Working Paper No. 670

The Product Space: What Does It Say About the Opportunities for Growth and Structural Transformation of Sub-Saharan Africa?

by

Arnelyn Abdon*
Asian Development Bank

Jesus Felipe*
Asian Development Bank and
Levy Economics Institute of Bard College

May 2011

* This paper represents the views of the authors and not necessarily those of the Asian Development Bank, its executive directors, or the countries that they represent.

Levy Economics Institute
P.O. Box 5000
Annandale-on-Hudson, NY 12504-5000
http://www.levyinstitute.org

ABSTRACT

In this paper we look at the economic development of Sub-Saharan Africa (SSA) in the context of structural transformation. We use Hidalgo et al.'s (2007) concept of *product space* to show the evolution of the region's productive structure, and discuss the opportunities for growth and diversification. The majority of SSA countries are trapped in the export of unsophisticated, highly standard products that are poorly connected in the product space; this makes the process of structural transformation of the region particularly difficult. The products that are *nearby* to those they already export have the same characteristics. Therefore, shifting to these products will do little to improve SSA's growth prospects. To jump-start and sustain growth, governments must implement policies and provide public inputs that will encourage the private sector to invest in new and more sophisticated activities.

Keywords: Industrial Policy; Product Space; Structural Transformation; Sub-Saharan Africa

JEL Classifications: O14, O25, O55

INTRODUCTION

The performance of Sub-Saharan Africa (SSA) (figure 1) during the last five decades has been dismal, and the reasons for such poor record have been widely discussed. Figure 2 shows that while the region has seen short episodes of steady growth in income per capita, it has had long periods of stagnation and contraction. In the late 1960s, the prospects for the region were promising. Income per capita was growing at about 5%. Consequently, per capita income increased from $489 in 1965 to $592 in 1974. But the gains accumulated during this short period were offset by the steady decline and contraction that started in the mid 1970s and lasted until the mid 1990s. By 1994, real per capita income had declined to $487, the same level it was three decades earlier. Since the late 1990s, SSA experienced again steady income growth. This steady growth before the financial crisis hit the world in 2008 resulted in a significant increase in income per capita, from $487 in 1994 to over than $600 in 2009. Still, this level of income is about the same as what it was in 1974 and is far behind the average GDP per capita of the non-high income countries of East Asia and the Pacific ($1,927), Latin America and the Caribbean ($4,673), and South Asia ($713).[2,3]

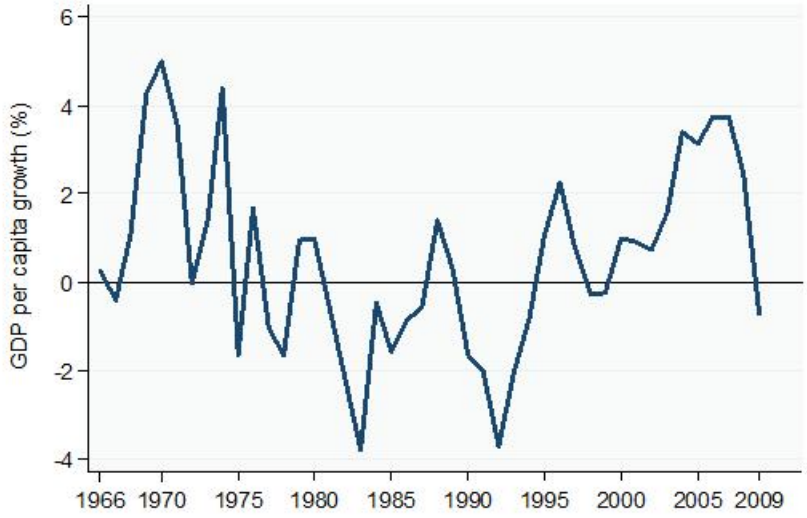
[2] Non-high income countries are those whose gross national income (GNI) per capita is below $11,906 (World Bank 2009 classification). Using this definition, Australia, Hong Kong, Macao, Japan, New Caledonia, New Zealand, Korea, and Singapore are excluded from East Asia and the Pacific; Bahamas, Barbados, Neth. Antilles and Aruba, and Trinidad and Tobago from Latin America and the Caribbean; and Equatorial Guinea from Sub-Saharan Africa. In this paper, the terms "non-high income countries" and "developing countries" are interchangeably used.

[3] It is interesting to note that in 1965 the average GDP per capita of SSA was $489, significantly higher than that of East Asia and the Pacific ($146) and that of South Asia ($202).

Figure 1: Sub-Saharan Africa

Source: Shapefile data downloaded from http://huebler.info/2009/world_adm0.zip

Figure 2: GDP Per Capita Growth (%)



Source: World Bank, World Development Indicators

This is clearly a development failure. Oxford economist Paul Collier (2007) has referred to most of Africa, and a few more countries around the world (a total of 58 countries), as the *bottom billion*, a group of low-income countries caught in at least one of four traps: conflicts, dependence on natural resources, landlocked with bad neighbors, and bad governance. These traps are not inescapable, but as long as they are there, they condition the affected countries' prospects for development.

The positive growth in per capita income during 2000-2008 is certainly a cause of optimism for the growth prospects of Sub-Saharan Africa. Growth started to pick up during 1995-2000, when the region achieved an average of about 0.8%. Afterwards, it increased to 2.3% during 2000-2005. Discussions in the literature have suggested that Africa may have reached a turning point, and that the 21st century is theirs to conquer. While many agree that Africa has experienced accelerated and prolonged growth in recent years, many others still question the sustainability of this growth.

The sustainability of SSA's growth was tested when the financial crisis rocked all economies. In 2009, SSA's aggregate GDP per capita contracted once again, this time by -0.7%. And while it is true that many countries, both developed and developing, experienced contraction in income in 2009, income per capita in East Asia, the Pacific and South Asia grew, on average, by about 6.5%.

Many studies have tried to explain why economic development seems to evade SSA. Easterly and Levine (1997) for example, show that the region's high level of ethnic diversity is the most important cause of Africa's slow growth. Sachs and Warner (1997) find that implementation of poor economic policies, particularly lack of openness to international markets, has played a significant role in the slow growth of the region. Bloom and Sachs (1998) argue that the region's "extraordinarily disadvantageous geography" is at the root of its inability to leap out of poverty. Artadi and Sala-i-Martin (2003) point to a number of reasons, including low levels of education, poor health, excessive public expenditure, and too many military conflicts, as key in explaining what they refer to as the "worst economic tragedy in the 20th century".

Collier and Gunning (1999) summarize the different explanations why SSA has suffered a "chronic failure of economic growth" into four categories: domestic-destiny, domestic-policy, external-destiny, and external-policy (Table 1). The authors conclude that destiny plays a lesser role than policy in Africa's development story, that is, Africa was not destined for slow growth. The

long period of stagnation and contraction of growth, the authors argued, has been due to policies that restricted trade.

Table 1: Why Has Africa Grown Slowly?

	Destiny	**Policy**
Domestic	Tropical Poor soil quality Low population density - High transportation cost - High natural resource endowment per capita - High ethno-linguistic diversity Colonial heritage - Smaller economies	Undemocratic - Expansion of public employment - Poor public services - Economic controls; heavy regulation
External	Population live far from the coast; landlocked - High transportation cost - Trade barriers Dependence on a few commodities; Deterioration of terms of trade High aid per capita	Anti-export policies High trade barriers Overvalued exchange rates Large foreign debt

Source: Authors' summary of Collier and Gunning (1999)

This paper looks at the economic development of Sub-Saharan Africa in the context of structural transformation. Specifically, we look at the evolution of the productive structure of the region. We use the *product space* (Hidalgo et al. 2007) to show that the majority of Sub-Saharan countries are in a "low-product" trap (Felipe et al. 2010a), which makes the process of structural transformation particularly difficult. Using the concepts underlying the construction of the product space, we discuss the opportunities for growth of countries in SSA, and discuss the opportunities for diversification for four countries, Ethiopia, Mozambique, Nigeria and Senegal. This complements the existing literature on the product space and its application to African countries, such as Hausmann and Klinger (2008) on South Africa; and Hidalgo (2011) on Kenya, Mozambique, Rwanda, Tanzania, and Zambia.

The rest of the paper is structured as follows: Section 2 discusses the role of structural transformation in economic development. This section also introduces the product space and shows SSA's location in comparison with other regions of the world. Section 3 discusses the opportunities for growth and diversification of four SSA countries: Ethiopia (landlocked), Mozambique (coastal), Nigeria (natural resource intensive), and Senegal (coastal). Finally, section 4 concludes.

1. STRUCTURAL TRANSFORMATION AND THE PRODUCT SPACE

The sequential evolution of the developed economies—from the production of less sophisticated to more sophisticated activities—shows that economic development is not only a process of continuously improving the production of the same goods, but also one that requires structural transformation, that is, the accumulation of the capabilities needed to upgrade production (by transferring resources) toward activities associated with higher levels of productivity. This shift is what leads to fast and sustained growth. This implies that development is a path-dependent process and the only way to traverse it is through significant structural transformation.[4]

Recent work by Hausmann et al. (2007), Hidalgo et al. (2007), Hidalgo (2009), and Hidalgo and Hausmann (2009), among others, gives emphasis to the role of structural transformation in inducing growth and development. Specifically crucial in their stories is that different products have different consequences for development.[5] Hausmann et al. (2007) show that the specific set of products that a country exports has important consequences for the pattern of development. Empirically, they show that, after controlling for factors such as initial income per capita, the sophistication of a country's export basket is a good predictor of future growth. This implies that development has to be understood as a process that involves not only the production of more of the same set of products, but also the introduction of new ones; that is, sustained growth involves the accumulation of more complex sets of capabilities. To analyze development and structural

[4] Chang (2009) strongly emphasizes this point in his critique of some recent interpretations of development as poverty reduction.

[5] This claim is not new. The importance of industrialization, for example, was highlighted by Nicholas Kaldor (1967) and others (on this see Felipe 2010). The novel and powerful contribution of the recent literature is the methods of analysis.

transformation from this perspective, Hidalgo et al. (2007) have developed a new analytical tool called the *product space*.

The product space is a network representation of all the products exported in the world. Central to the construction of the product space are two ideas: (i) that the ability of a country to export a new product is dependent on its ability to export similar products; and (ii) that commodities requiring similar capabilities are more likely to be exported together. Hidalgo et al. (2007) capture this notion of *similarity* between two products by observing trade outcomes rather than by looking at physical similarities between products or their inputs. They argue that that the production (and export) of different products requires different and very specific capabilities, such as human or physical capital, knowledge of markets, legal systems, institutions, etc. For example, the capabilities required to successfully export pineapples are very different from those required to export iPads. What differentiates these capabilities is that some of them can be easily redeployed into the production and export of many other products; that is, there are some goods that are "closer" to other goods. Likewise, there are many other products that are "far away" from other products. One example is the case of natural resources such as oil, which requires very specific capabilities that cannot be easily redeployed.

The product space, with a total of 775 nodes and 1,525 links, is graphically represented in figure 3. Each node (circle) represents a product under the SITC Revision 2 4-digit classification.[6] The color of each node corresponds to the Leamer's classification (Leamer 1984) to which the product belongs, and the size of each node is proportional to the product's share in world exports. The color of the link connecting any two nodes represents how similar the capabilities required for the two products are as measured by their *proximity*.[7,8]

---

[6] The number of nodes in the product space as constructed in Hidalgo, et al. (2007). It represents the product classes available in the Feenstra, et al. (2005) dataset.

[7] The proximity of two products i and j, φij, is the minimum between the probability that countries export i given they already export j and the probability that countries export j given that they already export commodity i:

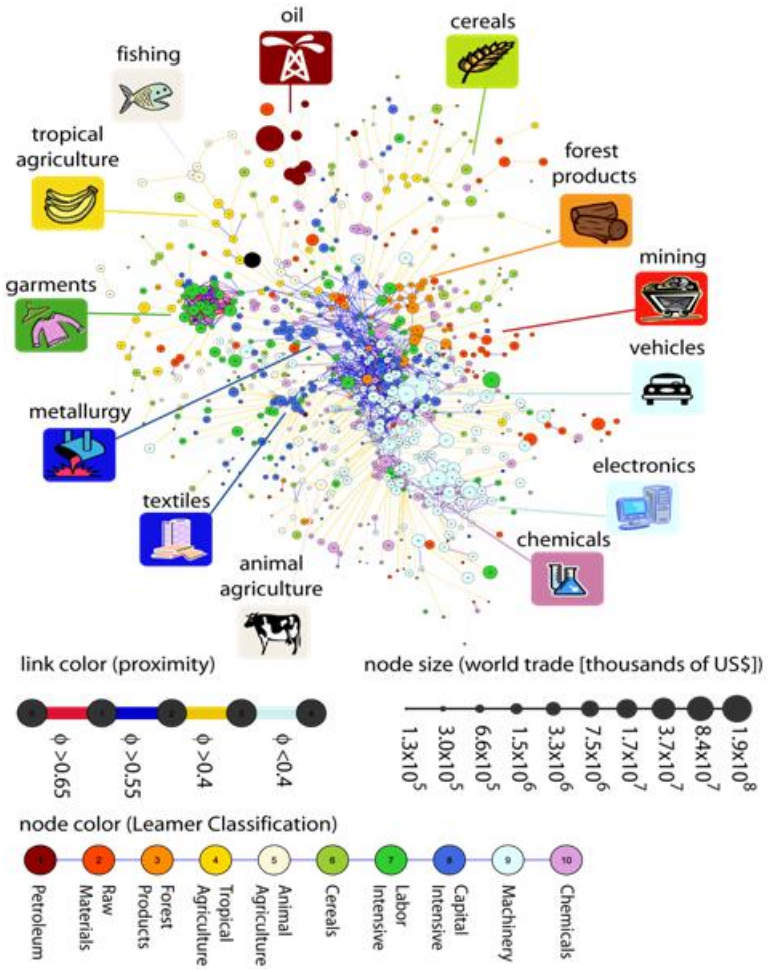
$$\phi_{ij} = \min\left\{P\left(RCA_i \geq 1 \mid RCA_j \geq 1\right), P\left(RCA_j \geq 1 \mid RCA_i \geq 1\right)\right\}$$

where RCA_i, which will be formally defined later, is the index of a country's revealed comparative advantage in exporting product i. This representation is based on the argument that if every country that exports i also exports j, then these two products must be very similar and require the same (similar) capabilities. On the other hand, if every country that exports i does not export j, then it would seem that the capabilities required to export i are entirely different from the capabilities required to export j.

[8] This implies that the physical distance between two nodes has no meaning. Nevertheless, the product space map was drawn such that product pairs with higher proximities are close to each other, and vice versa. For example, products in the garments sector are clustered together because their proximities with each other are high (in red or blue colors). The same is true for the products in the core of the product space.

The product space is highly heterogeneous. Peripheral products, such as petroleum, seafood, garments, and raw materials, are only weakly connected to other products. In the center of the network is a core of closely connected products, mainly machinery, chemicals, and capital-intensive (metal) products. There are also clusters of products, such as those in the garments and electronics clusters, where products are closely linked within each cluster but are not well connected with the rest of the product space.

Figure 3: The Product Space



Source: Hidalgo et al. (2007)

The heterogeneous structure of the product space has important implications for structural change. Products in the periphery are generally less sophisticated and with a lower income elasticity of demand for exports than those in the core, implying that not all products have the same consequences for economic development. A country that produces goods in the dense core of the

product space will find structural transformation a much easier process because the set of acquired capabilities can be easily redeployed into the production of other products. However, the shift to the production of other products will be more challenging for a country that specializes in peripheral products. On average, core products are the most sophisticated and well-connected to the rest of the product space, that is, these products provide more opportunities to redeploy the capabilities that they embody, which facilitates the export of a large number of other products. Consequently, countries that export a significant share of core commodities face very different prospects from those faced by countries with a low presence in the core. In other words, a country's position in the product space signals its capacity for structural transformation.

Figure 4 shows the product space of non-high income countries in East Asia and the Pacific, Latin America and the Caribbean, South Asia, and Sub-Saharan Africa for 1962 and 2007. We have removed the node colors and the sizes that represent the type of product and its share in world trade, respectively, to highlight only those products that the region exports with revealed comparative advantage (RCA).[9] The product space map is fixed to visualize the evolution of the region's productive structure—the products exported with RCA—over time. The products exported with RCA are the black squares.

All four regions started out as exporters of products located in the periphery in 1962. By 2007, the product space had evolved considerably. During this period, although the number of products exported with RCA had increased, SSA had made almost exclusively "nearby" jumps to products in the closely knitted garment sector and to other peripheral products, but was not able to make significant leaps into the more sophisticated and more connected products in the core. East Asia, South Asia, and, to some extent Latin America, on the other hand, have covered a significant number of garments and textiles. In East Asia, China, Malaysia, and the Philippines, among others, have become important links in the global electronics production chain, and these countries have

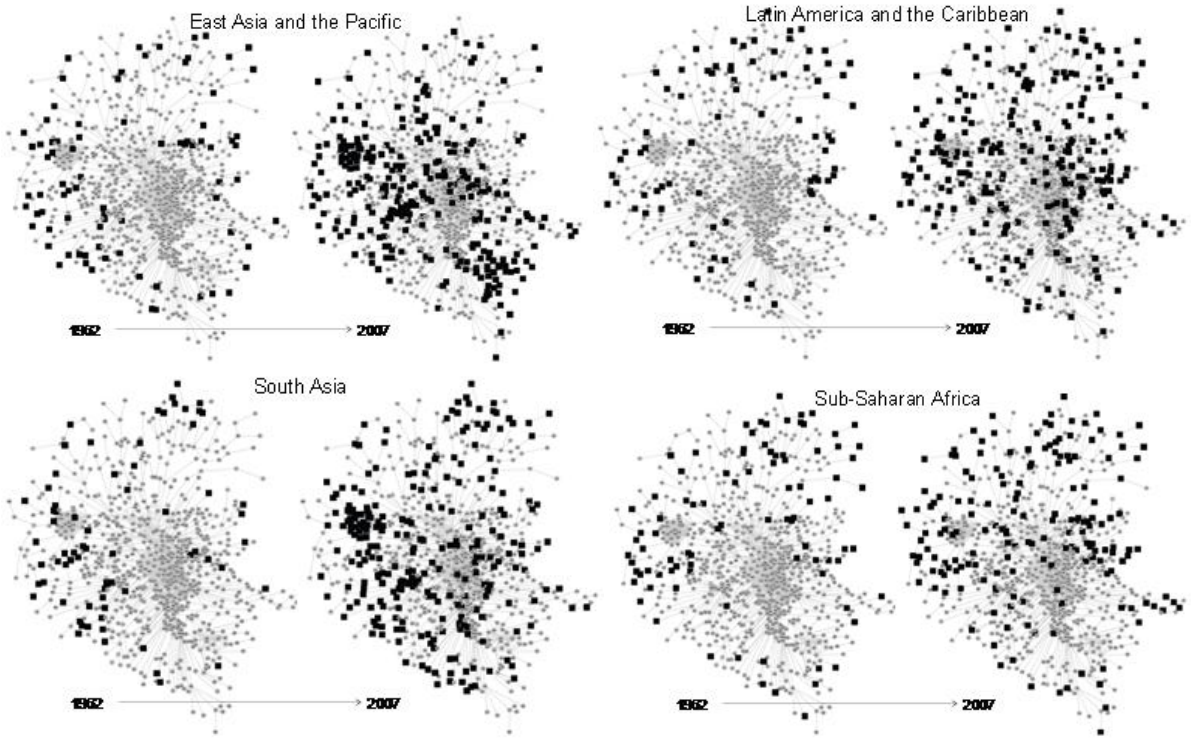
[9] We use Balassa's (1965) measure of revealed comparative advantage (RCA). It is the ratio of the export share of a product in the country's export basket to the same share at worldwide level:

$$RCA_{ci} = \frac{xval_{ci} \Big/ \sum_{i} xval_{ci}}{\sum_{c} xval_{ci} \Big/ \sum_{i}\sum_{c} xval_{ci}}$$

where, $xval_{ci}$ is the value of country c's export of commodity i. For purposes of our analysis, country c exports product i with RCA if $RCA_{ci} \geq 1$. Data to calculate the RCAs are from Feenstra, et al. (2005) for 1962-2000 and from United Nations Commodity Trade database for 2001-2007.

managed to jump into products in the core, other than electronics, in particular China (Felipe et al. 2010b).

Figure 4: Product Space Maps, by Region

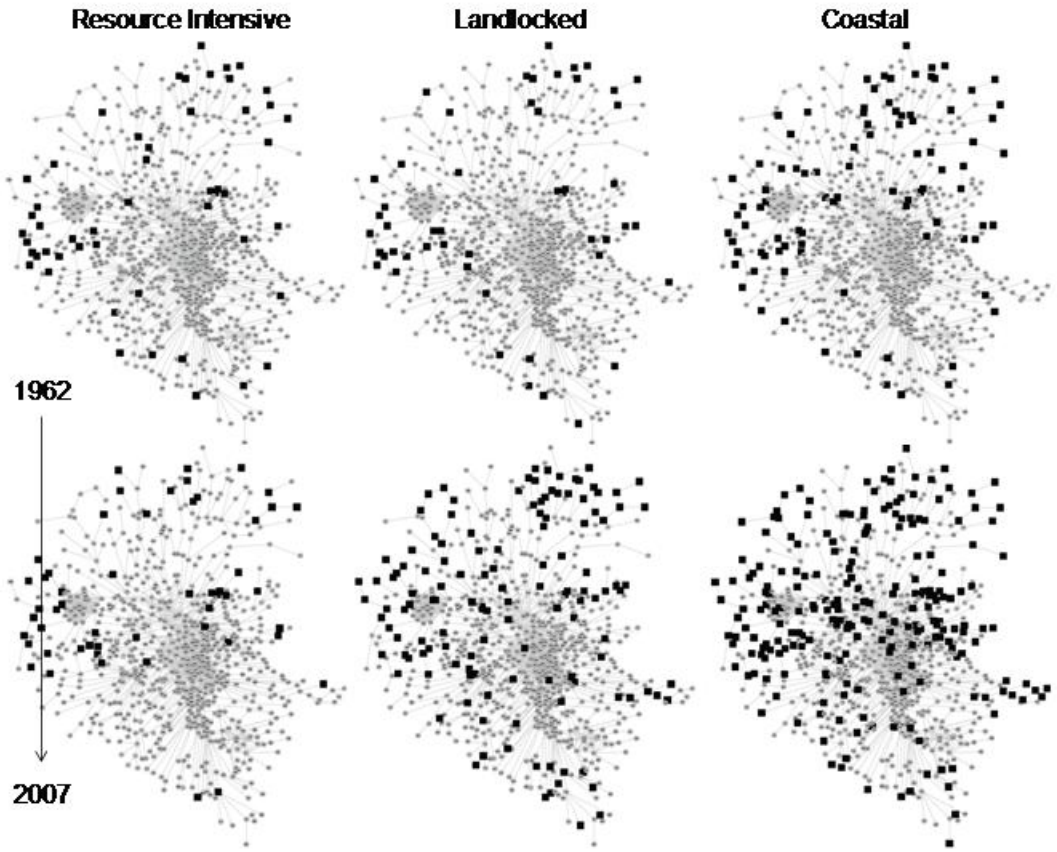


Source: Authors' calculations and Hidalgo et al. (2007)

Figure 5 shows the product structure of three subgroups in Sub-Saharan Africa. We have classified countries in the region into three mutually exclusive groups, according to endowment and location, as in Collier and O'Connell (2007), and Arbache, et al. (2008). The countries are grouped into (i) natural-resource intensive (11 countries); (ii) non-natural resource intensive, landlocked (10 countries); and (iii) non-natural resource intensive, coastal (17 countries).[10]

[10] The number of countries in each group represents only the countries for which we have data. Natural-resource intensive: Angola, Cameroon, Chad, Congo, Equatorial Guinea, Gabon, Guinea, Nigeria, Sierra Leon, Sudan, and Zambia. Non-natural resource intensive, landlocked: Burkina Faso, Burundi, Central African Republic, DR of Congo, Ethiopia, Malawi, Mali, Niger, Rwanda, and Uganda. Non-natural resource intensive, coastal: Benin, Cote d'Ivoire, Gambia, Ghana, Guinea-Bissau, Kenya, Liberia, Madagascar, Mauritania, Mauritius, Mozambique, Senegal, Seychelles, South Africa, Tanzania, Togo, and Somalia.

Figure 5: Product Space Maps, Sub-Saharan Africa



Source: Authors' calculations and Hidalgo et al. (2007)

Figure 5 highlights two important points in the paths followed by these three groups of countries between 1962 and 2007: (i) the number products in which each group has acquired comparative advantage (i.e., the degree of diversification); and (iii) the number of products in the core of the product space. The export structure of resource-rich countries barely changed during the last 45 years. They remain exporters of very few products, all of them in the periphery of the product space. Landlocked countries have managed to jump into new products in the periphery, but have not successfully exported (except for a few) well connected products in the core. Coastal countries, on the aggregate, have acquired revealed comparative advantage in a significant number of new non-peripheral products, particularly in the garments sector; and have also successfully ventured into some products in the core of the product space. However, the jumps into the core are mainly driven by South Africa. Indeed, in figure 6 we take out South Africa from the calculation of RCAs for the coastal countries. The result is a product space that resembles that of the landlocked economies.

Figure 6: Coastal, Excluding South Africa (2007)

Source: Authors' calculations and Hidalgo et al. (2007)

The evolution of the product spaces of East Asia, South Asia, and Latin America, shown in figure 4, did not happen overnight, and certainly not without deliberate and active government participation. For China, for example, Felipe, et al. (2010b) argue that China's ability to master and accumulate new and more complex capabilities was policy induced and not the result of the market. This accumulation process underlies China's fast development during the last half century. Similarly for India, Felipe et al. (2010c) argue that the bias of the *license-permit raj* towards the heavy machinery sector resulted in a well diversified and sophisticated manufacturing sector. Reinert (2009) emphasizes that the transition of countries from poor to rich during the last 500 years has been a process of emulating the policies implemented by those that had succeeded earlier, and this involved some form of policy intervention such as infant industry protection.

The sparse productive structure of Sub-Saharan Africa (figures 4 and 5) has significant implications for its diversification prospects. The region is poorly diversified, and its exports are (mostly) ubiquitous peripheral products, that is, exported by many other countries, implying the *standardness* of inputs or capabilities required in their production (Hidalgo and Hausmann 2009).[11]

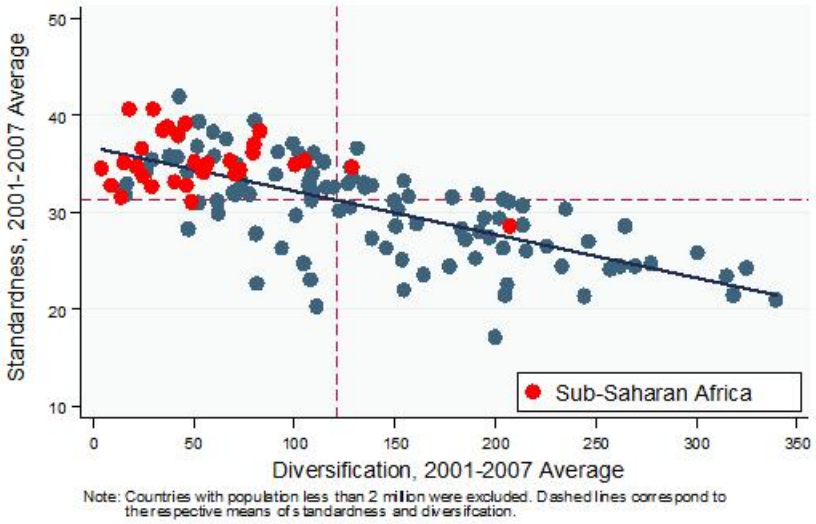
[11] Standardness is the average ubiquity of commodities exported with comparative advantage for each country. It is calculated as:

$$\frac{1}{diversification_c}\sum_i ubiquity_{ic}$$

where diversification is the number of products exported by country c with comparative advantage and ubiquity of commodity *i* is the number of countries exporting commodity *i* with comparative advantage.

Indeed, figure 7 shows that SSA countries, except South Africa (fourth quadrant) and Kenya (first quadrant), lie in the second quadrant—low diversification and more standard exports—of the diversification-standardness space.

Figure 7: Standardess and Diversification



The standardness and poor diversification of SSA's exports underlie the low sophistication of SSA's export basket. Following Hausmann, et al. (2007) we calculate the level of sophistication of a product (PRODY) as a weighted average of the GDP per capita of the countries that export the product, where the weights correspond to the relative comparative advantage of each country in exporting the good. In this sense, the sophistication or PRODY of a product is not an engineering notion but provides a measure of the income content of a product.[12] We then use PRODY to

---

[12]Algebraically, PRODY is calculated as:

$$PRODY_i = \sum_c \left[\frac{xval_{ci} \Big/ \sum_i xval_{ci}}{\sum_c \left(xval_{ci} \Big/ \sum_i xval_{ci} \right)} \right] \times GDPPC_c$$

Note that the Hausmann et al. (2007definition of revealed comparative advantage differs from the one used by Balassa (1984) (see footnote 9). We calculated PRODY as the average of the PRODYs calculated for the years 2003, 2004, and 2005. We have calculated PRODYs for 779 products available (out of the total 786 product classes in SITC Rev. 2 4-digit classification) during these three years.

calculate the sophistication of the entire export basket of the regions, which Hausmann, et al. (2007) referred to as *EXPY*. [13] Figure 8 and Table 2 show SSA's low export sophistication.

Figure 8 shows the evolution of each region's export sophistication level (*EXPY*). Up to the early 1980s, the sophistication of SSA's exports was similar to that of East Asia and the Pacific regions. However, the trend in *EXPY* for the two regions began to diverge in 1982—East Asia's export sophistication has caught up and exceeded that of Latin America, while that of SSA is now lower than that of South Asia.

In Table 2, we show another measure of product sophistication or *complexity* (Hidalgo and Hausmann 2009). Unlike PRODY, the calculation of product complexity does not involve the incomes of countries. Instead, following Hidalgo and Hausmann (2009) we use an iterative procedure that exploits the observable network structure of countries and the products they export. Here, complexity is associated with the set of capabilities required by a product. Felipe et al. (2011) use the methodology proposed by Hidalgo and Hausmann (2009) to calculate the complexity index of 124 countries and the complexity index of each of the products in the HS 6-digit classification, which comprises over 5,000 product classes. In Table 2, we show the ranking of SSA countries in terms of complexity and their export shares by complexity group. We divide the products into six quantiles according to their level of complexity (group 1 being the most complex and group 6 the least complex) and calculate the share in each country's total exports. The results show that, except for South Africa, over 50% of the exports of the 27 other SSA countries for which we have data are among the least complex products.

[13] The level of sophistication of a country's export basket (EXPY) is the weighted average of the level of sophistication of the products that it exports:

$$EXPY_c = \sum_i \left(\frac{xval_{ci}}{\sum_i xval_{ci}} \times PRODY_i \right)$$

Figure 8: Export Sophistication (EXPY)

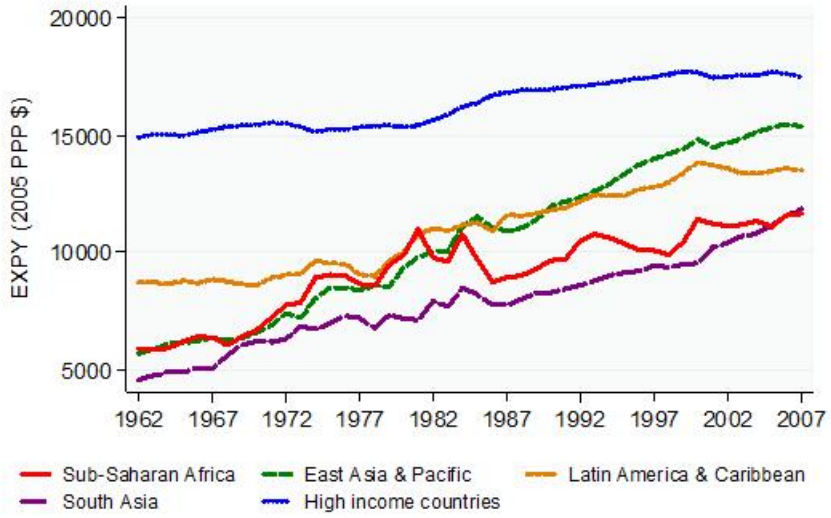


Table 2: Complexity Ranking and Share in Exports (%) by Product Complexity Quantiles, 2001-2007 Average

	Complexity Ranking	1	2	3	4	5	6
South Africa	36	17.4	15.8	10.0	17.6	18.7	20.6
Sierra Leone	39	4.2	9.1	15.3	6.9	7.4	57.2
Senegal	66	2.2	4.4	3.6	18.1	14.4	57.2
Central African Rep.	68	0.5	1.6	1.2	1.4	3.0	92.2
Niger	70	2.8	2.6	28.2	2.4	12.2	51.7
Burundi	73	3.2	5.0	4.0	8.1	5.2	74.6
Kenya	79	1.3	2.7	3.3	7.4	11.0	74.4
Uganda	84	0.9	3.4	1.9	4.6	10.0	79.1
Zambia	86	0.6	3.4	0.8	25.7	12.4	57.1
Rwanda	87	0.9	1.6	2.0	2.1	2.7	90.8
Burkina Faso	88	0.6	1.0	1.3	2.1	6.5	88.5
Mali	90	0.7	1.3	2.0	2.7	7.0	86.3
Togo	95	1.0	5.0	3.4	4.6	12.1	74.0
Chad	96	0.2	0.3	2.1	0.5	0.3	96.6
Côte d'Ivoire	103	0.4	3.8	1.3	5.3	11.8	77.3
United Rep. of Tanzania	104	0.9	1.1	1.7	3.1	7.8	85.4
Mozambique	105	0.5	0.6	5.8	17.3	50.3	25.5
Benin	106	0.3	3.2	0.7	2.0	11.5	82.3
Ethiopia	110	0.4	1.4	0.9	1.8	6.3	89.2
Cameroon	111	0.3	0.5	0.5	1.9	7.4	89.4
Ghana	112	0.4	1.0	0.8	4.7	11.4	81.6
Sudan	113	0.2	0.4	0.3	0.4	2.6	96.2
Malawi	114	0.4	0.7	0.8	1.2	4.8	92.1
Angola	115	0.1	0.1	0.1	0.1	0.6	99.0
Madagascar	116	0.4	0.8	1.7	2.2	4.3	90.6
Guinea	118	0.3	0.3	4.1	0.5	15.3	79.5
Congo	120	0.1	0.1	0.1	0.3	2.9	96.4
Nigeria	122	0.1	0.2	0.3	0.6	1.6	97.2

Source: Authors' calculations. See Felipe et al. (2011).

The low sophistication and high standardness of SSA's exports are a reflection of the region's low presence in the core of the product space. As discussed above, core products are highly connected to the rest of the product space, that is, these are generally high *path* products.[14] Using the concepts of sophistication and path that underlie the construction of the product space, Felipe et al. (2010a) find that 29 of the 38 Sub-Saharan countries included in their study are classified as countries in a "low-product" trap, 7 are in a "middle product" trap, and 2 countries are relatively well positioned.[15] Countries in the low- and middle- product traps are presented in Table 3.

[14] The *path* of a product is calculated as the sum of all proximities leading to it. The capabilities required for a product that has a high path are easier to be redeployed in the production of other products compared to that of a product with a lower path.

[15] These two countries are Seychelles and Sierra Leone. The simple criterion used in the classification of countries in Felipe, et al. (2010a) is not exempt of problems. While in most cases the results were what one would expect a priori, there are some cases that are difficult to explain. For example, high income countries like Australia and Iceland are classified alongside low income countries. In contrast, Sierra Leone is classified along with high income countries such as France, Netherlands, and Spain.

Table 3: Traps, Endowment, and Location

	Natural-resource intensive	**Non-resource intensive, landlocked**	**Non-resource intensive, coastal**
Low-product trap	Angola Cameroon Chad Congo Gabon Equatorial Guinea Guinea Nigeria Sudan Zambia	Burkina Faso Central African Republic DR of Congo Ethiopia Malawi Mali Rwanda Uganda	Benin Cote d'Ivoire Djibouti Ghana Kenya Madagascar Mauritania Mauritius Mozambique Togo Tanzania
Mid-product trap		Burundi Niger	Gambia Guinea-Bissau Liberia Senegal South Africa

Source: Endowment-location classification by Arbache, et al. (2008); Product trap classification by Felipe et al. (2010a)

Getting out of the trap, that is, diversifying and upgrading its productive structure, is Sub-Saharan Africa's key challenge. This is not easy. Export diversification and upgrading entail venturing into the production of new, more sophisticated, and less standard products. This process may involve information and coordination externalities (Hausmann and Klinger 2007). In addition, there is no single policy that can be tailored to fit all countries in the region, or even for groups of countries in the region.

Felipe, et al. (2010a) propose some generic policies that, when put in a country-specific context, will facilitate the escape from the bad product traps. For those in the low-product trap, the authors emphasize the importance of accumulating new capabilities. This will require human capital to acquire skills, technology, and knowledge; a higher drive to diversify and to increase

sophistication by embracing a realistic industrial vision; and the improvement of organizational abilities. For countries in the middle-product trap, on the other hand, focus must be toward increasing the number of products exported with RCA in the core of the product space.

2. OPPORTUNITIES FOR GROWTH AND DIVERSIFICATION

Opportunities for Growth

Sub-Saharan Africa is not destined for slow growth as Collier and Gunning (1999) have pointed out, and as the region's encouraging growth performance during the late 1960s and during the late 1990s proves. Indeed, the long-term growth forecasts for countries in the region are not gloomy. Felipe et al. (2010d) provide income per capita growth forecasts using a cross-country regression model where a country's long-run fundamentals are determined by its accumulated capabilities and by its capacity to undergo transformation. Felipe et al. (2010d) used export sophistication, export diversification, and a measure that captures the opportunities of the country for further structural change to forecast long-term growth rates. The results show that for 26 out of 36 SSA countries in the sample, the midpoint forecasts growth rates for 2010-2030 are higher than the respective average growth rates for 1990-2007 (Table 4).

Table 4: Growth Projections, 2010-2030

	Growth projection, ave. annual growth rate 2010-2030 (%)		Ave. annual growth rate 1990-2007 (%)		Growth projection, ave. annual growth rate 2010-2030 (%)		Ave. annual growth rate 1990-2007 (%)
	Low - High	Midpoint*			Low - High	Midpoint*	
Angola	3.3 - 4.9	4.12	4.9	Liberia	8.5 - 10.1	**9.31**	0.5
Benin	6 - 7.5	**6.75**	4.5	Madagascar	-7.5 - 8.5	0.51	2.4
Burkina Faso	5.2 - 5.7	5.49	5.8	Malawi	4.5 - 6.4	**5.45**	3.1
Burundi	5.6 - 7.1	**6.33**	0.6	Mali	4.3 - 4.6	**4.42**	4.2
Cameroon	4.5 - 5.4	**4.92**	2.3	Mauritania	4.5 - 5.5	**4.96**	3.4
Central African Republic	4.2 - 4.8	**4.52**	1.1	Mauritius	1.5 - 2.4	1.91	4.8
Chad	5.1 - 5.5	5.30	5.3	Mozambique	3.5 - 6.8	5.14	6.9
Congo, Rep.	3.3 - 4.7	**4.01**	3.2	Niger	7.5 - 8.5	**8.01**	2.8
Cote d'Ivoire	6.3 - 7	**6.66**	1.4	Nigeria	4.1 - 5.2	**4.68**	3.8
Djibouti	4.9 - 5.9	**5.38**	-0.3	Rwanda	4.3 - 5.4	**4.87**	3.4
Equatorial Guinea	1 - 2.4	1.68	20.5	Senegal	-6.9 - 8.2	0.65	3.8
Ethiopia	5.5 - 7.4	**6.46**	4.9	Sierra Leone	6.2 - 7.9	**7.06**	2.4
Gabon	1.9 - 3.3	**2.56**	2.0	South Africa	2 - 3.1	**2.52**	2.3
Gambia, The	6.6 - 7.4	**7.01**	3.9	Sudan	5.7 - 6	5.82	6.5
Ghana	5.9 - 6.9	**6.39**	4.6	Tanzania	6.9 - 8.1	**7.50**	4.3
Guinea	5.6 - 7	**6.27**	3.6	Togo	7.2 - 8.6	**7.86**	2.3
Guinea-Bissau	6.9 - 8.2	**7.52**	0.2	Uganda	6 - 7.8	6.89	7.0
Kenya	6.4 - 8.1	**7.21**	2.9	Zambia	4.1 - 5.6	**4.86**	2.0

*In bold are those countries with a higher growth rate than the average growth for 1990-2007.

Source: Felipe et al. (2010d)

It is important to point out that the projected growth in per capita incomes will not come like manna from heaven. The crucial assumption is that these countries will be able to use its existing capabilities to gain revealed comparative advantage in new and more sophisticated sets of products, and not simply continue exporting more of the same. This process will be more difficult for most of Sub-Saharan countries than for other non-high income countries. Felipe et al. (2010e) show this empirically by developing the *Index of Opportunities*. The *Index of Opportunities* is based on a country's accumulated capabilities to undergo structural transformation, and captures the potential of a country for further upgrading, growth, and development. The ranking of countries according

the Index of Opportunities reveals that almost all Sub-Saharan countries are at the lower half of the ranking among 96 non-high income countries (Table 5).

Table 5: Index of Opportunities Ranking (Non-high income countries)

Upper half		**Lower half**	
1. China	25. Colombia	**49. Burundi**	73. Bangladesh
2. India	26. Lebanon	50. Dominican Rep.	**74. Côte d'Ivoire**
3. Poland	27. Uruguay	**51. Ethiopia**	**75. Madagascar**
4. Thailand	28. Panama	**52. Mozambique**	**76. Sudan**
5. Mexico	29. Georgia	53. Libya	**77. Angola**
6. Brazil	30. Tunisia	**54. Uganda**	**78. Rwanda**
7. Ukraine	31. Costa Rica	55. Algeria	**79. Congo**
8. Indonesia	**32. Kenya**	56. Iran	80. Turkmenistan
9. South Africa	33. Nepal	57. Togo	**81. Central African Rep.**
10. Malaysia	34. Kyrgyz Rep.	58. Bolivia	82. Honduras
11. Romania	35. Moldova	59. Yemen	83. Lao PDR
12. Bulgaria	36. Venezuela	**60. Tanzania**	84. Papua New Guinea
13. Philippines	37. Pakistan	61. Albania	**85. Niger**
14. Belarus	38. Armenia	**62. Chad**	86. Mongolia
15. Turkey	39. Guatemala	63. Chile	**87. Cameroon**
16. Argentina	40. Syria	**64. Mali**	**88. Zambia**
17. Jordan	**41. Senegal**	**65. Liberia**	89. Nicaragua
18. Russian Federation	42. Azerbaijan	66. Morocco	90. Jamaica
19. Egypt	43. Kazakhstan	**67. Burkina Faso**	91. Cambodia
20. Latvia	44. Sri Lanka	**68. Nigeria**	**92. Guinea**
21. Viet Nam	45. El Salvador	**69. Ghana**	**93. Malawi**
22. Bosnia and Herzegovina	46. Uzbekistan	70. Tajikistan	**94. Benin**
23. Lithuania	47. Peru	71. Ecuador	**95. Mauritania**
24. Sierra Leone	48. Macedonia, FYR	72. Paraguay	96. Haiti

Source: Felipe et al. (2010e)

The positions of the Sub-Saharan countries, as indicated in Table 5, imply that most countries in the region have not accumulated a significant number of capabilities. The sophistication of the region's exports is not high enough to stimulate and maintain sustained growth. As stated earlier, these countries urgently need to implement policies that lead to the accumulation of

capabilities. But, where to begin? We show below how the product space can be used to identify which products require capabilities that are most similar to those that the country already has.

Opportunities for Structural Transformation

The products that a country currently exports not with RCA comprise its opportunity set for further structural transformation. In the context of the product space, the ease of acquiring RCA in these products depends on: (i) how diversified the country's current export basket is; and (ii) how close the current export basket of the country is to its opportunity set. Hausmann and Klinger (2006) capture this notion of distance between each of the goods in the opportunity set and those currently exported with RCA by calculating the *density*.[16] This is a proxy for the probability that a country successfully exports a new product, given its current set of capabilities.

Figures 9 and 10 show two different representations of the opportunity set for four SSA countries: Ethiopia, Mozambique, Nigeria, and Senegal. Figures 9a and 9b (comparison with Germany, Korea and Singapore) show the set of opportunities in the *sophistication-distance* space, where *sophistication* represents the income or productivity level associated with a commodity and *distance* is the inverse of the density so that products with distance close to zero are *relatively nearby*. We say "relatively nearby" because density is country-specific. The products that are "nearby" for a specific country are the ones that are the closest relative only to the country's export basket. Figure 10, on the other hand, shows where the opportunity set lies in the product space, grouped by distance.

Figure 9a shows that while Nigeria has the highest number of products in its opportunity set, these are "far" when compared with the products in the opportunity sets of Ethiopia, Senegal, and Mozambique. This is because Nigeria exports with RCA very few products. In 2007, Nigeria

[16] The density of commodity *j*, a product not exported with comparative advantage, is the sum of proximities between product *j* and all products that are exported with comparative advantage, scaled by the sum of all proximities leading to product *j*:

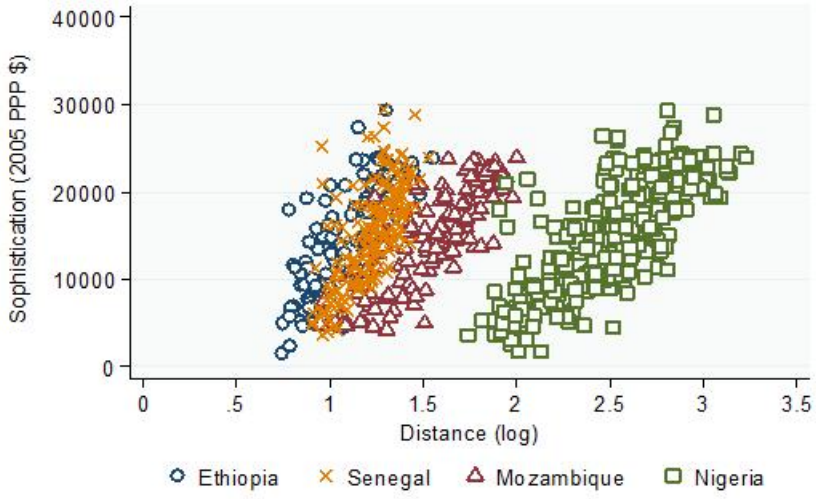
$$density_{cj} = \frac{\sum_i \varphi_{ij} x_{ci}}{\sum_i \varphi_{ij}}$$

where $x_{ci} = \begin{cases} 1 & \text{if } RCA_{ci} \geq 1 \\ 0 & \text{otherwise.} \end{cases}$ and ϕ_{ij} denotes the proximity between goods i and j. The density of any product lies between 0 and 1. The higher the density of a product not exported with RCA, the closer its required capabilities are to the country's existing capabilities.

exported a total of 318 products (out of the 779 SITC Rev. 2 4-digit), but it exports with RCA only 26. In contrast, Ethiopia exported 172 products, but 75 with RCA. The implication is that it would be easier for Ethiopia than for Nigeria to take advantage of its opportunities.

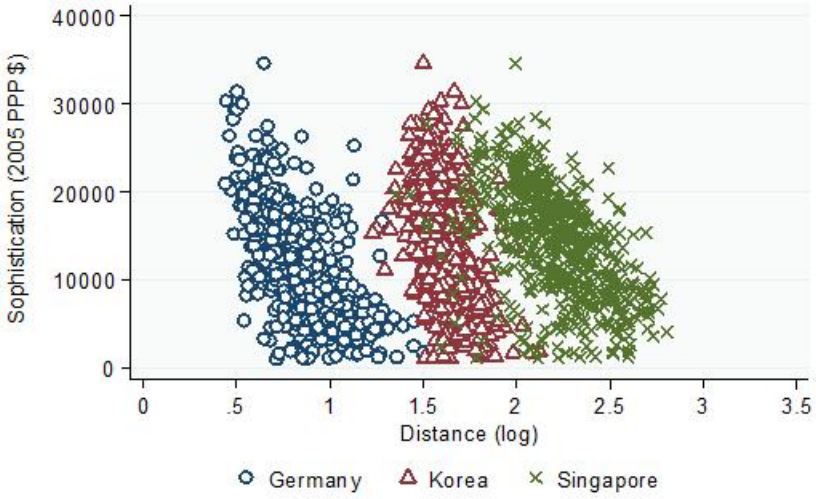
The trade-off between sophistication and distance for the four countries is also worth noting in figure 9a. This inverse relationship between sophistication and distance is typical of developing countries, whose accumulated capabilities are much closer to the ones required in the production and export of products with low sophistication (i.e., potential sophisticated exports are far). It is worth contrasting this with the opportunity sets of high-income countries such as Germany, Korea, and Singapore (figure 9b). These countries have accumulated a significant number of capabilities and can be easily redeployed into the production and export of more highly sophisticated products (i.e., potential sophisticated exports are close).

Figure 9a: Distance and Sophistication



Source: Authors' calculations

Figure 9b: Distance and Sophistication

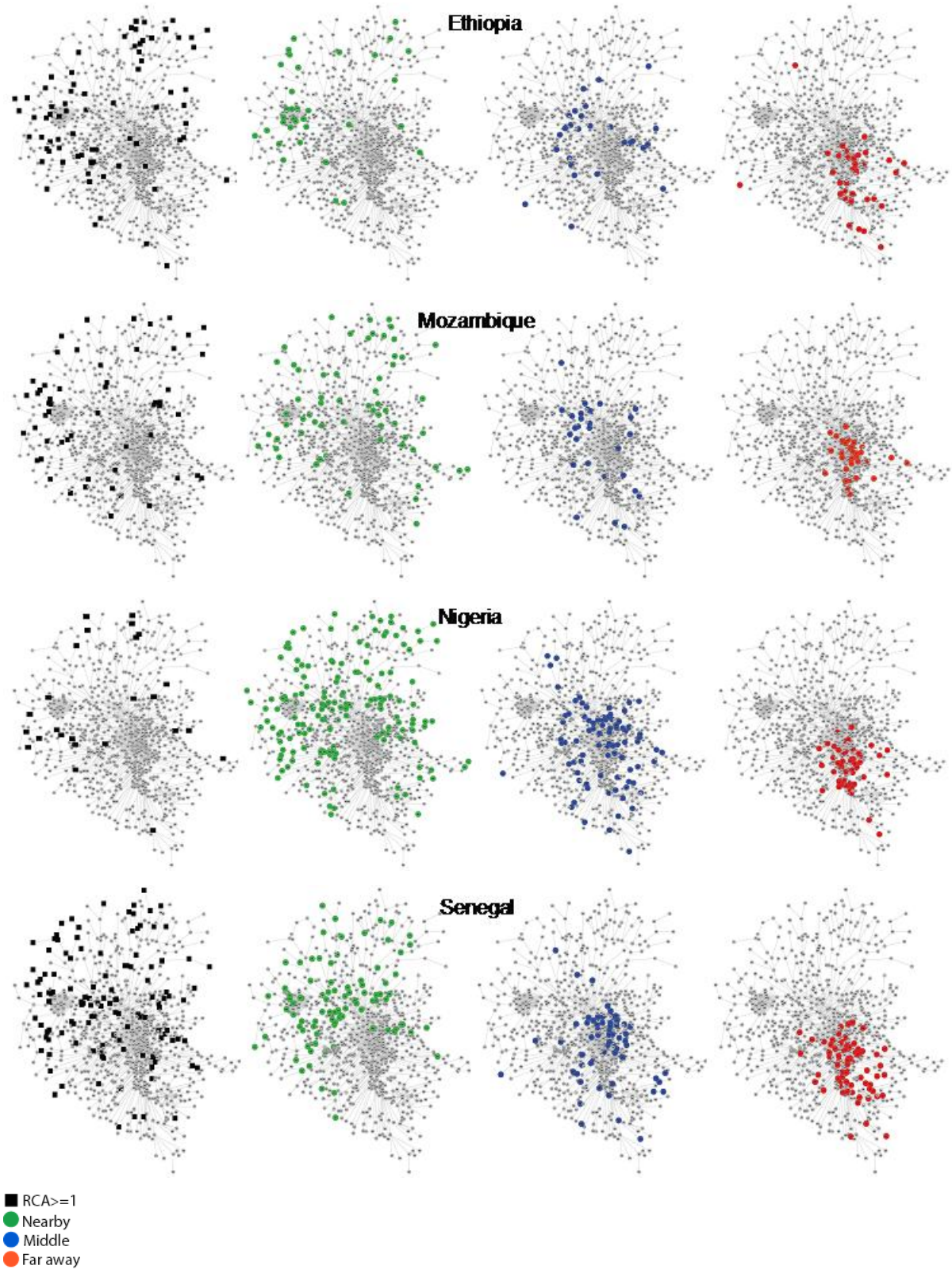


Source: Authors' calculations

Figure 10 shows where the opportunity sets of Ethiopia, Mozambique, Nigeria, and Senegal lie in the product space. First, we classify the products into three groups according to distance: *nearby*, *middle*, *far away*. *Nearby* products are those whose distance from the current export basket is below 0.5 standard deviations from the mean distance; *middle* products are those whose distance lies ±0.5 standard deviations from the mean; and *far away* products are those whose distance lies above 0.5 standard deviations from the mean. Second, we plot the products—represented by nodes in color—in the product space map by group. For reference, we also include the product space map showing the products that each country exports with revealed comparative advantage. Each row in figure 10 represents one country. The first product space shows the products that the country exports with RCA (black squares); and the second, third, and fourth show the products in the opportunity set that are *nearby* (green), *middle* (blue), and *far away* (red), respectively.[17]

[17] The top 10 products according to sophistication in each group are listed in the Appendix. This list must be interpreted with caution. The list was generated based on the structure of the product space without regard to geographic characteristics that constrains the production and export of specific products. For example, the list of *nearby* products for a landlocked country may include fish products.

Figure 10: The Opportunities Set in the Product Space



A few observations are worth noting. First, is the obvious similarity of the current productive structures (exports) of the four countries (first product spaces, with products marked in black) is the sparsely populated core and the prominence of peripheral products, similar to that of the region as a whole (figures 4 and 5). As a consequence of this peripheral export structure, *nearby* products (second product space, marked in green) are also products in the periphery. These products are, in general, not sophisticated and are poorly connected with other products in the space. This implies that relying on shifts to *nearby* products alone will do little to improve SSA's growth prospects.

Second, Ethiopia, Mozambique, and Senegal have some presence in the garments cluster (see first product space). The garment sector is typical of the development of countries that have undergone structural transformation. The fast growing countries of East Asia, for example, have produced and successfully exported a diverse set of garments before they have made strides into the production of more sophisticated products, such as electronics and other machinery. These three SSA countries must take advantage of the tight linkages in the garments cluster and the spillovers that this sector might generate.

Third, the products that matter most for growth, that is, those that are highly sophisticated and closely linked to the rest of space, are not *nearby* (second and third columns). This is particularly obvious for Ethiopia and Mozambique, where products in the core are all *far away*. Does this imply that moving towards products in the core of the product space is impossible? Not at all. As already pointed out, countries can engineer structural transformation by implementing policies and by providing public inputs that would encourage private investments in new activities. Also, note that these countries already export the products in the opportunity set, albeit without RCA. The problem is, therefore, to understand what constraints firms to export more.

3. CONCLUSIONS

What does the product space say about the opportunities for growth and structural transformation of Sub-Saharan Africa? In this paper we provide some answers to this question. Using the concepts that underlie the construction of the product space, we have studied the productive structures

(exports) of the Sub-Saharan region. The conclusion is that they are trapped in the export of products that are not sophisticated, standard, and are poorly connected in the product space.

The product space representation of the region reveals the concentration of most countries in peripheral products, and shows a sparsely populated core. This has significant implications for structural transformation. The current capabilities of the region, as revealed by the product space, are not enough to jump into more sophisticated and better connected products. The products that are *nearby* are also products in the periphery, and relying on shifts to these products will do little to improve SSA's growth prospects.

Long-term growth forecasts for the region show that SSA is not doomed for slow growth. But to jumpstart and, more important, to sustain growth, governments must implement policies and provide public inputs that will give incentives for the private sector to invest in new and more sophisticated activities.

Sub-Saharan Africa may be at a turning point, but in the absence of policies that could facilitate the accumulation of capabilities, growth will not be sustainable. The real turning point for Sub-Saharan Africa will be when countries in the region become less reliant on natural resource exports, and succeed in upgrading and diversifying their export baskets. We have emphasized that this process is not easy, but then we have also emphasized that it is not impossible.

REFERENCES

Arbache, Jorge, Delfin S. Go and John Page. 2008. "Is Africa's Economy at a Turning Point?" In Delfin S. Go and John Page, eds., *Africa at a Turning Point.* Washington, DC: The World Bank.

Artadi, Elsa. and Xavier Sala-i-Martin. 2003. "The Economic Tragedy of the XXth Century: Growth in Africa." NBER Working Paper No. 9865. July

Balassa, Bela. 1965. "Trade Liberalization and Revealed Comparative Advantage." *Manchester School of Economics and Social Studies* 33: 99-123.

Bloom, David E. and Jeffrey D. Sachs. 1998. "Geography, Demography, and Economic Growth in Africa," *Brookings Papers on Economic Activity* (2): 207-295.

Chang, Ha-Joon. 2009. "*Hamlet* without the Prince of Denmark: How Development has Disappeared from Today's 'Development' Discourse". In Shahrukh Rafi Khan and Jens Christiansen, eds., *Towards New Developmentalism: Markets as Means Rather Than Master.* Routledge: Abingdon.

Collier, Paul. 2007. *The Bottom Billion—Why the Poorest Countries Are Failing and What Can Be Done about It.* New York: Oxford University Press.

Collier, Paul, and Jan Willem Gunning 1999. "Why Has Africa Grown Slowly?" *The Journal of Economic Perspectives* 13(3): 3-22.

Collier, Paul and Stephen O'Connell. 2007. "Opportunities and Choices" In Benno J Ndulu, Stephen O'Connell, Robert H. Bates, Paul Collier and Chukwuma C. Soludo, eds., *The Political Economy of Economic Growth in Africa*, 1960-2000 Volume 1, Chapter 2. Cambridge: Cambridge University Press.

Easterly, William and Ross Levine. 1997. "Africa's Growth Tragedy: Policies and Ethnic Divisions." *Quarterly Journal of Economics* 112 November: 1203–50.

Feenstra, Robert C., Robert E. Lipsey, Haiyan Deng, Alyson C. Ma,and Hengyong Mo. 2005. "World Trade Flows: 1962-2000." *NBER Working Paper* 11040. National Bureau of Economic Research, Cambridge, MA.

Felipe, Jesus. 2010. *Inclusive Growth, Full Employment, and Structural Change: Implications and Policies for Developing Asia*. London: Anthem Press.

Felipe, Jesus, Utsav Kumar, Arnelyn Abdon, and Marife Bacate. 2011. "Product Complexity and Economic Development." *Structural Change and Economic Dynamics* (forthcoming).

Felipe, Jesus, Utsav Kumar, and Arnelyn Abdon. 2010a. “How Rich Countries Became Rich and Why Poor Countries Remain Poor: It’s the Economic Structure…Duh!” Working Paper No. 644. Annandale-on-Hudson, NY:Levy Economics Institute of Bard College.

Felipe, Jesus, Utsav Kumar, Norio Usui, and Arnelyn Abdon. 2010b. “Why Has China Succeeded? And Why it Will Continue to Do So.” Working Paper No. 611. Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Felipe, Jesus, Utsav Kumar, and Arnelyn Abdon. 2010c. “Exports, Capabilities, and Industrial Policy in India.” Working Paper No. 638. Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Felipe, Jesus, Utsav Kumar, and Arnelyn Abdon. 2010d. "Using Capabilities to Project Growth 2010-2030". Working Paper No. 609. Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Felipe, Jesus, Utsav Kumar, and Arnelyn Abdon. 2010e. "As You Sow So Shall You Reap: From Capabilities to Opportunities." Working Paper No. 613. Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Hausmann, Ricardo, Jason Hwang, and Dani Rodrik. 2007. "What You Export Matters." *Journal of Economic Growth* (12)1: 1-15.

Hausmann, Ricardo and Bailey Klinger. 2006. "Structural Transformation and Patterns of Comparative Advantage." CID Working Paper No. 128. Center for International Development, Harvard University.

Hausmann, Ricardo and Bailey Klinger 2008. “South Africa’s Export Predicament,” *Economics of Transition* 16(4): 609-637.

Hidalgo, César, Bailey Klinger, Albert-László Barabási, and Ricardo Hausmann. 2007. "The Product Space Conditions the Development of Nations." *Science* 317: 482-487.

Hidalgo, César 2009. "The Dynamics of Economic Complexity and the Product Space Over a 42 Year Period." Center for International Development at Harvard University. Working Paper No. 189. December. Harvard University.

Hidalgo, César, and Ricardo Hausmann. 2009. "The Building Blocks of Economic Complexity." *Proceedings of the National Academy of Sciences* 106(26): 10570-10575.

Hidalgo, César. 2011. “Discovering Southern and East Africa’s Industrial Opportunities.” The German Marshall Fund Paper Series. January.

Kaldor, Nicholas. 1967. Strategic Factors in Economic Development. Ithaca, NY: New York State School of Industrial and Labor Relations, Cornell University.

Leamer, Edward E. 1984. *Sources of International Comparative Advantage: Theory and Evidence.* Cambridge: MIT Press.

Reinert, Erik S. 2009. "Emulation versus Comparative Advantage" In Mario Cimoli, Giovanni Dosi, and Joseph E.Stiglitz, eds., *Industrial Policy and Development:* Oxford University Press.

Sachs, Jeffrey D. and Andrew M. Warner 1997. "Sources of Slow Growth in African Economies." *Journal of African Economies* 6(3): 335-376.

Appendix: Top 10 products in the opportunities set according to PRODY, by distance

Ethiopia	Prody (2005 PPP $)	Export Value ('000 USD)
Nearby		
Acyclic alcohols, and their derivatives	19,293	1,981
Edible offal of headings 0011-5 and 0015, fresh, chilled or frozen	18,935	225
Fish, dried, salted or in brine; smoked fish	17,889	438
Seeds, fruits and spores, nes, for planting	16,139	164
Other citrus fruits, fresh or dried	14,283	114
Edible products and preparations, nes	13,446	114
Ash and residues, nes	12,997	106
Bovine meat, fresh, chilled or frozen	11,985	225
Fish, fresh or chilled, excluding fillet	10,360	281
Building and monumental (dimension) stone, roughly squared, split	9,377	247
Middle		
Glycosides, glands, antisera, vaccines and similar products	27,361	256
Reaction engines	22,479	695
Polyethylene	20,811	169
Surveying, navigational, compasses, etc, instruments, nonelectrical	20,746	434
Parts, nes of machinery and equipment of headings 72341 to 72346	17,721	1,293
Inorganic chemical products, nes	17,635	126
Lighting fixture and fittings, lamps, lanterns, and parts, nes	17,410	131
Tires, pneumatic, new, for motor cars	17,132	704
Metallic oxides of zinc, iron, lead, chromium etc	17,124	145
Cutlery	15,836	119
Far away		
Amide-function compounds; excluding urea	29,375	159
Photographic film, plates and paper (other than cinematograph film)	25,859	112
Organic chemicals, nes	24,709	467
Machinery, accessories for type-setting, for printing blocks, etc	24,641	129
Machinery for specialized industries and parts thereof, nes	23,948	124
X-ray apparatus and equipment; accessories; and parts, nes	23,717	551
Parts, nes of the engines and motors of group 714 and item 71888	23,715	520
Chemical products and preparations, nes	22,738	140
Work trucks, of the type use in factories, dock areas, etc	22,585	224
Television, radio-broadcasting; transmitters, etc	21,744	110

Mozambique	Prody (2005 PPP $)	Export Value ('000 USD)
Nearby		
Sulphur (other than sublimed, precipitated or colloidal)	22,658	302
Wire, cables, cordage, ropes, plaited bans, sling and the like	18,403	156
Chemical wood pulp, soda or sulphate	18,053	592
Parts, nes of machinery and equipment of headings 72341 to 72346	17,721	1,124
Aircraft of an unladen weight exceeding 15000 kg	17,105	151
Fibre building board of wood or other vegetable material	16,765	471
Works of art, collectors' pieces and antiques	16,209	214
Seeds, fruits and spores, nes, for planting	16,139	129
Milk and cream, preserved, concentrated or sweetened	15,592	123
Wood of coniferous species, sawn, planed, tongued, grooved, etc	15,388	1,396
Middle		
Parts, nes of the aircraft of heading 792	21,688	1,704
Centrifuges	21,379	331
Waste paper and paperboard, etc	21,238	507
Aluminium and aluminium alloys, worked	20,778	257
Base metal indoors sanitary ware, and parts thereof, nes	20,740	130
Picture postcards, decalcomanias, etc, printed	20,644	200
Road tractors for semi-trailers	20,215	470
Parts, nes of and accessories for apparatus falling in heading 76	18,887	110
Refractory bricks and other refractory construction materials	18,306	426
Other electrical machinery and equipment, nes	17,468	1,271
Far away		
Sound recording tape, discs	26,415	213
Welding, brazing, cutting, etc machines and appliances, parts, nes	24,468	267
Machinery for specialized industries and parts thereof, nes	23,948	1,098
Medicaments (including veterinary medicaments)	23,588	514
Power hand tools, pneumatic or non-electric, and parts thereof, nes	23,480	328
Other food-processing machinery and parts thereof, nes	23,284	659
Chemical products and preparations, nes	22,738	2,340
Work trucks, of the type use in factories, dock areas, etc	22,585	120
Other non-electric parts and accessories of machinery, nes	22,044	287
Cocks, valves and similar appliances, for pipes boiler shells, etc	21,910	170

Nigeria	Prody (2005 PPP $)	Export Value ('000 USD)
Nearby		
Oxygen-function amino-compounds	26,407	3,013
Sulphur (other than sublimed, precipitated or colloidal)	22,658	278
Equine species, live	22,489	132
Reaction engines	22,479	1,949
Lubricating petroleum oils, and preparations, nes	20,934	107
Polyethylene	20,811	63,198
Aluminium and aluminium alloys, worked	20,778	83,782
Acyclic hydrocarbons	20,244	23,480
Edible offal of headings 0011-5 and 0015, fresh, chilled or frozen	18,935	125
Parts, nes of and accessories for apparatus falling in heading 76	18,887	1,098
Middle		
Anti-knock preparation, anti-corrosive; viscosity improvers; etc	29,311	122
Bacon, ham, other dried, salted or smoked meat of domestic swine	27,875	230
Furskins, raw	27,493	306
Watches, watch movements and case	26,269	1,456
Cellulose acetates	24,493	1,545
Complete digital central processing units; digital processors	23,685	19,968
Medicaments (including veterinary medicaments)	23,588	563
Regenerated fibre suitable for spinning	23,483	148
Other colouring matter; inorganic products use as luminophores	23,470	415
Off-line data processing equipment, nes	23,289	200
Far away		
Orthopaedic appliances, hearing aids, artificial parts of the body	30,041	117
Amide-function compounds; excluding urea	29,375	1,198
Sound recording tape, discs	26,415	266
Printing inks	25,512	919
Glass in the mass, in balls, rods or tubes (nonoptical); waste	25,391	2,278
Provitamins and vitamins	24,553	231
Welding, brazing, cutting, etc machines and appliances, parts, nes	24,468	546
Printing presses	24,445	6,655
Other polymerization and copolymarization products	24,342	1,490
Other printing machinery; machines for uses ancilliary to printing	24,283	141

Senegal	Prody (2005 PPP $)	Export Value ('000 USD)
Nearby		
Halogenated derivatives of hydrocarbons	34,628	178
Petroleum gases and other gaseous hydrocarbons, nes, liquefied	25,225	4,806
Albuminoid substances; glues	21,378	459
Lubricating petroleum oils, and preparations, nes	20,934	230
Aluminium and aluminium alloys, worked	20,778	2,227
Surveying, navigational, compasses, etc, instruments, nonelectrical	20,746	340
Acyclic hydrocarbons	20,244	104
Gas, liquid and electricity supply or production meters; etc	19,611	177
Acyclic alcohols, and their derivatives	19,293	1,037
Animals oils, fats and greases, nes	18,779	171
Middle		
Other nitrogen-function compounds	28,426	1,369
Printing paper and writing paper, in rolls or sheets	27,779	100
Glycosides, glands, antisera, vaccines and similar products	27,361	2,785
Oxygen-function amino-compounds	26,407	226
Photographic film, plates and paper (other than cinematograph film)	25,859	131
Agricultural machinery and appliances, nes, and parts thereof, nes	24,940	490
Organic chemicals, nes	24,709	578
Parts, nes of the engines and motors of group 714 and item 71888	23,715	261
Medicaments (including veterinary medicaments)	23,588	21,017
Oxygen-function acids, and their derivatives	23,543	148
Far away		
Nonmechanical or electrical instruments for physical, etc, analysis	28,779	461
Organo-sulphur compounds	27,575	165
Internal combustion piston engines, marine propulsion	26,738	145
Welding, brazing, cutting, etc machines and appliances, parts, nes	24,468	115
Printing presses	24,445	202
Other polymerization and copolymarization products	24,342	4,433
Machinery for specialized industries and parts thereof, nes	23,948	471
Complete digital central processing units; digital processors	23,685	218
Measuring, controlling and scientific instruments, nes	23,068	114
Paper and paperboard, coated, impregnated, etc, in rolls or sheets	22,936	645