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The impact of Chinese competition on Africa's manufacturing*

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Abstract

In this paper, the competition impact (the volumes of imports of manufactured goods by African countries and their relative prices captured by real exchange rates) that China exerts on Africa's manufacturing added value is empirically analyzed. Using panel data on 44 African countries covering the period 2000 to 2013, we find that the imports of manufactured goods from China by African countries exert a negative effect on their manufacturing and that a moderate real appreciation of their currencies relative to the renminbi has a positive effect, although it also increases their imports from China and raises the cost of labor. The positive effect of the real appreciation is probably due to the reduced cost of imports. However, as traditional theory predicts, a big real appreciation exerts a negative effect on Africa's manufacturing.

JEL : E6, F4, O5, L6

Key words: manufacturing, China, Africa, real exchange rates

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1. Introduction

Developing manufacturing industry has been the main way for developing countries to attain a high level of income, to create employment and to reduce poverty. While China as many other Asian countries has successfully promoted export-oriented manufacturing, this is far from the case for African countries. The share of the real manufacturing added value of African countries (in 2005 US dollars) in the world total is only 1.9% in 2013[1] while that of China is 18%[2]. Moreover the manufactured goods produced by African countries are principally sold in domestic markets. The low share of their exports is itself linked to the low level of their manufacturing production, since production for local markets generally acts as a learning process before exporting. With low income per capita, high poverty rates, and rapidly increasing populations, African countries have a real need to develop their manufacturing industry[3].

There is a sharp contrast between the low rate of growth of Africa's manufacturing added value and the rapid growth of its imports of manufactured goods particularly from China. While Africa's manufacturing added value (in real terms) increased at an annual average growth rate of 3.5% over the period 2000-2013, its imports of manufactured goods from China rose at an average annual growth rate of 28%, which is eight times higher than the first one. Moreover, the annual average growth rate of Africa's imports of manufactured goods from China was much higher than that of its imports from the rest of the world (12.9%). China's share in the global imports of manufactured goods by Africa increased from 5% in 2000 to 25% in 2013, with considerable variation between African countries. The huge growth of African imports from China justifies to focus our attention on their impact on African manufacturing and to investigate if this impact is different from that of the rest of the world.

Is China slowing down Africa's manufacturing activities through African huge growth of imports of manufactured goods? The answer is not self-evident as it depends on the natures of imported and locally produced manufactured goods. If Africa's imported goods are final goods similar to locally produced goods, the comparative advantage of China in manufacturing production may shift African production towards other sectors (agriculture or services)[4]; while if they are intermediate and capital goods and destined to produce manufactured goods, the imported goods could actually boost manufacturing production[5].

To our knowledge, few studies have analyzed China's competition effect on the manufacturing sector of African countries as a whole, except Giovannetti and Sanfilippo (2009) who consider 48

[1]Only 44 African countries are used in the calculation because of lack of data for the rest (The data is from the World Bank's *World Development Indicators* and authors' estimations*;* for a detailed explanation, see Section 3)**.**

[2] China is the biggest world manufacturer by real manufacturing value added in 2014.

[3] The poverty rate in Sub Saharan Africa was 42.7% in 2012 according to the World Bank.

[4] A shift from manufacturing to agriculture or service may lead a premature deindustrialization in developing countries (Rodrik, 2016) and to service in developed countries (Bernard et al., 2016).

[5] Lacovone et al. (2013) showed this effect in the case of Mexico.

African countries[6]. Some studies consider 6 African countries (Power, 2008; Kaplinsky and Morris, 2008, 2009; Ceglowski et al, 2015); other papers analyze specifically the relationship between China and an African country such as South Africa (Morris and Einhorn, 2008; Edwards and Jenkins, 2015), Ethiopia (Gebre-Egziabher, 2007, 2009; Redi, 2009; Sonobe et al, 2009) or Nigeria (Gabriel and Ahiuma-Young, 2008) among others.

All these studies focus either on the exports of manufactured goods by African countries or on production, but not on manufacturing value added. With the exception of Giovannetti and Sanfilippo (2009), the other papers do not include an econometric investigation to distinguish China's impact from the other determinants of African production or exports. Power (2008) and Kaplinsky and Morris (2008, 2009) compare the market share of textile and clothing exports from China and African countries in the United States from 2004 to 2006. Ceglowski et al. (2015) compare the production unit cost between 6 African countries and China. Via a Chenery decomposition, Edwards and Jenkins (2015) estimate the impact of the imports of manufactured goods by South Africa from China on its manufacturing output. Through a gravity model, which aims to explain the exports of manufactured goods by African countries to developed countries, Giovannetti and Sanfilippo (2009) add China's exports to the traditional determinants of trade in this kind of model and used the econometric generalized method of moments (GMM) to estimate China's impact on Africa's exports[7]. All these studies demonstrate the negative impact of Chinese competition.

In this paper, we propose a new econometric model to analyze the impacts of African imports of manufactured goods from China on African manufacturing, compared to those from the rest of the world. Its originality is four times. First, we consider the largest available sample of African countries thanks to the data of *World development indicators* from the World Bank: our sample includes 44 African countries over the period 2000 to 2013. Second, we study the impact of foreign competition on the manufacturing added value of African countries instead of the impact on their production or exports. Indeed African countries import many intermediate goods in order to produce manufactured goods and added value is a better indicator of the African manufacturing performance. On the other hand, it is likely that competition from foreign suppliers exerts its effects on African manufacturing mostly in domestic markets rather than in foreign markets, because African exports of manufactured goods represent a small share of African manufacturing production and represent a still smaller share of the demand in the world market. Third, we estimate a model explaining the manufacturing added value of African countries which includes competition indicators for China and for the rest of the world as well as all the traditional

[6] Recently, several studies have analyzed the impact of the Chinese competition on the manufacturing industry elsewhere. Lacovone et al. (2013) using sector-firm data and OLS/IV estimation and showed that China's competition has led an engine of creative destruction in Mexico's manufacturing industry. Jenkin (2015) argued that China's competition is observed in Brazil's domestic and foreign markets and a Dutch Disease effect is observed, but without empirical analysis. Other papers have focused on labor market. Autor et al. (2013, 2016) and Acemoglu et al. (2016) have analyzed the impact of China competition on the labor market of the United-States.

[7] Before them Eichengreen et al. (2007) and Greenaway et al. (2008) have used the gravity model and 2SLS/IV estimator to analyze the competition effect of China on the exports of other Asian countries.

determinants of manufacturing industry as control variables. Therefore the estimation of the model allows us to compare the impact on African manufacturing added value of African imports from China or from other countries. Forth, the competition indicators are relative to the volume of imports of manufactured goods (by African countries from China and from the rest of the world) as well as to the relative prices (captured by real exchange rates), while in the previous literature volume and relative price of imports are alternatively considered. It would have been relevant to distinguish between imports of manufactured intermediate or capital goods and final goods by African countries as their impact on African manufacturing may be opposite; but unfortunately the data are unavailable. However, a positive impact of a real appreciation of African currencies, which would induce a drop of the relative price of imports of intermediate and capital goods, would suggest that high imports of these goods could boost African manufacturing.

The rest of the paper is organized as follows. The second section presents the key facts regarding the manufacturing industry of African countries and its statistical links with their imports of manufactured goods and real exchange rates, which are the base of our econometric model presented in the third section. The forth section sets out the estimation method and presents the results. It appears that both the imports of manufactured goods from China and from the rest of the world by African countries exert negative effects on their manufactured added value. On the other hand, China exerts a specific effect on Africa's manufacturing by its rate of exchange: a moderate real appreciation of African currencies relative to renminbi has a positive effect, probably due to the reduced cost of imports, while a big real appreciation exerts the traditional negative effect. The political and economic implications of these results are given in the conclusion.

2. Key facts of African manufacturing value added and of its links with imports of manufactured goods and real exchange rates

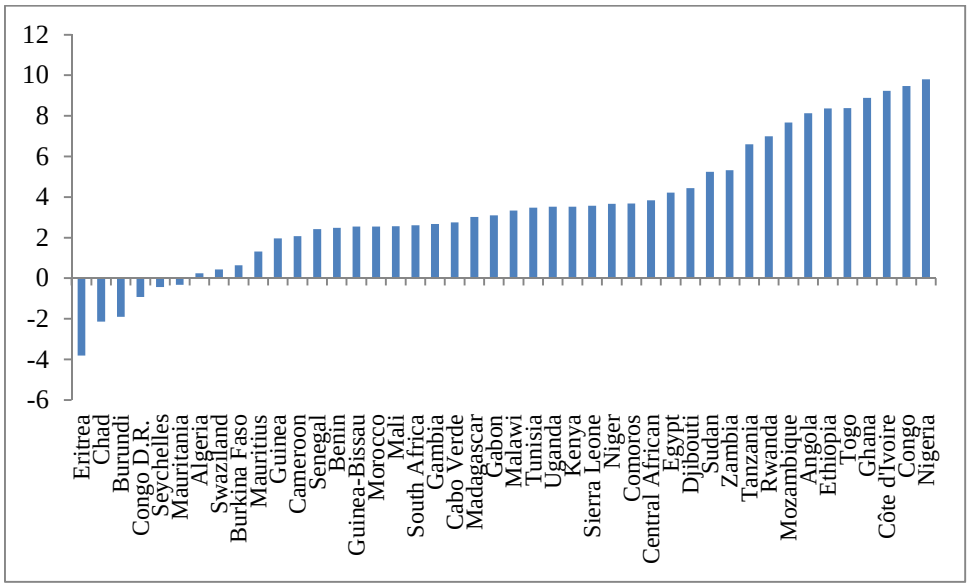
The added value of manufacturing is more relevant than the production as a measure of the industrial performance of African countries, because it is net of intermediate inputs, which are often imported. The manufacturing added value of African countries has evolved differently from one country to another, permitting the econometric investigation. The comparison of added value to exportations of manufactured goods justifies the choice of the added value as dependent variable, as it appears that manufacturing in Africa is mainly intended for domestic use. Finally, the growth of the imports of manufactured goods by African countries, as well as the change in their real exchange rates are both different among countries and often large, showing their relevance as determinants of manufacturing added value.

Manufacturing added value of African countries

Manufacturing industry in African countries is historically very weak, due to their natural resources and colonial histories. Manufacturing refers to the industries which belong to *International Standard Industrial Classification* (ISIC) divisions 15-37. According to the data of the *World Development Indicators* published by the World Bank, the real manufacturing added value (in 2005

US$) of 44 African countries rose from US$ 86 billion in 2000 to US$ 133 billion in 2013, i.e. at an annual average growth rate of 3.5%. The growth rate of real manufacturing added value varied from one country to another with two extreme countries (Eritrea, -3.8%; Nigeria, 9.8%). Only six African countries in the sample (Eritrea, Chad, Burundi, Côte d'Ivoire, Seychelles and Mauritania) had a negative annual growth rate of real manufacturing added value, while the other countries had on average a positive yearly growth rate (Fig. 1).

Figure 1. Annual average growth rates of manufacturing added value (2005 $) of African countries (2000-2013)



Source: World Bank *World Development Indicators* and authors' estimations.

As well as the data on total manufacturing added value, *World Development Indicators* publishes the share in manufacturing added value of the textile and clothing sector on the one hand and of the machine and transport equipment sector on the other hand, but it is only available for some of the countries and for a few years, which unfortunately are not allowing econometric investigation. The shares of textile and clothing in total real manufacturing added value strongly decreased in the 8 countries for which data are available (see Table 1). All these countries had a negative annual growth rate of the real added value of textile and clothing during the period except Ethiopia. On contrary, the shares of machine and transport equipment increased and their real growth rates were positive in all countries except Ethiopia[8].

[8] In total, all 8 countries had a positive growth rate of total real manufacturing added value, (Fig. 1).

Table 1: Shares of the real added values of the textile and clothing and the machine and transport equipment in total manufacturing added value and their annual average growth rates in 8 African countries

	Share in total manufacturing added value (%)				Annual growth rates (% 2005 $)	
	Textile and clothing		Machine and transport equipment		2000-2010	
	2000	2010	2000	2010	Textile and clothing	Machine and transport equipment
Ethiopia	11.6	8.06*	7.01	1.44	1.94*	-1.58*
Kenya**	8.79	4.32**	2.35	2.46	-3.41**	4.90**
Malawi	5.21	1.54	0.26	1.19	-3.52	11.9
Mauritius**	53.8	30.92**	1.34	3.03	-3.99**	3.84**
Morocco	17.8	9.74	4.20	4.66	-2.86	4.13
Senegal	3.1	1.97	1.66	1.94	-5.94	5.04
South Africa	5.3	1.77	13.71	14.36	-4.86	2.43
Tunisia	35.1	18.96	3.24	8.48***	-3.95	18.75***

* 2009; ** 2011; ***2007

Note: The real added values of textile & clothing, and machine & transport equipment are calculated as the products of their shares in total manufacturing added value multiplied by total manufacturing added value and divided by the deflator of manufacturing added value (2005=100). The deflator is calculated as the ratio between nominal and real manufacturing added values.

Source: World Bank *World development indicators*.

Exports of manufactured goods of African countries to the world

As underlined in the introduction, African manufacturing production is mainly sold in domestic markets. The share of African exports of manufactured goods in their total manufacturing output is generally low, although it varies from one country to another: Table 2 reports the shares for the countries in which the data are available and shows the two extreme cases: 0.3% in Burundi and 29% in Mauritius in 2010[9].

Table 2: Shares of African exports of manufactured goods in manufacturing output in 2010

Mauritius	28.70	Egypt	17.64
Morocco	28.36	Malawi	6.96
Senegal	20.17	Ethiopia	6.55
Botswana	19.19	Eritrea	2.92
Tanzania	18.26	Algeria	2.44
Kenya	18.24	Burundi	0.33
South Africa	17.85		

Source: UNCTAC *stat*. ONUDI *Indstat2.*

[9] We compare exports to output because exports are not added values as well as output.

Africa mainly exports raw materials, in particular oil, which accounted for more than a half of its total exports over the period from 2000 to 2013. The share of exports of manufactured goods of African countries in their total exports decreased from 22% in 2000 to 17% in 2013, in a context of increasing prices of raw materials. The real exports of manufactured goods of African countries increased from 2000 to 2013 at a rate of 7.5% per year on average, which is higher than the world average (5.3%), but from a very low initial level[10]. Therefore their share in the world exports of manufactured goods stayed very low, passing from 0.65% in 2000 to 0.86% in 2013. Europe and the United States are the main markets for African exports of manufactured goods, but their share decreased in favor of emerging markets during the same period[11]. The modest performance of African exports of manufactured goods is mainly due to the exports of textile and clothing whose share in total exports of manufactured goods of African countries passed from 34% to 17% while the export share of machine and transport equipment increased from 25% to 37%.

Imports of manufactured goods by African countries from China and from the rest of the world

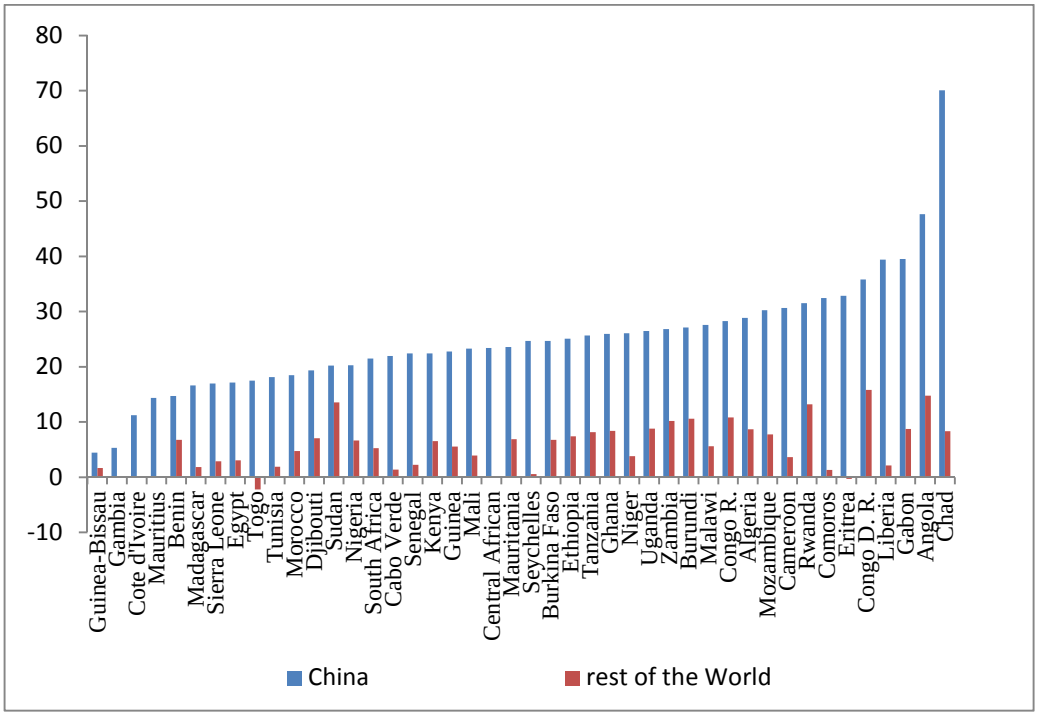
African imports of manufactured goods from China increased from US$ 4.4 billion in 2000 to US$ 86.7 billion in 2013, i.e. an average annual growth rate of 28%, which was much higher than that of imports from the rest of the world (13%). China's share in African global imports of manufactured goods thus increased from 5% in 2000 to 25% in 2013, with considerable variations between African countries (from a share of 2.7% in Swaziland to 61% in Togo in 2013). The yearly average growth rates of real imports of manufactured goods from China by African countries are all positive and significantly higher than those from the rest of the world.[12] The rates of growth have strongly varied from one country to another both for the imports from China and from the rest of the world with two extreme countries from Guinea-Bissau (4.4%) to Chad (70%) for the imports from China and from -2.2% in Togo to 15.8% in Congo D.R. for those from the rest of the world (Fig. 2).

[10] E.g. US$ 33 billion in 2000

[11] from 63% in 2000 to 41% in 2013

[12] In four countries (Togo, Eritrea, Cote d'Ivoire and Gambia) the imports from the rest of the world have decreased.

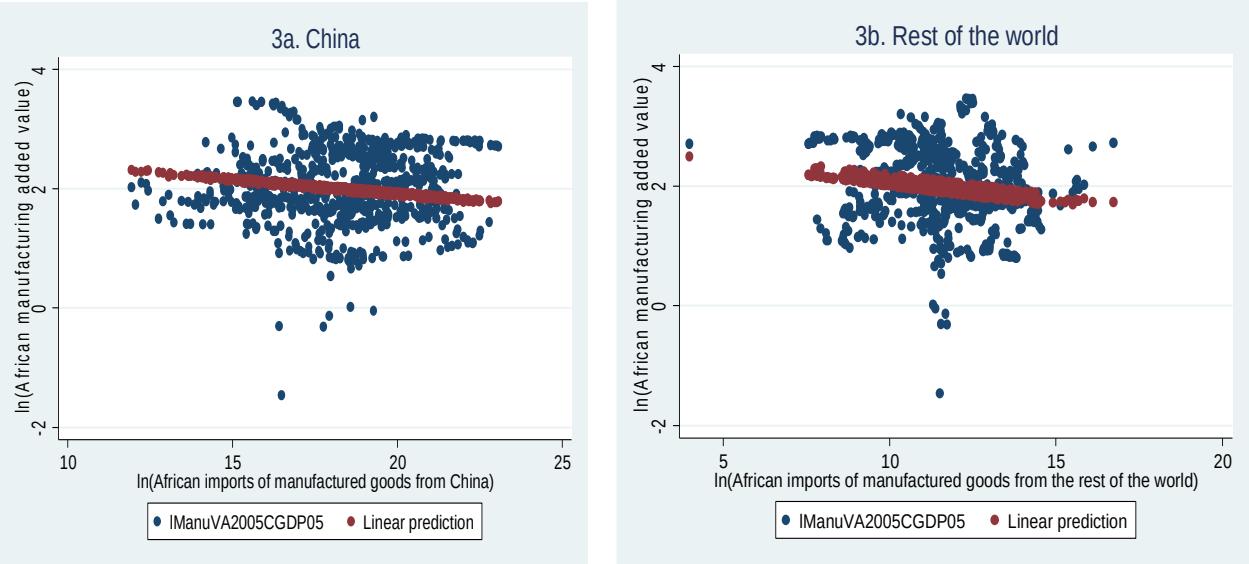
Figure 2. Annual average growth rates of the volumes of the imports of manufactured goods from China and the rest of the world by African countries (2000-2013)



Source: *Unctad Stats,* the United Nations.

The previous literature suggested that the strong growths of the imports of manufactured goods from China by African countries have negatively affected their manufacturing added value. This point seems to be reinforced by Fig 3a which represents the negative statistical relationship between the manufacturing added value of African countries and their imports of manufactured goods from China, both relative to the real GDP of African countries. Fig 3b shows that it also appears a negative relationship between manufacturing industry in African economies and the imports of manufactured goods from the rest of the world.

Figure 3. Statistical relationships between real manufacturing added value of African countries and their imports of manufactured goods from China and the rest of the world (relative to their real GDP 2005 US $) for the years 2000 to 2013



Note: individual and time period effects are controlled for the estimation on panel data for 44 African countries over the period 2000 to 2013.

Africa mainly imports textile and clothing, and machine and transport equipment from China. These two categories represented respectively 32% and 30% of African total imports of manufactured goods from China in 2000, and 19% and 37% in 2013. They respectively increased at an annual average growth rate of 18% and 27%, against only 2.7% and 8.1% from the rest of the world. The parallel between the growth of textile and clothing imports from China and the decrease of the production of the same goods in Africa is striking. On the contrary the stronger growth of African imports of machine and transport equipment seems to be less detrimental to the production of such equipment by African countries, probably because Africa's produced and imported of capital goods are not the same kind and because a part of capital imported goods are used for domestic manufacturing.

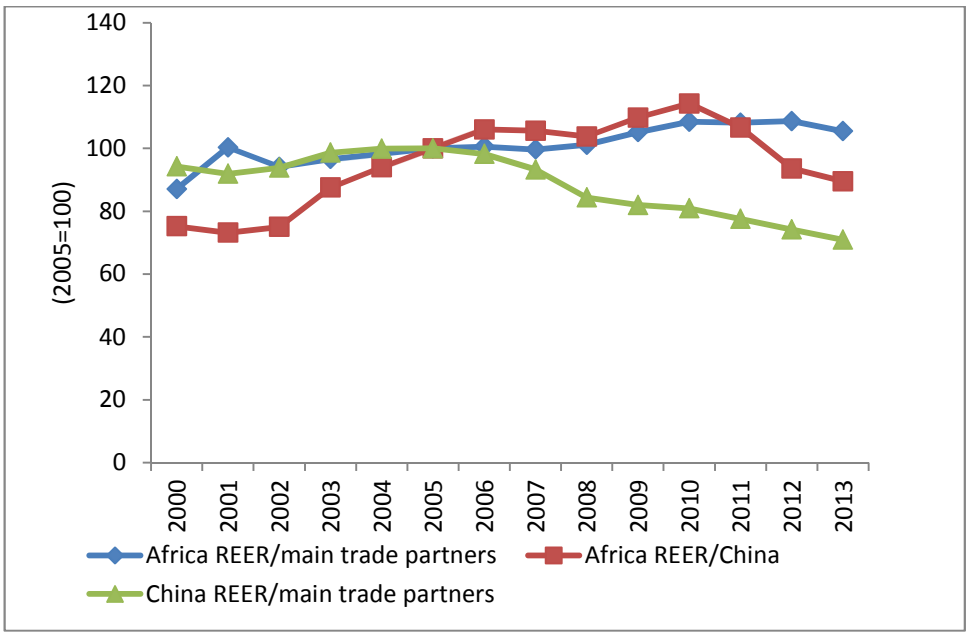
Real exchange rates of African countries

The changes in the imports of manufactured goods by African countries must also be compared to those of the real exchange rates of African countries which measure the relative prices between countries. The real exchange rate issue is all the more important because several African countries have experienced a strong appreciation of their real exchange rates (see Fig 4). The appreciation of the real exchange rate of Africa (as a whole) relative to the currencies of the main countries from which African countries import manufactured goods was 21% from 2000 to 2013[13]. This is higher

[13]The real exchange rate of Africa (African countries as a whole) is calculated as a geometric average of the real effective exchange rates of African countries weighted by the trade share of each African country in the total trade of the studied African countries. The real effective exchange rate of an individual African country is measured as the geometric average of the real bilateral exchange rate of this African country relative to its main trade partners weighted by the trade share of each partner in the total of all the studied trade partners of the country.

than the appreciation relative to the renminbi (19%), which is due to the recent appreciation of the renminbi relative to the US dollar since 2011. However, when considering just the period from 2000 to 2010, the real appreciation of African countries' currencies relative to the renminbi was higher (52%), than the appreciation of 25% relative to their other main trade partners. The evolution of the Chinese real exchange rate relative to the currencies of African countries as a whole has been markedly different from that of its exchange rate relative to the currencies of China's main trade partners. From 2000 to 2013, the renminbi depreciated by 19% in real terms relative to African currencies, while it appreciated by 25% relative to the currencies of China's main trade partners (Fig 4).

Figure 4. Real exchange rates of African countries relative to China and to their other main import partners compared to China's real exchange rate relative to its main trade partners

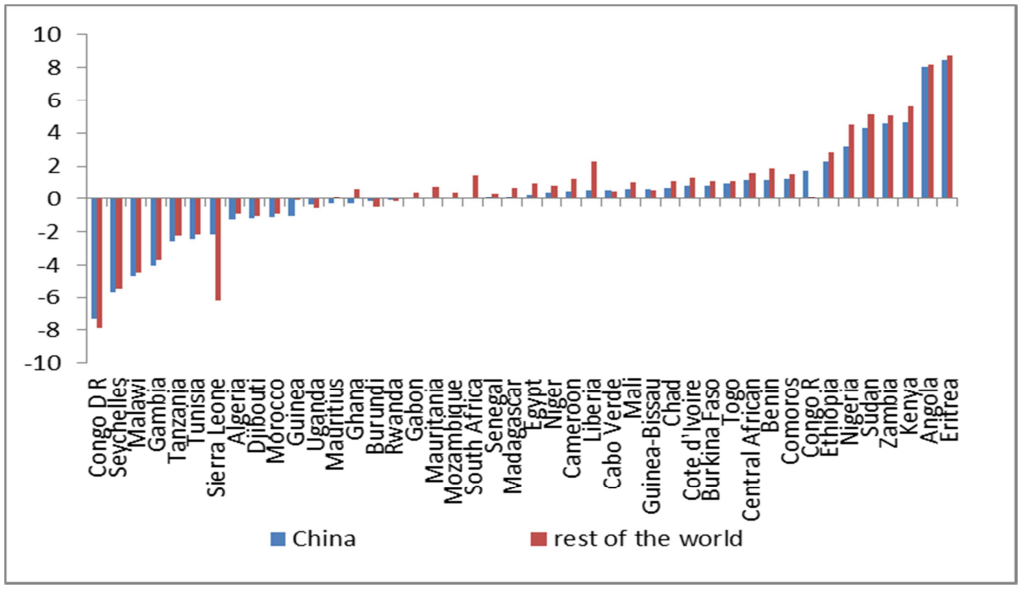


Note: A rise in the curve means an appreciation of the real effective exchange rate of African countries relative to their trade partners, or an appreciation of the real exchange rates of African countries relative to China, and it means a depreciation of the real effective exchange rate of China relative to its trade partners (and inversely).

Source: IMF's *International Financial Statistics* and CERDI calculations

The changes in the real exchange rates of individual African countries relative to China exhibit great diversity, as do their exchange rates relative to their other trading partners (Fig. 5). Over the period from 2000 to 2013, the currencies of 29 African countries appreciated relative to the renminbi in real terms, while those of the rest depreciated, with the two most extreme cases being the real appreciation of the Eritrean nakfa by 8.1% and the real depreciation of the Congolese franc (the currency of the Democratic Republic of Congo) by 7.3% (Fig 5). The diversity of the changes in the real exchange rates of African countries allows us to make an econometric estimation of the controversial impact of real exchange rates on African countries' manufacturing and to look at the channels of transmission.

Figure 5. Annual average changes of African real exchange rates, 2000-2013 (%)

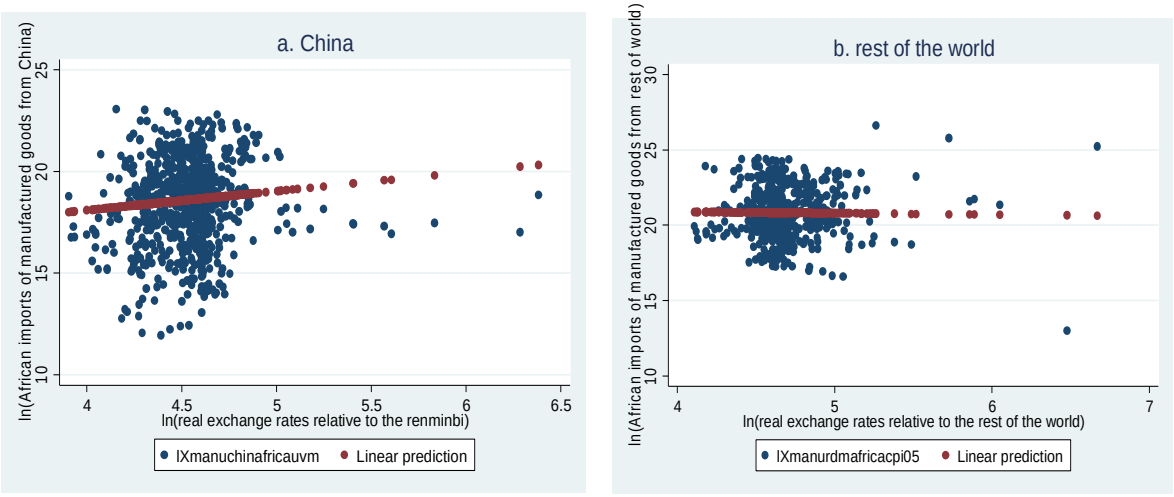


Note: A positive value means a real appreciation of African currencies relative to the renminbi and to the rest of the world.

Source: Authors' calculations using data from the IMF's *International Financial Statistics*.

It is likely that the real appreciations of African currencies have positively affected their imports of manufactured goods from China as found in Guillaumont Jeanneney and Hua (2015). This point seems to be supported by Fig 6a, which represents the statistical relationship between the imports of manufactured goods from China by African countries and their real exchange rates relative to the renminbi. This simple statistical relationship is positive, but with great dispersion for low level of real exchange rates; the positive relationship seems to be drawn by strong real appreciations of African currencies. The same relationship between the imports of manufactured goods from the rest of the world by African countries and their exchange rates relative to the currencies of the rest of the world is less evident (Fig 6b).

Figure 6. Relationships between the volumes of the imports of manufactured goods from China and from the rest of the world by African countries and their real exchange rates, 2000-2013



Note: individual and time period effects are controlled for the estimation on panel data for 44 African countries over the period 2000 to 2013.

To sum up, the statistical analysis shows that the manufacturing industry of African countries is mainly oriented to domestic market which justifies the choice of this paper analyzing manufactured added value rather than exports. It suggests that China's competition effect on manufacturing value added may pass through the volume of the imports of manufactured goods from China by African countries and through their real exchange rates relative to the renminbi. The competition effect from the rest of the world may be mainly due to the volume of imports of manufactured goods from the rest of the world. In the next section, an econometric model is proposed to check if the statistical links still exist once the control variables are added.

3. The econometric model

Two types of factors affect manufacturing added value in Africa: on the one hand, the competition that foreign exporters of manufactured goods exert with regard to African producers, and on the other hand domestic structural factors which determine transaction costs.

Impacts of foreign competitors

Exports of foreign countries to African markets (e.g. the imports of African countries) may influence African domestic production by their volume and by their price. The more plentiful the manufactured goods exported by foreign countries, the more significant the potential negative effect on the manufacturing of African countries is likely to be, all the more so as they are the same kind of goods. This volume effect can be written as

$$lnMAV_i = alnM_{fi} \qquad \text{with a} < 0 \qquad (1)$$

Where MAV_i is the manufacturing added value of an African country i, M_{fi} its imports of manufactured goods from country f, ln natural logarithm. The coefficient a captures the volume effect of imported goods.

The relative price of goods between African countries and foreign competitors may exert two opposite kinds of effect on manufacturing production. According to the traditional theoretical view, the higher the relative price between African countries and foreign competitors (e.g. a real appreciation of the exchange rates of African countries) the more significant the negative effect on the manufacturing of African countries is likely to be. Indeed, an increase of the relative price of domestic goods reduces the competitiveness of local businesses relative to foreign competitors and then stimulates imports of manufactured goods and reduces exports; in this way it may be detrimental to manufacturing[14].

In a more general way, a real appreciation not only implies a rise in domestic prices relative to foreign prices, but also a change in the internal structure of prices or a rise in the price of non-tradable goods relative to the price of tradable goods. Therefore, a currency appreciation

[14] Guillaumont Jeanneney and Hua (2015) have shown the positive effect of the appreciation of the currencies of African countries on their imports from China.

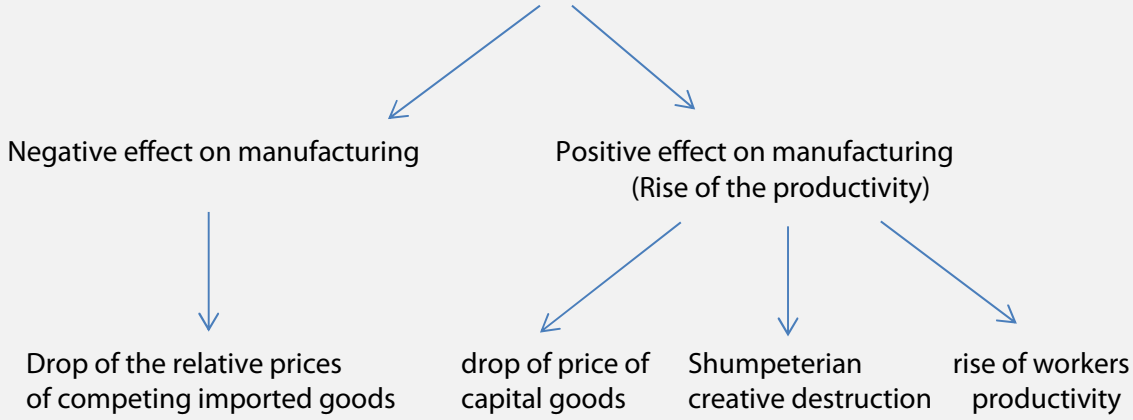
increasing the cost of labor (expressed in tradable goods), the profitability of manufacturing becomes damaged and the incitement to produce and innovate is reduced; resources are thus allocated to non-manufacturing non tradable sectors. It is why Rodrick (2008) advises the governments of low income countries to systematically undervalue their exchange rates in order to compensate for the handicaps they face due to market failures.

However, some arguments act in the other direction. The first argument is that a real appreciation reduces the relative cost of imported capital goods and increases wages relative to the cost of capital. This induces a more capital intensive production system, encourages technological innovations, and so increases labor productivity and manufacturing competiveness. Therefore, as already notes, it is certainly possible that imports of certain types of manufactured goods such as machines and transport equipment are favorable to the manufacturing competiveness of African countries. It should be noted that the share of Africa's imports of machines and transport equipment from China reached 37% in 2013.

Other arguments may be mentioned (Guillaumont Jeanneney and Hua, 2011). The intensification of foreign competition due to a real appreciation of a currency (or a rise of the domestic price relative to foreign ones) is favorable to the productivity of domestic manufacturing firms, as some of these firms are obliged to close their worst-performing factories or even close down. This is a kind of Schumpeterian "creative destruction" which benefits the best-performing businesses and seems to be the case, for example, for the Ethiopian shoe industry (Gebre-Egziabher, 2009; Redi, 2009; Sonobe et al, 2009). Another argument, and a more important one in a low-income country, is that a real appreciation of the real exchange rate increasing the real remuneration for unskilled workers expressed in tradable goods would induce an improvement in the efficiency of workers in countries where the wages of unskilled workers are still very low (Guillaumont and Guillaumont Jeanneney, 1991). As early as 1957, Leibenstein stressed that in developing countries, labor remuneration which is too low may negatively impact workers' health and their working capacity. He also showed that the motivation of workers affects efficiency – what he referred to as "X-efficiency" (Leibenstein, 1957, 1966). This hypothesis appears relevant to the context of Africa, where workers' wages are particularly low.

In brief, real appreciation of exchange rates may exert two opposite effects on manufacturing (Fig 7). We assume that a small appreciation of the local exchange rate would improve the productivity of local businesses, offsetting the rise in the cost of labor; however it is no longer true in the case of a big appreciation which would deteriorate competitiveness and profitability.

Figure 7
Manufacturing impact of real exchange rate appreciation



We add real exchange rate into equation 1 to capture these effects

$$lnMAV_i = alnM_{fi} + blnRER_{fi} \qquad (2)$$

with RER_{fi} real exchange rate of an African country i relative to its foreign partners, and b >0 captures the positive productivity effect. To capture the supposed non-linear effect of the real exchange rate or its turning point, a squared term of the real exchange rate is added to equation 2 as follows:

$$lnMAV_i = alnM_{fi} + blnRER_{fi} + c\ln RER_{fi}^2 \qquad (2bis)$$

In equation 2 (or 2bis) the coefficient of the real exchange rate does not capture the whole impact of the real exchange rate variable since exchange rates affect the volume of African imports, which is also in the equation. Omitting the volume of these imports would allow us to estimate the total effect of exchange rates. The coefficients of the exchange rates are then expected to be lower than those in equation 2 because the real appreciation of exchange rates favors imports which reduce the local manufacturing industry.

In equation 3 we separate China's effect from that of the rest of the world because African imports from China have grown faster than those from the rest of the world, and it is likely that they have a specific impact, due to their own characteristics:

$$lnMAV_i = a_c lnM_{ci} + a_r lnM_{ri} + b_c lnRER_{ci} + b_r lnRER_{ri} \qquad (3)$$

with $M_{ci}\ and\ M_{ri}$ the imports of manufactured goods of an African country i from China and from the rest of the world, RER_{ci} and RER_{ri} the real exchange rates of an African country relative to China and the rest of the world.

Impact of structural factors, tariff exonerations and trade agreements

Many structural factors affect the efficiency of domestic production through transaction costs. These include the size of the domestic market, the level of infrastructure, political stability and absence of violence, financial development and human capital, all of which are needed to explain the development of the manufacturing sector in Africa (Carey et al, 2007, Cadot et al, 2015). Certainly, the volume of imports of manufactured goods of African countries is sensitive to transaction costs, but much less than their domestic production[15]. Moreover, in landlockedness is traditionally considered as an obstacle to manufacturing industry in African countries. Exonerations of customs duties may influence Africa's manufacturing, as some African countries belong to customs unions and have signed agreements with the United States (i.e. the African Growth and Opportunity Act, or AGOA) or with the European Union (i.e. the "Everything but Arms" initiative, or EBA) allowing quota- and tariff-free access to their markets (de Melo and Portugal-Perez, 2012). We choose to introduce as customs unions the West African Economic and Monetary Union (WAEMU) and the Central African Economic and Monetary Community (CAEMC), because they have a common currency and are the most complete and efficient customs unions in Africa (Carrère, 2004, 2006)[16]. The suppression of customs duties by developed countries (in order to make African exports easier) may have positive impacts on manufacturing, while the expected signs of African customs unions are uncertain since they can stimulate imports as well as exports with neighboring countries. All these control variables as well as three disturbance terms (unobserved individual effects fixed over time, time effects, and error terms) are added to equation 3 as follows:

$$lnMVA_{it} = a_c lnM_{cit} + a_r lnM_{rit} + b_c lnTCR_{cit} + b_r lnTCR_{rit} + clnPC_{it} + dlnINF_{it} + eG_{it} + fInF_{it} + glnK_{it} + hL_{it} + j_1 AGOA_{iust} + j_2 EBA_{iEt} + j_3 CU_{it} + \mu_i + \tau_t + \varepsilon_{it} \quad (4)$$

Where *PC* is private consumption (which captures the size of the domestic market), *INF* level of infrastructure, *G* political stability and absence of violence, F financial development, K human capital, L a dummy variable for landlocked status, equal to 1 for landlocked African countries and 0 otherwise. *AGOA* and *EBA* are dummy variables with value equal to 1 when African countries participate in customs agreements with the United States or with Europe and 0 otherwise, *CU* represents two dummy variables, equal to 1 if African countries belong to a customs union either to West African Economic and Monetary Union (WAEMU) or to Central African Economic and Monetary Community (CAEMC). The indices *i*, *c*, *r* and *t* represent respectively, African countries,

[15] Seven overseas Special Economic Zones (SEZ) have been created in African countries by the Chinese government, with the objective of transferring its own successful experience of industrialization to the recipient countries, in order to develop African manufacturing activities (for details, see Bräutigam and Tang, 2011, 2014). Although they are expected to have a positive impact on manufacturing added value, they have not yet been shown to be statistically significant due to the fact that the SEZs are either in their first period of operation or are still under construction. Because at the moment the calculated coefficient for the special economic zones is not statistically significant, we have not included this variable in our model.

[16] WAEMU: Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. CAEMC: Cameroon, Chad, the Central African Republic, Congo, Equatorial Guinea and Gabon.

China, the rest of the world, and years. μ_i, τ_t , $and\ \varepsilon_{it}$ are disturbance terms (unobserved effects fixed over time, time period effects, and error terms).

The expected signs of the variables are positive except for the imports of manufactured goods by African countries from China and from other countries that are negative. The signs of real exchange rates, WAEMU and CAEMC are uncertain.

4. Econometric estimation

Sample and data

The econometric analysis of manufacturing added value is applied to the panel data for 44 African countries over the period 2000 to 2013. The first year corresponds to the first China/Africa Cooperation Forum and the choice of the African countries depends on data availability. Equatorial Guinea, Libya, Sao Tome & Principe, Somalia, and Zimbabwe are excluded because of lack of data for manufacturing added value. Botswana, Lesotho, Namibia, and Swaziland are excluded because of lack of data for the origin of their imports of manufactured goods (in the CEPII BACI database), which is used to calculate the trade weights in the real effective exchange rates.

The manufacturing added value is the net output of industries belonging to the International Standard Industrial Classification (ISIC) divisions 15-37 after summing all outputs and subtracting intermediate inputs. The data originate from the World Bank's *World Development Indicators* and are in real terms (2005 US dollars). For Algeria, the *World Development Indicators* give the growth rate of the real manufacturing added value in 2005 dollars, which are converted into volume by using manufacturing value added in 2005 published in the national accounts of Algeria. The *World Development Indicators* provide only nominal manufacturing added values for Chad, Côte d'Ivoire, Niger, and Ghana, which are here deflated by unit value of imports of the corresponding countries to obtain real terms[17] [18].

Data on the imports of manufactured goods by African countries from China and the rest of the world were obtained from UNCTAD statistics. The various real exchange rates come from CERDI and are calculated using the nominal exchange rates and consumer prices issued by the IMF in its *International Financial Statistics*. These are weighted by the geographical origin of imports of manufactured goods from CEPII's BACI database (Gaulier and Zignago, 2010).

Private consumption is real household expenditure in 2005 US dollars, taken from the United Nations Statistical Division. It represents the size of the domestic market and allows us to control for the various size of each African economy. The level of infrastructure is based on the African

[17] Unit values of imports are used since an index of domestic prices of manufactured is unavailable and since manufactured goods are main share of imports. .

[18] Data on manufacturing added value are also published by UNIDO, but they are available only for a few countries, in nominal terms, and for a few years. They are also published by the Groningen Growth and Development Center but only for 11 African countries (Timmer et al, 2014). The World Bank uses national accounts to measure manufacturing added values while UNIDO uses census data to calculate MAV (Ceglowski and Golub, 2007).

infrastructure development index calculated by the African Development Bank (2013), which includes transport, electricity, ICT, water and sanitation. The last year of data was 2010, and we have assumed that infrastructure levels are the same for 2011, 2012, and 2013. The political stability and absence of violence is taken from Kaufmann et al, (2010) and is calculated each year by the World Bank.[19] This measure has estimated values ranging from -2.5 to +2.5, with a higher value indicating better governance. Kaufmann et al, (2010) did not report the data for 2001, which is calculated as the average of the political stability and absence of violence for 2000 and 2002. Financial development is measured as the ratio of liquid liabilities (M3) relative to GDP; this comes from *Financial Development and Structure Dataset* (Thorsten et al, 2000) and *Global Financial Development* (the World Bank). Human capital is taken as the ratio of secondary school pupil enrolment to population, using data from *World Development Indicators*.[20] We used forward and backward extrapolation to fill in the missing observations.

AGOA is a dummy variable equal to 1 for the years in which the sub-Saharan African countries have received AGOA beneficiary status from the United States and 0 for the rest. In 2000, the United States adopted the African Growth and Opportunity Act (AGOA)[21] to facilitate the exports of sub-Saharan African countries to the American market by exonerating customs tariffs under some conditions. Approximately 30 countries are AGOA beneficiaries, and the list is revised each year by the United States. Several countries are added and others are excluded each year. *EBA* is a dummy variable equal to 1 for the 34 African LDCs[22] and 0 for the rest. The *Everything but Arms* (EBA) initiative, adopted by the European Union on 5 March 2001, has resulted in all imports to the European Union (EU) from the LDCs (as defined by the United Nations) being duty-free and quota-free, with the exception of weapons. WAEMU and CAEMC are two dummy variables equal to 1 if country belong to the unions, and zero for the rest.

As all the variables, except political stability, absence of violence and dummy variables are in logarithms, their coefficients represent elasticities. The means and standard deviations of the variables are provided in Table A1, and the definitions and sources of all the variables are presented in Table A2 in the Appendix.

[19] Kaufmann et al, (2010) propose six measures of governance quality: voice and accountability, political stability and absence of violence or terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption (for detailed data, see http://info.worldbank.org/governance/wgi/pdf/wgidataset.xls). It seems to us that political stability and absence of violence or terrorism is particularly relevant in the African context which is marked by political instability and civil wars. In any case, the results of the estimations are similar with the six measures, which in reality are co-related.

[20] We chose to refer to an education indicator rather than to a health indicator, because the availability of qualified workers is viewed by numerous authors as important for manufacturing development (Cadot et al, 2015). In this regard Barro-Lee's data on educational attainment would be a better measure of the level of education, but these data are only available for 20 countries and the years 2000, 2005, & 2010 during the studied period. Even though the data on secondary enrolment are more complete, they still have many missing values.

[21] See www.agoa.info for details.

[22] Angola, Benin, Burkina Faso, Burundi, Cape-Verde, Central African Rep., Chad, Comoros, Congo Dem Rep, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda and Zambia.

Estimation tests and methods

The principal potential econometric problem is the endogeneity of explanatory variables, a difficulty that is met in all the estimations on macroeconomic data due to simultaneity bias, to measurement errors of variables which are a particularly serious problem in African countries, and to the risk of omitted variables. The obtained results of Durbin-Wu-Hausman test do not allow us to accept the null hypothesis of exogeneity of Africa's imports and real exchange rates, as well as the private consumption of African countries, and the financial development of African countries; but not infrastructure, political stability and absence of violence, education, landlockedness, AGOA, EBA WAEMU and CAEMC. As the results of Pagan-Hall test do not allow us to accept the null hypothesis of homoscedasticity, the system estimator of the one-step Generalized Moment Model (GMM) of Blundel & Bond (1998) which is more efficient than IV/2SLS estimator is chosen[23]. The GMM system estimation approach combines an equation in levels in which lagged first-difference variables are used as instruments and a first-difference equation in which the instruments are lagged variables in levels[24]. These lagged variables were completed by the addition of international terms of trade of African countries, the ratio of real GDP per capita of African countries relative to China, official development aid, a dummy variable pegged to the euro, a dummy variable pegged to the dollar and the South-African rand, and oil dummy variable) which are used in Guillaumont Jeanneney and Hua (2015) to explain real exchange rates of African countries. The validity of the instruments is tested by using the Sargan over-identification test, and by verifying the sensitivity of estimated coefficients to reductions in the number of instruments (Roodman, 2009a, b). The results do not allow us to reject the hypothesis on their validity. The instruments are therefore independent of error terms.

However, the GMM has the weakness that the time-invariant independent variables (e.g. landlocked countries and other dummy variables) are lost from the estimation. In order to estimate these effects, the Hausman and Taylor's (1981) estimator is used. This estimator allows time-invariant independent variables such as Landlockedness, AGOA, EBA WAEMU and CAEMC to be kept and the endogenous variables to be instrumented in a random effects model. Moreover as a precaution against the risk of simultaneity of the dependant and explanatory variables, we have lagged one year real exchange rates, Africa's imports and the other determinants of manufacturing value added in the estimations[25].

Before performing the econometric regressions, we need to know if the variables are stationary at an absolute level to avoid spurious results. Panel data unit root tests (Levin et al, 2002 and Im et al, 2003) were applied in which time trend and panel-specific means (fixed effects) options were used; the variables are lagged by one period. The mean of the series across panels is subtracted from the

[23] The results of IV/2SLS estimator are very similar to those of GMM.

[24] Blundel and Bond (1998) showed that this estimator is more powerful than the first-differences estimator derived from Arellano and Bond (1991), which gives biased results in small samples with weak instruments.

[25] As we have no clear theoretical arguments to suppose a one year lag for the impact of real exchange rate variations, we also estimate the same regressions without lags: the result are near even if some elasticities are lower, which is on line with the reality of some delay. The results are available on request.

series to mitigate the impact of cross-sectional dependence (Levin et al, 2002). The results, reported in Table A3 of the Appendix, allow us to reject the null hypothesis that all the panels contain a unit root, so we can accept the hypothesis that the variables are stationary at an absolute level. The results of Chudik and Pesaran (2015) CD test of cross sectional dependence reported in table 3 suggest to accept the null hypothesis that the errors are weakly cross sectional dependent.

Results

The econometric results are presented in Table 3. The results of Hausman and Taylor's (1981) estimator indicate that Landlockedness, AGOA, EBA and the African custom unions have had no impact on African manufacturing added value, consistent with the fact that the share of exported goods in manufacturing added value is weak in African countries (columns 1, 3, 5 and 7 of Table 3). These results reinforce the choice of this paper which consists to analyze China's competition on African manufacturing value added in domestic market instead of in foreign market. The results of the Hausman and Taylor's (1981) estimator and GMM are very similar. The following comments are based on those with GMM (columns 2, 4, 6 and 8 of Table 3).

The key factors which affect manufacturing added value are domestic variables of African countries. A rise of 1% in household consumption increases manufacturing added value by 0.33% (Column 6 of Table 3). Good infrastructure, political stability and absence of violence or terrorism and financial development exert significant positive effects on manufacturing added value[26]. The effect of education is not statistically significant, probably due to the quality of the data for education.

The assumption that Africa's imports of manufactured goods from China and from the rest of the world are detrimental to African industrialization is confirmed. Their estimated coefficients are -0.04 and -0.08, respectively (Column 2, 4 and 6 of Table 3). The coefficient of African imports from China is lower than that from the rest of the world, probably due to the high share of machine and transport equipment in African imports from China. As the growth of African imports of manufactured goods from China (28%) was more than double the growth of imports from the rest of the world (12.9%) during the period from 2000 to 2013, China's negative impact on African manufacturing was at an annual average rate of decrease of manufacturing added value of -1.12% (-0.04 x 28%)) and that of the rest of the world was -1.03% (-0.08 x 12.9%), resulting in the total negative effect of imports from foreign countries on African manufactured added value of -2.15% per year on average, which is more than half the annual average growth rate during the same period (3.5%).

In contrast to the traditional view, a weak appreciation of the real exchange rates of African countries is favorable to manufacturing (column 2 of Table 3). This effect seems to be principally

[26]The ratio of private sector credit to GDP, which is the other usual indicator of financial development, was shown to be not significant, probably because banks' loans to small or medium-sized businesses are few; however the availability of a deposit account is more widespread. This result is consistent with that of Guillaumont and Kpodar (2011) on the impact of financial development on the reduction of poverty.

due to the appreciation relative to the renminbi (Columns 4 in Table 3), which probably reduces the price of current consumption goods more than the appreciation relative to the other foreign currencies. It could also be due to the reduced cost of capital due to the imports of machines and transport equipment from China (which made up 37% of the total imports from China in 2013). We have tested if this positive impact of the real exchange rate is decreasing and may be reversed. When the appreciation is strong, the rise of the cost of labor is no longer compensated by an improvement in the firm productivity. This appears to be the case when the real exchange rate and its square are simultaneously introduced into the regression (Columns 5, 6 Table 3). The turning point of the real exchange rate is 120, suggesting that a high appreciation of African currencies exerts a negative effect on manufacturing, while a lower appreciation of the currencies has a positive effect. During the studied period from 2000 to 2013, 11 African countries (Angola, Egypt, Eritrea, Ethiopia, Guinea, Gambia, Kenya, Madagascar, Sudan, Congo D. R. and Zambia) had their currencies appreciated relative to the renminbi more than 20% compared to 2005, at least one year and on average 3.5 years.

In order to estimate the total impact of real exchange rates, we removed the volumes of the imports of manufactured goods from China and the rest of the world from the regressions (Columns 8 in Table 3). The coefficient of real exchange rates of African countries against China remains significant and is slightly decreasing (from 0.23 in Column 4 to 0.21 in Column 8). This slight decrease (equal to 0.02) was expected according to Figure 6a and to the findings of Guillaumont Jeanneney and Hua (2015) about the positive elasticity of African imports from China relative to the real appreciation of African currencies, i.e. 0.38. As the elasticity of manufactured added value relative to imports from China is 0.04 (Columns 2, 4 and 6), the expected decrease is 0.02 [0.04 x 0.38 = 0.02]. In brief, the positive impact of the real appreciation of African currencies relative to the renminbi on manufacturing production is slightly compensated by its positive impact on the volume of China's exports which are detrimental to African production.

We estimated two supplementary equations to test the stability of the obtained results. We removed either South Africa or Mauritius from the sample to see if the results stay the same. South Africa has the largest and the most developed economy with the most advanced manufactured sector on the African continent, and is the largest importer of China's goods. Rodrik (2016) argued that Mauritius' manufacturing is the most developed in the African continent. The obtained results when either South Africa or Mauritius is removed from the sample (columns 9 and 10, table 3) are very similar to the total sample.

5. Conclusion

In this paper, we focus on the impacts of Chinese competition (represented by the volume of the imports of manufactured goods from China and real exchange rates) on Africa's manufacturing added value. To this end, we use a panel data of 44 African countries over the period from 2000 to 2013 to estimate a model of manufacturing. We control for the usual determinants, such as the size of the domestic market, the quality of infrastructure, political stability and absence of violence,

financial development, education, landlocked status, tariff exoneration and trade agreements, and we confirm that the size of the domestic market, improvements in domestic infrastructure and in financial development, political stability and absence of violence are essential for African manufacturing industry.

We find that the imports of manufactured goods by African countries from China and other countries exert a negative effect on African manufacturing, while a moderate real appreciation of African currencies relative to the renminbi influences manufacturing added value positively. This may be explained by the reduced cost of imported machine and transport equipment from China (which accounted for 37% of African total imports from China in 2013), by an engine of Schumpeterian creative destruction and by the reduced price of imported consumer goods, which raises the standard of living of poor workers and therefore improves their productivity. A systematic real depreciation of African exchange rates would probably not be appropriate, as it would have a negative impact on the productivity of local firms. However, a big real appreciation which pushes the real exchange rate index beyond 120 (on 2005 basis) could exert a negative effect on African manufacturing, as predicted by the traditional theory. We observe that during the studied period 2000-2013, 11 African countries had their currencies appreciated more than 20% relative to the renminbi compared to 2005 at least one year.

African manufacturing industry is still low. Locally produced manufactured goods are limited and are mainly intended for domestic markets. African manufacturing businesses suffer greatly in their domestic markets from import competition from China and other foreign countries, which makes African manufacturing industry much more difficult. In some African countries they also suffered from a big real appreciation of the currency which increases imports and excessively raises labor cost. From this standpoint, the appreciation of the renminbi relative to the African currencies since 2010 was good news (Fig. 4). It contributed to the recent decrease in labor cost in African countries as observed by Ceglowski et al (2015), while China is losing its competitiveness in labor intensive manufacturing industries. But recently the renminbi has depreciated relative to the dollar and in future its evolution is unpredictable.

As well as exchange rate policies, the improvements in infrastructure, financial development, and political stability and absence of violence, in which African governments should play a leading role, seem essential for the development of manufacturing in African countries.

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Appendices

Table 3: The determinants of real manufacturing added value of African countries (2005 US dollars), 2000-2013

	1 HT	2 GMM	3 HT	4 GMM	5 HT	6 GMM	7 HT	8 GMM	9 GMM no South Africa	10 GMM no Mauritius
ln(real imports of manufactured goods of	-0.06***	-0.04***	-0.06***	-0.04***	-0.06***	-0.04**			-0.04**	-0.03**
African countries from China)t-1	(-3.41)	(-3.03)	(-3.51)	(-3.16)	(3.41)	(-2.87)			(-2.99)	(-2.80)
ln(real imports of manufactured goods of	-0.08**	-0.08***	-0.08**	-0.08***	-0.07**	-0.08***			-0.08***	-0.09***
African countries from rest of the world)t-1	(-2.11)	(-3.18)	(-2.09)	(-3.42)	(-2.02)	(-3.41)			(-3.39)	(-3.53)
ln(real effective exchange rates of African	0.20***	0.28***								
countries relative to import partners)t-1	(3.37)	(5.67)								
ln(real exchange rates of African countries			0.004	-0.06	0.01	0.09	0.03	0.09	0.10	0.08
to its import partners except China)t-1			(0.03)	(-0.51)	(0.10)	(1.45)	(0.21)	(1.50)	(1.51)	(1.23)
ln(real bilateral exchange rates of African			0.25*	0.23***	4.93**	3.16**	0.22*	0.21**	3.17**	3.20**
countries relative to China)t-1			(1.86)	(3.95)	(2.10)	(2.22)	(1.72)	(2.82)	(2.14)	(2.22)
ln(real bilateral exchange rates of African					-0.52**	-0.33**			-0.33**	-0.34**
countries relative to China))² t-1					(-2.00)	(-2.08)			(-2.01)	(-2.08)
ln(private consumption of African	0.52***	0.30***	0.52***	0.30***	0.53***	0.33***	0.48***	0.19***	0.33***	0.34***
countries)t-1	(6.78)	(5.14)	(6.79)	(5.29)	(7.00)	(6.11)	(6.68)	(3.81)	(5.96)	(6.16)
ln(infrastructure of African countries)t-1	0.18***	0.28***	0.21***	0.32***	0.22***	0.31***	0.21***	0.28***	0.31***	0.31***
	(2.66)	(5.18)	(2.99)	(6.94)	(3.14)	(6.89)	(2.97)	(5.89)	(6.76)	(6.73)
political stability and absence of violence of	0.25***	0.13***	0.25***	0.13***	0.25***	0.13***	0.24***	0.14***	0.13***	0.12***
African countriest-1	(5.01)	(5.45)	(5.16)	(6.03)	(5.18)	(6.15)	(4.83)	(5.49)	(6.00)	(5.92)
Ln (M3/GDP of African countries)t-1	0.22***	0.23***	0.20***	0.24***	0.19***	0.26***	0.17***	0.23***	0.26***	0.25***
	(4.60)	(6.51)	(4.20)	(7.06)	(3.90)	(7.62)	(3.57)	(6.55)	(7.60)	(7.37)
ln(secondary education of African	-0.01	0.19	-0.01	0.11	-0.04	0.05	-0.03	0.04	0.06	0.06
countries)t-1	(-0.25)	(0.59)	(-0.29)	(1.41)	(-0.66)	(1.09)	(-0.61)	(0.93)	(1.48)	(1.39)
Landlocked African countries	-0.35		-0.34		-0.22		-0.22			
	(-0.69)		(-0.69)		(-0.49)		(-0.49)			
AGOA	0.01		0.01		0.01		0.01			
	(0.40)		(0.48)		(0.44)		(0.44)			
EBA	0.08		0.09		0.03		0.03			
	(0.73)		(0.83)		(0.33)		(0.33)			
WAEMU	-0.06		-0.04		-0.02		-0.02			
	(-0.10)		(-0.08)		(-0.03)		(-0.03)			

CEMAC	-0.65		-0.64		-0.50		-0.50			
	(-0.94)		(-0.92)		(-0.80)		(-0.80)			
Number of observations	568	568	568	568	568	568	568	568	548	548
Number of countries	44	44	44	44	44	44	44	44	43	43
Country-fixed effects	yes	yes	Yes	yes	yes	yes	yes	yes	yes	yes
Year-fixed effects	yes	yes	Yes	yes	yes	yes	yes	yes	yes	yes
CD test[a]	0.42	0.42	0.46	0.32	0.56	0.32	0.36	0.08	0.96	1.14
AR(2)		0.81		0.84		0.88		0.94	0.88	0.87
Sargan test[a]		0.929		0.844		0.934		0.911	0.91	0.84
Durbin-Wu-Hausman test[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pagan-Hall test[a]	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Notes: T-statistics corrected for heteroskedasticity by the White procedure are reported in parentheses. *, **, and *** indicate significance at the 10, 5, and 1% levels of confidence, respectively.

a: p-values

Appendix Table A1: Summary of variables

Variables	Obs	Units	Means	Std. Dev.	Min.	Max
Real manufacturing added values of African countries	568	Million 2005 $	2210	6.2	7.4	47200
Real imports of manufactured goods of African countries from China	568	Million 2005 $	776	1730	0.1	16300
Real imports of manufactured goods of African countries from rest of the world	568	Million 2005 $	4010	7790	33.7	56600
Real effective exchange rates of African countries relative to their import partners of manufactured goods	568	2005=100	104.1	21.2	57.9	345.9
Real effective exchange rates of African countries relative to their import partners of manufactured goods except China	568	2005=100	107.4	22.3	61.0	360.8
Real bilateral exchange rates of African countries relative to China	568	2005=100	94.7	18.4	49.6	272.3
Private consumption of African countries	568	Billion $	16.4	35.4	0.2	226
Infrastructure of African countries	568		18.36	16.86	0.37	84.41
political stability and absence of violence of African countries	568		-0.61	0.51	-1.56	0.86
M3/GDP of African countries	568		34	22	4.12	119
Secondary education of African countries	568		37	22	0	97
AGOA	568		0.70	0.45	0	1
EBA	568		0.5	0.5	0	1
WAEMU	568		0.18	0.39	0	1
CEMAC	568		0.11	0.15	0	1
Landlocked countries	568		0.25	0.43	0	1

Appendix Table A2: Definitions and sources of variables

Names of variables	Calculation methods	Sources
Real manufacturing added value of African countries	Real manufacturing value added of African countries (2005 US$)	World Bank *World Development Indicators*
Real imports of manufactured goods of African countries from China	China's exports of manufactured goods to African countries divided by the import unit values of African countries (2005=100)	UN *Comtrade* UN *UNCTAD stat*
Real imports of manufactured goods of African countries from rest of the world	Exports of manufactured goods of the world (except China) to African countries divided by import unit values of African countries (2005=100)	UN *Comtrade* UN *UNCTAD stat*
Real effective exchange rates of African countries relative to import partners of manufactured goods	Real effective exchange rates of African countries relative to import partners of manufactured goods	Calculated by CERDI using data from the IMF's *International Financial Statistics*
Real effective exchange rates of African countries of manufactured goods relative to import partners except China	Real effective exchange rates of African countries relative to import partners of manufactured goods except China	Calculated by CERDI using data from the IMF's *International Financial Statistics*
Real bilateral exchange rates of African countries relative to China	Nominal bilateral exchange rate of African countries versus China deflated by relative consumer prices between African countries and China	IMF's *International Financial Statistics*
Private consumption of African countries	Household consumption expenditure in 2005 $	United Nation Statistics Division
Infrastructure of African countries	A composite indicator of transport. roads and telecommunication in Africa	African Development Bank
Political stability and absence of violence of African countries	Political stability and absence of violence or terrorism	Kaufmann et al (2010)World Bank
Financial development of African countries	Ratio of liquid liabilities relative to GDP	Global Financial Development
Secondary education of African countries	Ratio of secondary enrolment relative to corresponding population	World development indicators
Landlocked African countries	Dummy variable equal to 1 for landlocked African countries, and zero for the rest.	Authors' identification
AGOA	Dummy variable equal to 1 for African countries benefiting from customs exonerations to the American market , and zero for the rest.	Agoa.info
EBA	Dummy variable equal to 1 for 30 African countries having the status of least developed countries, and zero for the rest.	European Union

WAEMU	Dummy variable equal to 1 for Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, Togo and zero for the rest.	Carrère, 2004, 2006
CAEMC	Dummy variable equal to 1 for Cameroon, Chad, Central African Republic, Equatorial Guinea, Gabon, and Republic of Congo and zero for the rest.	Carrère, 2004, 2006

Appendix Table A3. Results of panel data unit root tests

Variables	Levin-Lin-Chu unit root test*	Im-Pesaran-Shin unit root test*
Real manufacturing value added of African countries	0.0000	0.0000
Real imports of manufactured goods of African countries from China	0.0000	0.0000
Real imports of manufactured goods of African countries from rest of the world	0.0010	0.0000
Real effective exchange rate of African countries relative to import partners of manufactured goods	0.0027	0.0092
Real effective exchange rate of African countries relative to import partners of manufactured goods except China	0.0065	0.0073
Real bilateral exchange rates of African countries relative to China	0.0021	0.0088
Infrastructure of African countries	0.0000	0.1645
Private consumption of African countries	0.0000	0.0000
Political stability and absence of violence of African countries	0.0000	0.0000
M3/GDP of African countries	0.0021	0.0051
Secondary education of African countries	0.0036	0.0021

Note. *P-value. The panel data unit root tests are applied with time trend and panel (fixed effects) means.

"Sur quoi la fondera-t-il l'économie du monde qu'il veut gouverner? Sera-ce sur le caprice de chaque particulier? Quelle confusion! Sera-ce sur la justice? Il l'ignore."

Pascal

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