GGDC RESEARCH MEMORANDUM *186*

Is Sub-Saharan Africa Deindustrializing?

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September 2020

university of groningen

groningen growth and development centre

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Abstract

There is a general view that Africa is deindustrializing. We examine the extent to which the existing result is sensitive to sample size and new sectoral indicators. In addition to the usual linear fixed effect model, we use nonlinear panel data method that recognizes the fractional nature of manufacturing share of employment and output. We do not find convincing and robust evidence in support of the general view that Africa is deindustrializing prematurely. Manufacturing employment shares do not follow an inverse U-shape relationship. Conditional on income, population, and country-specific fixed effects, manufacturing output shares show positive and statistically significant trends over time. When we increase the coverage of countries to almost all countries in Africa, the results suggest that Africa is not deindustrializing, although there has not been any significant industrial development since the 1970s. This result masks important regional differences. A sub-regional analysis shows that East Africa is industrializing, whereas Southern Africa is the only region that seems to be deindustrializing. We examine the underlying drivers of manufacturing performance and discuss the implication for data collection and industrial policy in Africa.

Key words: Africa; deindustrialization; industrial development; economic growth

JEL Codes: O14

*I would like to thank my PhD advisor Neil Foster-McGregor and Gaaitzen de Vries for helpful suggestions. I am solely responsible for any remaining errors. .

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1 Introduction

In a recent paper, Rodrik (2016) argued that Sub-Saharan Africa, which could potentially become the next leader in labor-intensive manufacturing, is surprisingly deindustrializing prematurely. This has spurred a series of research suggesting that the role of manufacturing as a driver of long-run development is diminishing in Africa (e.g., Hallward-Driemeier and Nayyar, 2018), while others have suggested modern services as an alternative to a manufacturing-based development strategy in the region (Newfarmer et al., 2018). However, Rodrik's study is only based on a limited sample of (eleven) Sub-Saharan African countries in the Africa Sector Database (ASD) (see de Vries et al., 2015), which are relatively rich African countries that makes it difficult to conclude that Africa is indeed deindustrializing (Diao et al., 2017). Also, the ASD was built before the recent statistical revisions which have significantly improved sectoral indicators in Africa. For example, in the 1980s and 1990s, when statistical capacity declined in Africa, estimates of manufacturing GDP relied mostly on economic censuses, which did not cover many activities in the informal sector, resulting in structural undercounting of informal activities. However, in the recent wave of statistical reforms across Africa in the 2010s, many African countries have updated their sampling frame to cover more economic activities, which were previously not covered, including broader coverage of informal manufacturing activities.

While the patterns documented by Rodrik (2016) may reflect deindustrialization trends in these eleven countries, it is possible that a different pattern of industrialization may emerge when we use a more representative sample and/or dataset that accounts for the recent statistical reforms in this region. Hence, the objective of this paper is to examine the extent to which the existing result will change when we use new sectoral indicators and more representative sample size. The answer to this question is important for at least two reasons. First, to the extent that more nuance or contrary evidence emerges about the patterns of industrialization, then the argument for manufacturing-led industrialization may still be relevant for many sub-Saharan African countries today. Second, the predominantly pessimistic view about the future of African industrialization is based on a hasty inductive generalization, whereby inadequate sample of eleven countries is used to make unreliable inference about African industrialization in general. Given that these arguments are coming from academics and multilateral organizations which influence policy on the continent, many aspects of these arguments deserve further scrutiny.

To address our research objective, we utilize data from the Expanded Africa Sector Database (EASD) (Mensah and Szirmai, 2018) and the UN National Accounts: Analysis of Main Aggregates database (UN AMAD) combined with latest version of the Maddison Project Database (MPD) (Bolt et al., 2018). The EASD updates the existing ASD to take into accounts the recent statistical revisions in Africa, which adjust for the structural undercounting of manufacturing activities in existing database. Another concern in the literature is that countries in the ASD have relatively high per capita GDP, as well as educational, health and nutritional outcomes when compared with Africa as whole. This biases the sample in the ASD towards richer countries (Diao et al., 2017, 2018c). Given these concerns, the EASD expands the ASD by adding sectoral data for seven poorer countries (Burkina Faso, Cameroon, Lesotho, Mozambique, Namibia, Rwanda, and Uganda), updating the time coverage to cover the period 1960-2015. The UN AMAD covers manufacturing value added for 46 sub-Saharan African countries from 1970 to 2016. While the extant literature used the ASD, our use of the EASD and UN AMAD provides the novelty where we examine the sensitivity of existing results to sample size and new sectoral indicators and explore the potential drivers of manufacturing performance in Africa, an area that is lacking in the literature.

The analysis confirms our conjecture that the existing result may be sensitive to sample size and new sectoral indicators. Particularly, when we increase the sample size from 11 as in the original ASD to 18 countries in the EASD, we observe output industrialization over time, suggesting that the recent statistical revisions that include broader coverage of informal activities are important. When we increase the sample size to 46 countries, different patterns and trends emerge. We observe that deindustrialization is not the typical experience of most countries in the region. Instead, we observe a pattern where the manufacturing output share for a typical African country has not significantly changed since 1970. We document, however, important regional differences with East Africa industrializing and Southern Africa deindustrializing. For the manufacturing share of employment, we observe a declining trend.[1] The positive output trend and the negative employment trend point to potential productivity effect, an issue we explore further in section 5. In this paper, however, we emphasize the patterns of manufacturing share of output since the Kaldorian growth processes operate primarily through output rather than employment (Tregenna, 2009, p.433). Based on this extensive evidence, we argue that premature deindustrialization is not a typical experience of most Sub-Saharan African countries. Rather, we observe no significant industrial change, a trend broadly reflecting the increasing marginalization of industrial policy in the 1980s and 1990s. After the import-substitution era, it was argued that Africa's failed industrialization is due to government failure. Particularly, bad complementary macroeconomic management and inappropriate technology adoption. Therefore, structural adjustment programs were instituted to allow the private sector to drive growth with a resulting marginalization of industrial policy. The outcome of this approach to development is disastrous growth with no significant industrial change.

This paper contributes to the growing literature on structural change in Africa that emphasizes the importance of the manufacturing sector in the economic transformation of Africa (e.g., ACET, 2014; McMillan et al., 2014; McMillan and Headey, 2014; Mcmillan and Rodrik, 2011; Rodrik, 2018; de Vries et al., 2015) and the growing importance of informal manufacturing activities in Africa (Diao et al., 2018c,a,b; Diao and McMillan, 2018). This paper also makes a specific contribution to the thin literature, which has begun to question the general view that Africa is deindustrializing. As mentioned above, Diao et al. (2017, 2018c), based on the same dataset Rodrik (2016) used, argue that it is difficult to conclude that Africa is deindustrializing. They show that there is little empirical support for the premature deindustrialization thesis, stating that "the upshot of this analysis is that the majority of the countries in our sample still have potential for industrialization" (Diao et al., 2018c, p.42). In this literature, there is also a strong argument that African economies have generally not deindustrialized, emphasizing the special role of techno-entrepreneurship (Naudé, 2019a) and a possible manufacturing growth in the future through three forms of industrialization – traditional labor-intensive industrialization, manufacturing lookalike industrialization, and resurgent entrepreneurship-led industrialization (Naudé, 2019b). Also, a recent study on the role of manufacturing in

[1] The sample is still limited to only 18 countries in EASD. A larger sample may yield a different result.

structural change in Africa further emphasizes that there is no evidence in support of the widespread view that Africa is deindustrializing prematurely (Nguimkeu and Zuefact, 2019).[2]

Our study differs from the above literature in the following way. In addition to a more balanced panel that covers all countries in Sub-Saharan Africa and the novel dataset that covers broader manufacturing activities in the informal sector, this paper extends the empirical analysis from the mere examination of patterns of deindustrialization to potential causes of (de)industrialization in Africa following the existing theoretical literature on drivers of structural change and the empirical literature on the drivers of deindustrialization in advanced countries. The theoretical literature has emphasized preferences (Kongsamut et al., 2001), intersectoral productivity gaps (relative prices) (Baumol, 1967; Ngai and Pissarides, 2007), globalization and trade (Matsuyama, 2009; Rodrik, 2016) or both preferences and productivity gaps (Herrendorf et al., 2013) as drivers of structural change. The empirical literature has emphasized all three factors - income, intersectoral productivity gaps, and trade – as important drivers of deindustrialization in advanced countries (Saeger, 1997; Nickell et al., 2008; Kollmeyer, 2009; van Neuss, 2018).

Following this tradition, we examine the drivers of manufacturing performance in Sub-Saharan Africa. The analysis shows that preferences, unbalanced productivity growth, and international trade are key drivers of manufacturing performance in Sub-Saharan Africa. In particular, we found that income (squared) and population are significant positive correlates of manufacturing employment, indicating that purchasing power and the size of the domestic market are essential for the industrial development of Africa. Our analysis further shows that technical progress, through the price-taker mechanism, has had a negative effect on relative manufacturing employment, suggesting that African countries may have imported negative technology effects on employment from abroad. In addition, exporting to advanced countries increases manufacturing employment shares, but importing, in general, has adverse effects on employment shares. The negative effect is more substantial for imports coming from other developing countries outside Africa, highlighting the dominance of competition effect over the spillover effect. Surprisingly, intra-Africa trade has played a limited role in the industrialization of the continent, a result arising from the low levels of intra-African manufacturing trade. Therefore, the Africa Continental Free Trade Agreements (AfCFTA) presents a unique opportunity to boost manufacturing trade within Africa hence industrialization.

The rest of the paper is structured as follows: Section 2 discusses methods, data sources, and indicators of deindustrialization; Section 3 situates the patterns of industrialization in Africa in global and historical contexts; Section 4 provides statistical evidence on deindustrialization in Africa; Section 5 discusses the key drivers of manufacturing performance; and Section 6 concludes.

[2] This sample covers value added on 41 countries with several time gaps and covers employment on only 11 countries

2 Research methodology

2.1 Empirical models and a priori expectations

To show whether Africa is deindustrializing or not, we simultaneously consider the income effect, population effect and country-specific idiosyncratic factors that may affect the degree of industrialization in the long run. Over the course of development – i.e., as income and population increases – manufacturing activities are expected to have an inverted U-shape relationship with income per capita. To delineate the development effect from the time trend, this section follows Rodrik (2016) by including income per capita, population, and their quadratic terms in the model. The basic econometric model is stated as:

$$Manshare_{it} = \beta_0 + \beta_1 ln(Y)_{it} + \beta_2 ln(Y)^2_{it} + \beta_3 ln(pop)_{it} + \beta_4 ln(pop)^2_{it} + \gamma PD_t + \alpha_i + \varepsilon_{it} \quad (1)$$

Where $Manshare_{it}$ is the manufacturing share of employment or output of country i at time t, β_0 is the constant, lnY and $ln(Y)^2$ are the natural logarithm of per capita income and its squared value, $ln(pop)$ and $ln(pop)^2$ are the natural logarithm of population and its squared value and α_i are country fixed-effects that take into account any time-invariant country-specific features such as geography, endowments, and history that generate a varying degree of industrialization across different countries relative to the baseline conditions. After controlling for income, population, and country-specific fixed effects, we capture the patterns of industrialization over time using decadal dummies (PD_t) for the different decades since independence (1960s, 1970s, 1980s, 1990s and 2000s). The estimated coefficients of the period dummies show the degree of (de)industrialization of each decade relative to the control decade (1960s).

The main challenge our analysis faces is the biasedness that may arise from the fractional nature of our dependent variable. Since the manufacturing share of employment or output is bounded (fractional response variable), the linear fixed effects model may suffer similar drawbacks as linear probability models (Nguimkeu and Zuefact, 2019). Second, the usual test of an inverted U-shaped relationship between manufacturing activities and per capita income, which includes a quadratic term of income in a standard regression and a hump-shape is confirmed once the coefficient on income is positive and significant, and the coefficient of the quadratic term is negative and significant and, in addition, the estimated turning point is within the data range, is too weak (Lind and Mehlum, 2010). It is particularly problematic because when the true relationship is non-monotone over a small range of data but monotone over most of the data range, imposing a quadratic specification will yield an extremum point (Lind and Mehlum, 2010, p.110). Therefore, to identify a true inverted U-shape relationship between manufacturing activities and per capita income over relevant data values, the test must identify whether the relationship is increasing at low values within this interval and decreasing at high values within the interval. We deal with the empirical problems in the following ways. To ensure comparability with existing results, at the first stage of the analysis, we applied the fixed-effects linear panel estimator (with panel-corrected standard errors for robust inference) together with Lind and Mehlum U-test. At second stage of the analysis, we restrict the years of observation from 1970 to 2015 to obtain a balanced panel and use the robust fractional response method proposed by Papke and Wooldridge (2008) for balanced panels.

The second contribution of the paper is to estimate the underlying drivers of manufacturing outcomes in Africa. To achieve this objective, we estimate a variant of the models of Kollmeyer (2009) and van Neuss (2018). These models follow the tradition of Chenery (1960). In addition to income, these models include key independent variables and other control variables that have the potential to drive industrial development in the current context of globalization. The model is explicitly stated as follows:

$$\begin{aligned} Manshare_{it} = \beta_0 + \beta_1 ln(Y)_{it} + \beta_2 ln(Y)^2_{it} + \beta_3 ln(pop)_{it} + \beta_4 ln(pop)^2_{it} + \\ \alpha_1 UBP_{it} + \alpha_2 IT_{it} + \delta C'_{it} + \gamma_t + \alpha_i + \varepsilon_{it} \end{aligned} \tag{2}$$

Where UBP is is the unbalanced labor productivity growth which captures cross-sector differences in labor productivity, IT is international trade in manufactures, $C^{'}$ stands for other control variables, γ_t represents time fixed effects and ε the idiosyncratic error term. Our model is similar to the models of Kollmeyer (2009) and van Neuss (2018) but not comparable in the sense that in addition to per capita income, we control for population to account for the fact that the size of the domestic market is essential for industrial development.

A large domestic market is indicative of a large potential demand, although this will depend upon the level of income i.e., for a given level of income, a higher population is associated with a larger market. All else equal therefore, we expect a rising population to increase the demand for manufactures, with manufacturing firms responding by producing more manufactures at a lower cost per unit, generating scale economies. As the unit cost of manufactures falls, firms become more competitive domestically and internationally leading to further increases in demand and higher employment demand. Thus, we expect a positive relationship between population and manufacturing output/employment. However, beyond a certain threshold, population growth becomes a drag on manufacturing development (Malthus trap). From a classical Malthusian perspective, if agricultural technology is not well developed (as in many Africa countries), beyond a certain critical level of population when population growth outpaces the growth of agricultural output, agricultural consumption per capita will be lower than the subsistence level, industry will be denied critical raw materials, theoretically leading to a breakdown of the growth process (Zhou, 2009).

The level of income has long been recognized as a key driver of structural change. According to Engel's law and Bell's Law, structural change is driven by changes in the structure of demand resulting from changes in real income. Particularly, Engel's law states that as income increases, the share of income spent on agricultural products decreases. (Bell, 1976) argues that at the early stages of development, the proportion of income spent on manufactures will increase but during the post-industrial phase of development, there will be a secular shift of demand from manufactures to services. Recent literature on structural change shows that the process of the reallocation of economic activity across sectors is partly driven by changes in the structure of demand resulting from changes in real income (Kongsamut et al., 2001; van Neuss, 2018). Theoretically, structural change driven by non-homothetic tastes is modelled using the Stone-Geary utility function, which generates non-linear Engel curves. In this framework, the marginal rate of substitution (budget share) between different goods varies as income increases, inducing some activity reallocation towards the sectors which meet higher-order needs (van Neuss, 2019). The extended version of Engel's law shows that the budget share spent on manufacturing goods increases during initial stages of development then stabilizes, and eventually falls beyond a certain level of per capita income. Therefore, we expect an inverted U-shape relationship between per capita income and the manufacturing output/employment share. Structural change induced by changes in real income is often described as 'preference-driven structural change.'

Another primary cause of deindustrialization is rapid technological progress, which induces differential patterns of productivity growth at the sectoral level. The classical studies show that productivity gains in manufacturing exceed productivity gains in services because manufacturing often involves standardized and repetitive processes, which can easily be automated or mechanized, and this leads to a decline in the manufacturing share of employment. If the productivity gap between the manufacturing and non-manufacturing sectors continuously persists, and the pattern of demand among these sectors is constant, then employment growth should shrink in the manufacturing sector and expand in the non-manufacturing sector (Kollmeyer, 2009). Furthermore, Baumol (1967), through the idea of the 'cost disease' hypothesis, argued that cross-sector differences in technology drive the reallocation of economic activities across sectors. The cost disease hypothesis states that labor moves from sectors characterized by a relatively high rate of technical progress – dynamic sectors – to stagnant sectors, increasing the cost burden of the economy. Manufacturing is considered the progressive sector, whereas the service sector is characterized as the non-progressive sector.

Ngai and Pissarides (2007) provide a more persuasive premise and generalization to Baumol's cost disease hypothesis, showing that the reallocation of labor to a stagnant sector depends on the elasticity of substitution in demand between manufacturing goods and non-manufacturing goods. If the elasticity of substitution is less than one – i.e., if the consumers' relative choice over the consumption of manufacturing goods changes by less than the change in relative price – technological progress in manufactures leads to a decline in the employment share of manufacturing. If the elasticity of substitution is greater than one, the manufacturing share of labor is increasing in technological progress in manufacturing. In this case, while technological progress in manufacturing reduces employment, a technology-induced reduction in the relative price of manufacturing creates a more than proportionate increase in demand for manufactures, so the net effect is a growth in employment. Most empirical evidence supports a negative relationship between technological progress and employment in manufacturing. However, Nordhaus (2005), using sectoral data for the US economy, argued that rapid technological progress leads to employment growth in manufacturing because international competition reduces the market price of manufacturing goods, which in turn stimulates greater demand. In this case, the price effect creates more jobs than the technology effect displaces.

Rodrik (2016) shows that the effect of technological progress in manufacturing is not only mediated through the elasticity of substitution in demand between manufactures and non-manufactures but also the ratio of (domestic) supply to demand in manufacturing. In a case where the ratio is less than one – i.e., where the country is a large net importer of manufacturing goods – technological progress in manufacturing may increase manufacturing employment even if demand for manufactures is inelastic. If the proportion of domestic supply in total consumption (of manufactures) is low, the effect of technological progress in domestic manufacturing on relative prices is also low, compared to a country where the proportion of domestic supply in total consumption is high. As a result, for small open economies like many African countries, technological progress in manufacturing can lead to higher manufacturing output and employment.

Conversely, importing manufacturing goods to meet excess domestic demand can transfer the technology effect on relative prices elsewhere on domestic manufacturing employment, leading to a situation known as 'imported deindustrialization'. Technological progress in China, the EU, and the US – Africa's major trading partners – has made manufactured imports relatively cheaper than domestic goods, rendering the domestic manufacturing sector less competitive. Therefore for technological progress in (domestic) manufacturing to boost employment in African countries, the relative productivity growth in manufacturing must exceed the reduction in the relative price of manufactures on the world market (Rodrik, 2016). Most African countries in our sample are net importers of manufactures, so whether the domestic technology effect or imported deindustrialization effect will dominate is a matter of empirics.

Another driver of manufacturing employment is international trade. In the literature, economic globalization is implicated in the deindustrialization of advanced countries. It was at the core of the debate when deindustrialization coincided with unfavorable labor market developments in the North, with the fear being that trade with the South creates structural unemployment, drives a wedge between wages of skilled and unskilled labor, and contracts the absolute and relative manufacturing share of employment in the North (Saeger, 1997). This called for policy coordination to protect the manufacturing sector from low-wage competitors in the South. The theoretical basis for this debate is rooted in the framework of Frobel et al. (1980) which shows the evolving relationship between economic globalization and the patterns of manufacturing employment in the global North and South. During much of the industrial age, world trade patterns followed the classical international division of labor, in which developing countries specialized in the production of primary products and advanced countries specialized in the production of finished goods, creating a dynamic manufacturing sector in the North. However, these existing world trade patterns changed in the late 1960s creating a phenomenon described by Frobel et al. (1980) as the "new international division of labor". The new international division of labor involves the globalization of manufacturing supply chains, with multinational firms reducing production costs by relocating routine manufacturing jobs to the South, where wages are generally lower. This was made possible by the emergence of new technology such as ICT, which reduced barriers associated with geographic distance (Kollmeyer, 2009). Africa has not featured prominently in these discussions except for the argument of Page (2012) that the geographic shift (net relocation) of production from (out of) Africa was consistently negative between 1990 and 2005, resulting in a fall of manufactured exports. This is beginning to change with the reallocation of Chinese jobs to the garment sector of Ethiopia, for example.

A related theoretical literature has shown that under certain conditions, international trade spurs industrial development through technology spillover (Grossman and Helpman, 1991; Romer, 1990). Trade allows the import of intermediates, which often embody technological knowledge. By accessing intermediate inputs and machinery through trade, developing countries are able to build their manufacturing capabilities initially through reverse engineering and incremental innovation, before moving to the production of more sophisticated goods. The intensity of learning opportunities offered by intermediate inputs often depends on the technological distance from trading partners, with learning and spillover effects being stronger when trading partners share similar production capabilities (Amighini and Sanfilippo, 2014).

The other (control) variables often cited as important drivers of industrialization are the real exchange (RER) rate, human capital, foreign direct investment (FDI), and fixed domestic capital. The index of (RER) undervaluation is the ratio of the price of tradable goods to non-tradable goods. Undervaluation increases the price of the tradable sector (manufacturing sector) relative to the non-tradable sector. This enhances the relative profitability of the tradable sector and causes it to expand (Rodrik, 2008). The stock of human capital affects a country's specialization patterns. For African countries, improvements in the quality of human capital could change their specialization patterns from the production of primary commodities towards knowledge-intensive manufactured goods. FDI is an important source of employment creation either directly or indirectly through technology transfer particularly if it is channeled to the tradable sector. FDI increases manufacturing employment directly by creating jobs that did not exist in the manufacturing sector of the host country especially if it involves greenfield investment. The direct job creation is often higher if the greenfield investment goes to labor intensive sectors such as manufacturing (Jenkins, 2006; Jude and Silaghi, 2016). FDI can also affect the manufacturing labor demand of host countries indirectly through both competition effects and the spillover effects. On the one hand, if FDI entry creates competitive pressure that crowds-out domestic firms, the labor intensity of the receiving industries might be negatively affected (Mencinger, 2003). On the other hand, if foreign subsidiaries of multinational firms source locally, demand addressed to upstream sectors could increase, thus stimulating employment (Javorcik, 2004). Similarly, the efficient allocation of domestic investment should increase the relative size of the manufacturing sector, provided it is targeted at the tradable sector.

2.2 Data sources

The sectoral data for the measurement of manufacturing manufacturing share of employment or output come from three main sources: the Africa Sector Database which is integrated into the GGDC 10-sector database (Timmer et al., 2015) , the Expanded Africa Sector Database (Mensah et al., 2018) and the UN National Accounts: Analysis of Main Aggregates database. Based on these datasets, we measure deindustrialization using three indicators: the manufacturing share of total employment, the manufacturing share of real value added, and the manufacturing share of nominal value added. In the context of the existing debate, we show trends in all three shares, although our focus is on employment and real value added since nominal value added conflates movements in quantities and prices, making both movements inseparable.

Income and population data are sourced from the Maddison Project Database (Bolt et al., 2018), which provides information on income per capita (in 2011 USD) and population for all countries in the sample. We measure the technology-induced effect on manufacturing employment using the indicator of unbalanced productivity growth, which measures cross-sector differences in labor productivity growth. Unbalanced productivity growth (UBP) is the ratio of labor productivity in manufacturing to labor productivity in services. Following the existing literature on deindustrialization, we use UBP to capture the idea of Baumol's cost disease hypothesis. UBP is computed using data on real value added (converted to 2011 PPP) and employment from EASD.

The third explanatory variable aims at capturing the effect of international trade on manufacturing employment. We follow the approach of Kollmeyer (2009) and van Neuss (2018) to disaggregate trade flows into exports (and imports) to (and from) Africa, the North, and the South. The North is defined as Europe and North America whereas the South is defined as Middle East and North Africa, Asia, Central and South America, and Oceania, with some adjustments. We adjust the North and South classification by moving Australia, New Zealand, Israel, Japan, and South Korea to the North, and by moving Mexico and Turkey to the South. The classification is essential because the potential benefits that countries get from imported inputs depend on the technological distance with trade partners. For the export side, the distinction is important because there are a number of studies that have found a strong relationship between the country-of-destination characteristics and export performance (e.g., Baldwin and Harrigan, 2011). There are number of reasons why manufacturing firms exporting to the US and EU may generate a differential employment impact than countries exporting to African countries only, for example. According to the income preference hypothesis, higher income countries prefer more knowledge-intensive goods, therefore countries exporting to advanced countries may learn more than countries exporting to neighboring African countries. Even when the technology intensity of goods being exported to advanced countries, developing countries, and other African countries are the same however, product certification and market standards differ. As a result, firms exporting to advanced economies adopt the best production techniques and management practices to improve existing production and delivery processes. The resulting efficiency may lead to a differential employment effect. Furthermore, there is strong evidence that manufacturing goods from the North and the South embody different factor intensities. Consistent with the work of Kollmeyer (2009) and van Neuss (2018), trade in manufactures is defined as imports and exports in standard international trade classification (SITC) 5 to 8. Trade data are obtained from the World Trade Flows database (Feenstra et al., 2005)) for the period 1962-2000 and the BACI database for the period 2001-2015. We reclassify the BACI dataset from HS6 to SITC4 using a trade concordance table. We then expressed the value of imports and exports as a percentage of total manufacturing value added instead of total value added or GDP to avoid the potential distortion that the increasing share of services in Africa may introduce to the variables.

Our measure of undervaluation follows the index of Rodrik (2008), which measures the domestic price level adjusted for the Balassa-Samuelson effect. We use data on exchange rates (XR) and PPP from the Penn World Tables version 9.1 to compute the real exchange rate (RXR).[3] We adjust for the Balassa-Samuelson effect by controlling for GDP per capita (Y_{it}) and time fixed effects (γ_t).[4] The estimated coefficient of GDP per capita is -0.20, indicating that as income increases by 10 percent the real exchange rate falls by 2.0 percent in Africa. The results show a strong Balassa-Samuelson effect. Finally, the index of undervaluation is computed as the difference between the actual real exchange rate and the Balassa-Samuelson-adjusted rate.[5]

[3] $ln(RXR)_{it}$=$ln(XR_{it}/PPP_{it})$

[4] $ln(RXR)_{it}$=α+$ln(Y)_{it}$+γ_t+ε_{it}

[5] $lnUnd_{va}$= $ln(RXR)_{it}$ - $ln(\widehat{RXR})_{it}$

Data on net FDI inflows is taken from UNCTAD and expressed in its natural logarithm. Data on the stock of human capital is taken from the Penn World Tables version 9.1. Finally, fixed capital as a percentage of GDP is taken from World Development Indicators.

3 Africa's structural change in global and historical contexts

To motivate our analysis of Africa, we show the evolution of the structure of employment with respect to per capita income in the world and provide some historical interpretations. A long-standing observation is that the structure of production changes in the process of development (Lewis, 1954; Rostow, 1960). Kuznets (1973)in his Nobel Prize speech, referred to structural change as one of the main features of modern economic growth. At the early stages of development, countries are characterized by the preponderance of agricultural production, where most people live in the countryside and are mostly preoccupied with subsistence farming. The agricultural share of the labor force and national income is very high during this stage of development. At later stages of development, the industry share of the labor force and national income rises to a point and then declines, while the services share of labor and income increases monotonically. Figure 1, panels A-D, depicts this path of economic development in the last six decades. In Figure 1, Panel A, the agriculture share of total employment is as high as 90 percent at lower levels of income. However, as income increases, the proportion of the labor force in agriculture declines exponentially throughout the entire path of economic development.

Generally, the fraction of the labor force in agriculture continues to fall around the world, although the size of the share significantly differs even among developing regions. For example, while the agriculture share of employment is declining in Africa (blue diamonds), it is still high when compared with other regions. Three views explain the declining trend of the agricultural employment share: the labor push hypothesis, the labor pull hypothesis, and the subsistence constraint hypothesis. The labor push hypothesis states that the combination of improvements in farm technology and less-than-unity income elasticity of demand for food releases the agrarian workforce to other sectors as income increases (Caselli and Coleman II, 2001; Matsuyama, 1992). The labor pull hypothesis states that it is faster productivity growth in the modern sector due to advances in industrial technology that induces more workers in the agricultural sector to relocate to the modern industrial sector (Lewis, 1954; Harris and Todaro, 1970). Complementing the labor push hypothesis is the subsistence constraint hypothesis, which states that if a country consumes neither more nor less of the subsistence level of agricultural products,[6] then the fraction of labor in agriculture is directly proportional to the subsistence level of consumption and inversely proportional to the level of productivity in agriculture (Üngör, 2013). This implies that when agricultural productivity is low, more workers are required to produce the minimum subsistence consumption and vice versa.

Alvarez-Cuadrado and Poschke (2011) explore the historical experiences of 12 countries using data from the 19th century onwards and show that technological progress in man-

[6] The minimum subsistence good is a satiation point

ufacturing – the pull effect – was the main driver of the de-agriculturalization of today's industrialized countries until 1920. However, productivity improvements in agriculture – the push effect – is the primary driver of structural change after the 1960s. The implication is that advances in industrial technology are essential for successful structural transformation at the early stages of development. In contrast to the experience of earlier industrializers, recent evidence further suggests that the de-agriculturalization of Africa – depicted in Figure 2, panel A – is linked to improvements in agricultural productivity (Diao et al., 2018c) . Evidence on the subsistence constraint hypothesis indicates that this simple characterization alone explains as much as 90 percent of the decline in agricultural employment shares in some countries since the 1960s (see Üngör, 2013). The intuition and the empirical results of the subsistence constraint hypothesis further support the earlier indication that agricultural productivity has played a fundamental role in the structural transformation of the world in the last six decades.

While improvements in agricultural technology free more workers globally, the sectors in which the workers are moving into explains regional differences in catching up with the productivity level of the frontier. For example, the aggregate productivity level of East Asia was 15 percent of the US level in 1963. East Asian productivity reached 70 percent of the US level by 2010. The productivity of Latin American was 35 percent of the US level in 1963 but shrank to 25 percent by 2010. One stylized fact associated with the divergence between these two regions is that whereas a significant proportion of workers initially relocated to manufacturing industries, and later, to dynamic services in East Asia, the fraction of the workforce in manufacturing has been declining while the fraction of the workforce in domestic trade and personal services has been rising in Latin America since the 1960s. The sectoral heterogeneity, particularly the differential rate of labor productivity growth in the sectors receiving most workers, explains the divergence of the two regions (Üngör, 2017). The experience of Africa is no different from Latin America. The structural change of Africa has mostly been marked by informal tertiarization where workers are relocating from the traditional agricultural sector to informal trading activities with aggregate productivity of most countries below 15 percent of US productivity (see Mensah et al,2020).

Figure 1, panels B and C, further show that the manufacturing and the industry share of employment has followed a hump-shaped trajectory throughout development. Despite the commonly observed patterns of structural change especially with respect to de-agriculturalization and tertiarization, it is clear from Figure 1, panels B C, that countries and regions achieved different levels of industrial development at the same level of per capita income. While the predicted values of the agriculture and services shares of employment at each level of per capita income tend to fit the observed data quite well, the predicted values of the manufacturing share of employment at each level of per capita income do not fit the data so well. The highest manufacturing employment shares that countries reached before beginning to deindustrialize has fallen over time.

At the national level, unbalanced productivity growth – labor productivity in manufacturing grows much faster than in non-manufacturing – has led to the fear that technology is taking away global manufacturing jobs. Evidence suggests that while manufacturing jobs are declining at the country level for former industrialized and some newly industrializing countries, the world as a whole has not deindustrialized (Felipe and Mehta, 2016). The near-constancy of the global manufacturing share of employment and output since the 1970s is explained by the globalization of manufacturing supply chains. Thus, while technology is driving value added per worker to grow much faster than aggregate productivity within countries, global labor productivity in manufacturing is not growing faster than global aggregate labor productivity because rapid productivity growth within countries is offset by the negative geographic shift, namely the continual shift of manufacturing jobs from higher productivity countries and regions to lower productivity countries and regions (Felipe and Mehta, 2016).

Deindustrialization has been a key feature of advanced economies since the 1960s because of rapid technological progress, which induces differential patterns of productivity growth at the industry level. National experiences are marked by varying degrees of intensity of deindustrialization. For example, while the manufacturing share of employment in the US has steadily declined from about 25 percent in the 1950s to less than 10 percent in 2010, the manufacturing share of valued-added has remained roughly the same. In the United Kingdom, conversely, the manufacturing employment share decreased from about 30 percent in the 1970s to about 10 percent in 2010, with the manufacturing share in total value added also falling from about 25 percent to 15 percent (Timmer et al., 2015). On theoretical grounds, the structural shift of factors of production from manufacturing industries to services in developed countries is expected. At a high level of development (post-industrial phase), it is expected that the rate of technological progress and accompanying income level will induce a secular shift from the production of physical goods to the provision of services. What is unexpected and unwelcome is the 'supposed' deindustrialization of Africa.

4 Empirical analysis of deindustrialization in Africa

This section provides statistical evidence on deindustrialization after delineating the development effect using equation 1. Our baseline results are based on the EASD. For robustness and broader coverage, we supplement this data with the GGDC Africa sector database and the UN National Accounts database. Table 1 reports estimated results based on the baseline data. The table further shows the results without Mauritius in the sample. Our focus is on real measures – the manufacturing share of employment and real value added – although in the context of the existing debate, we also report results for nominal value added. After controlling for income, demographic trends, and country fixed-effects, the estimated coefficients of the period dummies for manufacturing share of employment are negative and significant for all decades relative to the 1960s. The Lind Mehlum test suggests that the true relationship between the manufacturing share of employment and per capita income is an increasing monotone. The relationship is increasing at lower and higher values of income per capita within the relevant data range.

For the nominal and real value added shares, the results show that the coefficients of the period dummies are postive and significant over time. When Mauritius is excluded from the sample, the coefficients of the period dummies show, again, a negative and significant effect in the case of the manufacturing share of employment, suggesting employment deindustrialization. Continuous deindustrialization would imply that the negative coefficient gets bigger (in absolute value) over time, however, the negative coefficient of the period dummy of the 2000s is smaller (in absolute value) than the 1990s, suggesting that there has not been much deindustrialization after the 1990s. Specifically, conditional on income, population, and country-specific idiosyncratic factors, the manufacturing share of employment is 1.3 percent lower in the 1980s, 1.7 percent lower 1990s, and 1.6 percent lower in the 2000s compared with the 1960s, suggesting a potential reverse of the trend. However, the manufacturing share of real value added is 2.3 percent higher in the 1970s, 5.2 percent higher in the 1980s, and 6.8 percent higher in the 1990s and 7.8 percent higher compared to the 1960s. This result for the manufacturing share of value added contrasts starkly with Rodrik's result, highlighting the importance of taking into account the recent statistical revisions that cover broader manufacturing activities including those in the informal sector.

We estimated model 1 using the same dataset Rodrik (2016) used (not reported but available upon request). For the full sample, there is no evidence of deindustrialization in Africa. However, once we exclude Mauritius, we find similar trends deindustrialization reported by Rodrik (2016). The Lind and Mehlum test, however, rejects the presence of an inverse U-shaped relationship between the manufacturing share of employment or output and per capita income. Thus the relationship between manufacturing activities and per capita income is monotonic with confidence intervals suggesting a wide range of possible extremum points.

As mentioned above, the manufacturing share of employment or output is bounded in [0,1]. Simply using the linear fixed effect model could lead to a situation where the prediction could fall outside the unit interval. To avoid potential mispecification, we use the fractional logit model proposed by Papke and Wooldridge (2008) for balanced panels. The result is reported in Table 2. The results are qualitatively and quantitatively consistent the those estimated with the linear model. The results in Table 1 and Table 2 indicate that the evidence of deindustrialization in Africa is not as robust as Rodrik (2016) presented. Albeit, the result is still limited to a small fraction of countries in Africa – 18 countries – with no coverage of Central Africa.

To cover all countries in SSA, we used the UN AMAD. The UN AMAD starts from the 1970s; hence the period 1970-79 is used as the benchmark period. The results based on the UN AMAD are reported in Table 3. The estimated coefficients of the period dummies are not statistically significant for the nominal manufacturing share of value added. For the real manufacturing share of value added, the estimated coefficient is 1.2 percent higher in the 1980s than the 1970s, 2.0 percent higher in the 1990s than the 1970s, but there is no statistically significant difference between the estimated shares in the MDGs era and the 1970s. For the industry share of output, estimated coefficients of the period dummies are not statistically significant. The results suggest that Africa is not deindustrializing. However, there has not been any significant industrial development since the 1970s.

Rodrik (2016) argues that when Mauritius, a high exporter of manufacturing goods, is excluded from the sample, all three measures of industrialization show a declining trend in Africa. We, therefore, follow the approach of Nguimkeu Zuefact (2019) to classify countries as intensive exporters of manufacturing in Africa if manufactured exports in the total volume of exports exceed 50 percent. The following countries were identified as intensive manufacturing exporters in Africa: Botswana, Lesotho, Eswatini, Cape Verde, and Mauritius. In our analysis, we excluded the intensive manufacturing exporters from the sample to test the conjecture that Africa is deindustrializing when intensive exporters of manufacturing are excluded from the sample. In contrast to Rodrik's results, our analysis for the restricted sample rejects the conjecture that Africa is deindustrializing when exporters of manufacturing are excluded from the sample. In particular, the real manufacturing share of output is 1.3 percent higher in the 1980s than the 1970s, 2.1 percent higher in the 1990s than the 1970s, and 0.9 percent higher in the 2000s than 1970s. The Lind and Mehlum test further shows that the true relationship between real manufacturing in value added and per capita income is not concave but monotonic, increasing in income.

The results on the manufacturing share of output in Tables 1, 2, and 3 present evidence on the varying degree of industrialization in Africa. The different geographical coverage of the tables and the different corresponding estimated coefficients of the period dummies are suggestive of the significance of geographic differences in manufacturing performance. Estimating the model using data for all countries may conceal essential differences in the pattern of industrialization across sub-regions. We explore this further by dividing the sample and estimating the model according to the African Union (AU)sub-regional boundaries. The results for the sub-regional analysis are presented in Table 4. The results highlight noticeable regional differences. For both the nominal and real manufacturing share of value added, while East Africa is industrializing, Southern Africa is deindustrializing. The estimated coefficients of the period dummies for East Africa are positive and significantly different from the control period. The results show that the real manufacturing share of value added is 1.5 percent higher in the 1980s than the 1970s, 3.6 percent higher in the 1990s than the 1970s, and 3.1 percent higher in 2000s than in the 1970s.

Conversely, the estimated coefficients on the period dummies for Southern Africa are negative and statistically significant. The manufacturing share in Southern Africa is 1.7 percent lower in the 1980s than the 1970s, 1.9 percent lower in the 1990s than the 1970s, and 2.1 lower in the 2000s than the 1970s. The appropriate U-curve test further confirms that the true relationship between the manufacturing share of output and per capita income is monotone in East Africa, but concave in South Africa with a turning point of 8394 (2011 US dollars). For West Africa, the real manufacturing share of value added is 2.5 percent lower in the 2000s than in the 1970s. But for the other periods, there was no statistically significant difference between the shares and the control period. The Lind Mehlum test suggests the presence of a strong inverted U-shaped relationship between manufacturing activities and per capita income. For Central Africa, we do not find evidence for changes in manufacturing shares over time.

We do not find convincing and robust evidence in support of the general view that Africa is deindustrializing prematurely (by relative size). Manufacturing employment shares do not follow an inverse U-shape relationship. Conditional on income, population, and country-specific fixed effects, manufacturing output shares show positive and statistically significant trends over time. When we increase the coverage of countries to almost all countries in Africa, the results suggest that Africa is not deindustrializing, although there has not been any significant industrial development since the 1970s. This result masks important regional differences. A sub-regional analysis shows that East Africa is industrializing, whereas Southern Africa is the only region that seems to be deindustrializing.

5 The deep drivers of manufacturing performance in Africa

Our baseline data (EASD) show that conditional on income, population, and country-specific idiosyncratic factors, the manufacturing share of employment is declining while the manufacturing share of output is increasing. These opposing trends point to a potential productivity effect. To understand this trend and other underlying drivers of manufacturing outcomes in Africa, we estimate model 2, examining the marginal effect of the key as well as other independent variables on the manufacturing share of employment in Africa. Table 5 presents the regression results. Column 1 shows the estimated coefficients of the key independent variables, Column 2 shows the estimated coefficients of all independent variables except trade, and Column 3 shows the result for all regressors. The results are qualitatively and quantitatively consistent across the three models. Our preferred model is model 3. As expected, the coefficients on internal factors except for income – i.e., population, and relative labor productivity growth – are statistically significant and exhibit the expected signs. The results show a U-shaped relationship between manufacturing share of employment and per capita income, suggesting that in Africa, conditional all other variables in the model, as income increases, it induces the reallocation of labor from the manufacturing sector of Africa. However, beyond a certain level of income, the growing affluence of consumers induces reallocation of labor into manufacturing. This is inconsistent with Bell's Law and the extended Engel's law where changes in the marginal rate of substitution (budget share) between the manufacturing and non-manufacturing sector initially induces the reallocation of activity in favor of the manufacturing sector. However, our results are consistent with existing studies on Africa which control for some of the key variables used in our model. For example, our results corroborate the results of Mijiyawa (2017), who finds a U-shape relationship between the manufacturing share of GDP and per capita income in Africa. The U-shape relationship between manufacturing activities and per capita income characterizes less competitive countries in a highly competitive and globalized world (ibid).

Population shows an inverted U-shape relationship with the manufacturing share of employment. There is no doubt that population, a proxy for the size of domestic market, is important for the industrialization of Africa. However, in African countries that are populated by poor consumers, beyond a certain level of population, the negative 'size' effect seems to dominate the positive scale economies.

The results further show that there is a negative relationship between technological progress in manufacturing relative to services and manufacturing employment in Africa. Thus, relatively faster productivity growth in the manufacturing sector shrinks manufacturing employment in Africa, confirming the Baumol's cost disease hypothesis. Two reinforcing reasons may explain this result. First, manufacturing goods are traded through global value chains (GVCs) which also acts as a channel for the diffusion of skilled-biased technologies in developing countries (Rodrik, 2018). However, the diffusion of these technologies adversely affects manufacturing employment in developing countries by replacing less skilled workers. As explained above, manufacturing goods exported to international markets embodies higher knowledge intensity and standards, which requires less manual work leading to the use of labor-saving technologies such as automation or mechanization.

In the context of Africa, our result is consistent with the recent study of Pahl et al. (2019), who show that technological change through the GVC participation has a negative effect on manufacturing jobs in emerging African countries.

Second, as price takers on the world market, African countries may have imported the negative effect of technological progress from abroad. After the SAPs, most African countries liberalized their trade regimes resulting in a significant surge in trade inflows. At the same time, technological progress reduced the relative prices of manufacturing goods on the world market. Examination of the underlying data shows that there was a marginal increase in the relative labor productivity of manufacturing, but this was not sufficient to counteract the magnitude of the reduction in the relative price of manufacturing from elsewhere.[7] The net effect is a shrinkage in manufacturing employment.

The variables intended to capture the contribution of international trade on relative manufacturing employment in Africa – manufactured exports and imports – exhibit the expected sign in model 1 and model 3. The only difference is that once we control for the other variables in model 3 the magnitude of the estimated coefficients reduces. Manufactured exports from other African countries, the global South and global North as a percentage of manufacturing output correlate positively with the manufacturing employment share. The role of manufactured exports to Africa is not statistically significant once we control for other factors (model 3), however, indicating the limited role that intra-African trade has played in building the productive capacity of the continent. The share of intra-African exports as a percentage of total African exports was 17 percent in 2017 compared to 59 percent in Asia, 69 percent in Europe, and 31 percent in North America (Songwe, 2019). It is projected that the successful implementation of the African Continental Free Trade Area (AfCFTA) will double the size of the manufacturing sector and create 14 million jobs in Africa by 2025 (Signé, 2018). The AfCFTA is promising for industrialization since recent evidence suggests that manufactured goods, which are more knowledge-intensive compared to primary products, make up 42 percent of intra-African exports compared to 15 percent of extra-regional exports (Songwe, 2019). This means AfCFTA will not only boost the size of industry but may also facilitate knowledge transfer and catch-up within Africa.

Manufactured imports from the North and the South correlate negatively with relative manufacturing employment, with the coefficient of imports from the South being bigger than the coefficient on imports from the North in absolute value. This suggests that the competition effect is stronger than the spillover effect. After the SAPs, most African countries opened their borders to trade. After hiding behind protective walls for decades, the domestic industry was not able to compete on cost with the South and on quality with the North after trade liberalization. As a result, they imported employment deindustrialization. The statistically significant coefficient of imports is, however, lower than exports, indicating that economic globalization increases relative manufacturing employment in Africa than it decreases.

The coefficient of the index of undervaluation is positive and statistically significant. This means that competitive exchange rates will make the tradable sector more profitable, in-

[7] Using data from EASD to calculate the change in relative manufacturing labor productivity of Africa and the GDDC 10-sector database to calculate the change in the relative price of manufacturing in China and the North (the major trading partners of African countries).

creasing the relative size of manufacturing by acting as a subsidy to remove distortions created by weak contracting institutions and market failures. Our result is consistent with the empirical findings of McMillan et al. (2014) where overvaluation of currencies through disinflationary monetary policy and foreign aid inflows inhibits structural change. It is also consistent with the theoretical predictions of Diao and McMillan (2018), where assumptions about a country's dependence on foreign aid inflows for infrastructure development could cause real exchange rate appreciation making the open modern sector less competitive. The stock of human capital is positively correlated with the share of manufacturing employment, confirming recent argument that improvement in human capital increases comparative advantage in manufacturing and modern services relative to agriculture (Porzio et al., 2020). Improving the quality of education and training in Africa is essential for producing knowledge-intensive goods. Domestic investment has a significant effect on relative manufacturing employment. FDI is also an important conduit for industrialization through knowledge transfer. In our model, FDI has a statistically strong effect on manufacturing employment. However, manufacturing FDI tends to flow into low-income countries where the human capital stock and wages tend to be low, creating a negative interaction effect. In our model, we measure this indirect effect by interacting FDI with the stock of human capital. The results show that FDI indirectly displaces manufacturing jobs in Africa. This is consistent with the observation that manufacturing FDI tends to flow into low-income countries with low-skilled labor and wages.

6 Conclusion and policy recommendations

Deindustrialization is a key feature of structural change around the world. While there is no debate about evidence on deindustrialization in Latin America and developed countries, the evidence on the pattern of deindustrialization in Africa is inconclusive. The representativeness and the coverage of the samples used in previous analyses often form the crux of the debate. This paper provides extensive evidence on deindustrialization in Africa, using carefully constructed data and other reliable sources. We find that the evidence on deindustrialization is sensitive to sample size. If we replicate the results of Rodrik (2016) with data for the 11 African countries in the 10-sector database of GGDC, we find similar patterns. However, if we increase the sample size from 11 to 18 and 45, different patterns and trends emerge. For the sample of 18 countries in the EASD, conditional on income, population and country fixed effects, we observe employment deindustrialization and output industrialization in Africa. When we increase the sample to cover all countries in (Sub-Saharan) Africa, we do not find evidence of (output) deindustrialization neither do we find evidence of industrialization, however. Therefore, the appropriate characterization of the evidence for a typical African country is industrial stagnation, not premature deindustrialization. We, however, document significant sub-regional heterogeneity with East Africa industrializing and Southern Africa deindustrializing. Based on the results of the drivers of the deindustrialization, we argue that the deindustrialization of Southern Africa is preference-induced whereas the significant industrialization of Eastern Africa is trade-induced. Higher levels of income in Southern Africa and higher levels of manufacturing exports observed in Eastern Africa explain the sub-regional heterogeneity.

In addition to investigating the patterns of deindustrialization, we examine the underlying drivers of the declining manufacturing employment trend (in Table 5). We found that income (squared) and population are significant positive correlates of manufacturing employment, indicating that purchasing power and the size of the domestic market are essential for the industrial development of Africa. Our analysis further shows that technical progress, through the price-taker mechanism, has had a negative effect on relative manufacturing employment, suggesting that African countries may have imported negative technology effects on employment from abroad. While international trade, in general, creates more manufacturing jobs than it displaces in Africa, intra-regional trade has played a limited role in the industrial development of the continent.

Our results underscore a number of important policy options for African economies to overcome the pervasive industrial stagnation. First, the results show that FDI and domestic investment are essential for the industrial development of the continent. Strategies to attract manufacturing FDI should be a key policy priority for many African countries, taking into consideration the different contexts. For example, relatively high-income countries like Botswana, Mauritius, and South Africa, where wages are high and the industrial structure is capital-intensive, are less attractive for greenfield manufacturing investments looking for low-wage countries. For such countries, relying on FDI for industrial development is a less viable strategy, therefore targeted domestic investment would be more important. Most African countries are low-cost countries with young populations, therefore attracting greenfield investment into the manufacturing sector is critical. However, some of the low-cost countries are endowed with natural resources and are vulnerable to Dutch disease. Other countries artificially overvalue their currencies through disinflationary monetary policy, making them less competitive in international markets. For these countries, in addition to attracting manufacturing FDI, implementing competitiveness polices such as undervaluation of domestic currencies could boost industrialization.

Second, imports from both the North and South have negative effect on relative manufacturing employment suggesting that the competition effect is stronger than the spillover effect in the context of Africa. African countries can offset the negative effect through competition policies such as subsidies and local content laws that have minimum requirements for the procurement of locals and services, local employment opportunities, technology, and skill transfer, etc. Finally, as the results of the drivers show, promoting manufacturing exports is important for the industrial development of the continent. In that sense, reducing trade frictions within Africa and expanding intra-regional trade through the AfCFTA is timely for the structural transformation of the region.

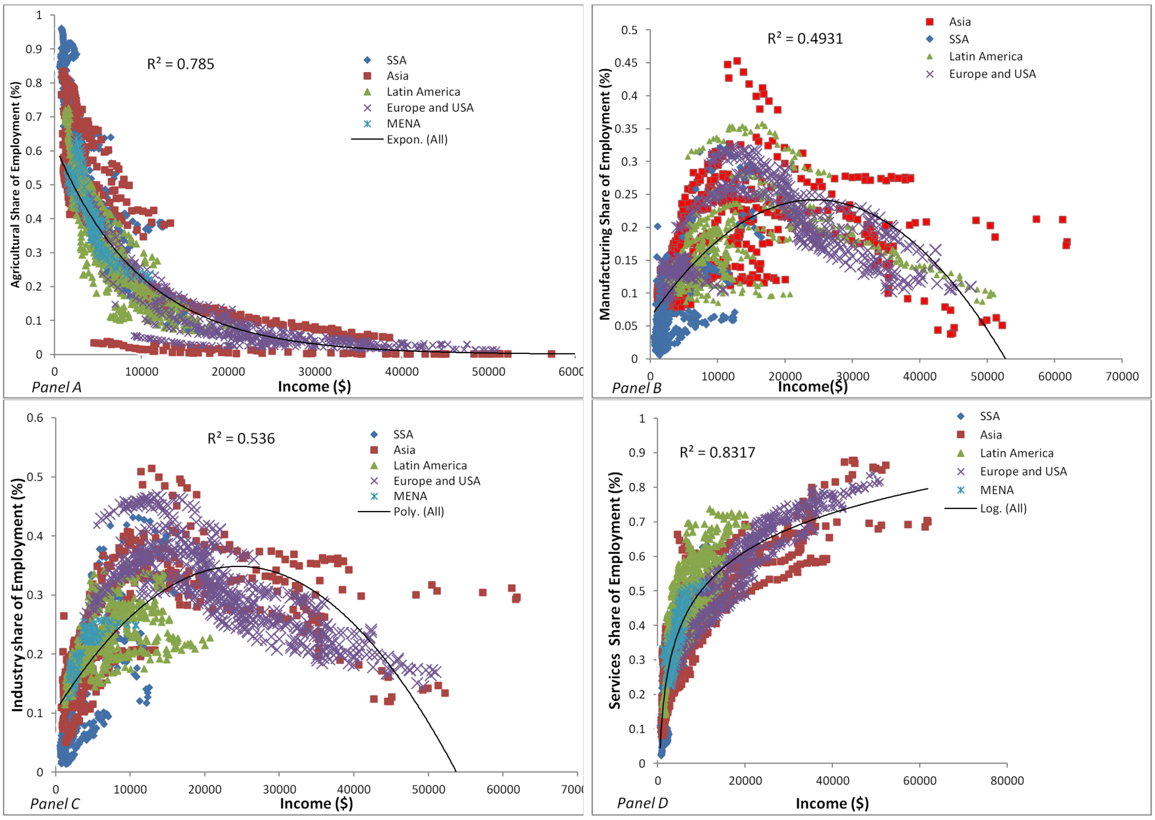

Figure 1: Evolution of sectoral employment shares in the world
Sectoral shares of employment and the level per capita income on a sample of 49 countries in the World. Based on data from the GGDC 10-sector database, the Expanded Africa Sector Database and the Maddison project database.

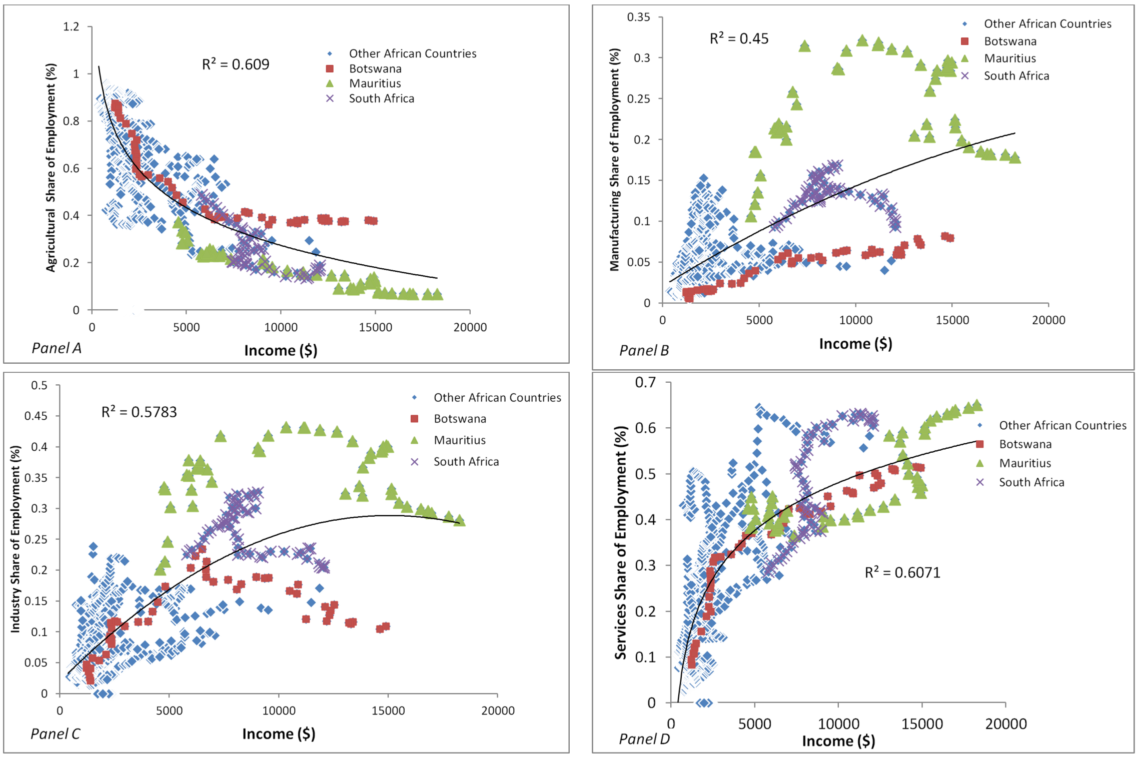

Figure 2: Evolution of sectoral employment shares in Africa
Sectoral shares of employment and the level per capita income on a sample of 18 countries in Africa. Based on data from the Expanded Africa Sector Database and the Maddison project database.

Table 1: Evidence on Deindustrialization in Sub-Saharan Africa (EASD)

	Sub-Saharan Africa			Sub-Saharan Africa excl. MUS		
Panel A: Reg. Estimates	EMP Manshare	Nom VA Manshare	Real VA Manshare	EMP Manshare	Nom VA Manshare	Real VA Manshare
Per capita Income (ln)	0.015	0.196***	0.208***	0.033**	0.249***	0.214***
	(0.031)	(0.036)	(0.034)	(0.014)	(0.046)	(0.039)
Per capita Income-sq.(ln)	0.000	-0.012***	-0.012***	-0.001	-0.015***	-0.012***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)
Population (ln)	0.017*	0.104***	-0.055***	0.045***	0.128***	-0.045***
	(0.010)	(0.023)	(0.016)	(0.007)	(0.023)	(0.016)
Population-sq.(ln)	0.000	-0.009***	0.001	-0.001**	-0.010***	0.000
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
1970s	-0.005**	0.034***	0.022***	-0.003	0.032***	0.023***
	(0.002)	(0.005)	(0.004)	(0.002)	(0.004)	(0.004)
1980s	-0.009**	0.067***	0.052***	-0.013***	0.061***	0.052***
	(0.003)	(0.007)	(0.005)	(0.003)	(0.006)	(0.005)
1990s	-0.009*	0.083***	0.070***	-0.017***	0.073***	0.068***
	(0.005)	(0.009)	(0.007)	(0.003)	(0.009)	(0.007)
2000s	-0.013**	0.082***	0.075***	-0.016***	0.073***	0.076***
	(0.006)	(0.011)	(0.009)	(0.004)	(0.011)	(0.009)
Intercept	-0.245	-1.095***	-0.537***	-0.416***	-1.394***	-0.594***
	(0.152)	(0.180)	(0.163)	(0.065)	(0.222)	(0.182)
Panel B: Lind and Mehlum U Test						
Slope at LB of Income (ln)	0.019***	0.059***	0.069***	0.018***	0.067***	0.069***
	(0.007)	(0.010)	(0.009)	(0.004)	(0.012)	(0.010)
Slope at UB of Income (ln)	0.021***	-0.031***	-0.021***	0.008*	-0.052***	-0.026***
	(0.010)	(0.009)	(0.008)	(0.004)	(0.012)	(0.009)
U test statistic		3.630	2.736		4.293	2.727
		[0.000]	[0.003]		[0.000]	[0.003]
Extremum point	-24.288	8.454	8.894	12.721	8.106	8.732
In 2011 US$		4694.44	7295.15		3315.79	6195.68
95%CI, Fieller Method	$(-\infty$,10.15)	(8.19,8.87)	(8.62,9.42)	(-5.36,∞)	(7.90,8.41)	(8.43,9.33)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of Countries	18	18	18	17	17	17
Observations	918	970	930	872	914	884
R-Squared	0.878	0.731	0.812	0.835	0.714	0.786

Notes: Panel-corrected standard errors are in parentheses and p-values in square brackets. Estimations are based on the Expanded Africa Sector Database (Mensah and Szirmai, 2018). LB, and UB denote lower boundary, and upper boundary respectively. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Fieller Method follows an inverse test to construct confidence intervals for the ratio of normally distributed statistics. For the U-test this method is preferred.

Table 2: Robustness (EASD)

	Sub-Saharan Africa			Sub-Saharan Africa excl. MUS		
	EMP Manshare	Nom VA Manshare	Real VA Manshare	EMP Manshare	Nom VA Manshare	Real VA Manshare
Per capita Income (ln)	0.118***	0.251***	0.264***	0.112***	0.276***	0.275***
	(0.028)	(0.041)	(0.034)	(0.025)	(0.045)	(0.038)
Per capita Income-squared (ln)	-0.006***	-0.015***	-0.015***	-0.006***	-0.017***	-0.017***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Population (ln)	0.042**	0.221***	0.016	0.070***	0.236***	0.034
	(0.020)	(0.032)	(0.021)	(0.017)	(0.031)	(0.021)
Population-squared (ln)	-0.000	-0.016***	-0.003***	-0.002*	-0.016***	-0.004***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
1980s	-0.007**	0.034***	0.029***	-0.012***	0.033***	0.027***
	(0.003)	(0.004)	(0.003)	(0.002)	(0.004)	(0.004)
1990s	-0.011***	0.052***	0.045***	-0.019***	0.048***	0.042***
	(0.004)	(0.006)	(0.005)	(0.003)	(0.006)	(0.005)
2000s	-0.018***	0.054***	0.052***	-0.020***	0.053***	0.052***
	(0.005)	(0.009)	(0.007)	(0.005)	(0.010)	(0.008)
Country fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Wald chi^2	9950.80	3205.93	5374.95	10699.60	3251.66	4724.47
Prob>chi^2	0.000	0.000	0.000	0.000	0.000	0.000
No. of Countries	18	18	18	17	17	17
No. of observation	810	810	810	765	765	765

Notes: Robust standard errors are in parentheses. The table reports the marginal effects of the coefficients from the fixed effect logit model for balanced panels developed by Papke and Wooldridge (2008). Estimations are based on the Expanded Africa Sector Database (Mensah and Szirmai, 2018). To obtain a balanced panel, we restrict the years of observation from 1970 to 2015. The control period in this model is 1970s. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Evidence on Deindustrialization in Sub-Saharan Africa (UN AMAD)

	Sub-Saharan Africa		Sub-Saharan Africa excl. HEC	
Panel A: Reg. Estimates	Nom VA Manshare	Real VA Manshare	Nom VA Manshare	Real VA Manshare
Per capita Income (ln)	-0.050***	0.136***	-0.102***	0.118***
	(0.018)	(0.026)	(0.021)	(0.027)
Per capita Income-squared (ln)	0.004***	-0.006***	0.007***	-0.005***
	(0.001)	(0.002)	(0.001)	(0.002)
Population (ln)	0.086***	0.132***	0.069***	0.121***
	(0.010)	(0.011)	(0.009)	(0.010)
Population-squared (ln)	-0.005***	-0.009***	-0.004***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.001)
1980s	0.003	0.012***	-0.001	0.013***
	(0.003)	(0.003)	(0.003)	(0.003)
1990s	0.004	0.020***	-0.004	0.021***
	(0.005)	(0.004)	(0.004)	(0.004)
2000s	-0.007	0.006	-0.016***	0.009*
	(0.006)	(0.006)	(0.006)	(0.005)
Intercept	-0.191**	-1.154***	0.084	-1.022***
	(0.087)	(0.131)	(0.093)	(0.130)
Panel B: Lind and Mehlum U Test				
Slope at LB of Income (ln)	-0.009	0.079***	-0.031***	0.072***
	(0.008)	(0.011)	(0.009)	(0.011)
Slope at UB of Income (ln)	0.041***	0.010	0.053***	0.018**
	(0.006)	(0.008)	(0.007)	(0.008)
U test statistic	1.136		3.634	
	[0.128]		[0.000]	
Extremum point	5.939	11.588	7.063	12.627
In 2011 US$	379.76		1168.79	
95% CI, Fieller Method	(3.38,6.82)	(10.42, 15.22)	(6.36,7.45)	(10.85,21.21)
Country FE	Yes	Yes	Yes	Yes
No. of Countries	46	46	41	41
Observations	2157	2157	1922	1922
R-Squared	0.703	0.783	0.680	0.785

Notes: Panel-corrected standard errors are in parentheses and p-values in square brackets. Estimations are based on the UN National Accounts: Analysis of Main Aggregate Database (UN AMAD). *HEC*, *LB*, and *UB* denote high manufacturing exporting countries, lower boundary, and upper boundary respectively. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Fieller Method follows an inverse test to construct confidence intervals for the ratio of normally distributed statistics. For the U-test this method is preferred.

Table 4: Evidence on Deindustrialization by Sub-region (UN AMAD)

	WestAfrica	EastAfrica	CentralAfrica	SouthernAfrica	WestAfrica	EastAfrica	CentralAfrica	SouthernAfrica
Panel A: Reg. Estimates	Nom.VA	Nom.VA	Nom.VA	Nom.VA	Real VA	Real VA	Real VA	Real VA
Per capita Income (ln)	0.176***	0.142***	-0.220***	0.162**	0.194***	0.081*	0.370***	0.242***
	(0.047)	(0.051)	(0.036)	(0.069)	(0.047)	(0.046)	(0.055)	(0.043)
Per capita Income-squared (ln)	-0.011***	-0.007**	0.014***	-0.009**	-0.015***	-0.003	-0.019***	-0.013***
	(0.003)	(0.003)	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Population (ln)	0.010	0.053***	-0.089***	0.562***	0.098***	-0.015	0.377***	0.336***
	(0.024)	(0.011)	(0.028)	(0.053)	(0.037)	(0.011)	(0.060)	(0.049)
Population-squared (ln)	-0.000	-0.006***	0.006***	-0.034***	-0.005**	-0.001	-0.025***	-0.020***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.000)	(0.003)	(0.002)
1980s	-0.001	0.015***	0.000	-0.016*	0.001	0.015***	0.002	-0.017***
	(0.004)	(0.003)	(0.005)	(0.008)	(0.006)	(0.004)	(0.009)	(0.006)
1990s	0.017***	0.030***	-0.003	-0.010***	-0.009	0.036***	-0.000	-0.019**
	(0.006)	(0.006)	(0.008)	(0.003)	(0.008)	(0.007)	(0.014)	(0.008)
2000s	0.005	0.028***	-0.008	-0.020***	-0.025**	0.031***	-0.008	-0.021**
	(0.009)	(0.008)	(0.013)	(0.006)	(0.011)	(0.009)	(0.019)	(0.010)
Intercept	-0.621***	-0.713***	1.288***	-2.921***	-0.963***	-0.284*	-2.908***	-2.459***
	(0.231)	(0.198)	(0.222)	(0.404)	(0.273)	(0.162)	(0.357)	(0.324)
Panel B: Lind and Mehlum U Test								
Slope at LB of Income (ln)	0.065***	0.069***	-0.078***	0.073***	0.052***	0.052***	0.186***	0.111***
	(0.016)	(0.020)	(0.016)	(0.027)	(0.015)	(0.017)	(0.025)	(0.017)
Slope at UB of Income (ln)	-0.068***	-0.019	0.091***	-0.033*	-0.118***	0.017	-0.034**	-0.046***
	(0.023)	(0.018)	(0.011)	(0.023)	(0.025)	(0.017)	(0.015)	(0.017)
U test statistic	2.980	1.060	4.980	1.450	3.35		2.28	2.74
	[0.001]	[0.145]	[0.000]	[0.074]	[0.000]		[0.012]	[0.003]
Extremum point	7.752	9.500	7.612	8.921	6.680	13.64	9.834	9.035
In 2011 US$	2327.12	13346.21	2021.95	7485.80	796.274	842457.07	18648.95	8394.29
95% CI, Fieller Method	(7.32, 8.60)	(8.71,16.73)	(7.14, 7.93)	(8.24, 17.29)	(6.10, 7.05)	(1.67, ∞)	(9.38, 10.57)	(8.56,9.97)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Countries	16	10	9	11	16	10	9	11
Observations	752	470	423	512	752	474	423	512
R-Squared	0.747	0.849	0.643	0.724	0.741	0.827	0.879	0.818

Notes: Panel-corrected standard errors are in parentheses and p-values in square brackets. Estimations are based on the UN National Accounts: Analysis of Main Aggregate Database (UN AMAD). LB, and UB denote lower boundary, and upper boundary respectively. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The Fieller Method follows an inverse test to construct confidence intervals for the ratio of normally distributed statistics. For the U-test this method is preferred.

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Table 5: Deep Drivers of Manufacturing Employment Shares in Africa, 1970-2015

	(1) Manshare_EMP	(2) Manshare_EMP	(3) Manshare_EMP
Per capita Income (ln)	-0.236***	-0.237***	-0.255***
	(0.046)	(0.036)	(0.039)
Per capita Income-squared (ln)	0.019***	0.019***	0.020***
	(0.003)	(0.002)	(0.003)
Population (ln)	0.298***	0.213***	0.253***
	(0.034)	(0.028)	(0.030)
Population-squared (ln)	-0.006***	-0.004***	-0.005***
	(0.001)	(0.001)	(0.001)
Unbalanced Productivity growth	-0.024***	-0.016***	-0.024***
	(0.003)	(0.002)	(0.002)
Man. imports from Africa (%MVA)	-0.026		0.014
	(0.017)		(0.015)
Man. imports from North (% MVA)	-0.015***		-0.010***
	(0.002)		(0.002)
Man. imports from South (% MVA)	-0.018***		-0.014***
	(0.003)		(0.003)
Man. exports to Africa (%MVA)	0.024***		0.007
	(0.008)		(0.007)
Man. exports to North (% MVA)	0.046***		0.029***
	(0.006)		(0.006)
Man. exports to South (% MVA)	0.004**		0.003*
	(0.002)		(0.002)
Index of Undervaluation		0.009***	0.007**
		(0.003)	(0.003)
Fixed capital (% GDP)		0.054***	0.057***
		(0.008)	(0.008)
Human capital		0.212***	0.152***
		(0.024)	(0.027)
Foreign Direct Investment (ln)		0.016***	0.011***
		(0.002)	(0.002)
Interaction: FDI and Human capital		-0.011***	-0.008***
		(0.001)	(0.001)
Intercept	-1.685***	-1.274***	-1.440***
	(0.308)	(0.239)	(0.244)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	620	576	576
R-squared	0.933	0.939	0.945

Notes: Panel-corrected standard errors are in parentheses. Estimations are based on the Expanded Africa Sector Database (Mensah and Szirmai, 2018). Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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