Africa’s manufacturing development under the rise of China: Threat or opportunity?

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Abstract

The study set out to investigate whether China’s rise complements or competes with Africa’s manufacturing sectors, using a system GMM estimator. The findings reveal that imports of intermediate manufactured goods from China boost manufacturing production in African economies but that total imports of manufactured goods dampen the growth rate of manufacturing production. Another key finding is that the positive impact of intermediate imports from China is lower when FDI is abundant. Also, although the China-invested SEZs in Africa likely contribute to manufacturing development, the majority of FDI inflows into Africa are directed not toward manufacturing sectors in Africa but instead to extractive sectors, which are less labor-intensive. Taken together these findings suggest that the African manufacturing sector faces a potential long-term inadequacy of competitiveness and investments in productivity-enhancing assets and skilled labor. These findings call for a policy of urgency in technology transfer and various productivity-enhancing assets.

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1. Introduction

China has become the top trading partner of Africa, overtaking traditional partners such as France, the United Kingdom, and the United States. Not surprisingly, the impact of China on African economies has become one of the controversial issues among researchers, commentators, and policymakers. Observation of bilateral trade between China and Africa reveals a low growth rate of Africa's manufacturing value added but a rapid growth in imports of manufactured goods from China. Specifically, Africa's manufacturing value added (in real terms) increased at an average annual growth rate of 3.1% over the period 2007–2017, while imports of manufactured goods from China rose at an average annual growth rate which (at 32%) is ten times higher than that. While the potential impact of China on manufacturing value added can be characterized as a complementary effect, the import competition triggered by China can be considered a substitution effect. Therefore, this paper analyzes these two effects concurrently in order to determine whether China constitutes a threat or an opportunity for African countries.

While the increasing volume of trade with China should be celebrated, the gap between the growth in manufacturing value added and the growth in imports from China has raised some concern that African economies are being flooded with cheaper consumer goods made in China, which is crowding out the local manufacturing base. This is consistent with the prediction by Altenburg et al. (2006) that China's rise in technology will result in higher barriers to entry for newcomers to technology in terms of competitiveness in exports. Giovannetti and Sanfilippo (2009) show the negative impact of Chinese competition. Similarly, Kaplinsky and Morris (2009) look at the trade impact of the Asian drivers and the prospects for Africa's export-oriented textile industry, and find that African exports are being squeezed out by Chinese and Vietnamese textile exports.

Moreover, most of the arguments presented in the literature on the economies of African countries fail to take imports of capital goods and intermediates into account. In one sense, China's rapid expansion in cheaper capital goods is benefiting Africa, which is importing more intermediate parts and components from China to feed into its production lines, but at the same time Africa faces competition from China in exports to third markets and in import penetration of domestic markets. The positive side of China's rise is characterized in terms of complementary effects, and the negative side as competitive impacts.

In response to concerns regarding the negative impacts of Chinese exports on the African manufacturing sector, China has implemented various initiatives. For example, China channels considerable amounts of FDI into the manufacturing sector in African countries and has established special economic zones (SEZs) in a number of them. These initiatives were expected to positively impact the value added in African manufacturing (Maswana and Davies, 2014). Given the importance of this sector, however, there is a dearth of research on the impacts of the China shock on manufacturing in developing countries (Paz, 2018), especially for those in Africa, for which there is limited empirical work that explains the seemingly low growth in the African manufacturing sector despite the region's high overall growth. Obviously, this is an important issue for African countries insofar as many studies (e.g., Rodrik, 2013) point out that the manufacturing sector is the driving force of economic growth and development.

Therefore, this study set out to determine whether China's rise complements or competes with Africa's manufacturing sector, whether disaggregation by stage of production of African imports of intermediate goods reveals that the manufacturing industry in Africa has been upgraded in response to China's rise, and whether Chinese FDI and SEZs have made the expected contributions to African manufacturing development. Specifically, a dataset that combines bilateral trade and other macroeconomic data for 37 African countries from 2007 through 2017 has been built, and a dynamic model has been estimated by the system GMM approach (Arellano and Bover, 1995) to try to overcome potential endogeneity issues.

To the best of our knowledge, few studies have analyzed China's competition effect on the manufacturing sector of African countries in terms of the threefold perspective of this study. First, we consider imports of intermediate manufactured goods, as their impact on African manufacturing may be opposite to that of the often-used measure, capital goods. Arguably, African countries import many intermediate goods in order to produce manufactured goods with added value. It follows that the study of intermediate manufactured imports could reveal an untold story of China's effect on African manufacturing performance. Second, we study the impact of China on the manufacturing value added of African countries instead of the impact on their exports of manufactured products, as is the case in most of the related literature. Third, the study includes hosting of a China-invested SEZ as a dummy variable to assess the effectiveness of China's direct effort in the development of African manufacturing performance, which is an inclusion not commonly found in the existing literature.

The rest of the paper is structured as follows: Section 2 reviews the literature on the relationship between manufacturing value added and imports, with a specific focus on

African countries' imports from China. An empirical model, data sources, and methodological considerations are presented in section 3. Section 4 presents analysis of data and discusses the results. Section 5 offers policy implications and concludes.

2. Literature Review

Generally, a successful process of economic transformation tends to be associated with moving from the manufacturing sector to services (Rodrik, 2016). What has been observed in most African countries, however, is a direct shift from agriculture to low-productivity service activities without expansion of the manufacturing sector (Ansu, 2013). This presents a challenge for African economies, since a vibrant manufacturing sector is required for facilitating the transition from a traditional to a modern economy (Clark, 2019). This requirement has led to some of the early policy recommendations articulated around manufacturing development and diversification of exports (Prebisch, 1950; Singer, 1950).

It has long been recognized that manufacturing has virtues that make it special in comparison with other economic sectors. Unlike agriculture, which presents diminishing returns of scale in production, manufacturing is an activity with increasing returns. This feature makes the manufacturing sector instrumental in the process of growth. For one thing, manufacturing tends to be a dynamic sector, technologically speaking. In fact, as demonstrated in Rodrik (2013), formal manufacturing sectors exhibit unconditional labor productivity convergence, unlike the rest of the economy. Also, manufacturing has traditionally absorbed significant quantities of unskilled labor, something that sets it apart from other high-productivity sectors such as mining or finance. Moreover, manufacturing is a tradable sector, which implies that it does not face the demand constraints of a home market populated by low-income consumers. It can expand and absorb workers even if the rest of the economy remains technologically stagnant. Taken together, these features make manufacturing the quintessential escalator for developing economies (Rodrik, 2016).

Several Latin American countries have also engaged in a structural transformation from manufacturing to services. However, this has reduced their overall economic growth, because labor has been reallocated toward low-productivity services, rather than to high-productivity services as in East Asian countries (Paz, 2018). Hence an early decline in the share of the manufacturing sector is a source of concern for policymakers in developing countries insofar as such a trend could well remove the main channel through which rapid growth has taken place in the past in regions such as East Asia.

In recent years, and with some exceptions confined largely to Asia, developing countries have been affected by these trends of falling manufacturing shares in both employment and real value added (Rodrik, 2016), in part in connection to China's manufacturing crowding out industrial development elsewhere.

Following China's entry into the WTO, some studies have investigated China's possible impact on trade performance of different groups of countries (Shafaeddin, 2002; Gaulier et al., 2006; Yang, 2006), mainly focusing on East Asia since the role of China in its home region has been crucial in the reorganization of global production networks in which China is now specializing in the assembling of intermediate products coming from its neighbor countries (Gaulier et al., 2006). There is evidence that Chinese trade specialization toward manufactured products has threatened both the "mature tigers" and the "new tigers" in the more advanced segments of production (Lall and Albaladejo, 2004; Yusuf, 2008).

Well beyond its nearby region of Asia, the explosive growth in Chinese trade in manufactured products also poses a challenge for other developing countries. For example, Jenkins and Barbosa (2012) observes that the increases in imports of cheap manufactured goods from China have threatened domestic production in some developing countries and have "squeezed out" their exports to third markets. These concerns are particularly acute for countries that have devoted most of their resources to developing textile and cloth export structures. These countries are faced with increased direct competition from China (Jenkins, 2008).

Moreover, cheap manufactured imports from China may have deterred domestic manufacturing development effort in developing countries that lack a comparative advantage, such as those in Africa. This in turn might have forced such countries to become net importers of manufactured goods. Also, the decline in the relative price of manufacturing in China has put a squeeze on manufacturing everywhere, including in African countries, most of which have experienced little in the way of technological progress. This is consistent with the strong reduction in both employment and output shares in developing countries (especially those that do not specialize in manufactures). In sum, while technological progress is no doubt a large part of the story behind deindustrialization in the advanced countries, in the developing countries trade and globalization have likely played a comparatively larger role. (Rodrik, 2016).

In recent years, there have been studies highlighting the price effects of China's growing presence in manufacturing. For instance, a work by Fu et al. (2010) has shown that, over the last twenty years, Chinese export competitiveness has influenced the export prices of almost all country groups, including those of groups of high-income countries in low-technology-product markets. In addition, there has been evidence of China's rapid trade expansion having a favorable impact on trade of East Asian emerging economies, particularly as regards improving their terms of trade. In contrast to the other studies, Coleman (2007) focuses on China's effect on changes in employment in other countries. Coleman (2007) reports that the surrounding economies and regions, regardless of their stage of development, generally tend to shift their employment away from the manufacturing sector because of the large increase in China's share of the world's exports of manufactured goods.

Despite the above dire assessment of China's effect on manufacturing development of other countries, there are broad studies that assert that the fear of China crowding out the Asian economies from their manufactured export markets is unfounded. For instance, Greenaway et al. (2008) splits Asian economies into low income, middle income, and high income, and concludes that while significantly affecting high-income Asian economies (e.g., Japan, Korea, and Singapore), the impact of Chinese exports on low- and middle-income Asian economies is insignificant. In this regard, Athukorala (2009) reported that the apprehension regarding China's exports crowding out those from the other Asian economies has been highly exaggerated in the policy debate. Viewed in the global context, market share growth of the Asian economies, including that of China, has occurred essentially at the expense of the rest of the world (Das, 2013), including Africa. In this connection, it can be argued that China has had a beneficial impact on African economies through its consumption and production of finished manufactured products. In some cases, China is a low-cost supplier to countries that have little or no manufacturing industry.

Furthermore, He (2013) indicates that imports from China positively affect the manufacturing sector in Africa, especially in terms of Africa's exports of manufactured products, and that this effect is stronger than that of imports from France and the United States. He (2013) also demonstrates that when the importing country has a limited absorptive capacity and/or the imported intermediate goods are highly substitutable for local production, the country will benefit more from importing goods from a developing country that has somewhat better technology (such as China) than from a developed country that has very superior technology (such as the United States).

Similarly, Jenkins and Edwards (2006) investigate the effect of the rise of China and India on 21 Sub-Saharan African (SSA) countries and conclude that the export structures of SSA countries are significantly different from those of China and India. Therefore, they claim, the threat of competition that has been observed in Asian economies, and in countries in Latin America and the Caribbean (LAC), is not a serious concern in Africa. They also determine that the effects from Asia in general, and from China in particular, are heterogeneous among SSA countries. For example, Angola, Nigeria, and the Sudan are important exporters of goods to Asia; Ghana, Ethiopia, Kenya, Tanzania, and Uganda are the main importers of goods from Asia; and Lesotho faces competition from China in third markets. In sum, African economies are poorly integrated into the manufacturing value chains dominated by China. Also, different African economies are at different stages of economic development, and thus compete with China at differing levels. This heterogeneity implies that each African country has been affected differently, depending on its economic position in the world market relative to that of China.

Nevertheless, studies looking at terms of trade have pointed out a negative China effect. In this regard, Villoria (2009) analyzed the impact of China on the terms of trade of a few African countries (Kenya, Mauritius, Botswana, Lesotho, Namibia, South Africa, and Swaziland) that export relatively more manufactured goods than the other African countries. The findings show that the reductions in export prices outweigh the decreases in import prices and that those countries stand to lose from China's expansion in exports of manufactures.

Golub et al. (2017) compared relative unit labor costs between China and Sub-Saharan Africa to study trends in the competitiveness of African manufacturing sectors. Basically, given that most African countries have a comparative advantage in capital-intensive goods (e.g., minerals), they addressed the question of whether labor-intensive sectors (e.g., manufacturing) could be enhanced as a result of the increasing involvement of China in Africa. They detected a negative effect of China because of relative wages in formal manufacturing sectors being very high in African countries. Along the same lines, Bloom et al. (2016) provide evidence that Chinese import competition decreases the probability of survival and employment in low-technology firms, many of which operate in the manufacturing sector in low-income countries.

Relatedly, Giovannetti and Sanfilippo (2009) analyzed the impact of Chinese exports to Africa on exports from African countries. They found that Africa is vulnerable to the competitive threat posed by China in world markets and that the flooding of African markets with low-cost manufactured goods occurs at the expense of local producers. The "low-technology manufactures" category includes textile fabrics, clothing, headgear, footwear, leather manufactures, travel goods, pottery, simple metal parts/structures, furniture, jewelry, toys, and plastic products (Lall and Albaladejo, 2003). Also, Giovannetti and Sanfilippo (2009) indicate that Chinese exports have a significant competition effect within Africa. They contend that textiles and clothing sectors, as well as high-technology industries such as machinery and equipment, chemicals, and non-metallic mineral products, are suffering from the displacement effects of their competition with China.

Another study line related to Chinese import competition that has attracted attention in recent years is related to resource reallocation (e.g., Maswana, 2009; Giovannetti and Sanfilippo, 2009). The idea that international trade induces resource reallocation has been held as a consensus in the international economics literature. Trade-induced resource reallocations have strong implications for manufacturing development in low-income countries (Melitz, 2003; Bernard et al., 2006). For instance, Bernard et al. (2006) show that when facing high exposure to competition from China, plants are more likely to switch to industries with lower exposure, and thus will shift resources from primarily labor-intensive industries to capital-intensive industries, which in the African context will be mainly the mining industry. This effect is reinforced in countries where new foreign direct investment is attracted into the primary sector.

As a well-known channel, expansion of the mining industry and the related exports contributes to an appreciation of the real exchange rate. This in turn makes other tradables, particularly manufactured goods, more expensive, thus further contributing to deindustrialization. The model by Corden and Neary (1982) assumes that rising commodity prices raise the marginal product of labor in the booming sector, resulting in a shift of labor to the booming sector and away from manufacturing (resource movement). The boom also leads to an increase in income and to higher demand for mining products goods. With the price of tradables set on world markets, the extra spending raises the absolute and relative prices of nontradables, resulting in appreciation of the real exchange rate. In response, labor shifts to the nontradables sector from the non-booming tradables, which contracts (spending effect). In short, conflicting empirical findings make it important to further investigate the impact of the bilateral real effective exchange rate (REER) on manufacturing development of Africa.

Contrasting conclusions from empirical studies may be attributed in part to the different methodologies that have been adopted. In general, researchers have adopted different approaches and used various datasets to conduct their analyses. The basic methods can be classified into three categories. The first is related to the computational general equilibrium

(CGE) model. Most CGE models in this literature are derived from the Global Trade Analysis Project (GTAP). This approach can be used in performing counterfactual analysis and in forecasting. However, strong assumptions are often required. Most of them are irrelevant in the African context (Hanson and Robertson, 2008). The second approach is related to various versions of gravity models, which have been extended to measure the effect of Chinese exports on other Asian countries' exports (Greenaway et al., 2006) and on Sub-Saharan African countries' exports (Giovannetti and Sanfilippo, 2009) The fundamental innovation in these models is to augment the traditional gravity equation by including Chinese exports to the same markets among the independent variables. The third approach is comprised of the production-function-based regressions, which use more detailed data and with instrumental variables; this approach works better in establishing the causality of the effects of trade on partner economies, and it assumes that sectoral value-added production functions exist and follow the usual features of the aggregate production (Herrendorf et al., 2015).

Most papers on structural transformation use sectoral production functions of the Cobb–Douglas form with capital shares that are equal to the aggregate capital share. The advantage of this approach is its convenience, as sectoral Cobb–Douglas production functions with equal capital shares can be aggregated to an economy–wide Cobb–Douglas production function with the same capital share. However, this ignores differences in sectoral capital intensity and the substitutability between capital and labor that may imply potentially important economic forces behind structural transformation.

The present paper analyzes the impact of Chinese expansion on manufacturing sectors in countries that do not export a relatively high volume of manufactured goods, as compared to those included in Villoria (2009). We do so by analyzing the impact of exports from China to Africa on the value added in the manufacturing sectors of the importing countries. We depart from Golub et al. (2017) by using the value added, which is more inclusive than labor costs and more representative of the production structures.

A negative impact on African manufacturing value added would confirm the rhetoric by some scholars who see Chinese expansion as a threat for Africa, such as that which is expressed in Villoria (2009), Giovannetti and Sanfilippo, and many others. However, a positive impact on African manufacturing value added would show that African countries are benefiting from the multiform Chinese expansion in Africa (Eisenman, 2012). That would also show that some countries without a comparative advantage in manufacturing sectors could enhance their advantage through trade partnerships with China. Moreover, a positive impact of China on the African manufacturing value added would support the assertions by Kim (2005) in that one of the main channels through which Chinese expansion could boost African manufacturing sectors is through the lower prices of imported goods (some of them being used as inputs in African manufacturing sectors).

3. Methodology and Data

3.1. Methodology

The intuition behind our baseline model is derived from Rotemberg and Woodford (1995) and Moro (2007), who find that a satisfactory explanation of total factor productivity (TFP) should take into account intermediate goods in the production process because the change in the level of TFP can account for two-thirds of the growth in output per worker in the United States. Therefore, intermediate goods represent an important factor of production in most sectors of industrialized economies. In the US, for instance, for a given amount of value added, roughly an equivalent amount of intermediate goods is used in the production process at the aggregate level. This can be applied to the manufacturing sector in Africa, as African manufacturing processes are heavily import dependent (Black et al., 2017). However, intermediate goods are excluded in a Cobb–Douglas production function, which is not always a good practice. In fact, the productivity of a subset of inputs depends on utilization of the remaining inputs. This reasoning can be applied to a firm that produces output using capital, labor, and intermediate goods. If there is a change in the utilization of intermediate goods, this will affect productivity of the remaining inputs, that is, capital and labor (Moro, 2007).

A representative manufacturing firm i maximizes the following production function

$$Y_{i,t} = A(K_{i,t})^{\alpha}(L_{i,t})^{\beta}(M_{i,t})^{\eta}, \quad (1)$$

with $\eta = 1 - \alpha - \beta$, under its budget constraint $C = rK_{i,t} + wL_{i,t} + pM_{i,t}$, (2)

where $Y_{i,t}$, $K_{i,t}$, $L_{i,t}$, $M_{i,t}$, r, w, and p denote respectively the exogenous productivity level, the added value of manufactured goods, capital stock, the price of intermediate goods, labor factor, , , the rental rate of capital, and the wage rate, all at time t.

Taking the natural log of each side of Eq. (1) yields

$$\ln Y_{i,t} = \ln A + \alpha \ln K_{i,t} + \beta \ln L_{i,t} + \eta \ln M_{i,t} \quad (3)$$

After accounting for country-specific and time fixed effects, the panel regression for Eq. (3) takes the form

$$\Delta y_{i,t} = \phi + \rho y_{i,t-1} + \theta x_{i,t} + \mu_i + v_t + \varepsilon_{i,t}, \quad (4)$$

Where $\phi = lnA$, $\theta = (\alpha\, \beta\, \eta)'$, and the lowercase letters denote the log-transformed variables: $y_{i,t}$ denotes the log of the manufacturing value added (*Y*), and $x_{i,t}$ is the set of variables that represent the logs of imports of intermediate goods (*K*), gross fixed capital formation (*L*), and manufacturing sector employment (*M*). The subscripts *i* and *t* are used for countries and time, respectively. μ_i, v_t, and $\varepsilon_{i,t}$ denote respectively the country-specific fixed effects, the time fixed effects, and the error.

One problem with estimating equation (4) via the method of ordinary least squares (OLS) is the endogeneity of the lag in the dependent variable. Specifically, in the presence of the country-specific effect μ_i, it is well known that the OLS estimate of the coefficient on the lagged dependent variable is likely to be biased upward, since the lagged dependent variable is positively correlated with the error term (see, for instance, Blundell and Bond, 1998). One approach to correcting for the fixed effects might consist of estimation of panel-data fixed effects or least-squares dummy-variable regression (entering a dummy variable for each country). However, Roodman (2006) shows that this will not entirely remove "dynamic panel bias" and in fact would result in downward bias on the lag in the dependent variable in the aforementioned example. One strategy for correcting for the unobserved heterogeneity is to difference the data. Equation (4), when first differenced, yields

$$y_{i,t} - y_{i,t-1} = \rho(y_{i,t-1} - y_{i,t-2}) + \theta(x_{i,t} - x_{i,t-1}) + (u_{i,t} - u_{i,t-1}), \qquad (5)$$

where $u_{i,t} = \mu_i + v_t + \varepsilon_{i,t}$, hence

$$\Delta y_{i,t} = \rho \Delta y_{i,t-1} + \theta \Delta x_{i,t} + \Delta\varepsilon_{i,t},$$

under the following moment restrictions (Arellano and Bond, 1991):

$$E[y_{i,t-s}\Delta\varepsilon_{i,t}] = 0,\ i = 1,\ldots,N\,;\ t = 3,\ldots,T\,;\ s \geq 2 \qquad (6)$$

and

$$E[x_{i,t-s}\Delta\varepsilon_{i,t} = 0,\ i = 1,...,N\,;\ t = 3,...,T\,;\ s \geq 2 \qquad (7)$$

The moment conditions in (6) and (7) imply that one can use lagged values of $y_{i,t}$ and $x_{i.t}$ dated $t-2$ and up as instruments for the equation in the first differences. In the case that $x_{i.t}$ is predetermined but not strictly exogenous, the lagged value date $t-1$ is also valid; and if it happens to be strictly exogenous, then all the $x_{i.t}$ are valid instruments. Nonetheless, those lagged variables have been found to be weak instruments (Arellano and Bover, 1995). To improve the efficiency of GMM estimators, Arellano and Bover (1995) and Blundell and

Bond (1998) have proposed a system GMM estimator. In that estimator, a system of two equations is built—the level equation and the differenced equation—by exploitation of the moments in (6) and (7), as well as additional moments as in (8), (9), and (10).
The following moment conditions are satisfied for the second part of the system (the regression in levels):

$$E[(y_{i,t-1} - y_{i,t-2})(\mu_i + \varepsilon_{i,t})] = 0 \tag{8}$$

$$E[(X_{i,t-1} - X_{i,t-2})(\mu_i + \varepsilon_{i,t})] = 0 \tag{9}$$

$$E[(f^j_{i,t-1} - f^j_{i,t-2})(\mu_i + \varepsilon_{i,t})] = 0 \tag{10}$$

The third condition allows for use of lagged first differences as instruments for levels.

So far, the biggest concern is whether we have allowed for sufficient inclusion of lags to control for the dynamic aspects of our empirical relationship. For the GMM estimates, if the assumptions of our specification are valid, then by construction the residuals in first differences (AR(1)) should be correlated, but there should be no serial correlation in second differences (AR(2)) (Arellano and Bond, 1991). Also, the dynamic panel GMM estimator uses multiple lags as instruments, which means that the system is likely to be overidentified (Roodman, 2006). Hence the Sargan test for overidentifying restrictions as derived by Arellano and Bond (1991) has been used.

3.2. Data

The data used for estimation were taken from different sources and cover 37 African countries[5] from 2007 through 2017. The countries were chosen on the basis of availability of data for all the variables of interest (import of intermediate goods from China, the flow of FDI from China, manufacturing value added, etc.). The manufacturing value added is the net output of industries belonging to International Standard Industrial Classification (ISIC) divisions 15–37, computed by summing all outputs and subtracting intermediate inputs. The data originate from the World Bank's World Development Indicators and are expressed in real

[5] Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, the Central African Republic, the Congo, Egypt, Ethiopia, Gambia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Seychelles, South Africa, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe.

terms (2005 US dollars). Disaggregated data on the imports of intermediate manufactured goods by African countries from China were obtained from the United Nations Trade Statistics (UN COMTRADE) database under Standard International Trade Classification (SITC) Revision 4 and from UNCTAD statistics; Data on China's FDI in the African manufacturing sector were taken from the SAIS-CARI loan database (Johns Hopkins University). Many structural factors affect the efficiency of domestic manufacturing production through transaction costs. These factors include indicators for financial development (the ratio M2/GDP) and human capital (the Human Capital Index), all of which were sourced from the World Bank's World Development Indicators.

4. Results

The study hypothesized that manufacturing value added is impacted by imports in similar categories from China. We estimate our model with the fixed effect method (FE) and the system generalized method of moments (GMM). Our results are reported in Tables 1 through 5. The results obtained with the FE method, as reported in Table 1, show that the coefficient of the initial value added is consistently negative, implying that countries with a higher level of manufacturing production have experienced lower growth rates in manufacturing production. This finding concurs with the beta convergence hypothesis, as it reflects that, ceteris paribus, it would take approximately 3.5 years for the gap between the current manufacturing production and its long-run value to be reduced by half.

The coefficient of gross fixed capital formation is positive, reflecting the capital intensity of manufacturing production in Africa, as stated by Villora (2009). In addition, when controlling for total manufactured imports, government spending, total FDI inflows, and the interaction between total FDI and imports of intermediate goods, imports of intermediate goods from China are shown to boost the growth in manufacturing production. This positive impact reflects the complementary effect of Chinese expansion, as elaborated earlier.

Moreover, the impact of total manufactured imports is negative, reflecting the negative impact of import competition on domestic producers. Specifically, a 1% increase in total manufactured imports is related to a decrease of about 0.117% in manufacturing value added.

FDI inflows boost the growth in manufacturing production. However, the interaction between total FDI and imports of intermediate goods is negative, which shows that the positive impact of intermediate imports from China is lower when FDI is abundant. This may reflect the fact that the majority of FDI is directed not toward manufacturing sectors in Africa but instead to extractive sectors, which are less labor-intensive. That negative coefficient also indicates that the impact of FDI in an African country is lower when manufacturing production in that country is higher.

We suspect that the fixed effects method of estimation may suffer from endogeneity bias. Therefore, we consider a dynamic panel model and a two-step GMM estimation technique. The results shown in Tables 2 through 5 indicate that the Sargan test statistics are not abnormal, and the Arellano–Bond AR(2) values suggest that the residual has no second-order autocorrelation. The post-regression analysis (see appendix) indicates that our instrumental variables are valid, because we fail to reject the null hypothesis that overidentification restrictions are valid (the p-value of the chi-square statistic, 0.2751, is greater than the confidence coefficient, 0.05). Our results also show that there is no first-order serial correlation of errors, because we fail to reject the null hypothesis of no autocorrelation of errors (the p-value of the standard normal statistic is 0.1687).

The results reported in Table 2 are qualitatively comparable to those in Table 1. Specifically, there is beta convergence in manufacturing production across African countries, manufacturing production is more capital intensive in Africa, and imports of intermediate manufactured goods boost production, but total imports of manufactured goods dampen the growth rate in manufacturing production. Overall, a 1% increase in total manufactured imports dampens the value added by 0.126%, while a 1% increase in imports of intermediate goods from China boosts the manufacturing value added by $0.211-(0.010*17.66)=0.0344\%$[6].

We checked the robustness of our findings by including other sets of interaction terms, and our main findings hold. First, we included the interaction between total imports of manufactured goods and imports of intermediate goods. Second, we included the interactions between the initial value added and each of the two import variables (separately). None of our main findings is refuted, as shown in Table 3, but we found that the convergence rate is likely to be smaller when African countries import more intermediate goods.

In Table 4, we replace total manufactured imports by manufactured imports from China. This variable is not significant, while the coefficient of intermediate imports from China is

[6] 17.66 is the average of the log of FDI inflows, where the average was taken over all the African countries included in this study.

positive, confirming the complementary effects of China through cheaper intermediate inputs. The post-estimation tests for equations (11) and (12) (in the appendix) show that our instrumental variables are not valid (we reject the null hypothesis that overidentification restrictions are valid at the 95% confidence level) and that the errors are not autocorrelated (we fail to reject the null hypothesis of no autocorrelation of errors at the 95% confidence level).

To address the negative rhetoric concerning the impacts of China in African countries via implementation of its special economic zones, we interact our variables of interest with a dummy variable (SEZ) that takes the value 1 for countries included in an SEZ, and 0 otherwise. The post-estimation tests for equations 13 and 14 (in the appendix) show that our instrumental variables are valid (we fail to reject the null hypothesis that overidentification restrictions are valid at the 95% confidence level) and that the errors are not autocorrelated (we fail to reject the null hypothesis that there are no autocorrelation of errors at the 95% confidence level). The results reported in Table 5 reveal one additional aspect of this: the positive impact of intermediate imports from China for countries hosting a China-invested SEZ. This likely confirms the effectiveness of China's intention to duplicate (in Africa) its own experience of industrial development. China's own manufacturing development was promoted mostly by FDI in its own SEZs, related technology transfer, and various productivity-enhancing assets (e.g., capital formation, education, and investment in technical infrastructure) and related policies.

From a broader perspective, the combination of the positive contribution to Africa's manufacturing output and the reduction in its rate of growth of development suggests that the African manufacturing sector faces a potential long-term inadequacy of competitive investments in productivity-enhancing assets and skilled labor. This inadequacy is often ignored. If not recognized and addressed, the array of emerging manufactured imports from China is likely to further undermine manufacturing development in African economies. No single economy has yet implemented a complete model for creating and managing a series of domestically focused technical skills that could lead to rapid growth in an endogenous manufacturing sector. However, some nations, such as South Africa and Mauritius, are embracing investments in the required productivity-enhancing assets to a greater degree than others. Thus the future of African manufacturing will be determined not only by the efforts of individual countries (although such efforts are of course indispensable) but also by the extent to which the China–Africa partnership generates new waves of technology transfer.

Although it is beyond the scope of this paper to examine, it should be acknowledged here that the slowdown in growth of the manufacturing sector in connection with imports from China may also be contributing to a decline in job generation in African economies, stagnating workers' wages and ultimately widening inequality. This concern is in line with the observation, confirmed in our analysis, that the majority of FDI is directed not toward manufacturing sectors in Africa but instead to extractive sectors, which are less labor-intensive. Further empirical studies of this mechanism are needed, with the hope of lending further insight into the findings of the present study. Whether Chinese imports affect the African manufacturing sector differently than imports from elsewhere requires further research, perhaps at the firm level, to gain a better understanding of the mechanisms at play.

Lastly, the usual caveats inherent in our and similar empirical studies should be acknowledged. For example, while we see our results (based on panel macro-economic datasets) as robust to the GMM estimation technique, they are only as good as the quality of the available data.

5. Conclusion

The study set out to investigate whether China's rise complements or competes with Africa's manufacturing sectors, using a system GMM estimator. The findings reveal that imports of intermediate manufactured goods from China boost manufacturing production in African economies but that total imports of manufactured goods dampen the growth rate of manufacturing production. Hence the rise of China has likely created new challenges for manufacturing development in many African economies.

Another key finding confirms the effectiveness of China's intention to duplicate (in Africa) its own experience of industrial development with the establishment of SEZs in Africa. Nevertheless, although the China-invested SEZs in Africa likely contribute to manufacturing development, the majority of FDI inflows into Africa appears to be directed not toward manufacturing sectors.

Furthermore, since Chinese goods are taking an increasing share of domestic markets in many African countries, claims that China is a factor that leads to deindustrialization in Africa should not be ruled out. In light of our findings, however, to conclude that China is a major factor in the trend observed in manufacturing development in Africa seems exaggerated.

From a broader perspective, a positive contribution to manufacturing output that is accompanied by a slowing down in the rate of growth of development suggests that the African manufacturing sector faces a potential long-term inadequacy of competitiveness and investments in productivity-enhancing assets and skilled labor. This inadequacy is often ignored. If not recognized and addressed, the array of emerging manufacturing imports from China is likely to further undermine manufacturing development in African economies.

These findings call for a policy of urgency in technology transfer and various productivity-enhancing assets such as manufacturing skills development and investment in technical infrastructure. Such urgency is justified given the considerable and far-reaching potential for manufacturing sector development and job creation in Africa, as well as its centrality to the core agenda of many African policymakers.

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Appendix

Table 2. Regressions of Growth of value added on Imports of intermediate goods from China (system GMM)

	Reg 5	Reg 6	Reg 7
Initial Value Added	-0.161***	-0.170***	-0.158***
	(0.037)	(0.034)	(0.033)
Import of Intermediate goods from China	0.013	0.002	0.211***
	(0.012)	(0.011)	(0.072)
log of gross fixed capital formation	0.124***	0.094***	0.101***
	(0.026)	(0.025)	(0.024)
log of total industrial employment	0.115**	0.086	0.069
	(0.058)	(0.054)	(0.053)
log of total manufacturing imports	-0.103*	-0.117**	-0.126**
	(0.057)	(0.054)	(0.052)
log of total fdi inflows		0.022***	0.136***
		(0.008)	(0.04)
Interaction between total FDI and imports of intermediate goods			-0.010***
			(0.004)
Constant	3.061***	3.151***	0.684
	(0.007)	(0.006)	(1.087)
Sargan test	0.2751	0.3729	0.1494
AR(1)	0.0023	0.0014	0.0069
AR(2	0.1687	0.2592	0.3172
Obs.	246	229	229

Note: -The p-value for each corresponding test statistic is displayed in parenthesis.
-*, ** and *** indicate that the variable is significant at the level of 10%, 5%, and 1%, respectively
-Sargan test of over-identifying restrictions and the corresponding p-values for the validity of the additional moment restriction neceasry for system GMM.
-AR(1) and AR(2) refers to Arellano-Bond test and the values reported are the p-values for the first and second order autocorrelated disturbances in the first differences equations.

Table 3. Regressions of Growth of manufacturing value added with interaction terms (system GMM)

	Reg 7	Reg 8	Reg 9
Initial Value Added	-0.158***	-0.157***	-0.525**
	(0.033)	(0.033)	(0.236)
Import of Intermediate goods from China	0.211***	0.232*	-0.081
	(0.072)	(0.126)	(0.253)
log of gross fixed capital formation	0.101***	0.100***	0.102***
	(0.024)	(0.025)	(0.024)
log of total industrial employment	0.069	0.069	0.078
	(0.053)	(0.053)	(0.052)
log of total manufacturing imports	-0.126**	-0.062	-0.461
	(0.052)	(0.316)	(0.751)
log of total fdi inflows	0.136***	0.136***	0.208***
	(0.04)	(0.04)	(0.043)
Interaction between total FDI and imports of intermediate goods	-0.010***	-0.010***	-0.016***
	(0.004)	(0.004)	(0.004)
Interaction between total imports of manufacturing goods and imports of intermediate goods		-0.005	-0.015
		(0.026)	(0.052)
Interaction initial value added and imports of intermediate goods			0.023***
			(0.006)
Interaction between initial value added and tot manufacturing imports			0.025
			(0.057)
Constant	0.684	0.421	6.090*
	(0.087)	(0.675)	(0.317)
Sargan test	0.1494	0.0730	0.0730
Arellano-Bond AR (1)	0.0069	0.0097	0.0097
Arellano-Bond AR (1)	0.3172	0.4258	0.4258
Obs.	229	229	229

Note: -The p-value for each corresponding test statistic is displayed in parenthesis.
-*, ** and *** indicate that the variable is significant at the level of 10%, 5%, and 1%, respectively
-Sargan test of over-identifying restrictions and the corresponding p-values for the validity of the additional moment restriction neceasry for system GMM.
-AR(1) and AR(2) refers to Arellano-Bond test and the values reported are the p-values for the first and second order autocorrelated disturbances in the first differences equations.

Table 4. Regressions of Growth of manufacturing value added with manufacturing imports from China (system GMM)

	Reg 10	Reg 11	Reg 12	Reg 13	Reg 14
Initial Value Added	-0.178***	-0.190***	-0.181***	-0.181***	-0.596***
	(0.039)	(0.036)	(0.035)	(0.035)	(0.146)
Import of Intermediate goods from China	0.009	-0.009	0.201***	0.201***	-0.09
	(0.018)	(0.016)	(0.075)	(0.075)	(0.151)
log of gross fixed capital formation	0.110***	0.076***	0.082***	0.082***	0.091***
	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)
log of total industrial employment	0.114*	0.085	0.067	0.067	0.087
	(0.059)	(0.055)	(0.054)	(0.054)	(0.053)
log of manufacturing imports from China	0.011	0.026	0.025	0.025	-0.263
	(-0.021)	(0.019)	(0.019)	(0.019)	(0.19)
log of total fdi inflows		0.019**	0.133***	0.133***	0.211***
		(0.008)	(0.041)	(0.041)	(0.047)
Interaction between total FDI and imports of intermediate goods			-0.010***	-0.010***	-0.017***
			(0.004)	(0.004)	(0.004)
Interaction between imports of manufacturing goods from China and imports of intermediate goods					-0.001
					(-0.008)
Interaction between initial value added and imports of intermediate goods					0.020**
					(-0.008)
Interaction between initial value added and imports of manufacturing from China					0.014
					(-0.01)
Constant	2.956***	3.027***	0.569	0.569	7.579***
	(0.045)	(0.002)	(0.106)	(0.106)	(0.405)
Sargan test	0.0728	0.1252	0.2751	0.2701	0.0938
Arellano-Bond AR (1)	0.0089	0.0127	0.0023	0.0025	0.0129
Arellano-Bond AR (1)	0.4177	0.5466	0.1687	0.1451	0.2066
Obs.	242	225	225	225	225

Note: -The p-value for each corresponding test statistic is displayed in parenthesis.
-*, ** and *** indicate that the variable is significant at the level of 10%, 5%, and 1%, respectively
-Sargan test of over-identifying restrictions and the corresponding p-values for the validity of the additional moment restriction neceasry for system GMM.
-AR(1) and AR(2) refers to Arellano-Bond test and the values reported are the p-values for the first and second order autocorrelated disturbances in the first differences equations.

Table 5. Regressions of Growth of manufacturing value added with SEZ dummy

	Without FDI		With FDI	
	Reg 15	Reg 16	Reg 17	Reg 18
Initial Value Added	-0.161***	-0.180***	-0.160***	-0.189***
	(0.037)	(0.039)	(0.032)	(0.034)
Import of Intermediate goods from China	0.005	0.01	0.345***	0.337***
	(0.013)	(0.021)	(0.08)	(0.083)
log of gross fixed capital formation	0.125***	0.119***	0.112***	0.093***
	(0.026)	(0.027)	(0.024)	(0.025)
log of total industrial employment	0.124**	0.121**	0.07	0.064
	(0.059)	(0.06)	(0.052)	(0.053)
log of total manufacturing imports	-0.066		-0.098*	
	(0.062)		(0.058)	
log of manufacturing imports from China		-0.002		0.031
		(0.025)		(0.021)
log of total fdi inflows			0.217***	0.218***
			(0.044)	(0.046)
Interaction between total FDI and imports of intermediate goods			-0.018***	-0.018***
			(0.004)	(0.004)
SEZ* Import of intermediate goods from China	0.041	0.009	0.088***	0.087**
	(0.027)	(0.039)	(0.026)	(0.035)
SEZ*log of total manufacturing imports	-0.171		-0.193	
	(0.146)		(0.133)	
SEZ*log of manufacturing imports from China		0.071		0.038
		(0.049)		(0.044)
SEZ* log of total fdi inflows			0.046	0.026
			(0.029)	(0.028)
Constant	3.008***	2.876***	-1.101	-1.26
	(0.772)	(0.768)	(1.167)	(1.193)
Sargan test	0.0492	0.0492	0.0788	0.1017
Arellano-Bond AR (1)	0.0178	0.0178	0.0186	0.0205
Arellano-Bond AR (1)	0.2822	0.2822	0.2572	0.4257
Obs.	246	242	229	225

Note: -The p-value for each corresponding test statistic is displayed in parenthesis.
-*, ** and *** indicate that the variable is significant at the level of 10%, 5%, and 1%, respectively
-Sargan test of over-identifying restrictions and the corresponding p-values for the validity of the additional moment restriction neceasry for system GMM.
-AR(1) and AR(2) refers to Arellano-Bond test and the values reported are the p-values for the first and second order autocorrelated disturbances in the first differences equations.
-For the SEZ dummy, I use the following countries : Zambia, Nigeria , Ethiopia, Egypt, Mauritius, and Algeria. http://aeaa.journals.ac.za/pub/article/view/103