated and thus offers substantially fewer employment opportunities to a smaller range of workers.

We also observed in the analysis in the previous section, that Asian economies have been better able to shift production into increasingly complex manufactured products, relative to their SSA

counterparts. Furthermore, the sheer scale of entry into these new product markets is again substantially greater than that achieved by their SSA counterparts. This is reflected in a bigger increase in the Asian region's economic complexity score (0.34) relative to that experiences in SSA (0.13). Part of the explanation for the Asian regions ability to shift easily into relatively more complex manufactured products relates to the complexity of its existing export basket and the associated connectedness of this relatively more complex export basket. This is reflected in the economic complexity levels for the region, which have shifted from -0.06 to 0.28. Conversely, although shifting upward, the economic complexity levels in SSA are substantially lower (-1.05 to -0.92). The lower levels of connectedness associated with less complex export baskets provides insight into the regions inability to grow its productive capabilities and shift to more complex manufacturing products.

Finally, we observe that the elasticity of manufacturing employment in relation to a percentage change in economic complexity is substantially higher for SSA (10.42) than Asia (0.05). This is perhaps unsurprising since employment growth in manufacturing in SSA is occurring off a relatively low base. This may suggest that there is potential for more rapid manufacturing-led employment growth within the SSA region, which offers hope to countries within the region that are faced, as noted in detail above, with young and growing labour forces.

4. Conclusion

The major challenge facing the countries that comprise sub-Sahara Africa is a young and growing labour force. This challenge can be viewed as an opportunity since an expanded labour force, if employed, can increase output and thereby generate economic growth. However, the question of key importance concerns where these jobs are going to emerge from. The Asian story is one where industrialisation and the growth of manufacturing activities acted as a source of growth and employment. As such, the question arises whether countries within sub-Saharan Africa can experience a similar manufacturing-led growth path.

The analysis above shows a sub-Saharan African productive structure that is disconnected and characterized by products with low levels of economic complexity. Inherent in a productive structure characterized by lower levels of economic complexity is the notion of limited productive capabilities. Furthermore, as revealed in a previous study, these productive capabilities are distant from those needed in order to produce increasingly complex

manufacture products (Bhorat et al., 2016). This stands in contrast to an East and South Asian productive structure that is connected and complex. East Asian economies are able to shift into increasingly complex manufactured products because the productive capabilities imbedded in their existing productive structure are similar to those required in order to shift into these products.

This has implications for the extent to which the manufacturing sector can generate employment. The sheer scale and diversity of the manufacturing sector in Asia allows for the generation of a large number and diversity of employment opportunities. Conversely, the marginal nature of the African manufacturing sector points to limited employment opportunities. However, the relatively high employment to economic complexity elasticity for Africa offers hope. By growing complexity, countries within the region may initially be able to undergo relatively rapid employment growth if they grow their manufacturing sectors. Nevertheless, if Africa is to generate jobs through manufacturing led industrialisation it needs to accumulate the productive capabilities that will allow it to do so.

References

Bhorat, H., Steenkamp, F. & Rooney, C., (2016). *Africa's Manufacturing Malaise*, UNDP-RBA Working Paper series 3/2016. Available at: http://www.africa.undp.org/content/rba/en/home/library/working-papers/africa-s-manufacturing-malaise.html.

Bhorat, H., Naidoo, K. and Ewinyu, A. (2017). The Tipping Point: The Youth Bulge and the sub-Saharan African Labor Market. Forseight Africa 2017 Report. Brookings Institution: Washington, D.C.

Bustos, S. & Yildirim, M., (2016). ecomplexity: Creates Economic Complexity Variables.

Diop, M. et al., (2015). Africa Still Poised to Become the Next Great Investment Destination. Available at: http://www.worldbank.org/en/news/opinion/2015/06/30/africa-still-poised-to-become-the-next-great-investment-destination [Accessed March 1, 2017].

Drummond, P. Thakoor, V. and Yu, S. (2014). Africa Rising: Harnessing the Demographic Dividend. IMF Working Paper No. 14/143. IMF: Washington DC. Available at: https://www.imf.org/external/pubs/ft/wp/2014/wp14143.pdf

Filmer, D. & Fox, L., (2014). *Youth employment in Sub-Saharan Africa*, Washington, DC : World Bank Group.

Hausmann, R. et al., (2014). *The Atlas of Economic Complexity: Mapping Paths to Prosperity*, Cambridge, Massachusetts: MIT Press.

Hidalgo, C.A. et al., (2007). The product space conditions the development of nations. *Science, New Series*, 317(5837), pp.482–487. Available at: http://www.jstor.org/stable/20037448.

Hidalgo, C.A., Hausmann, R. & Dasgupta, P.S., (2009). The buidling blocks of economic complexity. *Proceedings of the National Academy of Sciences of the United States of America*, 106(26), pp.10570–10575. Available at: http://www.jstor.org/stable/40483593 .

ILO, 2014. *Global employment trends (2014): Risk of a jobless recovery?*, International Labor Organization: Geneva. Available at: http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_233953.pdf. Lall, S., 2000. The technological structure and performance of developing country manufactured exports, 1985-98. *Oxford Development Studies*, 28(3), pp.337–369. Available at: http://dx.doi.org/10.1080/713688318.

McMillan, M., Rodrik, D. & Verduzco-Gallo, Í., (2014). Globalization, structural change, and productivity growth, with an update on Africa. *World Development*, 63, pp.11–32. Available at: http://www.sciencedirect.com/science/article/pii/S0305750X13002246 [Accessed September 8, 2015].

Mcmillan, M.S. & Rodrik, D., (2011). *Globalization, structural change and productivity growth*, NBER Working Paper No. 1743. NBER: Cambridge: MA. Available at: http://www.nber.org/papers/w17143.pdf.

OECD, (2013). *Africa Economic Outlook 2013: Structural Transformation and Natural Resources*, OECD Publishing: Paris.

OECD, (2012). *African Economic Outlook 2012: Promoting Youth Employment*, OECD Publishing: Paris.

Page, J., (2012). Can Africa industrialize? *Journal of African Economies*, 21(2), p.ii86-ii125. Available at: http://jae.oxfordjournals.org/cgi/doi/10.1093/jae/ejr045.

Rodrik, D., (2013). Africa's Structural Transformation Challenge. *Project Syndicate*. Available at: https://www.project-syndicate.org/commentary/dani-rodrik-shows-why-sub-saharan-africa-s-impressive-economic-performance-is-not-sustainable?barrier=accessreg [Accessed March 3, 2017].

Rodrik, D., (2014). *An African growth miracle?*, NBER Working Paper No. 20188. NBER: Cambridge: MA. Available at: http://www.nber.org/papers/w20188%5Cnhttp://www.nber.org/papers/w20188.pdf.

Rodrik, D., (2016). Premature deindustrialization. *Journal of Economic Growth*, 21(1), pp.1–33.

Shimeles, A. & Ncube, M., (2015). The Making of the Middle-Class in Africa: Evidence from DHS Data. *The Journal of Development Studies*, 51(2), pp.178–193. Available at: http://www.tandfonline.com/doi/abs/10.1080/00220388.2014.968137.

Shirotori, M., Tumurchudur, B. & Cadot, O., (2010). *Revealed Factor Intensity Indices*, Policy Issues in International Trade and Commodities Study Series No. 44, United Nations.

Sparreboom, T. & Albee, A., (2011). *Towards Decent Work in sub-Saharan Africa: Monitoring MDG Employment Indicators*, International Labor Organization: Geneva.

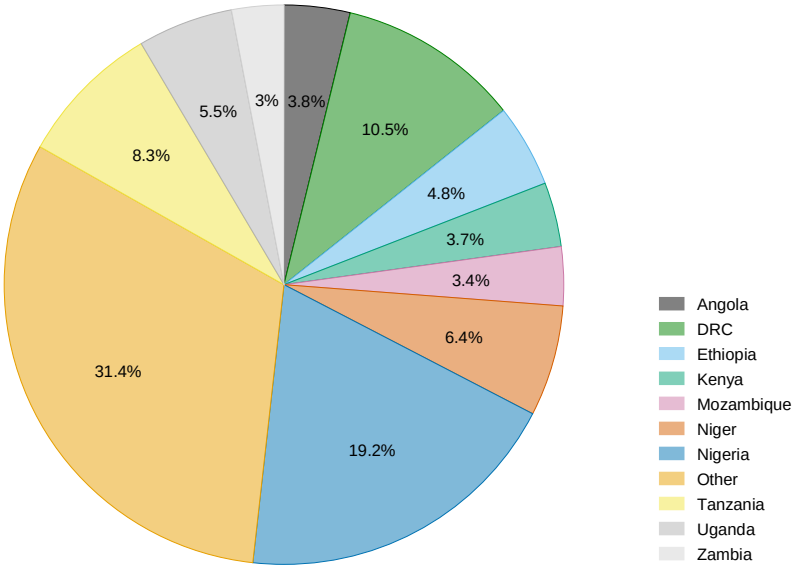
Tacchella, A. et al., (2012). A New Metrics for Countries' Fitness and Products' Complexity. *Scientific Reports*, 2(723), pp.1–4.

The Economist, (2000). Hopeless Africa. Available at: http://www.economist.com/node/333429 [Accessed March 1, 2017].

Timmer, M.P., de Vries, G. & de Vries, K., (2014). *Patterns of structural change in developing countries*, Groningen GGDC Research Memorandum 149, Growth and Development Centre, University of Groningen, Brussels.

UNECA, (2014). *Economic Report on Africa 2014*, Addis Ababa: Ethiopia. Available at: http://repository.uneca.org/unecawebsite/content/era-2014-download-form.
Appendix

Appendix Figure 1: Share of Sub-Saharan African Population Growth by Country, 2015-2100



Source: Authors' calculations using the UN World Population database.

Appendix Table 1: Share of Employment by Sector for Asian and SSA Aggregates, 1975-2010

	Africa			Asia		
Sector	**1975**	**2010**	**Change**	**1975**	**2010**	**Change**
Agriculture	67.8	58.9	-8.9	68.4	40.1	-28.3
Mining	1.1	0.7	-0.4	0.9	0.9	0.0
Manufacturing	6.2	6.6	0.4	11.0	15.8	4.8
Services	22.7	30.9	8.2	17.2	35.5	18.3
Other	2.2	2.9	0.7	2.5	7.7	5.2

Source: Authors' calculations using Groningen Growth and Development Centre 10-sector database (see Timmer et al., 2014).

Appendix Table 2: List of Countries Included in Complexity Estimations

ISO	Country	ISO	Country	ISO	Country
AGO	Angola	GTM	Guatemala	OMN	Oman
ALB	Albania	HND	Honduras	PAK	Pakistan
ARE	United Arab Emirates	HRV	Croatia	PAN	Panama
ARG	Argentina	HUN	Hungary	PER	Peru
AUS	Australia	IDN	Indonesia	PHL	Philippines
AUT	Austria	IND	India	PNG	Papua New Guinea
AZE	Azerbaijan	IRL	Ireland	POL	Poland
BEL	Belgium-Luxembourg	IRN	Iran	PRT	Portugal
BGD	Bangladesh	ISR	Israel	PRY	Paraguay
BGR	Bulgaria	ITA	Italy	QAT	Qatar
BIH	Bosnia Herzegovina	JAM	Jamaica	ROM	Romania
BLR	Belarus	JOR	Jordan	RUS	Russian Federation
BOL	Bolivia	JPN	Japan	SAU	Saudi Arabia
BRA	Brazil	KAZ	Kazakhstan	SEN	Senegal
CAN	Canada	KEN	Kenya	SER	Serbia
CHE	Switzerland	KGZ	Kyrgyzstan	SER	Serbia
CHL	Chile	KHM	Cambodia	SGP	Singapore
CHN	China	KOR	Rep. of Korea	SLV	El Salvador
CIV	Côte dIvoire	KWT	Kuwait	SUD	Sudan
CMR	Cameroon	LAO	Lao	SUD	Sudan
COG	Congo	LBN	Lebanon	SVK	Slovakia
COL	Colombia	LBY	Libya	SVN	Slovenia
CRI	Costa Rica	LKA	Sri Lanka	SWE	Sweden
CUB	Cuba	LTU	Lithuania	SYR	Syria
CZE	Czech Rep.	LVA	Latvia	THA	Thailand
DEU	Germany	MAR	Morocco	TJK	Tajikistan
DNK	Denmark	MDA	Moldova	TKM	Turkmenistan
DOM	Dominican Rep.	MDG	Madagascar	TTO	Trinidad and Tobago
DZA	Algeria	MEX	Mexico	TUN	Tunisia
ECU	Ecuador	MKD	Macedonia	TUR	Turkey
EGY	Egypt	MLI	Mali	TZA	Tanzania
ESP	Spain	MNG	Mongolia	UGA	Uganda
EST	Estonia	MOZ	Mozambique	UKR	Ukraine
ETH	Ethiopia	MRT	Mauritania	URY	Uruguay
FIN	Finland	MUS	Mauritius	USA	USA
FRA	France	MWI	Malawi	UZB	Uzbekistan
GAB	Gabon	MYS	Malaysia	VEN	Venezuela
GBR	United Kingdom	NGA	Nigeria	VNM	Viet Nam
GEO	Georgia	NIC	Nicaragua	YEM	Yemen
GHA	Ghana	NLD	Netherlands	ZAF	South Africa
GIN	Guinea	NOR	Norway	ZMB	Zambia
GRC	Greece	NZL	New Zealand	ZWE	Zimbabwe

Notes: We follow the same procedure for choice of country as applied in the Atlas of Economic Complexity (Hausmann et al., 2014). The following criteria apply: First, countries must have GDP and export information. Second, countries must have a population in excess of 1.2 million and trade value in excess of $1 billion. Finally, countries must have reliable data.

Appendix Table 3: Share of Exports by Region and Lall Classification, 1995-2013

Lall Classification	Eastern & Southern Africa			West Africa			East Asia & Pacific			South Asia		
	1995	2013	Δ	1995	2013	Δ	1995	2013	Δ	1995	2013	Δ
High-tech Manufactures	0.8	0.9	0.1	0.4	0.3	-0.1	21.8	25.0	3.2	2.8	8.3	5.5
Medium-tech Manufactures	4.1	4.1	-0.01	1.4	5.2	3.8	15.6	18.2	2.6	11.7	15.9	4.2
Low-tech Manufactures	14.0	3.7	-10.3	2.2	1.0	-1.1	20.0	15.2	-4.7	56.0	32.6	-23.4
Primary Products	67.8	80.8	13.0	75.2	83.6	8.4	22.4	20.3	-2.1	18.0	15.5	-2.5
Resource-based Manufactures	13.1	10.4	-2.7	20.9	9.8	-11.1	20.1	21.0	0.9	11.4	27.6	16.2
Total	100	100		100	100		100	100		100	100	

Source: Authors' calculations using trade data from BACI data (HS 6-digit, revision 1992).
Notes: 1. The sample of countries is reduced to those for which we estimate complexity measures.

Appendix Table 4: Lall (2000) Technology Classification

LALL TECHNOLOGY CLASSIFICATION	EXAMPLES
PRIMARY PRODUCTS (PP)	Fresh fruit, meat, rice, cocoa, tea, coffee, wood, coal, crude petroleum, gas
MANUFACTURED PRODUCTS	
Resource based manufactures	
RB1: Agro/forest based products	Prepared meats/fruits, beverages, wood products, vegetable oils
RB2: Other resource based products	Ore concentrates, petroleum/rubber products, cement, cut gems, glass
Low technology manufactures	
LT1: 'Fashion cluster'	Textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods
LT2: Other low technology	Pottery, simple metal parts/structures, furniture, jewellery, toys, plastic products
Medium technology manufactures	
MT1: Automotive products	Passenger vehicles and parts, commercial vehicles, motorcycles and parts
MT2: Process industries	Synthetic fibres, chemicals and paints, fertilisers, plastics, iron, pipes/tubes
MT3: Engineering industries	Engines, motors, industrial machinery, pumps, switchgear, ships, watches
High technology manufactures	
HT1: Electronics and electrical products	Office/data processing/telecommunications equip, TVs, transistors, turbines, power generating equipment
HT2: Other high technology	Pharmaceuticals, aerospace, optical/measuring instruments, cameras
OTHER TRANSACTIONS	
other	Electricity, cinema film, printed matter, 'special' transactions, gold, art, coins, pets

Source: (Lall, 2000)

Appendix Table 5: ECI and Change in ECI for sub-Saharan African and East and South Asian Countries, 1995-2013

Country	WB Income Group	Region	1995	2013	Change
Japan	High income: OECD	East Asia	2.43	2.18	-0.25
Singapore	High income: nonOECD	East Asia	0.73	1.62	0.89
Rep. of Korea	High income: OECD	East Asia	0.62	1.47	0.85
Malaysia	Upper middle income	East Asia	-0.03	0.81	0.85
South Africa	Upper middle income	Sub-Saharan Africa	0.63	0.51	-0.12
China	Upper middle income	East Asia	-0.02	0.47	0.49
Thailand	Upper middle income	East Asia	-0.33	0.43	0.76
India	Lower middle income	South Asia	0.04	0.18	0.14
Zambia	Lower middle income	Sub-Saharan Africa	-0.27	0.01	0.28
Philippines	Lower middle income	East Asia	-0.85	-0.15	0.70
Uganda	Low income	Sub-Saharan Africa	-0.52	-0.27	0.25
Zimbabwe	Low income	Sub-Saharan Africa	-0.01	-0.43	-0.42
Indonesia	Lower middle income	East Asia	-0.71	-0.57	0.14
Mongolia	Upper middle income	East Asia	-0.80	-0.60	0.20
Ghana	Lower middle income	Sub-Saharan Africa	-1.40	-0.64	0.76
Tanzania	Low income	Sub-Saharan Africa	-1.00	-0.70	0.30
Kenya	Lower middle income	Sub-Saharan Africa	-0.23	-0.72	-0.48
Malawi	Low income	Sub-Saharan Africa	-0.96	-0.74	0.22
Senegal	Lower middle income	Sub-Saharan Africa	-0.87	-0.76	0.11
Viet Nam	Lower middle income	East Asia	-1.49	-0.79	0.70
Congo	Lower middle income	Sub-Saharan Africa	-0.56	-0.80	-0.24
Mauritius	Upper middle income	Sub-Saharan Africa	-1.03	-0.81	0.22
Angola	Upper middle income	Sub-Saharan Africa	-1.72	-0.92	0.80
Côte d'Ivoire	Lower middle income	Sub-Saharan Africa	-0.85	-0.93	-0.09
Mali	Low income	Sub-Saharan Africa	-0.85	-0.99	-0.14
Pakistan	Lower middle income	South Asia	-1.00	-1.05	-0.06
Mozambique	Low income	Sub-Saharan Africa	-0.89	-1.06	-0.17
Mauritania	Lower middle income	Sub-Saharan Africa	-1.06	-1.10	-0.04
Sri Lanka	Lower middle income	South Asia	-1.28	-1.29	-0.01
Gabon	Upper middle income	Sub-Saharan Africa	-1.20	-1.31	-0.11
Nigeria	Lower middle income	Sub-Saharan Africa	-1.98	-1.36	0.62
Ethiopia	Low income	Sub-Saharan Africa	-1.05	-1.37	-0.32
Madagascar	Low income	Sub-Saharan Africa	-1.46	-1.48	-0.01
Guinea	Low income	Sub-Saharan Africa	-0.99	-1.51	-0.53
Papua New Guinea	Lower middle income	East Asia	-2.40	-1.51	0.89
Cameroon	Lower middle income	Sub-Saharan Africa	-1.02	-1.52	-0.51
Cambodia	Low income	East Asia	-1.81	-1.83	-0.03
Lao	Lower middle income	East Asia	-1.72	-1.84	-0.12
Bangladesh	Lower middle income	South Asia	-1.64	-2.09	-0.46

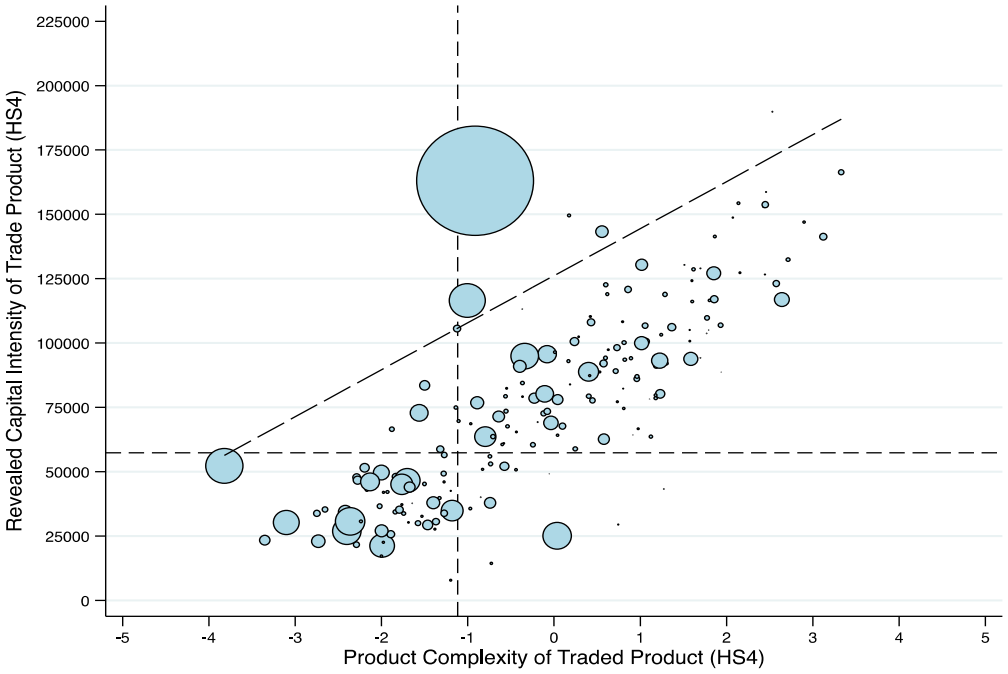
Source: Authors' calculations using trade data from BACI data (HS 6-digit, revision 1992).
Notes: 1. The sample of countries is reduced to those for which we estimate complexity measures.

Appendix Table 6: Export Dynamics by Region and Lall Classification, 1995-2013

Lall Classification	Sub-Saharan Africa		Developing East and South Asia	
	Continue	Entry	Continue	Entry
	A. Aggregate by Region			
High-tech Manufactures	34	71	143	137
Medium-tech Manufactures	176	245	415	413
Low-tech Manufactures	496	234	975	200
Primary Products	342	96	359	117
Resource-based Manufactures	291	191	502	280
Other	11	7	12	6
	B. Country average within Region			
High-tech Manufactures	1	18	12	39
Medium-tech Manufactures	6	46	41	91
Low-tech Manufactures	25	92	165	160
Primary Products	32	57	49	69
Resource-based Manufactures	19	79	54	110
Other	1	1	1	2

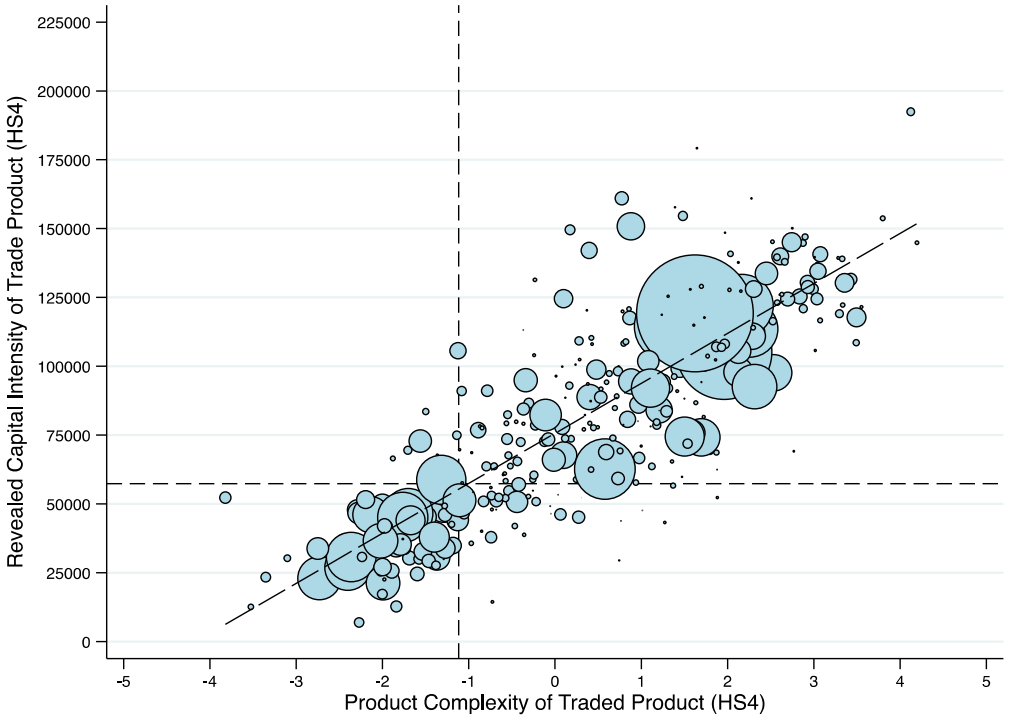
Source: Authors' calculations using trade data from BACI data (HS 6-digit, revision 1992).
Notes: 1. The sample of countries is reduced to those for which we estimate complexity measures.

Appendix Figure 2: Evolution of Sub-Saharan Africa's Export Portfolio for Non-Commodity-based Manufactures – Existing Products, 1995-2013



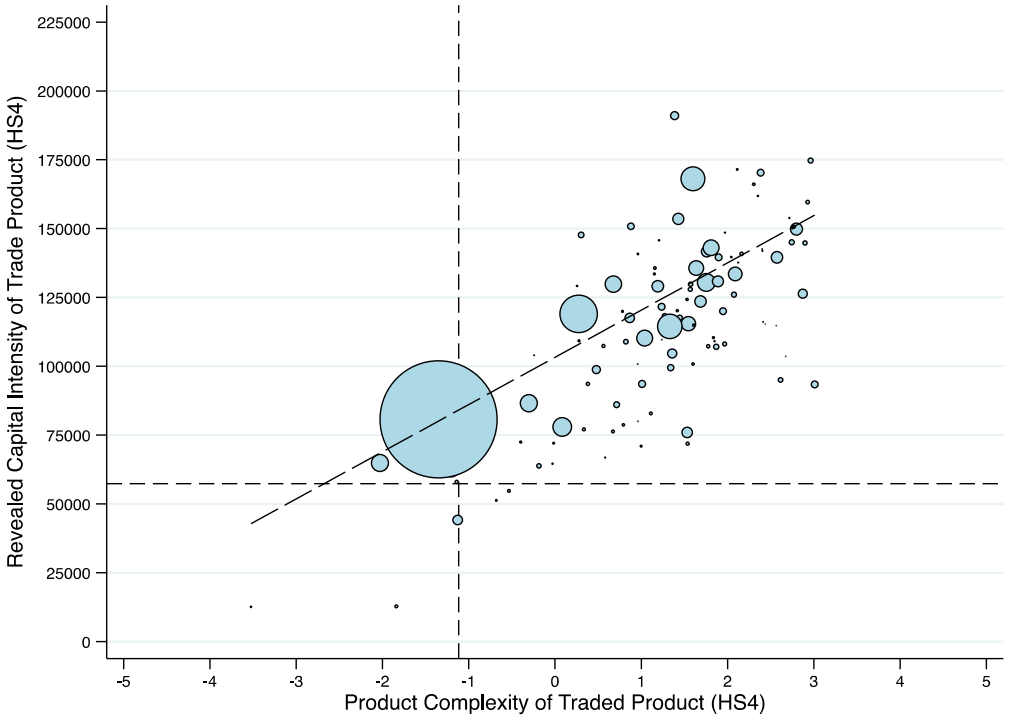
Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to non-commodity-based manufacturing products.

Appendix Figure 3: Evolution of East and South Asia's Export Portfolio for Non-Commodity-based Manufactures – Existing Products, 1995-2013



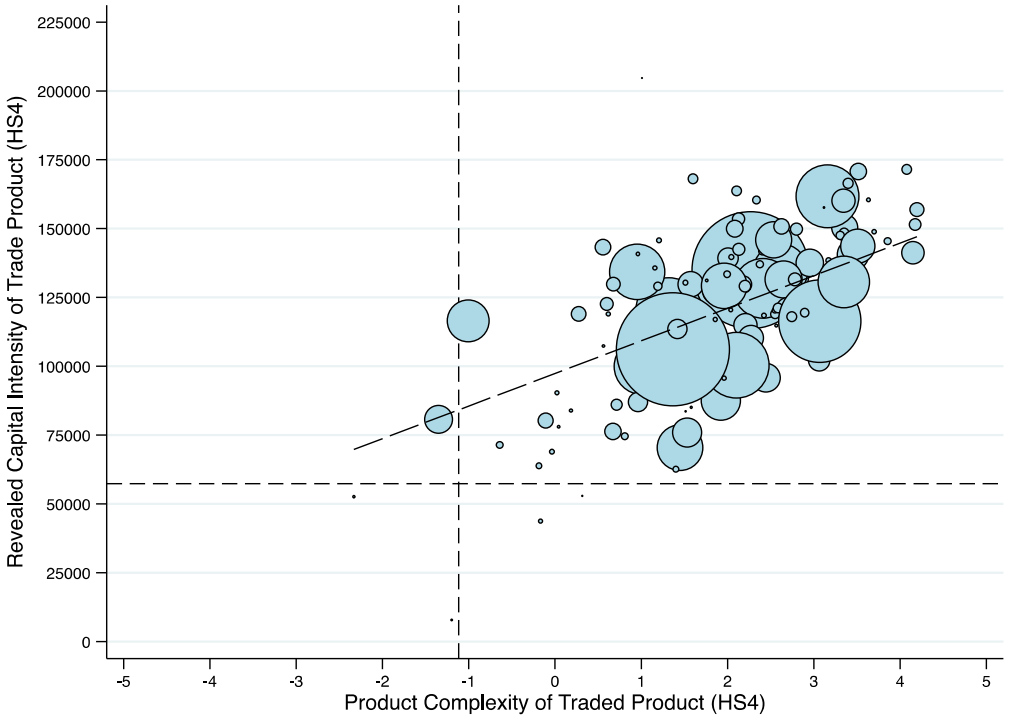
Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to non-commodity-based manufacturing products.

Appendix Figure 4: Evolution of Sub-Saharan Africa's Export Portfolio for Non-Commodity-based Manufactures – Entry into New Products in 2013



Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to non-commodity-based manufacturing products.

Appendix Figure 5: Evolution of East and South Asia's Export Portfolio for Non-Commodity-based Manufactures – Entry into New Products in 2013



Source: Authors' calculations using trade data from BACI data (HS 4-digit, revision 1992) to create product complexity measure, and revealed factor intensity data developed by Shirotori et al. (2010).
Notes: 1. Traded products are classified at the 4-digit level of the Harmonised System (HS), with each bubble representing a 4-digit product line. 2. The size of each bubble represents the share of that product in total exports in the final period, 2013. 3. The horizontal and vertical lines in each scatter plot represent the average revealed capital intensity and the average product complexity for low-technology manufactures falling within the fashion cluster of the Lall (2000) classification (i.e. clothing and textiles). 4. Trade flows are restricted to products in which at least one country within a region has a revealed comparative advantage. 5. Trade flows restricted to non-commodity-based manufacturing products.