Can Chinese foreign direct investment promote industrialization in African countries?

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Abstract

This paper investigates the relationship between Chinese foreign direct investment and industrialization for 41 African countries over the period 2003-2015. Based on System Generalized Method of Moments (GMM), empirical findings show that Chinese foreign direct investment did not significantly influence the industrialization process in African countries.

1. Introduction

Most developing countries, today industrialized, have gone through a real strategy of structural transformation. Structural transformation refers to the allocation of resources from less productive sectors to more productive sectors (Naudé et al. 2016). That is, the transition from the primary sector to the secondary sector and afterwards from the secondary sector to the tertiary sector[1]. However, most African countries have not respected this pattern (Cadot et al. 2015). African economies have moved directly from the primary sector to the tertiary sector, justifying the low level of industrialization of the continent. Industrialization is not an option but a necessity if African countries aspire to effective and sustainable economic development (Badiane and Makombe, 2015). In the history of capitalism, few countries have developed their economies without developing a strong industrial base, so much so that the terms "industrialized country" and "developed country" are used interchangeably (UNECA, 2016).

There is a growing consensus in the literature that industrialization process can create more jobs (Lavopa and Szirmai, 2012) and thus reduce unemployment, alleviate poverty (Kimura and Chang, 2017), accelerate technological development (Grynspan, 1982), promote economic diversification (Mbaegbu, 2016) and therefore increase economic growth (ONUDI, 2002; Hausmann et al. 2005). Notwithstanding this perception of industrialization, the facts suggest that in most African countries the process of industrialization has not taken off in any significant way (World Bank, 2015). The contribution of Africa's manufacturing sector to the continent's GDP had fallen from 19% in 1975 to 11% in 2014 (Balchin et al. 2016). The lack of industrial development in Africa is partially related to the challenge of attracting sufficient foreign direct investment (World Bank, 2015), infrastructure bottlenecks, particularly energy (Rodrick, 2016), political and managerial deficiencies, low level of human capital and malfunctioning credit markets (Qobo and Le Pere, 2017; Page, 2012).

To boost industrialization process, African countries need to mobilize huge financial resources to finance infrastructures projects (such as road and energy), education and technology. Rich China, with its experience of industrialization and its huge financial potential through foreign direct investment (FDI) is an important opportunity of financing for African countries. Indeed, many African countries have implemented various policy incentives to attract more Chinese foreign direct investment. Accordingly, Chinese FDI flows increased from just $491.23 million in 2003 to $3.37 billion in 2013 (MOFCOM, 2014). In 2014, the cumulative total amount of Chinese FDI in Africa exceeded $30 billion, more than 60 times that of 2003, making China the 5th largest investor in Africa and the 1st developing countries investor in Africa (Busse et al. 2016).

Whereas the substantial bulk of the literature has focused on the impact of FDI on economic growth (Nkoa, 2018; Jude and Levieuge, 2017; Gumby et al. 2017; Gui-diby, 2014) scholarly focus on the impact of FDI on the industrialization process, notably in Africa is limited. In essence, to the best of our knowledge there is only two studies that have examined the impact of foreign direct investment on the industrialization process in Africa, notably, Gui-Diby and Renard (2015) and Nkoa (2016). While Nkoa (2016) established a positive link between foreign direct investment and industrialization in Africa, the inquiry by Gui-Diby and Renard (2015) on a panel of 49 African countries indicated that FDI did not have a significant impact on industrialization of these countries. What about Chinese FDI? This study is related to these two papers and investigates the impact of Chinese foreign direct investment on the

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[1] As a first step, the share of agriculture in GDP is shrinking, while the modern sectors (manufacturing industry, mining extraction, high added value services, etc.) are gaining momentum. Once a certain per capita income level (between US $ 11,000 and US $ 14,000) is exceeded, a second phase begins, in which the manufacturing sector contracts, as services continue to expand (Vergne and Ausseur, 2015).

industrialization process in African countries. The results show that Chinese FDI have no significant effect on industrialization in African countries.

The rest of the paper is organized as follows: Section 2 describes the data and methodology. Section 3 presents and analyses the results. Section 4 concludes.

2. Data and methodology

2.1Data

We investigate a panel of 41 African countries with data for the period 2003-2015 from: (i) World Development Indicators (WDI, 2016) and (ii) Chinese Ministry of Commerce (MOFCOM, 2016). The periodicity and countries under investigation are chosen according to data availability. The full description of the data is as follows:

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Industry value added	481	28.53737	15.0362	4.148005	84.28298
Employment in industry	520	12.87673	8.805329	1.8	38.9
Chinese FDI (log)	526	17.92622	2.04485	9.21034	22.50733
Infrastructures	519	3.727597	6.360057	.0061202	31.50345
Human capital	312	46.22313	24.38444	7.45998	99.86019
Imports	510	44.89421	24.89904	10.49242	236.3918
Exports	510	35.45587	19.85619	4.428757	118.8641
GDP growth rate	529	4.96597	5.407954	-36.69995	37.99873
Government expenditure	502	15.02694	5.846711	2.047121	46.60109
Financial development	507	23.49521	26.69208	.7959868	160.1248
Ressource rents	526	14.97915	13.79539	.0011427	61.51365

Table 2: Correlation matrix

	Indus_va	Employ	FDI	Infras	HK	IMP	EXP	GDPg	Gov_ex	FD	Rents
Indus_va	1.0000										
Employ	0.5350	1.0000									
FDI	0.1033	0.1288	1.0000								
Infras	0.2277	0.7386	0.1018	1.0000							
Educ	0.4534	0.8226	0.2236	0.7547	1.0000						
IMP	-0.1673	0.0600	-0.0466	0.2215	0.0512	1.0000					
EXP	0.5087	0.4714	0.0582	0.4922	0.4712	0.4098	1.0000				
GDPg	0.0161	-0.1612	-0.0221	-0.1193	-0.1597	-0.0435	0.0660	1.0000			
Gov_ex	0.1040	0.1605	-0.1770	0.0784	0.1595	0.3046	-0.0549	-0.1473	1.0000		
FD	0.1152	0.6193	0.2115	0.6711	0.7085	0.1101	0.2548	-0.1500	0.3303	1.0000	
Rents	0.2871	-0.2077	0.2365	-0.3469	-0.2695	0.2168	0.2833	0.1091	-0.2314	-0.3458	1.0000

Note: Indus_va : Industry value added. Employ: Employment in industry. FDI: Chinese FDI. Infras: infrastructures. Educ : Human capital. IMP: Imports. EXP: Exports. GDPg: GDP growth rate. Gov_ex : Government expenditure. FD: financial development. Rents: Resource rents.

The dependent variable is industrialization, measured by industry value added. To analyze the sensitivity of our results, we use Employment in industry as an alternative measure of industrialization. We obtain these variables from the World Bank: African Development Indicators. Our main independent variable is the logarithm of Chinese foreign direct investment stock in Africa. We obtain this variable from the Chinese Ministry of Commerce (MOFCOM, 2016). To ensure that estimated results are not biased by omitted variables, we include eight control variables in this study. They comprise (i) GDP growth rate, (ii) Exports, (iii) Imports, (iv) Government expenditure, (v) Financial development, (vi) Resource rents, (vii) Human capital, and (viii) infrastructures. While Table 1 presents descriptive statistics for all variables used, Table 2 provided the correlation matrix between variables and shows a weak positive correlation between Chinese FDI and industrialization. However, as correlation does not mean causality, these correlations will be tested empirically in the next section.

2.2 Methodology

To investigate the impact of Chinese FDI on the industrialization process in African countries, we follow Gui-Diby and Renard (2015) and Nkoa (2016) and specify the following model:

$$Indus_{it} = \alpha + \beta_1 Indus_{it-1} + \beta_2 FDI_{it} + \beta_3 X_{it} + \mu_i + v_t + \varepsilon_{it} \tag{1}$$

Were $Indus_{i,t}$ represents the level of industrialization for country i in period t, FDI_{it} is the logarithm of Chinese foreign direct investment stock in Africa, X_{it} is a vector which includes all control variables, μ_i is an unobserved country-specific effect, v_t is time specific effect and ε_{it} is the error term.

The presence of the lagged value of industrialization ($Indus_{it-1}$) in the Eq (1) puts our model inside the context of dynamic panel model. We apply the System Generalized Method of Moment (GMM) proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). GMM is useful for several reasons. First, GMM estimator is widely used to address the endogeneity problem that appears in panel data estimation (Arellano and Bover, 1995 and Blundell and Bond, 1998). Second, GMM estimator also consider the biases that appear due to country-specific effects. Third, GMM also avoids simultaneity or reverse causality problems. GMM method has two variant namely, the one-step estimators and two-step estimators. However, the two-step estimator has been proved to be more efficient than the one-step estimator because it uses optimal weighting matrices (Law et al., 2018). The consistency of the GMM estimators depends on two things: the validity of the assumption that the error term does not exhibit serial correlation (AR(2)) and the validity of the instruments (Hansen test).

3. Results

Table 3 reports the estimated results obtained from the System GMM method. The Hansen test confirms that the instruments used in the model are valid. Moreover, the results show that the p-value of AR (2) tests indicate that problems of correlation do not exist in the second order.

Column (1) in Table 3 presents the baseline regression containing only Chinese foreign direct investment, GDP growth and industrialization. The other models are extensions of this basic specification. In Column (1) the coefficient associated with Chinese FDI is negative and non-significant, meaning that Chinese FDI do not have a significant effect on industrialization

in African countries. This result is in agreement with the evidence from Gui-Diby and Renard (2015), who show that the impact of foreign direct investment on the industrialization process is insignificant in African countries. However, our findings contradict those of Nkoa (2016), who find a significant positive effect of foreign direct investment on industrialization in Africa. We check whether the baseline specification results hold after controlling for the potential determinants of industrialization. Columns (2) to (6) report these results, which corroborate the findings shown in Column (1). The results in Columns (2) to (6) show that Chinese FDI do not have any significant effect on the industrialization process in African countries.

Table 3: Chinese FDI and industrialization

	Dependent variable : Industry, value added					
	(1)	(2)	(3)	(4)	(5)	(6)
Chinese FDI	-0.167	-0.179	-0.0603	-0.160	-0.194	0.0790
	(0.113)	(0.190)	(0.364)	(0.163)	(0.214)	(0.0705)
Exports		0.415***				
		(0.0542)				
Imports		-0.143***				
		(0.0138)				
GDP growth rate	0.107*	0.106**	0.206*	0.119*	0.426***	0.190***
	(0.0574)	(0.0443)	(0.117)	(0.0602)	(0.154)	(0.0418)
Human capital			-0.0211			
			(0.0892)			
Government expenditure				-0.310**		
				(0.144)		
Financial development					0.0375***	
					(0.0125)	
Ressource rents					0.242***	
					(0.0461)	
Infrastructure						0.692***
						(0.0954)
Lag of dependent variable	0.941***	0.654***	0.941***	0.946***	0.855***	0.894***
	(0.00522)	(0.0406)	(0.0778)	(0.0117)	(0.0243)	(0.0121)
Constant	3.902*	5.306	2.268	8.200***	0.819	-1.973
	(2.025)	(4.241)	(5.023)	(2.534)	(3.837)	(1.389)
Observations	440	423	266	416	419	434
Number of country	39	39	36	39	39	39
AR(1) test	0.000895	0.000212	0.00667	0.000643	0.000291	0.000323
AR(2) test	0.600	0.446	0.704	0.464	0.587	0.678
Instruments	11	12	10	10	18	23
Hansen OIR	0.132	0.213	0.811	0.461	0.568	0.147
Fisher	17299***	345.7***	250.9***	2454***	903.5***	1672***

Note: Standard errors are in parentheses. ***,**,*, Significant at the 1%, 5% and 10% levels respectively

Several factors can explain this result. First, the business environment in Africa is not conducive (Busse et al. 2016). Despite the efforts made by several African countries to improve the business environment, the problems of regulation, the fight against corruption and the security of foreign investors still seem to be bottlenecks in the process of industrialization in Africa. Second, Chinese FDI accounts for only a small proportion of GDP in Sub-Saharan Africa. Finally, Chinese FDI, initially concentrated in extractive activities (Sanfilippo, 2010), diversify and move towards other sectors such as services, agriculture, finance and manufacturing. However, these changes take time for the effects to be perceptible on the industrialization process of African countries.

Table 4: Alternative measure of industrialization

	Dependent variable : Employment in industry					
	(1)	(2)	(3)	(4)	(5)	(6)
Chinese FDI	0.0468	0.00545	0.0879	0.0421	0.00965	-0.0165
	(0.0309)	(0.0177)	(0.0564)	(0.0268)	(0.0121)	(0.0206)
Exports		0.00991**				
		(0.00409)				
Imports		-0.00270**				
		(0.00125)				
GDP growth rate	0.0183***	0.0149***	0.0174*	0.00872**	0.00974***	0.00757*
	(0.00637)	(0.00322)	(0.00928)	(0.00393)	(0.00333)	(0.00384)
Human capital			-0.0130			
			(0.0140)			
Government expenditure				-0.0636***		
				(0.0213)		
Financial development					0.00557***	
					(0.00173)	
Ressource rents					0.00369	
					(0.00384)	
Infrastructure						0.0666***
						(0.0185)
Lag of dependent variable	0.990***	1.001***	1.019***	1.004***	0.982***	0.971***
	(0.00552)	(0.00420)	(0.0273)	(0.00616)	(0.00463)	(0.00842)
Constant	-0.730	0.340	-1.243	0.173	-0.0908	0.490
	(0.533)	(0.351)	(0.807)	(0.433)	(0.209)	(0.356)
Observations	474	457	270	449	452	461
Number of country	40	40	38	40	40	40
AR(1) test	0.0199	0.0204	0.0293	0.0234	0.0203	0.0216
AR(2) test	0.566	0.594	0.602	0.549	0.554	0.496
Instruments	14	27	14	21	31	24
Hansen OIR	0.281	0.342	0.836	0.275	0.116	0.483
Fisher	23852***	52920***	2811***	21156***	54986***	11625***

Note: Standard errors are in parentheses. ***,**,*, Significant at the 1%, 5% and 10% levels, respectively.

The control variables have the expected sign. We find evidence of positive effects of GDP growth rate, Exports, resource rents, financial development and infrastructures on industrialisation, while Imports and government expenditure exert a negative effects on industrialisation. Human capital does not exert a significant effect on industrialisation in African countries.

We also check for sensitivity of ours results by considering an alternative measure of industrialization. For this purpose, we consider employment in industry as a measure of industrialization. Gui-Diby and Renard (2015) and Nkoa (2016) used this variable to measure industrialization process in Africa. Table 4 reports these results based on this alternative measure of industrialization. Once again, these results confirm the findings reported in Table 3. Chinese foreign direct investment did not have a significant effect on the industrialization process in African countries.

4. Conclusion

This study investigates the relationship between Chinese foreign direct investment and industrialization on a panel of 41 African countries for the period 2003–2015. We base the empirical evidence on the System Generalized Method of Moments (GMM). Results show that Chinese foreign direct investment have no significant effect on the industrialization process in African countries. Our findings remain robust when an alternative measure of industrialization is used. These results are in line with Gui-Diby and Renard (2015), who noted that FDI did not significantly influence industrialization in African countries.

Appendix

Table 5: Definitions of variables

Variables	Variables definitions (measurement)	Sources
Indus_va	Industry, value added (% of GDP)	World Bank (WDI)
Employ	Employment in industry (% of total employment)	World Bank (WDI)
Chinese Foreign investment	Chinese Foreign direct investment stock	MOFCOM
Import	Imports of goods and services (% of GDP)	World Bank (WDI)
Export	Exports of goods and services (% of GDP)	World Bank (WDI)
GDP Growth rate	Gross Domestic Product (GDP) per capita growth (annual %)	World Bank (WDI)
Governement ependiture	General government final consumption expenditure (% of GDP)	World Bank (WDI)
Financial developement	Domestic credit to private sector (% of GDP)	World Bank (WDI)
Education	School enrollment, secondary (% gross)	World Bank (WDI)
Natural ressource	Total natural resources rents (% of GDP)	World Bank (WDI)

Table 6: List of counties

Algeria	Ethiopia	Niger
Angola	Gabon	Nigeria
Benin	Ghana	Rwanda
Botswana	Guinea	Senegal
Cameroon	Kenya	Seychelles
Central African Republic	Liberia	Sierra Leone
Chad	Madagascar	South Africa
Comoros	Malawi	Tanzania
Congo, Dem. Rep.	Mali	Togo
Congo, Rep.	Mauritania	Tunisia
Cote d'Ivoire	Mauritius	Uganda
Egypt, Arab Rep.	Morocco	Zambia
Equatorial Guinea	Mozambique	Zimbabwe
Eritrea	Namibia	

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