Impact of China’s Economic Cooperation and OFDI on its Trade with Africa

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ABSTRACT

China’s increasing engagement in Africa since 2000 is often seen as driven by market potential and natural resources endowments with however an absence of empirical studies. To complete this absence, a “financial engagement augmented” gravity model is proposed. It is applied to China’s bilateral trade with 45 Sub-Saharan African countries over the period from 2000 to 2010. We show that the activities of economic cooperation favour exports to Africa whereas its OFDI increases exports to and imports from Africa; both explaining 35% of the annual average growth rate of China’s exports to Africa; and only OFDI accounted 45% for the imports from Africa. China tends to export manufactured goods to countries having better governance while to import raw materials from those having bad governance. The exports of China’s manufactured goods are sensible to real exchange rates whereas the imports of raw materials from Africa are not, but facilitated by the official diplomatic relationship. China’s special economic zones created in Africa decrease the exports of China’s textile and clothing; lighten thus the Chinese competition on African industry. African countries should thus take this opportunity to diversify their industry and to be integrated to the world production system.

Classification JEL: O55; F1; F14, P33
Keywords: Economic cooperation, outwards foreign direct investments, China, Africa, trade

1. INTRODUCTION

The success of the “open door” policy launched in 1978 allows China to become now a middle income country. It rises however the problems of over-production of manufactured goods and the scare of raw materials needed to sustain its high growth. To resolve these problems, China has been making great effort, particularly since the “go out” strategy, to look for new markets across the world. As part of this effort, China turned to Africa following the first China-Africa Cooperation Forum in 2000. China’s trade with Africa has intensified; beginning at a very low level, it has increased at a rate much higher than that of China’s total trade.

This trade intensification between China and Africa corresponds to a period when China’s economic cooperation (CEC) and outward foreign direct investments (OFDI)¹

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¹ China’s foreign economic cooperation is not an OFDI activity, because Chinese contractors neither risk their own equity capital nor control any foreign affiliate (World Bank, 2008). It is an agreement between a Chinese contractor and a host government that assigns the first the responsibility to realize a project and to secure the
increase strongly. China’s economic cooperation in Africa dated in 1955, and refers to contracted engineering projects in infrastructure undertaken by Chinese contractors and financed by international organizations, foreign investors, local governments or the Chinese government through its foreign aid programs (National bureau of Statistics of China). The revenue of China’s contracted engineering projects realized in Africa increased much more quickly than its total revenue in the world (from 11% of the total in 2000 to 36% in 2010).

China’s direct investments in Africa are recent, with small and medium-size private enterprises focusing in the manufacturing trade sector (market-seeking) and state-owned enterprises (SOEs) mainly implicating in large raw materials projects (resource-seeking) (UNCTAD, 2007; Wang, 2007; Kaplinsky and Morris, 2009; Shen, 2013). These investments are facilitated by aid packages in the infrastructures financed by the Chinese government (Cai, 1999). Beginning at a very weak level, China’s African direct investments increased very quickly.

Most previous studies have assessed the merits and risks in China’s moving to Africa, but without empirical analysis (Goldstein et al., 2006; Kaplinsky et al., 2007; Wang, 2007; Zafar, 2007; Asche et al. 2008 and Pilling, 2009 etc…). The recent empirical studies mostly focused on the determinants of China’s OFDI in Africa (Biggeri and Sanfilippo, 2010; Sanfilippo, 2010; Claassen and Bezuidenhout, 2011; Cheung et al., 2012). Only a few papers analysed the determinants of China Africa trade. By using a panel data on 30 African countries and over the period from 1995 to 2007, Alege (2011) showed that traditional gravity variables and African integrating trade agreements are the important determinants of Sino-Africa bilateral trade. De Gruwe et al. (2012) used a traditional gravity model to estimate the role of African government quality in China Africa trade over the period from 1996 to 2009. They show that China strongly imports from African countries having a lower political standing; while China, as developed countries, exports more towards the countries having better governance. However, these two papers do not include China’s economic cooperation and OFDI in their analysis.

Using the panel data of 45 African countries over the period from 2000 to 2010, this paper contributes to the literature by estimating the impact of China’s contracted engineering projects and investments on its exports to and imports from Africa. The obtained results show that, via China’s contracted engineering projects in Africa, the economic cooperation helps Chinese enterprises to export manufactured goods whereas the OFDI favour both exports to and imports from Africa. Thus, market seeking and resources seeking are the objectives of the Chinese investments in Africa, which are facilitated by China’s economic cooperation. We show that China’s economic cooperation and investments in Africa explained 35% of the annual average growth rate of China’s exports to Africa, and only OFDI accounted for 45% for its imports from Africa. China tends to export manufactured goods to countries having better governance while to import raw materials from those having bad governance. The exports of China’s manufactured goods are sensible to real exchange rates whereas the imports of raw materials from Africa are not, but facilitated by the official diplomatic relationship. China’s special economic zones created by the Chinese government in Africa decrease sensibly the exports of China’s textile and clothing; lighten thus the Chinese competition on African industry.

The rest of the paper is organized as following. The second section presents the evolution of China’s economic cooperation and OFDIs in comparison to that of China-Africa trade. The third section proposes a gravity model augmented with economic cooperation and OFDIs, which is applied to the panel data on China’s bilateral trade with 45 African countries.

required capital against the management rights and the resulting profits for a pre-determined period before transferring the rights to the host government (Cheung et al., 2012).
over the period from 2000 to 2010 in section 4. The economic and political implications are given in the conclusion.

2. Evolution of China-Africa trade in comparison with that of China’s contracted engineering projects and OFDI in Africa

2.1. Evolution of China-Africa trade

Beginning at a very low level, China’s trade with Africa has been intensified since the first *China-Africa Cooperation Forum* in 2000. Its exports to Africa passed from US$ 5 billion in 2000 to US$ 60 billion in 2010 with an annual average growth rate of 31%, which is much higher than that of its total exports to the world (23%). China’s imports from Africa passed from US$ 5.6 billion in 2000 to US$ 67 billion in 2010, with an annual average growth rate of 35% (against 19% for its imports from the world) (see figure 1).

Figure 1. The evolution of China-Africa trade and its share of Chinese and African imports and exports

![Graph showing the evolution of China-Africa trade and its share of Chinese and African imports and exports](image)

Source: UN UNCTAD Stat.

Even the recent trade boom, Africa is still a small trade partner for China. The share of China’s exports to Africa in its total to the world passed from 2% in 2000 to 3.8% in 2010 and that of China’s imports from Africa in the total from 2.5% in 2000 to 4.8% in 2010. On contrary, China becomes the most important trade partner for Africa countries since 2009. Its share in total African exports and imports increased respectively from 3.2% and 3.3% in 2000 to 13.2% and 12.1% in 2010 (figure 1). China becomes a dominant partner for many African countries. Sudan, Angola and Democratic Republic of Congo export respectively 61%, 52% and 48% of their exports to China in 2010. Lesotho and Liberia import 47% and 42% of their imports from China in the same year.

China’s African export partners are more diverse than its import partners, and both of them have become increasingly diverse between 2000 and 2010. In spite of this diversification, both remain relatively concentrated. The three importers of Chinese goods the most important in 2010 (South Africa, Nigeria and Liberia) totalled thus a half of Chinese exports to Sub-Sahara-Africa. As concerns China’s imports, Angola, South Africa and Sudan
stay the three most important partners, representing 74% of China’s imports from South Sahara Africa; despite Burkina Faso, Malawi, Gambia, Eritrea, Cape Verde and Sao Tome & Principe had become new partners.

China’s exports to Africa are dominated by manufactured goods (95% of the total in 2010), in which the machinery and transport equipment increased at the highest annual average rate (38% in 2010), following by textile and clothing (25% in 2010). China’s imports from Africa are dominated by raw materials (86% of the total in 2010). Among them, the fuel is the most important good imported by China, passed from US$ 3.7 billion in 2000 to 41.5 billion in 2010, followed by ores and metals which increased very quickly (at an annual average growth rate of 43%), passed from US$ 0.5 billion in 2000 to US$ 16 billion in 2010. Thus, China-Africa trade corresponds well to the conventional international trade model according to which each country exports the goods in which it has comparative advantage, and imports the goods in which it has comparative disadvantage.

2.2. Evolution of China’s contracted engineering projects in terms of economic cooperation and OFDI in Africa

China’s economic cooperation with Africa existed since the Bandung Conference in 1955 and was mainly based on political and ideological considerations. Economic motivations have been increasingly taken into account since 1978. They have been reinforced since the first China-Africa Cooperation Forum in 2000 and particularly “China’s African Policy” in 2006. The Chinese government provides active financial supports which allow Chinese enterprises (mostly undertaken by Chinese state-owned enterprises) to win bids on the African market, mainly in the fields of building highways and roads, bridges, schools, shopping centers, housing and office buildings, water conservancy, dams and power plants etc. China enterprises win about a quarter of all major World Bank construction contracts in Africa, a half of contracts funded by the Africa Development Bank (Brautigam, 2011a) and all the projects of the Chinese aid programs to Africa. Thanks to the last ones, Africa is now China’s second largest engineering contract market (Cheung et al. 2012).

The turnover of China’s economic cooperation in Africa increased very quickly from US$ 1.3 billion in 2000 to 36.3 billion in 2010, i.e. at an annual growth rate of 37%, leading its share in the total to the world increased from 11% in 2000 to 36% in 2010 (figure 2). As the share of revenue coming from China’s aid programs in Africa increase very quickly, several studies (OECD, 2008; Berthélemy, 2009; Biggeri and Sanfilippo, 2010; Sanfilippo, 2010) approximated economic cooperation to China’s aids in Africa because the official aid data are unavailable. The amount of economic cooperation indicates the existing economic ties between China and the host country, because the projects required endorsements by local authorities (Cheung et al. 2012).

China’s outward direct investment in Africa has positively been affected by the “go out” policy, which encourages Chinese enterprises to invest in overseas markets. There was almost no Chinese FDI in the African continent before 1979. Its level was very weak during the “open door” policies in which the main objective of China was to attract inward FDIs from developed countries. Since 1990s, China is emerging as a global capital provider thanks to its high international reserves, and became a major investor in the developing world (UNCTAD, 2007). China invests in African countries, which are traditionally considered to be risky and not usually favored by investors of developed countries (Cheung et al., 2012).

China’s investments in Africa have gone up quite substantially. Between 2003 and 2010, China’s ODI stocks rose twenty-six times, passed from US$ 0.5 billion in 2003 to 13

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2 Brautigam (2011a) criticized this approximation.
billion in 2010$^3$ (figure 2), i.e. at an annual average growth rate of 61%, which is higher than its total growth rate (40% on average). However, its share in China’s total OFDI is still weak, passed from 1.5% in total in 2000 to 4.1% in 2010.

Figure 2. Evolution of China’s economic cooperation and OFDI stocks with Africa and their shares in the total

![Graph showing the evolution of China's economic cooperation and OFDI with Africa and their shares in the total.](image)

Source: China Statistical Yearbook and Statistical Bulletin of China’s Outward Foreign Direct Investment.

China has contracted projects in terms of economic cooperation in all African countries and direct investments in 48 of the 50 countries having diplomatic relationship in 2010$^4$. But their geographical distribution is not equal, and tends to concentrate to African producers of oils and metals. In 2010, the main oil producers are among the most important receptors. Angola, Algeria, Libya, Nigeria, Sudan, Equatorial Guinea and Republican Congo received in total 60% of China’s economic cooperation to Africa.

China’s OFDIs are more concentrated than China’s economic cooperation. The first eight African countries received 77% of China’s total OFDI to Africa in 2010. The share of South Africa represents 31.8% of the total, following by Nigeria. Zambia became the third recipient, following by Algeria, Democratic Republican Congo and Sudan. South Africa is the only African country among the 20 top recipients (classified 8$^{th}$) of China’s OFDI in stocks in the world (China’s OFDI Statistical Bulletin, 2011).

The above statistical analysis shows a coincidence between China’s trade boom with Africa and the strong development of the economic cooperation and OFDI. Consequently, besides the traditional variables, we should take China’s economic cooperation and OFDI into account when analyzing the determinants of China’s exports to and imports from Africa.

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$^3$ The data of China’s OFDI are published since 2003 in Statistical Bulletin of China’s Outward Foreign Direct Investment. They are underestimated because they reflect only government-approved investment projects rather than actual money transfers. Over the period from 1991 to 2005, only the data on the projects of China's outward overseas direct investment approved by the Chinese authorities were published in China Commerce Yearbook.

$^4$ Burkina Faso and Swaziland have diplomatic relationship with China but receives no investment from China.
3. A theoretical model of the impact of China’s economic cooperation and OFDI on the trade between China and Africa

3.1. An augmented gravity model

To isolate the effects of economic cooperation and OFDI on China’s trade with Africa, we propose a “financial engagement augmented” gravity model, in which real exchange rate is added to capture the international competitiveness of Chinese goods. Gravity model is widely applied in the literature of bilateral trade (Anderson, 2011 for literature review); Real exchange rates are used in traditional trade models to estimate aggregate trade (Goldstein and Khan, 1985).

We suppose that there are n exporting countries (i =1…n) in which each has m import markets, and m importing countries (j=1….m) in which each has n export markets. These export and import markets are either separated from one another by transaction costs or brought closer by measures facilitating trade.

The supply of exports of a country i to an importing country j (\(X_{ij}^s\)) depends on its capacity of supply (\(Y_i\)), on the ratio of the export price of exporting country i to importing country j (\(PX_{ij}\)) to the domestic price of country i (\(PD_i\)) (expressed in the same currency), on transaction costs (\(\tau_{ij}\)) and on measures facilitating trade (\(\rho_{ij}\)) between the two countries, as follows:

\[
X_{ij}^s = c_0 Y_i \left( \frac{PX_{ij}^s \times EN_i^s}{PD_i} \right)^{\tau_{ij} \times \rho_{ij}}
\]

(1)

Where, \(EN_i^s\) nominal exchange rate of country i in terms of national currency units per dollar.

Similarly, the demand of a country j for the products of a country i (denoted as \(M_{ji}^d\)) depends on the GDP of importer j (\(Y_j\)), on the ratio of import price of country j from country i (\(PM_{ji}^s\)) to domestic price of alternative goods of importer j (\(PD_j\)) (expressed in the same currency), on transaction costs between the two countries (\(\tau_{ji}\)), and on measures facilitating trade (\(\rho_{ji}\)). The bilateral import demand function is written as follows:

\[
M_{ji}^d = d_0 Y_j \left( \frac{PM_{ji}^s \times EN_j^s}{PD_j} \right)^{\tau_{ji} \times \rho_{ji}}
\]

(2)

Where, \(EN_j^s\) nominal exchange rate of country j in terms of national currency units per dollar.

The market equilibrium between two countries implies that \(X_{ij}^s = M_{ji}^d\), \(PX_{ij}^s = PM_{ji}^s\), \(\tau_{ij} = \tau_{ji}\) and \(\rho_{ij} = \rho_{ji}\)

(3)

From equations 1, 2 and 3, we obtain the following bilateral export and import equations by eliminating the prices:

\[
X_{ij} = M_{ji} = e_0 Y_i Y_j \times ER_{ij} \times \tau_{ij} \times \rho_{ij}
\]

(4)

Where, \(X_{ij}\) is the volume of China’s exports to an African country j, or the volume of imports of an African country j from China (\(M_{ji}\)).

Or \(M_{ji} = X_{ji} = e_0 Y_i Y_j \times ER_{ji} \times \tau_{ji} \times \rho_{ji}\)

(5)

Where, \(M_{ji}\) is the volume of China’s imports from an African country j, or the volume of exports of an African country j to China (\(X_{ji}\)).
Impact of China’s Contracted Engineering Projects and OFDI on its Trade with Africa

\[ e_0 = \frac{d_0 c_1}{d_2 - c_2}, \quad e_1 = \frac{d_0 c_1}{d_2 - c_2}, \quad e_2 = \frac{c_2 d_1}{d_2 - c_2}, \quad e_3 = \frac{d_0 c_2 - c_2 d_2}{d_2 - c_2}, \quad e_4 = \frac{d_0 c_3 - c_3 d_3}{d_2 - c_2}, \]

\[ e_5 = \frac{d_0 c_4 - c_4 d_4}{d_2 - c_2} \]

\[ ER_{ij} = \frac{EN_{ij}^* \cdot PD_{ij}^*}{PD_{ij}^*} = EN_{ij} \cdot PD_{ij}^* \]

\[ EN_{ij} \text{ and } ER_{ij} \text{ represent the nominal and the real bilateral exchange rates of importing country } j \text{ relative to the exporting country } i; \text{ An increase means that the currency of exporting country } i \text{ depreciates, or conversely the currency of importing country } j \text{ appreciates.} \]

3.2. The equations to be estimated

Transaction costs in equations 4 and 5 can be captured by a dummy variable for the landlocked countries \((I_i)\) and a variable measuring the quality of governance \((G_i)\) (see Anderson and Marcouiller, 2002; De Grauwe et al., 2012). The measures facilitating trade are represented by a dummy variable for African countries having established diplomatic ties with China \((R_{ij})\), China’s economic cooperation in Africa \((EC_{ij})\) and China’s foreign direct investments in Africa \((FI_{ij})\). We add finally a dummy variable of China’s special economic zones created by the Chinese government in Africa to export equation and an oil dummy variable to import equation. We rewrite equations 4 and 5 in logarithms (except for dummy variables and quality of governance having values from -2.5 to 2.5) and add disturbance terms \((\mu_j)\) unobserved individual effects fixed over time, \(\gamma_i\) temporal effects, and \(\eta_j\) error terms in order that the equations can be estimated empirically.

The equation 4 of China’s real exports to Africa is rewritten as:

\[ \ln X_{ij} = \ln b_0 + e_1 \ln Y_{ij} + e_2 \ln Y_{ij} + e_4 \ln Y_{ij} + e_6 \ln Y_{ij} + e_8 \ln Y_{ij} + e_5 \ln Y_{ij} + e_7 \ln Y_{ij} + e_9 \ln Y_{ij} + e_3 \ln Y_{ij} + e_0 \ln Y_{ij} + e_1 + \gamma_i + \mu_j. \]

The equation 5 of China’s real imports from Africa is written as:

\[ \ln M_{ij} = \ln b_0 + e_1 \ln Y_{ij} + e_2 \ln Y_{ij} + e_4 \ln Y_{ij} + e_6 \ln Y_{ij} + e_8 \ln Y_{ij} + e_5 \ln Y_{ij} + e_7 \ln Y_{ij} + e_9 \ln Y_{ij} + e_3 \ln Y_{ij} + e_0 \ln Y_{ij} + e_1 + \gamma_i + \mu_j. \]

The equations 6 and 7 allow testing if China’s economic cooperation and OFDI help to realize the objectives of the Chinese government: open up new markets for manufactured goods and secure raw materials to guarantee the needs of China’s domestic economy. As China’s economic cooperation and OFDI are simultaneously introduced to the equations, the coefficients \(e_{52}\) and \(e_{53}\) respectively capture their direct effects on exports and imports, which do not pass through their interaction.

Then, to capture the possible indirect effects of China’s economic cooperation via its impact on OFDI, the last one is regressed on the economic cooperation such as:

\[ \ln FI_{ij} = \ln b_0 + b_1 \ln EC_{ij} + \eta_j + \gamma_i + \mu_j. \]

This equation allows us to check if China’s investments are effectively a transmission channel through which economic cooperation influences China Africa trade; and if so, to calculate its indirect effect. This last one can be calculated as the product of its coefficient of economic cooperation obtained in equation 8 multiplied by the coefficient of OFDI in equations 6 and 7 such as \((b_1e_{53})\).

Inversely, to capture the indirect effects of China’s OFDI via its impact on the economic cooperation, the last one is regressed on the OFDI such as:

\[ \ln EC_{ij} = \ln c_0 + c_1 \ln FI_{ij} + \eta_j + \gamma_i + \mu_j. \]

This equation allows checking if China’s economic cooperation is effectively a transmission channel through which Chinese investments influence China Africa trade; and if so, to calculate the indirect effect, which is the product of its coefficient obtained in equation 9 multiplied by the coefficient of OFDI in equations 6 and 7 such as \((c_1e_{52})\).
Finally, the total effect of China’s economic cooperation and investments can be respectively obtained by adding direct effects and indirect effects as \((e_{52} + b_1e_{53})\) and \((e_{53} + c_1e_{52})\). The second column of Table 3 resumes the direct and indirect effects of economic cooperation and investments on China Africa trade.

4. An econometric analysis of the impact of economic cooperation and OFDI on trade between China and Africa

The objective of this section is to isolate among the determinants of trade between China and Sub-Saharan African countries the role of economic cooperation and OFDI. We present successively the samples, definitions and calculations of variables, the econometric tests and methods and finally the empirical results.

4.1. Samples, definitions and calculations of variables

The econometric analysis is applied to the panel data of China’s trade to 45 Sub-Saharan African countries over the period from 2000 to 2010. Somalia and Zimbabwe are excluded because of lack of data. The studied period begins in 2000 because that year marked the launch of the first China-Africa Cooperation Forum and the beginning of China’s exports to and imports from four new export markets (Botswana, Lesotho, Namibia and Swaziland). The sample is reduced to 43 countries over the period from 2003 to 2010 when China’s outwards foreign direct investments are added to estimations, because China published OFDI data only since 2003 and does not invest in Burkina Faso and Swaziland. The sample is unbalanced, with some countries having more observations than others among the independent variables.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs.</th>
<th>Units</th>
<th>Means</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>China’s real exports to Africa</td>
<td>495</td>
<td>millions $</td>
<td>275</td>
<td>674</td>
<td>0.03</td>
<td>5974</td>
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<tr>
<td>China’s real imports from Africa</td>
<td>351</td>
<td>millions $</td>
<td>330</td>
<td>1008</td>
<td>0.001</td>
<td>8274</td>
</tr>
<tr>
<td>Real GDP of China</td>
<td>495</td>
<td>billions $</td>
<td>2053</td>
<td>666</td>
<td>1198</td>
<td>3243</td>
</tr>
<tr>
<td>Real GDP of Africa</td>
<td>495</td>
<td>millions $</td>
<td>9555</td>
<td>25130</td>
<td>0.8</td>
<td>187234</td>
</tr>
<tr>
<td>Real bilateral exchange rates</td>
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<td>2000=100</td>
<td>118</td>
<td>33</td>
<td>36.3</td>
<td>272</td>
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<td>African landlocked countries</td>
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<td></td>
<td>0.31</td>
<td>0.46</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Distance</td>
<td>495</td>
<td>Kilometers</td>
<td>10930</td>
<td>1399</td>
<td>7878</td>
<td>12968</td>
</tr>
<tr>
<td>African governance quality</td>
<td>495</td>
<td></td>
<td>-0.58</td>
<td>0.73</td>
<td>-2.17</td>
<td>0.99</td>
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<td>Diplomatic relationships</td>
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<td>0.98</td>
<td>0.13</td>
<td>0</td>
<td>1</td>
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<tr>
<td>China economic cooperation in</td>
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<td>millions $</td>
<td>131</td>
<td>370</td>
<td>0</td>
<td>3945</td>
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<tr>
<td>Africa (CEC)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Chinese OFDIs in Africa</td>
<td>351</td>
<td>millions $</td>
<td>64</td>
<td>191</td>
<td>0</td>
<td>2298</td>
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<tr>
<td>China’s special economic zones in</td>
<td>495</td>
<td></td>
<td>0.05</td>
<td>0.21</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Africa (SEZ)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Oil producing African country</td>
<td>495</td>
<td></td>
<td>0.217</td>
<td>0.413</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: definitions and sources see tables annex 1 and 2.

China’s nominal bilateral exports to and imports from Africa are originated from UN COMTRADE. They are respectively deflated by import and export unit values of corresponding African country to obtain the volumes. Export and import unit values are obtained from UN UNCTAC Stat. GDPs of China and African countries are expressed in 2000 USS and come from the World Development indicators, World Bank. Governance is a measure of political stability and absence of violence/terrorism proposed by Kaufmann et al.
Higher values indicate better governance outcomes. Kaufmann et al. (2010) did not report the governance for 2001, which is calculated as the average of the governance between 2000 and 2002. The data on the turnover of China economic cooperation come from China Statistical Yearbooks. China’s outward FDI stocks are originated from Statistical Bulletin of China’s Outwards Foreign Direct Investments, which publishes the data since 2003. They are deflated by import unit value of corresponding African recipient. The means and standard deviations of the variables are provided in Table 1.

4.2. Econometric tests and methods

A potential econometric problem to estimate the equations 6 and 7 is multicollinearity among explanatory variables. The most widely-used diagnostic for multicollinearity is the variance inflation factor (VIF), which estimates how much the variance of a coefficient is “inflated” because of linear dependence with other predictors. A common rule of thumb is that if VIF is superior to 5, then multicollinearity is high (Kutner, 2004). The results of VIF reported in the last column of table A2 show that all are inferior to 3. Thus, multicollinearity is not a serious problem for estimation in this study.

A second potential econometric problem is the endogeneity of economic cooperation and OFDI. Endogeneity is 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 China, and to the risk of omitted variables. It causes inconsistency of the OLS estimates and requires instrumental variable methods to obtain consistent parameter estimates. The Durbin-Wu-Hausman test is often used to check endogeneity. The results reported in table 2 show that China’s economic cooperation and OFDI are effectively endogeneous.

In order to deal with the endogeneity problem and to allow time invariant variables in gravity model, Hausman-Taylor (1981) model with instrumental variables techniques are used in this study as econometric method. It consists estimating a random effect model and uses exogenous time-varying variables as instruments for the endogenous time-varying variables and exogenous time-invariant variables plus the unit means of the exogenous time-varying variables as instruments for the endogenous time-invariant variables.

As a precaution against the risk of simultaneity of the dependent and explanatory variables, we have lagged one year all the explanatory variables such as China’s economic cooperation, China’s OFDIs, real GDPs of China and African countries, real exchange rates, and diplomatic relationship except for oil and inland dummy variables. Moreover, China’s economic cooperation and OFDIs are lagged one year in equations 7 and 8.

4.3. Results of econometric estimations

The econometric results are reported in table 2. In order to have a global idea concerning the respective impact of China’s economic cooperation and OFDI on the recent impressive growth of China’s trade with Africa, the first four columns report the results with one of the two variables. The results show that China’s economic cooperation lagged one year exerts a significant positive impact on China’s exports (column 1), but not for imports (column 2); while China’s OFDIs lagged one year influence significantly China’s imports from Africa (column 4), but not for exports (column 3).

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5 Kaufmann et al. (2010) propose six measures of governance quality such as voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory Quality, rule of law, and control of corruption with estimated values for these governance indicators in the range from -2.5 to 2.5 from 1996 to 2008 except for the years 1997, 1999 and 2001, where higher values indicate better governance outcomes. For detail data, http://info.worldbank.org/governance/wgi/pdf/wgidataset.xls. The results of six measures are similar.
When the two variables are added to the estimations, their coefficients capture the direct effects, i.e. those which do not pass through the other variable. The results show that China’s economic cooperation lagged one year exerts a statistically significant positive impact on exports (column 5), mainly due to its positive effect on exports of machinery and transport equipment (column 6), but a negative effect on China’s imports (column 8); and that the OFDI lagged one year exerts a direct positive effect on China’s exports of textile and clothing (column 7) and on the imports from Africa (column 8).

To capture the possible indirect effect of China’s economic cooperation on exports and imports via its impact on OFDI, the last one is regressed on China’s economic cooperation, both lagged one year (column 9). The estimated coefficient is 0.93, which confirms the hypothesis that China’s economic cooperation actively accompanied Chinese enterprises to invest in Africa. Thus, economic cooperation is effectively the transmission channel through which the Chinese investments influence China Africa trade. Concerning exports, China’s economic cooperation exerts an indirect effect via its investments only on exports of textile and clothing (0.93*0.18=0.17), but not on exports of machinery and transport equipment in which OFDI does not exert a significant direct impact (table 3). It exerts moreover an indirect positive effect on imports (0.93*0.40=0.37) and this positive indirect effect set off the direct negative effect to lead a statistical insignificant impact on imports (table 3). Thus, the total effect of China’s economic cooperation is to 0.18 for exports (0.20 for machinery and transport equipment and 0.17 for textile and clothing).

Finally, to capture the possible indirect effect of China’s OFDIs on exports via its economic cooperation, the last one is regressed on China’s OFDIs, both lagged one year (column 8). The coefficient is estimated to 0.40, which confirms the hypothesis that OFDIs may require more financial assistance in terms of aids to improve investment environment, or provide opportunities to develop privately projects in terms of economic cooperation (Berthelemy, 2009). Thus, the indirect effect of OFDI via the economic cooperation is estimated to 0.07 (0.40*0.18) on China’s exports and to 0.08 (0.40*0.20) on machinery and transport equipment, but is not statistically significant on the exports of textile and clothing. It is estimated to -0.16 (0.40*(-0.39)) on China’s imports. Consequently, the total effects of China’s investment are estimated to 0.07 on exports and to 0.26 on imports (table 3).

Not only the coefficients of the economic cooperation and OFDIs are significant, but the elasticity values also show that the results are economically relevant. During the period from 2000 to 2010, the annual average growth rate of China’s aggregate exports to Africa has been augmented by 6.66% thanks to China’s economic cooperation in Africa and by 4.27% thanks to China’s investments in Africa. More precisely, the exports of China’s machinery and transport equipment have been augmented by 7.4% and 6.3% for textile and clothing. The annual average growth rate of imports from Africa has been augmented by 15.9% thanks to China’s OFDI in Africa, while the economic cooperation did not contribute to import growth. Consequently, China’s economic cooperation and OFDI contribute to respectively explain 35% and 45% of the annual average growth rates of exports to and imports from Africa.

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6 This result is similar to what obtained in Berthelemy (2009). With the estimated coefficient (0.44), he concluded that the stock of FDI has a positive and significant influence on turnover of economic cooperation.

7 The annual average growth rate of was 37% for China’s economic cooperation. The impacts of economic cooperation on the annual average growth rate of China’s exports to Africa is 6.66% (0.18*37%=6.66%), and 7.4% (0.20*37%) for exports of transport and equipment and 6.29% (0.17*37%) for textile and clothing.

8 The annual average growth rate was 61% for China’s investments in Africa. The impacts of CFDI on the annual growth of China’s exports is 4.27% (0.07*61%) and 15.9% (0.26*61%) for imports of raw materials from Africa.

9 The annual average growth rate was 31% for China’s exports to Africa. The contribution of China’s economic cooperation and investments is 30% ((6.66+4.27)*100/31).
Concerning the impact of other variables on exports, a 1% increase of China’s GDP leads an increase of its exports to Africa of 1.45%, which is higher for machinery and transport equipment than for textile and clothing. In the same way, an increase of 1% of Africa GDP increase 0.52% its imports from China, which is higher for textile and clothing than for machinery and transport equipment. The real depreciation of the renminbi increases China’s exports to Africa with the estimated coefficient of 0.52. The impact is higher for machinery and transport equipment than for textile and clothing. A good political stability favours China’s exports to Africa while the established diplomatic relationship did not exert an impact on exports. China’s exports of textile and clothing are moreover slowed down by transaction cost and the creation of China’s special economic zones in Africa by the government.

Concerning China’s imports, African GDP favours its exports to China. An increase of 1% of African GDP increases its exports to China of 1.44%. An increase of 1% in China’s GDP increases its imports from Africa of 0.85%. Contrary to China’s exports, the quality of the African governance has unexpected negative coefficient in import equations. China tends to import more from the countries having bad governance as in De Grauw et. (2012). The unexpected sign may be explained either by China’s difficulties to access to main African exporters of raw materials which are traditional partners of developed countries, or by China’s policy of "non-interference" in the domestic affairs of African countries, or by the fact that the African countries rich in natural resources tend to have bad governance. The good diplomatic ties between China and African countries favour China’s imports from Africa. The real exchange rates of China do not exert a significant impact on China’s imports of raw materials from Africa. This result is waited because the prices of raw materials are determined in the world market.

10 The annual average growth rate was 35% for China’s imports from Africa. The contribution of China’s investments is 45% (15.9*100/31).
Table 2. Impact of China’s economic cooperation and OFDI on China’s exports to and imports from Africa, 2000-2010

<table>
<thead>
<tr>
<th></th>
<th>Ln(real exports)</th>
<th>Ln(real imports)</th>
<th>Ln(real exports)</th>
<th>Ln(real imports)</th>
<th>Ln(real exports)</th>
<th>Ln(real imports)</th>
<th>Ln(real OFDI)t-1</th>
<th>Ln(real economic cooperation) t-1</th>
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</thead>
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<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
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<tr>
<td>Ln(China’s real GDP) t-1</td>
<td>1.70***</td>
<td>2.60***</td>
<td>1.61***</td>
<td>0.40*</td>
<td>1.45***</td>
<td>1.89***</td>
<td>0.34**</td>
<td>0.85*</td>
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<tr>
<td></td>
<td>(19.7)</td>
<td>(8.71)</td>
<td>(10.1)</td>
<td>(1.91)</td>
<td>(10.1)</td>
<td>(9.27)</td>
<td>(2.39)</td>
<td>(1.90)</td>
</tr>
<tr>
<td>Ln(Africa’s real GDP) t-1</td>
<td>0.59***</td>
<td>1.05***</td>
<td>0.98***</td>
<td>1.07**</td>
<td>0.52***</td>
<td>0.50***</td>
<td>0.96***</td>
<td>1.44***</td>
</tr>
<tr>
<td></td>
<td>(5.71)</td>
<td>(5.38)</td>
<td>(5.62)</td>
<td>(2.79)</td>
<td>(3.83)</td>
<td>(3.38)</td>
<td>(4.63)</td>
<td>(4.40)</td>
</tr>
<tr>
<td>Ln(Real bilateral exchange rate) t-1</td>
<td>0.47***</td>
<td>-0.62</td>
<td>0.41**</td>
<td>-0.41</td>
<td>0.52**</td>
<td>0.62**</td>
<td>0.22**</td>
<td>-0.11</td>
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<tr>
<td></td>
<td>(3.83)</td>
<td>(-1.35)</td>
<td>(2.09)</td>
<td>(-0.76)</td>
<td>(2.85)</td>
<td>(2.34)</td>
<td>(2.73)</td>
<td>(-0.21)</td>
</tr>
<tr>
<td>African landlocked countries</td>
<td>-0.87*</td>
<td>-0.29</td>
<td>-0.63</td>
<td>0.01</td>
<td>-0.77</td>
<td>-0.58</td>
<td>-1.15*</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>(-1.64)</td>
<td>(-0.36)</td>
<td>(-1.04)</td>
<td>(0.01)</td>
<td>(-1.18)</td>
<td>(-0.88)</td>
<td>(-1.78)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Ln(China’s economic cooperation in Africa) t-1</td>
<td>0.16***</td>
<td>-0.10</td>
<td>0.40**</td>
<td>-0.93**</td>
<td>0.38**</td>
<td>0.15*</td>
<td>0.54**</td>
<td>-0.96***</td>
</tr>
<tr>
<td></td>
<td>(7.17)</td>
<td>(-1.24)</td>
<td>(2.96)</td>
<td>(-2.38)</td>
<td>(3.26)</td>
<td>(1.88)</td>
<td>(2.73)</td>
<td>(-2.63)</td>
</tr>
<tr>
<td>Ln(China’s OFDIs in Africa) t-1</td>
<td>-0.06</td>
<td>2.06*</td>
<td>-0.25</td>
<td>2.22**</td>
<td>-0.23</td>
<td>0.07</td>
<td>-0.50</td>
<td>2.25**</td>
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<tr>
<td></td>
<td>(-0.19)</td>
<td>(1.79)</td>
<td>(-0.86)</td>
<td>(2.68)</td>
<td>(-0.78)</td>
<td>(0.17)</td>
<td>(-1.15)</td>
<td>(2.75)</td>
</tr>
<tr>
<td>Ln(China’s OFDIs in Africa) t-1</td>
<td>0.16***</td>
<td>-0.10</td>
<td>0.40**</td>
<td>-0.93**</td>
<td>0.38**</td>
<td>0.15*</td>
<td>0.54**</td>
<td>-0.96***</td>
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<tr>
<td></td>
<td>(7.17)</td>
<td>(-1.24)</td>
<td>(2.96)</td>
<td>(-2.38)</td>
<td>(3.26)</td>
<td>(1.88)</td>
<td>(2.73)</td>
<td>(-2.63)</td>
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<tr>
<td>Ln(China’s OFDIs in Africa) t-1</td>
<td>-0.24*</td>
<td>-0.12</td>
<td>-0.18</td>
<td>-0.21</td>
<td>-0.79***</td>
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<td>(-0.95)</td>
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<tr>
<td>Oil producing African country</td>
<td>2.80**</td>
<td>2.46*</td>
<td>2.51**</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(2.88)</td>
<td>(1.85)</td>
<td>(2.33)</td>
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</tr>
<tr>
<td>Constant</td>
<td>-47.5***</td>
<td>-79.0***</td>
<td>-50.6***</td>
<td>-23.0*</td>
<td>-39.3***</td>
<td>-53.6***</td>
<td>-16.2***</td>
<td>-39.7***</td>
</tr>
<tr>
<td></td>
<td>(-21.1)</td>
<td>(-10.1)</td>
<td>(-11.4)</td>
<td>(-1.89)</td>
<td>(-9.85)</td>
<td>(-9.40)</td>
<td>(-2.30)</td>
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<td>Durbin-Wu-Hausman endogeneity test</td>
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<td>0.02</td>
<td>0.03</td>
<td>0.00</td>
<td>0.04</td>
<td>0.00</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Notes. China’s economic cooperation and OFDI are considered as endogenous variables in Hausman –Taylor estimator. *, ** and *** indicate significance at the 10%, 5% and 1% levels of confidence, respectively.
Table 3: Direct and indirect effects of China’s economic cooperation and investments on China Africa trade, 2000-2010

<table>
<thead>
<tr>
<th></th>
<th>Coefficients</th>
<th>China’s exports</th>
<th>Machinery &amp; transport equipment</th>
<th>Textile &amp; clothing</th>
<th>China’s imports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct effect of Economic cooperation</td>
<td>e52</td>
<td>0.18</td>
<td>0.20</td>
<td>insignificant</td>
<td>-0.39</td>
</tr>
<tr>
<td>Direct effect of Chinese investments</td>
<td>e53</td>
<td>insignificant</td>
<td>Insignificant</td>
<td>0.18</td>
<td>0.42</td>
</tr>
<tr>
<td>effect of economic cooperation on investments</td>
<td>b1</td>
<td>0.93</td>
<td>0.93</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>effect of Chinese investments on economic cooperation</td>
<td>c1</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>Indirect effect of economic cooperation via its impact on investments</td>
<td>b1*e53</td>
<td>insignificant</td>
<td>Insignificant</td>
<td>0.17</td>
<td>0.39</td>
</tr>
<tr>
<td>Indirect effect of investments via its impact on economic cooperation</td>
<td>c1*e52</td>
<td>0.07</td>
<td>0.08</td>
<td>insignificant</td>
<td>-0.16</td>
</tr>
<tr>
<td>Total effect of economic cooperation</td>
<td>e52 + b1*e53</td>
<td>0.18</td>
<td>0.20</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>Total effect of Chinese investments</td>
<td>e53 + c1*e52</td>
<td>0.07</td>
<td>0.08</td>
<td>0.18</td>
<td>0.26</td>
</tr>
</tbody>
</table>

5. Conclusion

This study contributes to the literature by proposing an augmented gravity model to estimate the role of China’s economic cooperation and OFDIs in the evolution of China-Africa trade over the period from 2000 to 2010. We show that the economic cooperation favours not only directly the exports of machinery and transport equipment, but also indirectly the exports of textile and clothing via its favourable impact on OFDIs. Market-seeking and Resources-seeking are the objectives of the Chinese investments in Africa, which are facilitated by China’s economic cooperation. We show also that the GDPs of China and Africa influence positively China’s trade with Africa. The exports of China’s manufactured goods are sensible to real exchange rates, while its imports of raw materials are not. China tends to export to African countries having good governance, while to import more from countries which have bad governance. The good diplomatic ties play an important role on the imports of raw materials from Africa, but do not exert a significant impact on exports. The transaction cost and China’s special economic zones in Africa decrease the exports of textile and clothing to Africa.

By trading more with Africa, China becomes less dependent on the market of developed countries and helps African countries to be integrated to the world trade by largely investing in infrastructure in which most of African counties are in deficit; while infrastructure projects have been ignored by western donors (Foster et al., 2008). Those African countries which are abundantly endowed with natural resources have profited from a strong growth in their raw material exports to China. Certainly, this is an immediate source of economic growth\footnote{The growth rates of African GDPs have been higher during the period of the Sino-African trade intensification (Weisbrod and Whalley, 2011).}; however in the long term, this may become a disadvantage for these countries when they want to diversify their production towards manufactured goods, since China’s economic cooperation and investments increase exports of China’s manufactured goods.

This disadvantage may be notwithstanding reduced by the creation of China’s special economic zones in Africa by the Chinese government; which have the objective of developing
manufactured goods in particular textile and clothing sector in which China has now less comparative advantage (Brautigam, 2011b). The African countries should take this opportunity to diversify their economies.

References


