Does Chinese aid promote manufacturing industry in Africa?

Alain NDIKUMANA

Abstract

We examine the effects of Chinese aid on manufacturing industry in Africa, using methodology that enables to account for endogeneity and heterogeneity across the sample. We find a negative and immediate effects on the manufacturing industry in Africa. We provide evidence that it is a brake on development of manufacturing industry in Africa since it is linked to the consumption of raw materials from China such as steel, aluminum, cement, timber used in the implementation of major infrastructure projects in Africa. Our study brings two major contributions. The first one is the empirical implementation of the theoretical framework developed by McCormick (2008) which illustrates how manufacturing industry could be promoted by Chinese aid, especially targeted aid to productive infrastructure. Second one provides new evidence on how Chinese aid, which is tied, hinder manufacturing industry promotion in Africa. Therefore, policymakers should ensure that this aid is not linked to the purchase of raw materials from China needed to implement infrastructure projects when they are produced and available by local industries.

Key words: Chinese aid, infrastructure projects, manufacturing industry, Africa.
JEL classification: B22, C23, F35, P33

Ecole Nationale Supérieure de Statistique et d'Economie Appliquée d'Abidjan, Abidjan, Côte d'Ivoire ;
alain.ndikumana@ensea.edu.ci

1. Introduction

For more than half a century, development aid has been seen as one of the levers to stimulate economic growth and, by extension, to promote economic development (Rosenstein-Rodan, 1943). Between 1990 and 2018, the share allocated to Africa increased by more than a two-third, on average, from US$39.3 to US$65.3 billion, a 66.1 per cent increase (OCDE, 2019). In addition, AidData (2019) shows 96.2 per cent increase of overall aid to Africa from US$48.7 billion to US$95.1 billion over 2000-2013.The contribution to Africa by non-Development Aid Committee donor countries, including China, have been driving these figures up, with 14.6 per cent of this aid being provided by China (Table A1). Since the 2000s, China has become a key economic partner of Africa through a development financing model focused on infrastructure and trade. In fact, China's development assistance to African countries has reached unprecedented levels, although it is still below that of traditional donors from the West and Japan (Cabestan, 2013). Meanwhile, official development finance from China has risen tremendously in the past two decades across the globe, including in the world's poorest continent Africa. (Humphrey & Michaelowa, 2019).

Despite the 2008 crisis[1], Chinese aid to Africa steadily increased from US$4.1 billion to US$24.9 billion over 2000-2013, a 607.3% increase (Table A1). Furthermore, China's economic rise has begun to transform the global economic landscape. China's emergence as a global economic power is both a threat and an opportunity for structural transformation in Africa (Brautigam & Brautigam, 2009). China has set up a development financing model called "Angola Model" which consists of buying raw materials, in this case oil in return for infrastructure projects (construction of roads, railways, dams or port facilities) by Exim Bank or the China Development Bank. Under this model, Chinese aid is mainly 'tied', with more than 70 per cent going to infrastructure projects in Africa (Cabestan, 2013). The share of Chinese aid allocated to infrastructure and economic services increased significantly during the period 2000-2013. It rose from 36.2 per cent in 2000 to 78.3 per cent in 2013, representing in average more than half (52.7 per cent) over this period (Figure A2).

In "The end of Africa's economic boom…", Roweden (2015) stated that "Africa will never go far without manufacturing". The promotion of the manufacturing sector in Africa and its financing are currently at the heart of political economy of development debates as illustrated in the international development frameworks. The topic is at the center of the United Nations Sustainable Development Agenda 2030 via its SDG 9 through target 9.2 which aims to promote a sustainable and inclusive industry, and in the African Development Bank's Agenda 2063 as one of the five priorities. The achievement of this goal requires development of the manufacturing sector. This has therefore aroused a particular commitment by the international community to finance this sector through mobilization of the capital necessary to realize this goal (Ndikumana, 2022).

[1] See Figure A1

According to the *2018 African Economic Outlook*, infrastructure projects are among the most profitable investments a company can make (African Development Bank 2018). Productive infrastructure projects help to create and maintain a country's economic growth, thus generating the financial resources needed to carry out any other project (Guèye, 2018). Cross-country evidence shows a close connection between public infrastructure investment and the rate of economic growth. This is clearly illustrated by the case of Ethiopia. It turns out that Ethiopia is the third largest recipient of Chinese aid, is an illustration of this with US$6.9 billion over the period 2000-2013 (Table 1). Ethiopian economy grew by 10.8% annually between 2003-2004 and 2014-2015, thanks to the productive sectors (MOFED 2010; NPC 2016), twice the sub-Saharan African average. Government has focused on long-term investment programs, with a particular focus on infrastructure development (especially in the energy and transport sectors) (African Development Bank, 2019). One of the key constraints to growth in Africa is the lack of infrastructure, especially electricity and transport, which undermines the development comparative advantages in key industries. According to new estimates by the African Development Bank, the continent's infrastructure needs amount to US$130–170 billion per year, with a financing gap in the range of US$68-108 billion (Guèye, 2018).

In recent years, donor countries have increasingly used different aid allocation channels to boost aid effectiveness. One delivery channel that has grown tremendously is 'multi-bi aid' contributions to multilateral organizations earmarked for specific development purposes (Reinsberg, 2019). Therefore, the continent should opt for a more pragmatic approach to infrastructure financing, focusing primarily on new financing models. African countries can directly integrate into the global economy by developing well-targeted infrastructure to support competitive industries and sectors in industrial parks and export processing zones that can serve as relays to global markets (Guèye, 2018). Thus, foreign aid promotes manufacturing by helping to close the "financing gap" (gap between domestic investment and domestic savings), therefore making investments in manufacturing possible. This includes by financing infrastructure. The Chinese financing model called "Angola model" emphasizes financing for infrastructure. For this purpose, aid uses to pay local materials such as cement, locally made equipment or parts, etc, it may boost the manufacturing sector directly. Direct effects will be greatest in countries that manufacture the components of the infrastructure. Indirect effects of aid that improves roads, ports, electricity supply, water supply, communications, and other elements of a country's physical infrastructure will be increased output, greater production efficiency, and shorter lead times. A further indirect effect might be increased demand for manufactured goods by construction workers, transporters, and others with jobs generated by the infrastructure aid. Indirect effects of infrastructure aid are more widely available. As long as there is some existing manufacturing industry, increased demand is likely to benefit the sector (McCormick, 2008). With a strong focus on productive infrastructure projects, China's aid allocation model could help to alleviate the infrastructure financing gaps and to develop the manufacturing industry. Therefore, empirical research question pursued in this study is: "Does Chinese aid promote manufacturing industry in Africa? "

This paper seeks to examine the impact of aid on manufacturing sector, with a focus on Chinese aid in 37 African countries (Table A1) over the 2000–13 period. We use the overall amount of Chinese aid commitments[2], Chinese aid Infrastructure and social services, Chinese aid Infrastructure and economic services and Chinese aid productive services as share to GDP. The Manufacturing value-added data are taken from the UNIDO database. Socio-economic indicators such as share of manufacturing exports in total exports, Foreign Direct Investment, Gross capital formation, Gross National Expenditure as share to GDP are obtained from the World Bank's World Development Indicators (WDI) database and used as control variables determinants of manufacturing as well as country specific factors like road density which indicates infrastructure development. The model is estimated using panel data econometric methodology that enables to account for potential endogeneity of regressors and heterogeneity across the sample. To address concerns about endogeneity, we use a new instrumental variable[3] that combines geographical variation in the probability that a subnational region receives Chinese aid with exogenous temporal variation in the supply of Chinese aid that results from China's production of steel. China is the world's leading producer and exporter of steel (Stratfor, 2016). The Chinese government considers steel to be a strategically important commodity and therefore maintains production capacity in excess of domestic demand. This strategy results in a time-varying surplus of steel, some of which China then uses for aid projects in Africa. Our instrument for aid is the interaction of steel production with the recipient-specific probability of receiving Chinese aid (Dreher et al., 2021).

First, the more Chinese aid a country has received, the smaller its share of manufacturing to GDP. The coefficient estimate suggests that a 1 per cent increase in total Chinese aid as a percentage of GDP is associated with a reduced share of manufacturing in total GDP of about 1.064–1.178 per cent. Again, 10-percentage points change in total Chinese aid as a percentage of GDP is associated to a 0.3 to 0.4 percentage point decrease in manufacturing value added as a percentage of GDP. So, the inflow of aid is correlated with slower manufacturing growth. Second, we find an impact of a 1 percent change in Chinese aid to infrastructure and economic services as a percentage of GDP on manufacturing value added as a percentage of GDP increases from 1.067 to 2.147 percent. Then, the inflow of aid to infrastructure and economic services is correlated with shrinkage of manufacturing sector.

Our study brings two major contributions. The first one is the empirical implementation of the theoritical framework developed by McCormick (2008) which illustrates how manufacturing sector could be promoted by Chinese aid, especially targeted aid to productive infrastructure. Second one provides new evidence on how Chinese aid, which is tied, hinder manufacturing industry promotion in Africa especially in countries producing natural resources. Therefore, policymakers should ensure that this aid is not linked to the purchase of raw materials from China needed to implement infrastructure projects when they are produced and available by local industries.

[2] Commitments are considered to be made on the date on which the loan or grant agreement is signed or on which the obligation assumed is brought to the attention of the beneficiary by any other means. For example, 77.7 per cent of Chinese projects (see Table C1) and 85.88 per cent of OECD aid have been disbursed (see Table C2).

[3] This new IV has been constructed by (Dreher et al., 2021)

However, our results have limitations because they do not indicate that this effect is short-term or long-term. They also do not consider political or institutional factors that may influence the development of manufacturing such as the quality of institutions, the business climate, political stability, or geographical position of the country.

The remainder of the paper is organized as follows: Section 2 provides a brief review of the relevant literature. Section 3 discusses the empirical strategy and provides a description of the data, some stylized facts, and the empirical model. The results are discussed in section 4 and the final section concludes with a discussion of the policy implications from the results.

2. Literature review

The economic literature on the development of the industrial sector highlights the link between capital accumulation and industrialization through the provision of foreign capital in the form of ODA (Ndikumana, 2022) ;(McCormick, 2008).

Theoretical literature on aid effectiveness initiated by (Rosenstein-Rodan, 1943) and (Lewis, 1954) through their theory of the "Big Push" formalized by (Murphy et al., 1989) not only emphasizes the notion of sectoral priority but also analyzes the conditions for the transition from a subsistence economy to an industrial economy that creates growth. This theory shows that foreign aid, by mitigating exchange rate and savings gaps and poverty traps in countries with the highest ratio of domestic investment to GDP financed by this aid, is a means of overcoming obstacles to industrialization and capital accumulation in less developed countries. A country can escape the poverty trap if the economy's temporarily high ratio of domestic investment to GDP is financed by international loans, rather than from domestic saving (Barro & Sala-i-Martin, 2004).

In addition, some studies in the empirical literature show the impact of aid on growth of manufacturing industry through channel of real exchange rate appreciation. Rajan and Subramanian examine the effects of aid on the growth of manufacturing, using a methodology that exploits the variation within countries and across manufacturing sectors. They tested in 2005, 2008 and 2011 the link between aggregate aid and the growth of labour-intensive industries and tradable and exportable goods through the effect of aid on the real exchange rate. They examined the effect of aid inflows on the competitiveness of the industrial sector (as measured by the interaction between aid and labour-intensive industry) in different countries by comparing growth between labour-intensive and capital-intensive industries. The results indicate that labor-intensive industries (likely to be affected by higher wages) grow relatively more slowly than capital-intensive and non-exportable sectors, respectively, in countries with high aid flows (Rajan & Subramanian, 2005). Furthermore, findings in their studies using a methodology that exploits the variation within countries and across manufacturing which examine the effects of aid on the growth of manufacturing show that aid inflows have systematic adverse effects on a country's competitiveness, as reflected in the lower relative growth rate of exportable industries. Some evidence are provided which indicate that the channel for these effects is the real exchange rate appreciation caused by aid inflows (Rajan et al., 2008) (Rajan & Subramanian, 2011). Some other outcomes propose an original identification strategy to measure the impact of aid on exports exploiting the input–output linkages in an economy to analyze how aid to service sectors affects manufacturing exports (Ferro et al., 2014).

They find that aid to the transportation and energy sectors are the most effective when the objective is to increase exports of a recipient country. The effectiveness of aid to transportation in terms of exports growth diminishes for country groups with higher income, whereas the effectiveness of aid to energy and business services increases with the income of the group.

Regarding to Chinese aid, its aid program has leapt out of the shadows in the last two decades. Media reports about huge aid packages, support for pariah regimes, regiments of Chinese labor, and the ruthless exploitation of workers and natural resources in some of the poorest countries in the world sparked fierce debates (Brautigam & Brautigam, 2009). The rise of China as a donor country for aid to Africa and its method of financing have attracted the interest of development analysts and more particularly on its financing.

Thus, a first wave of research has analyzed the determinants of China's Official Financing. With China rapidly expanding its aid programme in the Pacific Islands region, there is a growing concern among established powers about China's sway over the aid-dependent Pacific Island states (Van Grieken & Kantorowicz, 2021). While political considerations shape China's allocation of aid, China does not pay substantially more attention to politics compared to Western donors. What is more, China's aid allocation seems to be widely independent of recipients' endowment with natural resources and institutional characteristics. Overall, denoting Chinese aid as "rogue aid" seems unjustified (Dreher & Fuchs, 2015).Recently, several countries, most notably China, have emerged as alternative sources of foreign aid. It assumes that the distribution of foreign aid was determined by the aid donors' self-interest and also by the aid recipients' needs. (Furuoka, 2017). Dreher and Fuchs (2015) focus on China, specifically, and using various sources of data on the cross-country allocation of Chinese foreign aid projects, find that its aid is not influenced by the governance characteristics of recipient countries. Nor do they find evidence that China's aid allocation is motivated by a desire to access natural resources in recipient countries. But Chinese aid does favor poor and populous countries, and countries that vote with China in the U.N. General Assembly (Dreher et al., 2018).

Another series of research work attempted to highlight the impact of Chinese aid on economic growth or on development of some key sector. On economic growth, the results are mixed. Some say that Chinese aid has no effect on growth. Chinese foreign aid in Africa does not have an impact on growth (Busse et al., 2016). Other find that China's aid has significant positive effects on African economic growth. In addition, the relationship between aid and growth varies according to the different categories of aid, and its marginal contribution is nonlinear (Dong & Fan, 2020). Introducing a new dataset of official financing from China to 138 developing countries between 2000 and 2014. The results demonstrate that Chinese development finance boosts short-term economic growth. An additional project increases growth by between 0.41 and 1.49 percentage points two years after commitment, on average. (Dreher et al., 2020).

The existing literature on Chinese targeted aid show how aid to infrastructures affects development on subnational scale. For example, aid to electric power infrastructures improves the social welfare of household in African countries in increasing the household's likelihood of having access to electricity. Using data from Johns Hopkins SAIS CARI China-Africa Loan Database and the Demographic and Health Survey (DHS) Program Database, findings highlight that after the Bui Dam's completion in Ghana, the likelihood for households living in the treatment regions having access to electricity increased by about 4 per cent (Tang & Shen, 2020). Regarding Chinese aid to transport infrastructure, it has a positive impact on the spatial concentration of economic activity. Chinese-financed transportation projects reduce spatial concentration within but not between regions. Transport projects decentralize activity particularly strongly in regions that are more urbanized, located closer to the coast, and less developed. Firms also have incentives to move out of cities in response to new transportation infrastructure but they depend on a number of factors, not least how much a particular industry benefits from agglomeration economies (Bluhm et al., 2020).

The economic literature on the link between China's engagement and manufacturing sector in Africa consider China's emergence which is a global economic power as both a threat and an opportunity for structural transformation in Africa (Bräutigam & Tang, 2014). Real and potential economic threats have been telegraphed by media headlines that deplore the impact of Chinese imports on weak industrial sectors, as well as concerns that Chinese investment in natural resources will further "lock" Africa into its traditional role as a raw material exporter (Amsterdam, 2012). At the same time, however, econometric studies suggest a more nuanced picture. Using a two-stage analytical framework and drawing on a wide range of secondary data, McCormick (2008) assess the likely impact of aid from China and India on the development of Africa. In this work, a theoretical framework for analyzing the effects of China & India on African Manufacturing sector is proposed and looks at the implications of Chinese and Indian aid to manufacturing for development outcomes such as growth, distribution, governance, and environment. The analysis shows clearly that the potential impact of Chinese and Indian aid on Africa is significant, but that the actual effects of these emerging donors on countries depends to a large extent on the institutional and structural conditions of the recipients (McCormick, 2008).

The economic literature on the development of industrial sector highlights the effect of productive infrastructure on manufacturing sector. Baum-Snow et al. (2017) examine the effect of road and railway infrastructure on the spatial distribution of economic activity in China, and find that ring road investments displaced 50 percent of industrial GDP from central cities to outlying areas (Baum-Snow et al., 2017). This gives rise to a pattern where industries relying on manufacturing and less-skilled jobs decentralize more than those with more high-skilled and managerial employment (Rossi-Hansberg et al., 2009). As Baum-Snow et al. (2017) point out, the urban distribution of economic activity in many developing countries today largely resembles that of early 20th century America, in which industry was initially overwhelmingly concentrated in urban centers. At the same time, Hornbeck & Rotemberg (2019) examine impacts of market integration on the development of American manufacturing, as railroads expanded through the latter half of the 19th century. Using new county-by-industry data from the Census of Manufactures, we estimate substantial impacts on manufacturing productivity from relative increases in county market access as railroads expanded. In particular, the railroads increased economic activity in marginally productive counties.

Allowing for the presence of factor misallocation generates much larger aggregate economic gains from the railroads than previous estimates. Our estimates highlight how broadly used infrastructure or technologies can have much larger economic impacts when there are inefficiencies in the economy (Hornbeck & Rotemberg, 2019).

While we are not the first to investigate the impact of China's engagement on the development of Africa, especially on manufacturing sector (McCormick, 2008),(Bräutigam & Tang, 2014), (Busse et al., 2016) , Chinese aid under its model, which consists in financing the bulk of infrastructure projects in Africa with more than 70 per cent could promote manufacturing sector. The critical question then becomes: Does Chinese aid promote manufacturing industry in Africa?

3. Stylized facts and data sources

3.1. Data sources

We use annual data covering the period from 2000 to 2013 from AidData's Global Chinese Official Finance Dataset for the 37 African countries . We extract them from this dataset the total amount of all aid committed by China and targeted aid on different sectors like Infrastructure and social services, Infrastructure and economic services, aid to productive sectors and other type of aid. These are thereafter normalized in dividing them by GDP and multiplied by 100. Data on manufacturing value added come from the UNIDO database. Other control variables include socio-economic indicators such as share of manufacturing exports in total exports, the ratio Foreign Direct Investment to GDP, ratio Gross capital formation to GDP, ratio Gross National Expenditure to GDP and infrastructure indicators like road density. Data on these variables are obtained from the World Bank's WDI dataset.

Another data source used in our paper in relationship with time variation in Chinese funding is the (logged) annual amount of Chinese steel production (in thousand tons), labeled Steel (data from the World Steel Association, 2010; World Steel Association, 2014) which is used in the construction of an instrumental variable essential to tackle on the problems of endogeneity of Chinese aid (Dreher et al., 2021). The analyses consider the total amount of all aid committed and targeted on the data of the different sectors rather than the amount disbursed. Two reasons motivated this choice because the aid literature gives some limits on the use of disbursed aid. First, in many cases, data on aid disbursed at the sector level is lacking because it is spottying most aid data sources. Second, aid disbursement is unpredictable relative to commitments in the sense that the amount of aid could be disbursed mainly during periods when domestic production or revenue is high and withheld when domestic economic activity declines (Maruta, 2018)**.**

3.2. Stylized facts

Table 1 presents potential relationship between dependent variable and key interest variable of our study. It shows that the destination of Chinese aid to Africa is substantially concentrated, within 15 top countries absorbing 74.7 per cent of total aid over the period 2000-2013. These are: Nigeria, Angola, Ethiopia, South Africa, Kenya, Zimbabwe, Tanzania, Ghana, Cameroon, Egypt; Côte d'Ivoire, Mauritius, Equatorial Guinea; Uganda and the Democratic Republic of Congo. It should also be noted that these 15 countries represent 74.9 per cent of the continent's manufacturing value added. In addition, the ranking by manufacturing value added as a share of GDP also reveals that 7 of the top 15 recipients of Chinese aid in Africa are among the top 20 countries with the highest manufacturing value added. These are Egypt, the Democratic Republic of Congo, Mauritius, South Africa, Cameroon, Zimbabwe, and Kenya.

Table 1 : Countries ranking by economic indicators

Country	Chinese aid Total in billion $ constants 2011	MVA Total in billion $ constants 2015	MVA/GDP in %	Rank by Chinese aid	Rank by MVA	Rank by MVA/GDP in %
Nigeria	9.1	295.3	9.7	1	3	24
Angola	7.9	57.9	4.0	2	11	39
Ethiopia	6.9	14.9	4.6	3	21	38
South Africa	6.6	474.2	16.0	4	2	10
Kenya	6.5	64.0	11.0	5	9	20
Zimbabwe	6.3	17.6	13.2	6	19	14
Tanzania	4.7	19.3	9.1	8.0	17.0	25.0
Ghana	4.6	60.5	8.3	9	10	30
Cameroon	4.4	46.5	15.1	10	13	11
Egypt	3.1	562.5	16.6	12	1	5
Cote d`Ivoire	2.6	51.4	10.0	13	12	23
Mauritius	1.6	18.6	16.3	15	19	7
Equatorial Guinea	1.2	19.4		16	16	
Uganda	1.0	21.5	10.4	18	15	21
Congo. Democratic Republic of	0.8	67.4	16.6	20.0	8.0	6.0
Sub total	67.4	1790.9				
Total	90.2	2391.4				
Shares	74.7%	74.9%				

Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, and UNIDO.
Note: South Sudan and Sudan are excluded because Sudan became a State in 2008. Data which exists before this year consider Sudan as one country.

Table 2 summarizes the descriptive statistics of the key variables used in the regression over the period 2000–13. It highlights in average 11.69 per cent in manufacturing value added as share to GDP (MVAGDP) compared to 0.75 per cent of Chinese aid as share to GDP over the period 2000–13. In addition, the minimum and maximum varies between 0.00 and 20.67 per cent, with a standard deviation of 1.76 per cent.

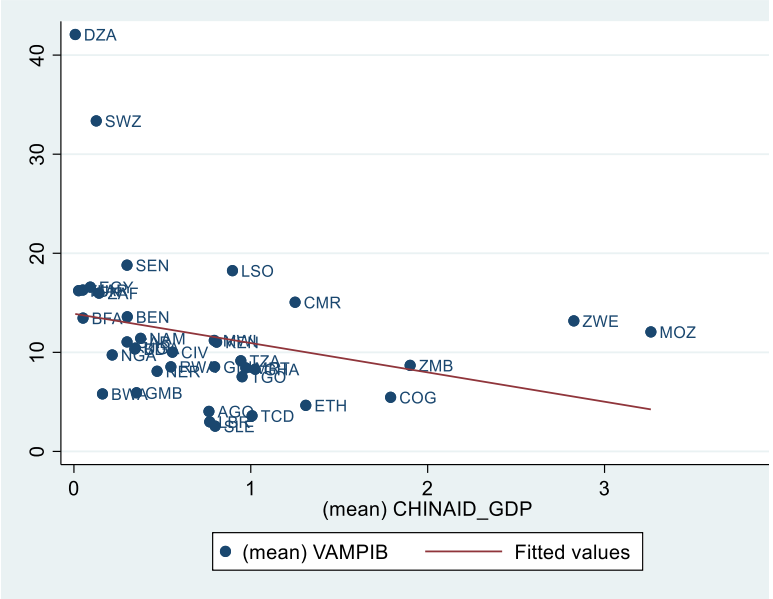
Table 2: Descriptive statistics of key variables in Africa over the period 2000–13

VARIABLES	N	Mean	Std Dv	Min	Max
Share of manufacturing exports in total exports (in %)	433	26.11	25.27	6.94e-05	94.87
Ratio Manufacturing value-added to GDP (in %)	518	11.69	7.922	0.233	49.88
Ratio Foreign Direct Investment to GDP (in %)	518	4.384	9.040	-5.208	103.3
Ratio Gross capital formation to GDP	473	22.18	9.638	0,00	61.05
Ratio Gross National Expenditure to GDP (in %)	462	106.1	15.76	57.70	201.0
Ratio Chinese aid to GDP (in %)	518	0.747	1.762	2.62e-10	20.67
Ratio Chinese aid Infrastructure and social services to GDP (in %)	518	0.144	0.472	2.39e-10	4.398
Ratio Chinese aid Infrastructure and economic services to GDP (in %)	518	0.459	1.581	2.62e-10	19.32
Ratio Chinese aid productive services to GDP (in %)	518	0.0984	0.475	2.24e-10	5.596

Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, and UNIDO.

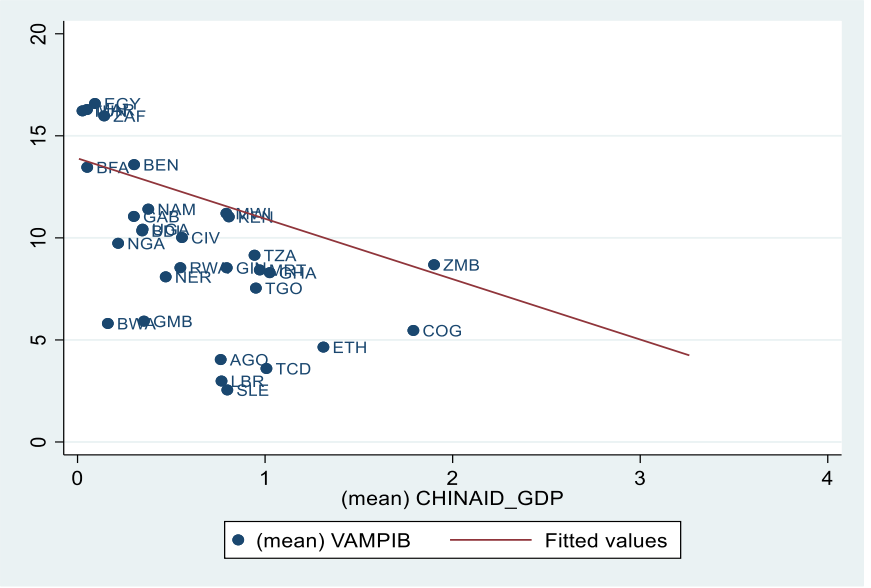
The data shows strong relationships between manufacturing value added as a share of GDP for all countries and key variables of interest, and points to the presence of outliers such as Algeria and Eswatini (Figures 1-2). All these figures show a negative relationship between manufacturing value added as a percentage of GDP and Chinese aid as share to GDP. The same trend is also observed by disaggregating Chinese aid (Figures 3-8). Surprisingly, we see that more Chinese aid as percentage of GDP increases, more manufacturing value added as a share of GDP declines.

Figure 1: Average Chinese aid distribution as percentage to GDP by country, 2000 and 2013 (in %)



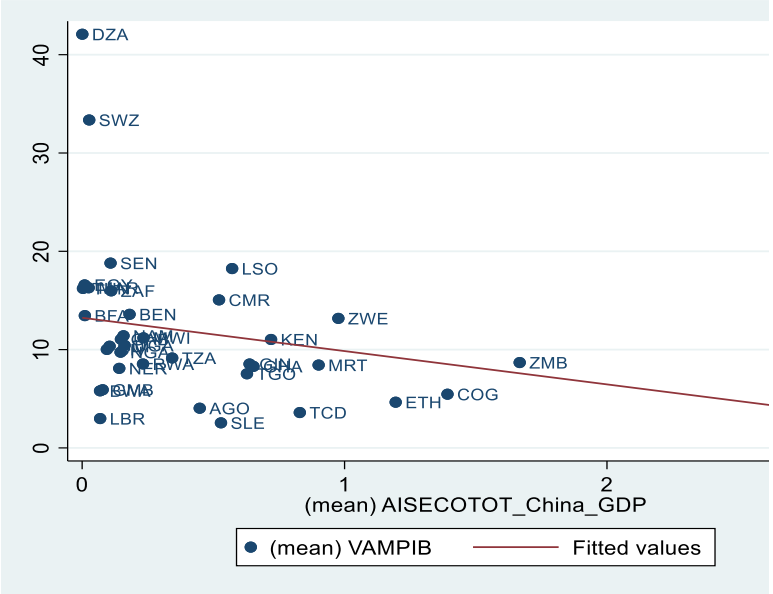
Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.

Figure 2: Average Chinese aid distribution as percentage to GDP by country, 2000 and 2013 (in %)



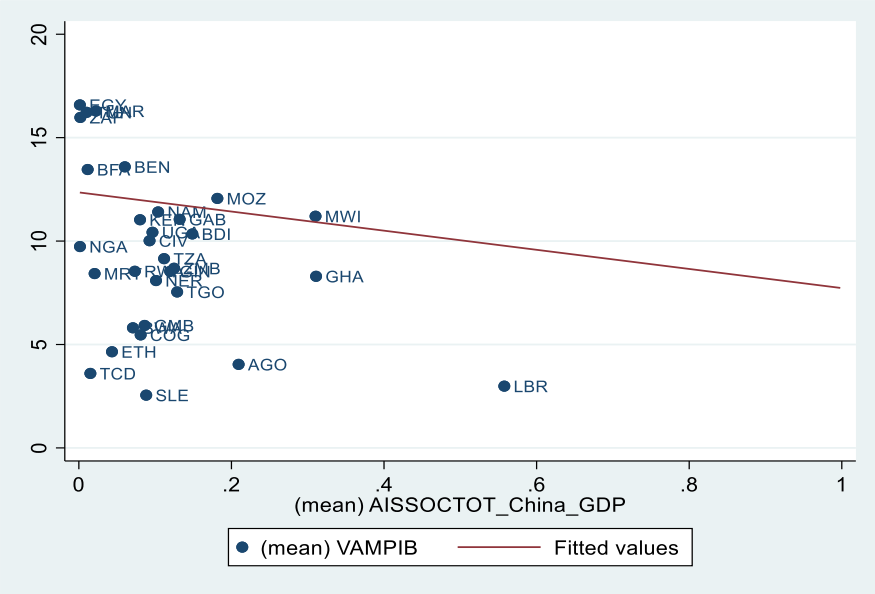
Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.
Note: Algeria and Eswatini are excluded in figure 2.

Figure 3: Average Chinese aid to infrastructure and economic services distribution as percentage to GDP by country, 2000 and 2013 (in %)



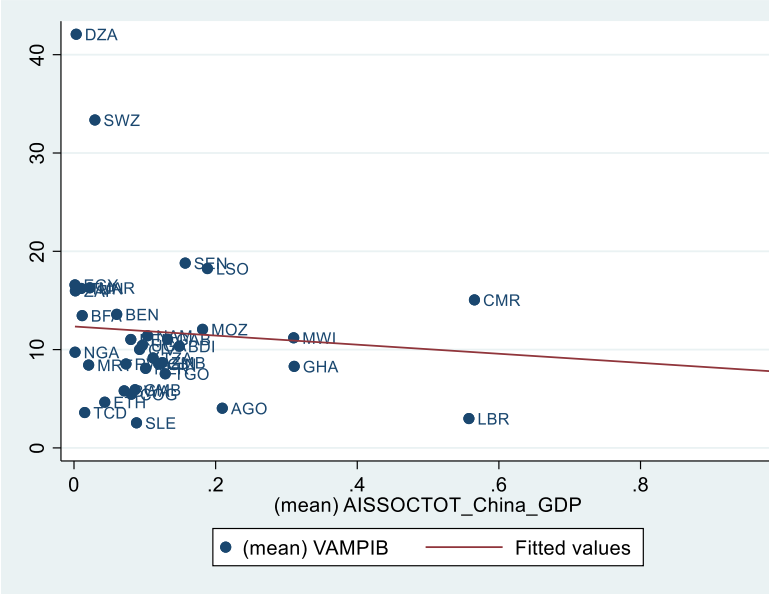
Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.

Figure 4: Average Chinese aid to infrastructure and economic services distribution as percentage to GDP by country, 2000 and 2013 (in %)



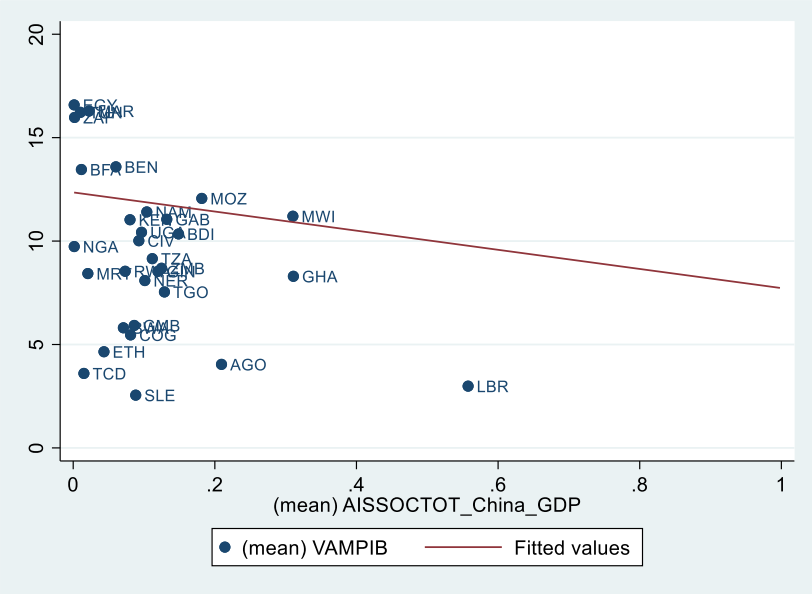
Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.
Note: Algeria, Eswatini, Senegal, Lesotho, Cameroon, Zimbabwe and Mozambique are excluded in figure 4.

Figure 5: Average Chinese aid to infrastructure and social services distribution as a percentage to GDP by country, 2000 and 2013 (in %)



Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.

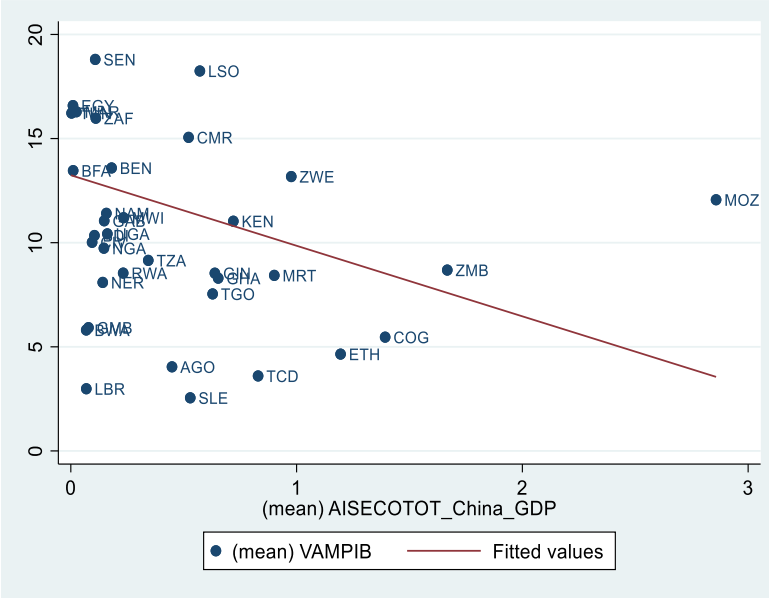
Figure 6: Average Chinese aid to infrastructure and social services distribution as a percentage to GDP by country, 2000 and 2013 (in %)



Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.

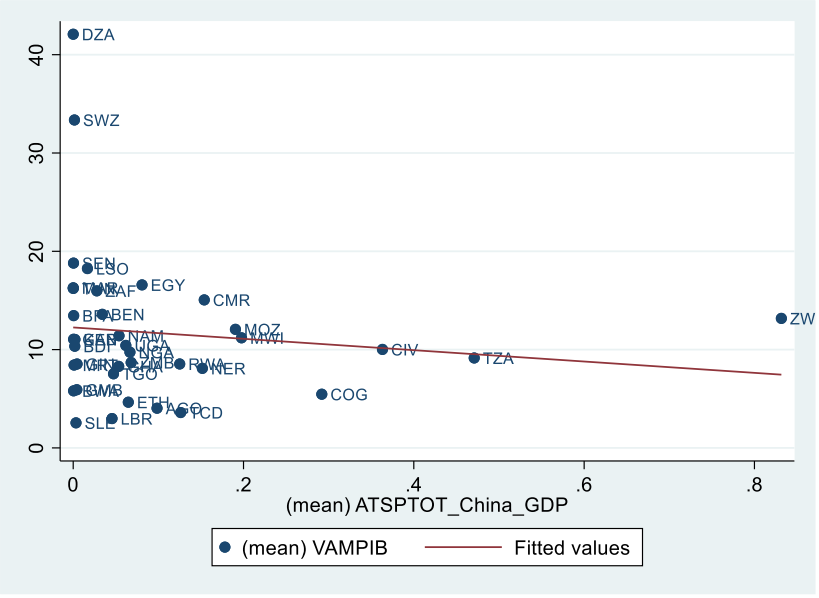
Note: Algeria, Eswatini, Senegal, Lesotho, Cameroon and Zimbabwe are excluded in figure 6.

Figure 7: Average Chinese aid to productive services distribution as share to GDP by country, 2000 and 2013 (in %)



Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.

Figure 8: Average Chinese aid to productive services distribution as share to GDP by country, 2000 and 2013 (in %)



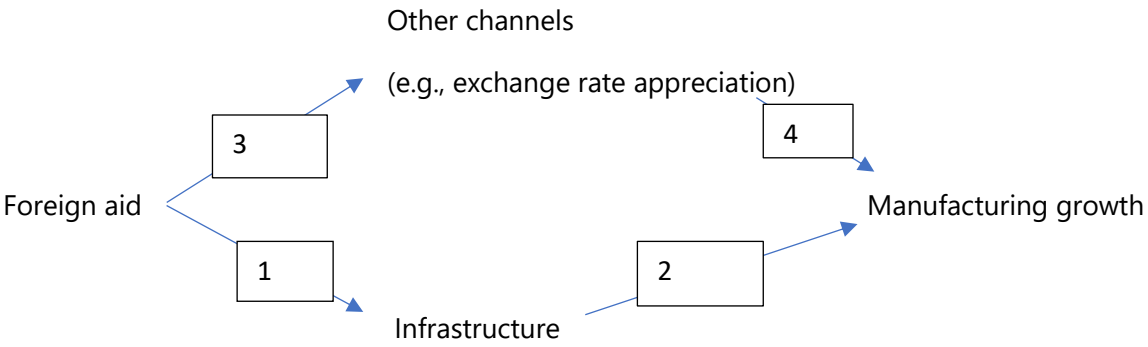
Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, and UNIDO.
Note: Mozambique is excluded in figure 8.

4. Empirical Strategy

The following is a schematic representation of the effects of aid on manufacturing growth.

The links between aid and manufacturing are illustrated in figure below:

Figure 9: Links between aid and manufacturing



Since that the third and fourth channels has been examined in the literature, including by Rajan and Subramanian's approach (2011), aid may undermine manufacturing through real exchange rate appreciation arising from aid strengthening of the national currency. This reduces international competitiveness of the country's tradable goods, which discourages investment in those sectors as well as exports. Their findings show that aid inflows have systematic adverse effects on a country's competitiveness, as reflected in the lower relative growth rate of exportable industries.

Indeed, our paper expands this literature by exploring the infrastructure channel of the effects of aid on manufacturing, focusing on Chinese aid. We assume that foreign aid may also affect manufacturing through other channels as shown Mc Cormick (2008). Implementation of new infrastructure by paying necessary raw materials such as cement, equipment or parts locally made by using Chinese aid may promote manufacturing sector directly and indirectly. Here, the idea is also to see if China's improvement of infrastructure could increase the development of the manufacturing sector. The benefits from improved infrastructure, however, depend on the location of that infrastructure and its relevance to present or potential manufacturing. The location of new or improved infrastructure will influence investment decisions, thus affecting the geographic distribution of employment opportunities.

To explore the linkages between Chinese aid and manufacturing, we specify and estimate two empirical models. The first model examines direct effects of total Chinese aid on manufacturing. It is specified as follows:

$$Y_{it} = \alpha_i + \beta \ \ Aid_{it} + \theta X_{it} + \varepsilon_{it} \quad (1)$$

where α_i, β, θ are model coefficients, Y_{it} is manufacturing value added as a share of GDP for a country i at time t, Aid_{it} is a total Chinese aid and the output for a country i, X_{it} are control variables as determinants of manufacturing such as the growth in household final consumption expenditure in percentage of GDP as a proxy for local demand, growth rate of gross capital formation in percentage

of GDP as a proxy of accumulation of physical capital and increases value added manufacturing, the exports of manufactured goods in percentage of total exports, net inflows of FDI in percentage of GDP and infrastructure. and ε_{it} is the error term of the model.

The second model focuses on the impact of Chinese aid to infrastructure on manufacturing, and is specified as follows:

$$Y_{it} = \alpha_i + \beta \ \ AidInfr_{it} + \theta X_{it} + \varepsilon_{it} \quad (2)$$

where $AidInfr_{it}$ is a Chinese aid financing infrastructure (highways, railways, hydroelectric power, dams or port facilities, water systems) and other variables are as defined in equation 2.

Here, we discuss the estimation methodology, how you control for potential issues of endogeneity and others.

To address this concern, we apply a two-stage least squares (2SLS) approach inspired by (Dreher et al., 2021), Nunn and Qian (2014). Our instrumental variable is an interaction that exploits time variation in China's production of steel and cross-country variation in the probability of countries receiving Chinese aid. Our source of time variation in Chinese funding is the (logged) annual amount of Chinese steel production (in thousand tons), labeled Steel (data from the World Steels Association, 2010; World Steel Association, 2014). China is the world's leading producer and exporter of steel (Stratfor, 2016). The Chinese government considers steel to be a commodity of strategic importance and has facilitated the rapid expansion of its production by, among other things, heavily subsidizing Chinese state-owned enterprises (SOEs). It has a track record of generating an oversupply of steel (Zheng, Bigsten, & Angang, 2009) and looking for overseas markets where it can ''dump" its steel products at16 artificially low prices (Spegele & Miller, 2016; Stratfor, 2016). Copper (2016: 166) notes that ''[i]n 2005, a high official in China spoke of serious overproduction in 11 sectors of the Chinese economy, including cement, steel, textiles, and autos" and ''Foreign aid and external investing ... were the means used to increase exports"17 of overproduced goods. For these reasons and because most Chinese development projects in Africa require some form of construction activity, Chinese official financing commitments to Africa should increase with the production of steel each year. Steel production has prima facie credibility as part of our instrument because China's global development finance program is guided by a ''going global" strategy explicitly designed to promote national exports and stimulate business for Chinese firms overseas (Davies, Edinger, Tay, & Naidu, 2008; Chen & Orr, 2009;.18 Giovannetti & Sanfilippo, 2009). As such, most Chinese grants and loans are directly tied to the acquisition of Chinese goods, including steel.

*Table 3: Impact of Chinese aid on manufacturing industry in Africa over 2000-13 with Lag China steel production (1,000 MT) *avg. prob. of any China aid as an instrument*

	1	2	3	4	5	6	7	8
VARIABLES	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Ratio Chinese aid to GDP (in %)	-0.115**	-0.118**	-1.064***	-1.168***	-1.178***	-1.442***	-1.221**	-1.141**
	(0.0537)	(0.0536)	(0.362)	(0.396)	(0.396)	(0.477)	(0.530)	(0.497)
Ratio Foreign Direct Investment to GDP (in %)		0.00776		0.0302	0.0306	0.123*	0.0751*	0.0721
		(0.0237)		(0.0192)	(0.0193)	(0.0746)	(0.0412)	(0.0442)
Road Density					-9.659			
					(10.47)			
Share of manufacturing exports in total exports (in %)						0.047**		
						(0.0230)		
Ratio Gross capital formation to GDP (in %)							0.0265	
							(0.0309)	
Ratio Gross National Expenditure to GDP (in %)								0.0129
								(0.0205)
Constant	11.77***	11.74***	12.48***	12.43***	13.75***	11.77***	11.92***	11.08***
	(1.265)	(1.280)	(1.490)	(1.489)	(2.097)	(1.766)	(1.681)	(2.635)
Observations	518	518	518	518	518	433	462	462
Number of countries	37	37	37	37	37	34	35	35
F stat			112.07	105.58	101.32	85.46	110.42	113.06

Note: The dependent variable is Manufacturing Value Added as a share to GDP in %. Standard errors in parentheses. ***, ** and * represent statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively.
Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, data from the World Steels Association, 2010; World Steel Association, 2014 and UNIDO.

*Table 4: Impact of Lag China steel production (1,000 MT) *avg. prob. of any China aid on Chinese aid in Africa over 2000-13*

The dependent variable is CHINAID_GDP in %	1	2	3	4	5	6
VARIABLES	First stage G2SLS	First stage G2SLS	First stage G2SLS	First stage G2SLS	First stage G2SLS	First stage G2SLS
Lag China steel production (1,000 MT) *avg. prob. of any China aid	0.918 ***	0.868***	0.876***	0.859***	0.745***	0.761***
	(0.1868)	(0.1871)	(0.1884)	(0.1992)	(0.2104)	(0.2067)
Ratio Foreign Direct Investment to GDP (in %)		0.016	0.016	0.107***	0.046***	0.052***
		(0.0095)	(0.0095)	(0.0223)	(0.0181)	(0.0181)
Road Density			0.759			
			(5.693)			
Share of manufacturing exports in total exports (in %)				-.007		
				(0.0111)		
Ratio Gross capital formation to GDP (in %)					-.002	
					(0.0166)	
Ratio Gross National Expenditure to GDP (in %)						-.007
						(0.0113)
Constant	-4.198***	-3.997***	-4.141***	-4.033***	-3.351***	-2.793***
	(1.301)	(1.281)	(1.5437)	(1.3551)	(1.3763)	(1.7122)
Observations	518	518	518	433	462	462
Number of countries	37	37	37	34	35	35

Note: The dependent variable is Chinese aid as a share to GDP in %. Standard errors in parentheses. ***, ** and * represent statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively.

Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, data from the World Steels Association, 2010; World Steel Association, 2014 and UNIDO.

*Table 5: Impact of variation in Chinese aid on variation of manufacturing industry in Africa over 2000-13 with Lag China steel production (1,000 MT) *avg. prob. of any China aid as an instrument*

	1	2	3	4	5	6	7	8
VARIABLES	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Change in China's aid-to-GDP ratio (in % points)	-0.00433**	-0.00493**	-0.0316**	-0.0382**	-0.0394**	-0.0337***	-0.0400**	-0.0398**
	(0.00171)	(0.00195)	(0.0140)	(0.0153)	(0.0153)	(0.0114)	(0.0163)	(0.0156)
Ratio Foreign Direct Investment to GDP (in %)		0.00386		0.00530**	0.00540**	0.00151	0.0141***	0.00890**
		(0.00700)		(0.00211)	(0.00212)	(0.00413)	(0.00408)	(0.00439)
Road Density					-0.802			
					(0.703)			
Share of manufacturing exports in total exports (in %)						0.00308*		
						(0.00178)		
Ratio Gross capital formation to GDP (in %)							0.00663*	
							(0.00357)	
Ratio Gross National Expenditure to GDP (in %)								0.00846***
								(0.00232)
Constant	2.236***	2.217***	2.142***	2.096***	2.201***	2.147***	1.928***	1.190***
	(0.103)	(0.115)	(0.117)	(0.113)	(0.150)	(0.105)	(0.148)	(0.270)
Observations	518	518	518	518	518	433	462	462
Number of countries	37	37	37	37	37	34	35	35
F stat			51.62	47.99	46.22	42.80	47.16	46.94

Note: The dependent variable is Change in MVA_GDP in % points. Standard errors in parentheses. ***, ** and * represent statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively.

Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, data from the World Steels Association, 2010; World Steel Association, 2014 and UNIDO.

*Table 6: Impact of Lag China steel production (1,000 MT) *avg. prob. of any China aid on variation Chinese aid in Africa over 2000-13*

	1	2	3	4	5	6
	First stage	First stage	First stage	First stage	First stage	First stage
VARIABLES	G2SLS	G2SLS	G2SLS	G2SLS	G2SLS	G2SLS
Lag China steel production (1,000 MT)*avg. prob. of any China aid	2.439 ***	2.229 ***	2.266 ***	2.592 ***	2.278 ***	2.338 ***
	(0.4571)	(0.4408)	(0.4461)	(0.5060)	0.4894)	(0.4848)
Ratio Foreign Direct Investment to GDP (in %)		0.286	0.028	0.102	0.075	0.088
		(0.0261)	(0.0261)	(0.0646)	(0.0517)	(0.0556)
Road Density			3.023			
			(9.0789)			
Share of manufacturing exports in total exports (in %)				-0.024		
				(0.0299)		
Ratio Gross capital formation to GDP (in %)					0.005	
					(0.0466)	
Ratio Gross National Expenditure to GDP (in %)						0.010
						(0.0310)
Constant	-16.580***	-15.572***	-16.187***	-17.244***	-16.161***	-15.337***
	(2.8477)	(2.6845)	(3.0753)	(3.1773)	(2.9160)	(4.1073)
Observations	518	518	518	433	462	462
Number of countries	37	37	37	34	35	35

Note: The dependent variable is Chinese aid as a share to GDP in %. Standard errors in parentheses. ***, ** and * represent statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively. Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, data from the World Steels Association, 2010; World Steel Association, 2014 and UNIDO.

*Table 7: Impact of Chinese aid to infrastructure and economic services on manufacturing industry in Africa over 2000-13 with Lag China steel production (1,000 MT) *avg. prob. of any China aid as an instrument*

	1	2	3	4	5	6	7	8
VARIABLES	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Chinese aid to infrastructure and economic services as a share to GDP (in %)	-0.110*	-0.114*	-1.484***	-1.663***	-1.679***	-2.147***	-1.148*	-1.067*
	(0.0631)	(0.0626)	(0.551)	(0.626)	(0.628)	(0.824)	(0.684)	(0.635)
Ratio Foreign Direct Investment to GDP (in %)		0.00734		0.0357	0.0362	0.194*	0.0773*	0.0753
		(0.0238)		(0.0228)	(0.0229)	(0.111)	(0.0457)	(0.0500)
Road Density					-9.990			
					(11.14)			
Share of manufacturing exports in total exports (in %)						0.0527*		
						(0.0270)		
Ratio Gross capital formation to GDP (in %)							0.0204	
							(0.0298)	
Ratio Gross National Expenditure to GDP (in %)								0.00869
								(0.0205)
Constant	11.74***	11.71***	12.37***	12.29***	13.66***	11.27***	11.83***	11.32***
	(1.265)	(1.280)	(1.569)	(1.574)	(2.228)	(1.877)	(0.607)	(2.130)
Observations	518	518	518	518	518	433	462	462
Number of countries	37	37	37	37	37	34	35	35
F stat			98.57	90.17	86.42	67.02	94.81	99.31

Note: The dependent variable is MVA_GDP in %. Standard errors in parentheses. ***, ** and * represent statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively. Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, data from the World Steels Association, 2010; World Steel Association, 2014 and UNIDO.

*Table 8: Impact of Lag China steel production (1,000 MT) *avg. prob. of any China aid on Chinese aid to infrastructure and economic services in Africa over 2000-13*

	1	2	3	4	5	6
VARIABLES	First stage G2SLS	First stage G2SLS	First stage G2SLS	First stage G2SLS	First stage G2SLS	First stage G2SLS
Lag China steel production (1,000 MT) *avg. prob. of any China aid	0.663 ***	0.615 ***	0.621 ***	0.578 ***	0.641 ***	0.658 ***
	(0.1710)	(0.1706)	(0.1718)	(0.1770)	(0.2332)	(0.2273)
Ratio Foreign Direct Investment to GDP (in %)		0.014	0.014	0.106	0.048	0.057
		(0.0088)	(0.0088)	(0.0204)	(0.0168)	(0.0191)
Road Density			0.347			
			(4.9162)			
Share of manufacturing exports in total exports (in %)				-0.002		
				(0.0100)		
Ratio Gross capital formation to GDP (in %)					-0.005	
					(0.0162)	
Ratio Gross National Expenditure to GDP (in %)						-0.017
						(0.0111)
Constant	-3.11***	-2.919***	-2.995***	-2.954***	-2.972***	-2.086***
	(1.1728)	(1.1440)	(1.3685)	(1.1686)	(1.1679)	(1.5003)
Observations	518	518	518	433	462	462
Number of countries	37	37	37	34	35	35

Note: The dependent variable is Chinese aid to infrastructure and economic services as a share to GDP in %. Standard errors in parentheses. ***, ** and * represent statistical significance at 1 per cent, 5 per cent, and 10 per cent, respectively. Source: author's calculations based on data from AidData's Global Chinese Official Finance Dataset, World Development Indicators, data from the World Steels Association, 2010; World Steel Association, 2014 and UNIDO.

Table 9: Impact of ODA to productive sectors on manufacturing growth in Africa over the period 2000–13 including variables on the role of institutions and financing constraints

	1	2	3	4	5	6	7	8
VARIABLES	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Ratio Chinese aid to GDP (in %)	-1.159***	-1.179***	-1.284***	-1.275***	-1.148***	-1.166***	-0.775**	-5.960
	(0.394)	(0.397)	(0.408)	(0.414)	(0.401)	(0.395)	(0.387)	(6.531)
Ratio Foreign Direct Investment to GDP (in %)	0.0297	0.0262	0.0286	0.0297	0.0294	0.0331*	0.0276	0.162
	(0.0193)	(0.0196)	(0.0201)	(0.0200)	(0.0195)	(0.0196)	(0.0173)	(0.230)
Control of corruption	0.113							
	(0.743)							
Rule of Law		0.942						
		(0.822)						
Political Stability No Violence			0.604					
			(0.395)					
Voice and Accountability				0.774				
				(0.718)				
Government Effectiveness					0.189			
					(0.762)			
Regulatory Quality						-0.691		
						(0.749)		
Bank Credit to private Sector (in % to GDP)							-0.0612***	
							(0.0211)	
Trading accros borders: cost of exports (in %)								3.158
Constant	12.49***	13.06***	12.84***	12.99***	12.53***	12.02***	13.18***	-7.491
	(1.582)	(1.610)	(1.530)	(1.570)	(1.563)	(1.580)	(1.601)	(25.60)
Observations	518	518	518	518	518	518	502	287
Number of countries	37	37	37	37	37	37	37	36
Instrument	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F stat	102.77	102.46	98.23	99.77	101.49	104.82	126.62	23.21

5. Discussion of main results

Table 3 presents our overall Chinese aid impact results on promotion of the manufacturing sector. However, estimated with OLS (columns 1 and 2) shows correlation between total Chinese aid as a percentage of GDP and manufacturing value added as a percentage of GDP, while 2SLS regressions (columns 3 to 8) show a causal effect between these variables. Unlike expected sign, we get a strong negative and statistically significant link between total Chinese aid as a percentage of GDP and manufacturing value added as a percentage of GDP. The coefficients of total Chinese aid as a percentage of GDP are negative and statistically significant at the 5 per cent level of significance for OLS regressions and 1 per cent for 2SLS estimates. OLS estimates (columns 1 and 2) reveal that a 1 percent increase in total Chinese aid as a percentage of GDP leads to a 0.11 percent decrease in manufacturing value added as a percentage of GDP. This causal effect is more pronounced with 2SLS estimates by controlling other factors which can influence manufacturing sector. This negative impact varies between 1.064 and 1.178 percent. Meanwhile, we note that the first-stage F statistic for the excluded instrument is between 85 and 113, suggesting that it is unlikely that our estimates suffer from weak-instrument bias.

Table 4 presents results from the first stage (columns 1 to 6) which depend on the instrumental variable considering the interaction between the probability of receiving aid and the previous production of steel. As expected, there is a strong and statistically significant positive relationship between total Chinese aid as a percentage of GDP and our instrumental variable at the 1 percent level of significance. In other words, countries that are common recipients of Chinese aid receive a little more from Chinese aid a year after China steel production is high.

To support our analyses, we perform the same analysis this time using changes in total Chinese aid as a percentage of GDP and manufacturing value added as a percentage of GDP. The results in Table 5 (columns 1 and 2) show OLS regressions while the rest shows 2SLS estimates (columns 3 to 8). All these results always highlight this negative and statistically significant link between the change in the percentage points of Chinese aid as a percentage of GDP and the change in percentage points of manufacturing value added as a percentage of GDP at the 5 per cent level of significance. Thus, we note that a 10-percentage point change in total Chinese aid as a percentage of GDP leads to a 0.3 to 0.4 percentage point decrease in manufacturing value added as a percentage of GDP. Note here also that the first-stage F statistic for the excluded instrument is between 48 and 51 which validates once again the strength of our instrumental variable.

In table 6, we also include the results of the first stage by analyzing the interaction effect between the probability that a country *i* receive Chinese aid in year *t* and the Chinese steel production in year *t-1* on the change in total Chinese aid received by that country as a percentage of GDP. The results are like those found in Table 4. Its effect remains positive and statistically significant at the 1 per cent level of significance.

Next, we continue our analyses this time by exploring the channel of the effects of Chinese aid to economic infrastructure and services on the promotion of the manufacturing sector given that it accounts for more than 70% of all Chinese aid to Africa.

Table 7 (columns 1-2) reports correlation between Chinese aid allocated to economic infrastructure and services as a percentage of GDP and manufacturing value added as a percentage of GDP with OLS estimates, while regressions by 2SLS (columns 3 to 8) show a causal relationship between these variables. These results support those obtained by considering China's overall aid where the strong negative and significant relationship between the two variables is remained. The coefficients of Chinese aid to infrastructure and economic services as a percentage of GDP are statistically negative and significant at the 10 per cent level of significance for OLS estimates and 1 per cent (columns 3 to 6) and 10 per cent (columns 7 and 8) for 2SLS estimates. OLS regressions (columns 1 and 2) reveal that a 1 percent increase in Chinese aid to economic infrastructure and services as a percentage of GDP leads to a 0.11 percent decrease in manufacturing value added as a percentage of GDP. 2SLS estimates and controlling for other variables (columns 3 to 8), the negative and statistically significant impact of a 1 percent change in Chinese aid to infrastructure and economic services as a percentage of GDP on manufacturing value added as a percentage of GDP increases from 1.067 to 2.147 percent. Once again, the first-stage F statistic for the excluded instrument is still between 67 and 99, suggesting that it is unlikely that our estimates suffer from weak-instrument bias.

For the estimates of the first stage (columns 1 to 6) which depend on the instrumental variable considering the interaction between the probability of receiving aid and the previous production of steel. As expected, Table 8 shows a positive and significant link between Chinese aid for economic infrastructure and services as a percentage of GDP and our instrument at the 1 per level of significance. In other words, countries that are common recipients of Chinese aid receive a little more from Chinese aid a year after China achieved domestic overproduction of steel.

On the one hand, these results are counter intuitive because they infirm an overall conceptual framework developed by (McCormick, 2008) which illustrates how manufacturing sector could be promoted by Chinese aid, especially targeted aid to productive infrastructure. Nevertheless, Chinese monetary aid is tied to the use of Chinese goods and services. Since that Chinese objective is to sell its raw materials overproduction such as steel, aluminum, cement, iron, glass and timber (Spegele & Miller, 2016) through the financing of major infrastructure projects, its allocation is detrimental to the promotion of the manufacturing sector by disadvantaging the productive sectors. Indeed, while Chinese aid is largely conditioned using raw materials from China, it hinders the development of the manufacturing sector in most African countries since industrialization is still in its embryonic state. However, it would have been beneficial, for example, for a country producing these building materials necessary for these major infrastructure projects when they are purchased locally from its industries.

On the other hand, they confirm the work of van Wijnbergen's seminar on foreign aid (1985, 1986)[4] building on the work of (Corden & Neary, 1982) in the context of natural resource discoveries. In a simple two-good model, increased aid will have two effects. First, aid could disproportionately be targeted at expanding non-tradable services such as construction, health care, and education for which there is substantial unmet demand. This will increase wages in that sector (given a fixed supply of skilled labor in the short run), will draw skilled labor into the non-tradable sector, and will increase wages overall.

[4] Quoted by (Rajan & Subramanian, 2011)

Given that the international price of traded goods is fixed, the higher wage in terms of traded goods will reduce traded sector profitability, competitiveness, and lead to a decline in exports. In Corden and Neary (1982)'s terminology, this is the resource movement effect. In addition, the higher wages will be spent, raising the price of non-traded goods relative to traded goods (the real exchange rate) and further hurting traded sector competitiveness. Corden and Neary (1982) would term this the spending effect. Our results corroborate with theirs in the way that most of China's aid is absorbed by top countries producing natural resources among them Nigeria, Angola, South Africa, Zimbabwe, Ghana, Cameroon, Egypt, Côte d'Ivoire, Equatorial Guinea and the Democratic Republic of Congo. The more aid is spent on traded goods or factors (imported capital goods and foreign consultants) and on factors that are not in limited supply (unskilled labor), the more the supply of factors and non-traded goods respond to aid inflows, and the more domestic fiscal contraction takes place, the less likely will wages and prices be bid up to an excessive degree and the less likely will the real exchange rate appreciate (see Berg et al. (2005)). The more aid a country has received, the smaller its share of manufacturing through the channel of the appreciation of the recipient country's real exchange rate (Rajan & Subramanian, 2011).

However, economic literature shows that economic performance of a sector of activity such as manufacturing can be influenced by other endogenous variables including institutional factors. Several studies found that that governance is highly positively correlated with economic development in developing countries, however the effect is not the same across different regime and income groups (Acemoglu & Robinson, 2010). They highlighted the impact of institutional quality on per capita production. Therefore, it is relevant to test the robustness of our results by introducing these variables on the quality of institutions. Suppose countries with low manufacturing growth rates are also those with poor quality institutions, and therefore aid to these countries is systematically impacted by problems of poor governance. In this case, there will be part of growth of this sector that would be attributable to the institution’s quality.

To this end, we introduce six variables that measure the quality of the institutions developed by Kaufmann, Kraay, and Zoido-Lobatón measures of institutional development. These variables are: voice and accountability; political stability and absence of violence; government effectiveness; regulatory burden; rule of law; and freedom from graft. The method used to calculate each subindex gives it approximately a unit normal distribution, with an increase always meaning better quality of institutions.

The results are presented in Table 9 (columns 1-8) when they are included in the estimation. The coefficient of our interest variable continues to be significant and negative. The core coefficient between growth rate of aid and growth rate of manufacturing sector remains qualitatively similar in magnitude and significance.

6. Conclusions

For more than two decades, Chinese aid has been subject of a lot of studies following its large volume vis-à-vis Africa. Most of the empirical work has focused on impact it could have on economic development in Africa. Its funding model is also flexible compared to Western donors in terms of the criteria and mechanisms for its allocation. Its strategy of allocating between the different sectors has also continued to be criticized at a time when it favours the financing of infrastructure and economic services in exchange for natural resources.

While Chinese aid to Africa in overall represents on average 14.9 per cent of development aid and more than 78 per cent especially to infrastructure and economic services, it is more relevant to know whether this financing model advocated by China promotes the development of the manufacturing sector in Africa. Our findings show that this approach has negative effects on the manufacturing industry in Africa because firstly this aid is largely directed towards infrastructure and economic services. Secondly, it is a brake on the development of the manufacturing industry in Africa since it is linked to the consumption of raw materials such as steel, aluminum, cement, timber used in the implementation of major infrastructure projects in Africa. Third, it could be also related to the Dutch disease phenomenon which is an economic phenomenon linking the exploitation of natural resources to the decline of local manufacturing.

When there is a controversial debate on effectiveness of China's aid and more specifically on that oriented towards infrastructure, our findings have policy implications on how to apprehend its effects on manufacturing industry promotion in Africa especially in countries producing natural resources. Since that poor economic infrastructure in Africa (transport, energy) is a handicap to the manufacturing industry, we provide an econometric analysis proving that improvement of this infrastructure financed by Chinese aid is not likely to increase the development of this industry due to its tied nature. Consequently, it puts this sector at a disadvantage through increased export earnings from natural resources and consequently the appreciation of the national currency. Our results show that Chinese aid has a negative and immediate effect on manufacturing promotion in Africa.

However, our results have limitations because they do not indicate that this effect is short-term or long-term. They also do not consider political or institutional factors that may influence the development of manufacturing such as the quality of institutions, the business climate, political stability, or geographical position of the country.

7. References

Acemoglu, D., & Robinson, J. (2010). The Role of Institutions in Growth and Development. *Review of Economics and Institutions*, *1*(2), Article 2. http://www.rei.unipg.it/rei/article/view/14

Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed). MIT Press.

Bluhm, R., Dreher, A., Fuchs, A., Parks, B. C., Strange, A. M., & Tierney, M. J. (2020). *Connective Financing*. 50.

Brautigam, D., & Brautigam, P. of I. D. D. (2009). *The Dragon's Gift : The Real Story of China in Africa*. OUP Oxford.

Bräutigam, D., & Tang, X. (2014). "Going Global in Groups" : Structural Transformation and China's Special Economic Zones Overseas. *World Development*, *63*, 78-91. https://doi.org/10.1016/j.worlddev.2013.10.010

Busse, M., Erdogan, C., & Mühlen, H. (2016). China's Impact on Africa – The Role of Trade, FDI and Aid. *Kyklos*, *69*(2), 228-262. https://doi.org/10.1111/kykl.12110

Cabestan, J.-P. (2013). China-Africa Relations : The New Responsibilities and Challenges of a Potential World Power. *Herodote*, *150*(3), 150-171. https://doi.org/DOI 10.3917/her.150.0150

Corden, W. M., & Neary, J. P. (1982). Booming Sector and De-Industrialisation in a Small Open Economy. *The Economic Journal*, *92*(368), 825-848. https://doi.org/10.2307/2232670

Dong, Y., & Fan, C. (2020). The role of China's aid and ODI in the economic growth of African countries. *Emerging Markets Review*, *44*, 100713. https://doi.org/10.1016/j.ememar.2020.100713

Dreher, A., Eichenauer, V. Z., & Gehring, K. (2018). Geopolitics, Aid, and Growth : The Impact of UN Security Council Membership on the Effectiveness of Aid. *The World Bank Economic Review*, *32*(2), 268-286. https://doi.org/10.1093/wber/lhw037

Dreher, A., & Fuchs, A. (2015). Rogue aid ? An empirical analysis of China's aid allocation. *The Canadian journal of economics*, *48*(3), 988-1023. https://doi.org/10.1111/caje.12166

Dreher, A., Fuchs, A., Hodler, R., Parks, B. C., Raschky, P. A., & Tierney, M. J. (2021). Is Favoritism a Threat to Chinese Aid Effectiveness? A Subnational Analysis of Chinese Development Projects. *World Development*, *139*, 105291. https://doi.org/10.1016/j.worlddev.2020.105291

Dreher, A., Fuchs, A., Parks, B., Strange, A., & Tierney, M. J. (2020). *Aid, China, and Growth : Evidence from a New Global Development Finance Dataset*. 113.

Ferro, E., Portugal-Perez, A., & Wilson, J. S. (2014). *Aid to the Services Sector : Does it Affect Manufacturing Exports?* (SSRN Scholarly Paper ID 2425414). Social Science Research Network. https://doi.org/10.1111/twec.12151

Furuoka, F. (2017). Determinants of China's and Japan's Foreign Aid Allocations in Africa : China's and Japan's Foreign Aid Allocations. *African Development Review*, *29*, 376-388. https://doi.org/10.1111/1467-8268.12275

Guèye, C. (Éd.). (2018). *Alternative Report on Africa (AROA) : = Rapport Alternatif Sur l'Afrique (RASA)*. AROA-Africa.

Humphrey, C., & Michaelowa, K. (2019). China in Africa : Competition for traditional development finance institutions? *World Development*, *120*, 15-28. https://doi.org/10.1016/j.worlddev.2019.03.014

Lewis, W. A. (1954). Economic Development with Unlimited Supplies of Labour. *The Manchester School*, *22*(2), 139-191. https://doi.org/10.1111/j.1467-9957.1954.tb00021.x

Maruta, A. (2018). Can aid for financial sector buy financial development? *Journal of Macroeconomics*, *62*. https://doi.org/10.1016/j.jmacro.2018.11.003

McCormick, D. (2008). China & India as Africa's New Donors : The Impact of Aid on Development. *Review of African Political Economy*, *35*(115), 73-92. https://doi.org/10.1080/03056240802011501

Murphy, K. M., Shleifer, A., & Vishny, R. W. (1989). Industrialization and the Big Push. *The Journal of Political Economy*, *97*(5), 1003-1026. http://www.jstor.org/stable/1831884

Ndikumana, A. (2022). *Does aid to the productive sectors cause manufacturing sector growth in Africa?* https://doi.org/10.35188/UNU-WIDER/2022/153-2

Rajan, R. G., & Subramanian, A. (2005). *WHAT UNDERMINES AID'S IMPACT ON GROWTH?* 63.

Rajan, R. G., & Subramanian, A. (2011). Aid, Dutch disease, and manufacturing growth. *Journal of Development Economics*, *94*(1), 106-118. https://doi.org/10.1016/j.jdeveco.2009.12.004

Rajan, R. G., Subramanian, A., Bio-tchané, A., Bulíř, A., Birdsall, N., Bourguignon, F., Chhibber, A., Clemens, M., Cordella, T., Devarajan, S., Gelb, A., Harford, T., Hicklin, J., Islam, N., Johnson, S., Kraay, A., Krishna, P., Krueger, A., Nowak, M., … Srinivasan, T. N. (2008). *Aid and Manufacturing Growth*.

Rosenstein-Rodan, P. N. (1943). Problems of Industrialisation of Eastern and South-Eastern Europe. *The Economic Journal*, *53*(210/211), 202-211. https://doi.org/10.2307/2226317

Spegele, B., & Miller, J. W. (2016, mai 9). China continues to prop up its ailing factories, adding to global glut. *The Wall Street Journal Eastern Edition*, A1.

Stratfor. (2016). *The Story of Steel in China*. Stratfor. https://worldview.stratfor.com/article/article/story-steel-china

Van Grieken, B. J., & Kantorowicz, J. (2021). Debunking Myths about China : The Determinants of China's Official Financing to the Pacific. *Geopolitics*, *26*(3), 861-888. https://doi.org/10.1080/14650045.2019.1654459

Appendix A

Table A 1: List of countries studied

Algeria	Malawi
Angola	Mauritania
Benin	Morocco
Botswana	Mozambique
Burkina Faso	Namibia
Burundi	Niger
Cameroon	Nigeria
Chad	Rwanda
Congo, Republic of	Senegal
Cote d`Ivoire	Sierra Leone
Egypt	South Africa
Eswatini	Tanzania
Ethiopia	Togo
Gabon	Tunisia
Gambia	Uganda
Ghana	Zambia
Guinea	Zimbabwe
Kenya	
Lesotho	
Liberia	

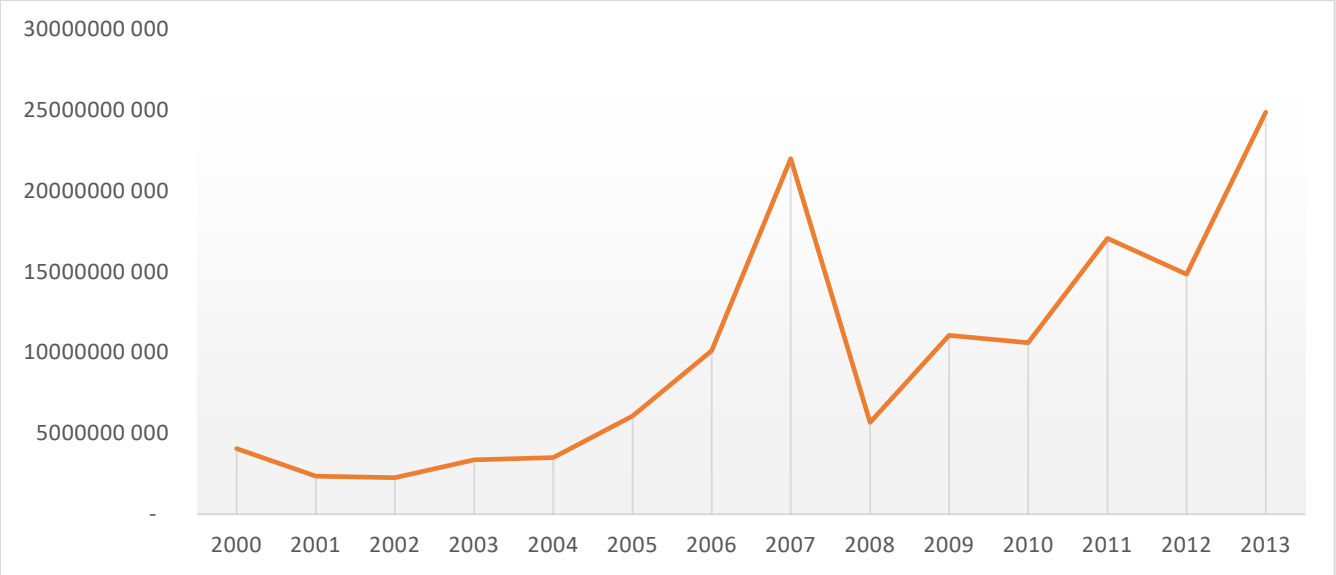
Table A 2: Aid distribution by sector, 2000 and 2013

	Volume by donor (in billion USD constant 2011)			Donor shares (%)	
Year	DAC AND NO DAC countries	CHINA	Total	DAC AND NO DAC countries	CHINA
2000	44.7	4.1	48.7	91.6	8.4
2001	41.3	2.4	43.6	94.6	5.4
2002	46.4	2.3	48.7	95.3	4.7
2003	48.8	3.4	52.2	93.6	6.4
2004	51.8	3.5	55.3	93.6	6.4
2005	55.6	6.1	61.7	90.1	9.9
2006	66.6	10.1	76.7	86.8	13.2
2007	57.8	22.0	79.8	72.4	27.6
2008	63.9	5.7	69.6	91.8	8.2
2009	77.8	11.1	88.8	87.5	12.5
2010	65.5	10.6	76.1	86.1	13.9
2011	50.4	17.1	67.5	74.7	25.3
2012	65.7	14.8	80.6	81.6	18.4
2013	70.7	24.9	95.6	74.0	26.0
Total	807.1	137.9	945.1	85.4	14.6

Source: Author's calculations based on data from AidData's Core Research Release Version 3.0 and AidData's Global Chinese Official Finance Dataset.

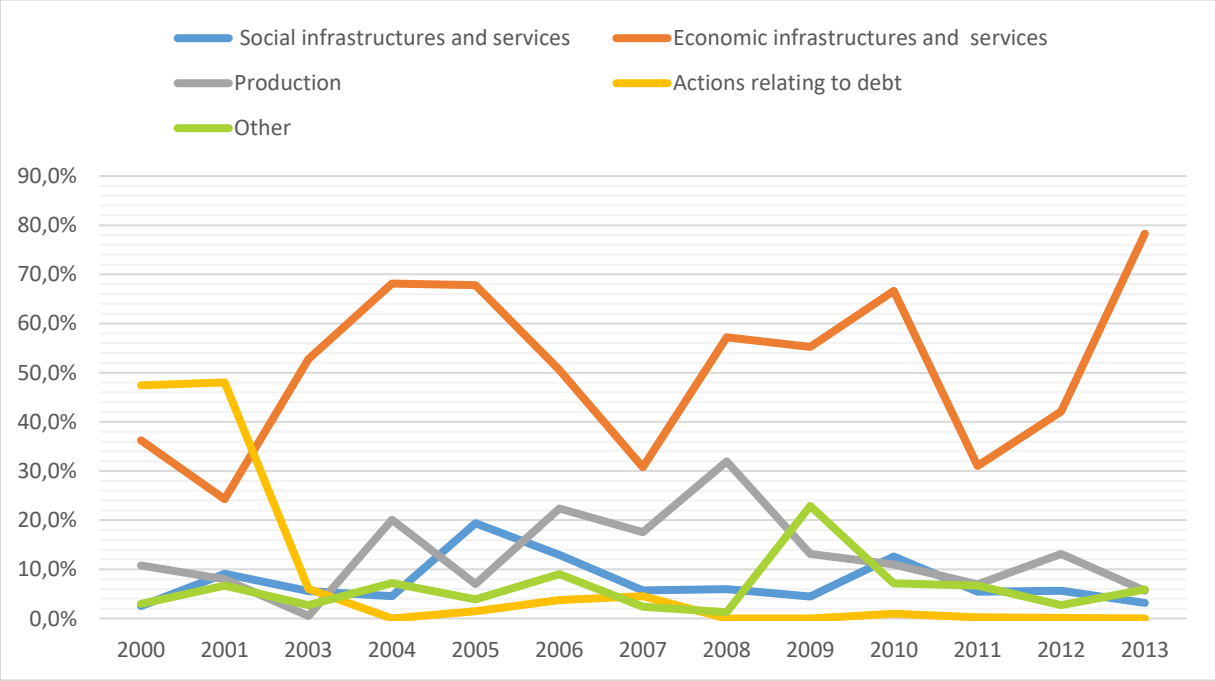
Appendix B

FigureB10: Chinese aid to Africa, 2000 to 2013 (USD constant 2011)



Source: author's calculations based on data from AidData's Core Research Release Version 3.0 and AidData's Global Chinese Official Finance Dataset.

Figure B11: Distribution of Chinese aid by sector, 2000-2013 (percent of total)



Source: author's calculations based on data from AidData's Core Research Release Version 3.0 and AidData's Global Chinese Official Finance Dataset.

Appendix C

Table C1: Status of Chinese project to Africa between 2000 and 2013

Status	Amount in USD 2011 constants	%
Completion	24,478,425,568	17.7
Implementation	54,573,504,255	39.6
Pipeline : Commitment	28,150,000,923	20.4
Pipeline : Pledge	30,729,806,534	22.3
Total	137,931,737,280	100

Source: author's calculations based on AidData's Chinese Official Finance to Africa, 2000–2013, version 1.2 database

Table C2: Disbursement's rate aid to Africa distribution for 2000-2013 period

Year	Total commitments	Total disbursements	Disbursement rate in %
2005	29,312	24,669.06	84.16
2006	37,572	31,666,01	84.28
2007	29,164	24,662,2	84.56
2008	36,236	27,378,58	75.56
2009	35,745	28,192,37	78.87
2010	33,451	29,140,29	87.11
2011	32,953	32,523,06	98.69
2012	33,217	30,271,15	91.13
2013	33,055	30,054,77	90.92
2014	32,497	29,050,13	89.39
2015	32,246	26,877,19	83.35
2016	33,091	27,213,32	82.24
2017	34,547	29,776,4	86.19

Source: author's calculations based on OECD database for 2000-201