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On the importance of Chinese investment in Africa

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Abstract

With the growing presence of China in Africa over the last two decades, this paper investigates the impact of Chinese foreign direct investment (FDI) on economic performance in Africa, which we compare to that of the traditional economic partners of African countries, including the U.S., France, and Germany. Also, we explore whether China's new relationship with Africa has somehow altered the preexisting relationship between Africa and its traditional partners. Our results, using the fixed-effects and instrumental variable approaches to 36 countries over the period 2003–2012, indicate that Chinese FDI improves income in Africa. We also find that the impact is more pronounced for U.S. and German investment. Moreover, there is evidence that Chinese investment crowds out U.S. investment in Africa, whereas France seems to be competing with China. These results imply that as the Chinese economy grows, the demand for resources has increased its intensive competition with the U.S. rather than with France.

JEL classification: F21; O11; O55

Keywords: Foreign direct investment; Standard of living; Africa

1. Introduction

China's engagement in Africa has been growing in many aspects such as trade, investment, and aid. Over the last decade, although the traditional partners of the African countries, namely the European Union and the United States, continue to dominate foreign direct investment (FDI) in Africa, the rise of China is highly noticeable. For instance, from 2003 to 2011, the flow of Chinese investment to Africa grew by more than 30 times, while that of the United States grew only by about one third (UNCTAD Bilateral FDI Statistics, 2014).

The growth rate of the stock of Chinese outward investment around the world was positive during the period 2004–2011 with an average of 37.93%. As shown in Table 1, total investment increased until 2007. The subsequent years show a decrease in the growth rate probably because of the global financial crisis of 2008. Investment in Africa shows a similar pattern. However, unlike the world investment, investment in Africa has been at higher rates around mid-2000. Although this investment has gone a bit down compared to others from 2009, the average growth rate of Chinese investment in Africa is the second highest (57%) apart from that of Europe (65%). In terms of flows, Africa ranks third with an average of 107% after Oceania (128%) and North America (113%).[1] Some of the top destinations of Chinese investments in Africa include South Africa, Nigeria, Zambia, Algeria, Sudan, and Angola. The stock of foreign direct investment in these countries represents more than 50% of the total investment in Africa in 2012 (Leung and Zhou, 2014), and most of the investment is concentrated in mining, finance, and construction industries.

This explosion of Chinese FDI in Africa is preceded by different presidents' visits to Africa. For example, following President Jiang Zemin's tour in Africa in 1996, a new relationship was established between China and Africa (Alden, 2005). This relationship is driven by the increased demand for resources to support China's fast-growing economy and it has given considerable weight to economic cooperation and development at the expense of political and ideological considerations. This new

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[1] These figures are not, however, reported in the table to conserve space.

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Table 1
Growth rate (%) of Chinese outward direct investment (stock) around the world.

Year	Asia	Africa	Europe	Latin America	North America	Oceania	World
2004	25.85	83.12	38.81	79.00	65.76	15.18	34.78
2005	22.33	77.34	88.12	38.72	38.94	19.55	27.76
2006	17.15	60.28	78.31	71.71	25.63	44.47	31.15
2007	65.11	74.51	96.43	25.42	104.21	94.83	57.16
2008	65.77	74.90	15.15	30.52	12.93	108.48	56.03
2009	41.30	19.59	69.01	−5.10	41.67	68.21	33.58
2010	22.96	39.75	81.06	43.41	51.01	34.09	29.08
2011	33.00	24.55	55.63	25.75	72.08	39.50	33.91
Average	36.68	56.75	65.32	38.68	51.53	53.04	37.93

Source: authors' calculations using the 2011 Statistical Bulletin of Chinese Outward Foreign Direct Investment.

relationship, which some people termed "win–win", is destined to help not only China, but also African countries in terms of growth and development. President Hu Jintao, during his visit to Gabon in 2004, has emphasized the free of political conditionality of the relationship and particularly the mutual benefits that underlie it (Alden, 2005). However, if there are many papers that have discussed the investment of China in Africa, not many things have been said among scholars about these mutual benefits or win-win deals.

This paper investigates the impact of Chinese FDI on economic performance in Africa. Specifically, we first examine whether Chinese investment is conducive for development in Africa. Our main hypothesis is that if China gets returns on its investments in Africa, the win-win deal will require an improvement in the standard of living of Africans. Secondly, we compare Chinese FDI to that of Africa's traditional partners – the U.S., France, and Germany – in enhancing African growth. Lastly, we explore whether China's new relationship with Africa has somehow altered the preexisting relationship between Africa and any of those traditional economic partners.

Our paper contributes to the existing literature in a couple of ways. First, it fills the gap by providing econometric analyses on the relationship between Chinese FDI and income of African countries. To the best of our knowledge, Asiedu (2006) and Cheung et al. (2012) are the only ones who provide a formal econometric analysis of Chinese outward direct investment in Africa. However, their studies focus on the determinants of Chinese outward direct investment. Secondly, previous studies on the relationship between FDI and growth mostly use aggregate FDI of the host country, that is, total foreign investment in the host country. Our study uses specific FDIs, such as China's FDI, the United States' FDI, or Germany's FDI. Lastly, we provide evidence whether the presence of China has distorted existing economic relationships on the continent. The results of this study should help government authorities in Africa to better select or diversify their economic partners.

Our results using the fixed-effects and the instrumental variable approaches to 36 countries over the period 2003–2012 indicate that Chinese FDI has a positive effect on the standard of living in Africa. We also find evidence that U.S. and German investment, unlike French investment, raise income per capita more than that of China. Moreover, there is evidence that Chinese investment crowds out U.S. investment in Africa, thereby undermining the preexisting relationship between Africa and the U.S., whereas France seems to be competing with China.

The rest of the paper is structured as follows: in Section 2, we review the literature. In Section 3, we present the methodology and the data. Section 4 presents results for the United Sates. Section 5 presents results for the European Union. Section 6 concludes.

2. Literature review

It is important to start with a brief overview of the motivation or the determinants of FDI. Gelb (2005) has reported that market-seeking and resource-seeking determine South-South investments. In an empirical analysis, Cheung et al. (2012) investigate the determinants of Chinese outward direct investment in Africa and find that market-seeking, risk factor, and resource-seeking motivate their investment in Africa. Trade intensity and China's contracted projects are also found to be significant determinants. Likewise, Asiedu (2006) has also investigated the determinants of Chinese FDI in Africa. She uses a panel that comprises 22 countries in Sub-Saharan Africa and finds that countries that are endowed with natural resources or have large markets have attracted more FDI. Moreover, her results indicate that good infrastructure, an educated labor force, macroeconomic stability, openness to FDI, an efficient legal system, less corruption, and political stability also promote FDI. A key takeaway from this discussion is that FDI is motivated by self-interest. That is, foreign investors invest in a recipient country and expect to reap profits from their investment. Theoretically, that is the motivation behind investment. It is then fair to say that China gets returns on its investment. The next question is whether African countries also benefit from this investment.

Many studies have investigated Chinese FDI in Africa, but most of them are limited to analytical frameworks. Put differently, very few studies have used sound theories and econometric methods in their investigation. For example, Klaver and Trebilcock (2011) analyze the Chinese investment in Africa, and more importantly, they ask the question of whether Chinese investment in Africa is good or bad for Africa. They point out seven ways Chinese investment contribute to African growth: commodity prices (China's demand for resources raised commodity prices), capacity to extract (many African countries lack the capacity to extract their own resources), infrastructure

(China's contribution to African development is arguably most significant in infrastructure), manufacturing (Chinese investment has potential to develop Africa's manufacturing sector), employment (Chinese investment creates employment), market access (China improves Africa's access to its market by reducing Chinese tariffs), and consumers (Chinese FDI benefits African consumers by lowering prices of manufactured goods and food). These benefits come with some drawbacks. First, the authors talk about the resources for infrastructure deals; that is, the benefits of China's contribution to African infrastructure may be exceeded by the high costs. Secondly, Chinese FDI may provide few spillovers in technology, skills, and employment. Lastly, Chinese FDI may deindustrialize Africa by out-competing African firms given that African manufacturing is already weak. Analyzing China-Africa relations, Ademola et al. (2009) conclude that the negative effects may outweigh the positive ones for many African countries, but without econometric analyses.

Theories on Chinese FDI include Alfaro et al. (2004), who examine the different links between foreign direct investment, financial markets, and growth. They model an economy with a continuum of agents that have different level of ability. Agents have two choices: they can work for the foreign company in the FDI sector and use their wealth to earn a return or they can choose to undertake entrepreneurial activities, which are subject to a fixed cost. A key assumption of their model is that local firms benefit from spillovers from the FDI sector. That is, potential entrepreneurs can take advantage of better managerial practices, networks, access to markets, and other spillovers from the foreign firms located in the domestic country. The model shows that increased FDI increases output in the FDI sector (foreign production) and in the domestic sector (domestic production). In addition, they show that better financial markets can lead to FDI having greater effects on output. Their empirical results in 39 countries, including 12 Sub-Saharan African countries, indicate that FDI contributes to economic growth owing to the development of the local financial market. This result suggests that only countries with well-developed financial markets gain significantly from FDI in terms of their growth rates. Put differently, FDI per se has no effect on growth. Alfaro et al. (2010) build on their previous work and formalize a mechanism that emphasizes the role of local financial markets in enabling FDI to promote growth through backward linkages. They quantify the response of growth to FDI and show that an increase in the share of FDI leads to higher additional growth in financially developed economies relative to financially underdeveloped ones.

De Mello (1997) surveys about 100 articles on FDI and growth in developing countries and concludes that the ultimate impact of FDI on growth in the recipient country depends on the scope for efficiency spillovers to domestic firms – by which FDI leads to increasing returns in domestic production – and increases in the value-added content of FDI-related production. For Borensztein et al. (1998), if there is a highly educated workforce to exploit FDI spillovers, then FDI will have a positive effect on growth. This argument has been refuted by Alfaro et al. (2009), who find no evidence of physical or human capital as the main channels through which countries benefit from FDI. Balasubramanyam et al. (1999), on the other hand, have suggested that the positive relationship between FDI and growth depends on trade openness, while Alfaro et al. (2004, 2010) argue that it depends on the financial market development. For Azman-Saini et al. (2010), the relationship between FDI and growth depends on economic freedom or better on the political and economic framework (Alguacil et al., 2011). Alfaro et al. (2009) have also added that FDI contributes to growth in a well-developed financial market through improvements in total factor productivity.[2] According to Carkovic and Levine (2002), there are many issues with some of these past macroeconomic studies. The authors point out simultaneity bias, country-specific effects, and lag dependent variable as potential problems in the past studies. They then use the Generalized Method of Moments methodology that accounts for these issues and find no robust cross-county evidence of FDI on growth. A fundamental contribution of their paper is that it reconciles the microeconomic and macroeconomic evidence. A similar exercise is performed by Havranek and Irsova (2011), who collect 3626 estimates of spillovers from FDI and find that model misspecifications reduce the reported estimates. They further report that spillovers are greater in countries that are financially underdeveloped and open to trade.

A couple of studies have empirically investigated the relationship between FDI and economic development. Gohou and Soumaré (2012) examine the effect of FDI on poverty reduction in Africa. Their results indicate a significant positive relationship between FDI net inflows and poverty reduction in Africa, which vary from one region to the other. It is important to note that human development index and real GDP per capita are the two measures of poverty used by the authors. The positive relationship is also highlighted by Fowowe and Shuaibu (2014) and Fauzel et al. (2015). These two studies have used poverty headcount to measure poverty. Otchere et al. (2016) in a study of direction of the causality between FDI and financial market development find that FDI has a positive and significant effect on economic growth in Africa. This result is corroborated by Soumaré (2015) when investigating FDI and economic development in Northern Africa.

Other studies have looked at Chinese FDI in Africa. While Kolstad and Wiig (2011) and Cheung et al. (2012) focus on the determinants of China's FDI in Africa, Yao and Wang (2014) focus on whether China's FDI has displaced OECD countries' FDI. We build on the literature and investigate the impact of Chinese FDI on standards of living in Africa.

3. Methodology and data

3.1. Methodology

We take the usual production function of the type Cobb–Douglass in which output (Y) is determined by two factors, capital (K) and labor (L) as laid out in the Solow's model.

[2] See also Cipollina et al. (2012), who, using a cross-country industry data, find that growth enhancing effect of FDI comes primarily from an increase in total factor productivity (TFP) and from factors accumulation.

Defining output per worker (y) and capital per worker (k), the production function takes the following form:

$$y = f(k) \tag{1}$$

In Eq. (1), k is our variable of interest that represents China's foreign direct investment in different countries in Africa. That is, we replace the local capital by the foreign capital (FDI). Accordingly, and taking the log, we redefine and extend Eq. (1) as follows:

$$\ln(y_{it}) = \alpha_i + \alpha_1 \ln\left(FDI_{jt}\right) + \alpha_2 \ln(School_{it}) + \alpha_3 \ln(Openness_{it}) + \alpha_4 \ln(Regulation_{it}) + \alpha_5 \ln(Investment_{it}) + \alpha_6 \ln(Credit_{it}) + \varepsilon_{it} \tag{2}$$

where i represents a given country in Africa and j stands for China. School (*School*), trade openness (*Openness*), regulatory quality (*Regulation*), financial development (*Credit*), and local investment (*Investment*) are controls. α_i is the country fixed-effects and ε is the error term. This model can be considered as the extended version of Mankiw et al. (1992). Alfaro et al. (2004) have used similar empirical models. The log specification implies that the coefficients are elasticities.

The dependent variable y is measured by real GDP per capita in a given African country. Our main variable *FDI* is measured by both the stock and flow of China's foreign direct investment. Consistent with the growth models on the relationship between output and capital, our main assumption is that China's investments in Africa improve the standard of living in Africa.

The schooling variable (*School*) represents the human capital variable and is measured by the secondary school enrollment. This variable has also been used by Mankiw et al. (1992), who find that education has a positive effect on growth. That is, better education systems improve the standard of living. Thus, we expect a positive effect of schooling on GDP. We include trade openness (*Openness*) defined as the sum of exports and imports to GDP. Trade openness is expected to have a positive effect on GDP. Alfaro et al. (2004) have also used this variable and find a positive relationship. Regulatory quality (*Regulation*) accounts for the quality of institutions. Better institutions are believed to promote private sector development and increase GDP. Investment (*Investment*) is measured by the gross capital formation as a percentage of GDP and is expected to have a positive effect on GDP. Lastly, we include private credit as a percentage to GDP (*Credit*) to measure the extent of financial development. Higher credit is associated with better financial intermediation. As such, we expect private credit to have a positive effect on the GDP as documented in the financial development literature – see Levine et al. (2000), for example.

Our third model compares Chinese investment in Africa to that of one of Africa's traditional partners. Africa's main traditional partners are the European Union and the United States. We start with the United States. The model is an extension of Eq. (2) in which we introduce U.S. FDI (FDI_{USA}) along with Chinese FDI (FDI_{CHINA}).

$$\ln(y_{it}) = \alpha_i + \alpha_1 \ln(FDI_{CHINAt}) + \alpha_2 \ln(FDI_{USAt}) + \alpha_3 \ln(School_{it}) + \alpha_4 \ln(Openness_{it}) + \alpha_5 \ln(Regulation_{it}) + \alpha_6 \ln(Investment_{it}) + \alpha_7 \ln(Credit_{it}) + \varepsilon_{it} \tag{3}$$

As before, FDI_{USA} is also expected to have a positive effect on output.

In the fourth model, we test whether China's investment in Africa has altered the preexisting relationship between Africa and its traditional partners. Yao et al. (2010) report that Chinese firms are backed by the Chinese government via low-cost credit; as a consequence, Western firms are crowded out from the foreign market. Further, Yao and Wang (2014) report that China's FDI has displaced that of the OECD countries using a set of 155 host countries that mixed both developed and developing countries. In this study, we focus more on a homogeneous group of developing countries. Cheung et al. (2012) define the following model when examining the determinants of FDI:

$$FDI_{it} = \alpha_0 + \alpha_1 MKT_{it-1} + \alpha_2 ECI_{it-1} + \alpha_3 RISK_{it} + \alpha_4 NTR_{it-1} + \varepsilon_{it} \tag{4}$$

where FDI_{it} is Chinese outward direct investment in country i at time t; *MKT* is market seeking factors measured by the host country's GDP that proxies for market size, the host country's per capita real GDP that proxies for market opportunities, and the growth rate of real GDP in the host country that proxies for market growth potential; *ECI* represents the economic interactions between the home and host country proxied by the trade intensity between the two countries; *RISK* is a risk factor that is proxied by rule of law and corruption among others; *NTR* is natural resource proxied by energy (crude oil, natural gas, and coal) and mineral (bauxite, gold, iron).

Although designed for China, we do not think that this model would change for any foreign investor in Africa. The literature highlighted above mentions similar determinants for foreign investments in Africa. Thus, consistent with the literature, we redefine Eq. (4) as follows:

$$\ln(FDI_{USAit}) = \alpha_i + \alpha_1 \ln(FDI_{CHINAit-1}) + \alpha_2 \ln(MKT_{it-1}) + \alpha_3 \ln(ECI_{it-1}) + \alpha_4 \ln(RISK_{it}) + \alpha_5 \ln(NTR_{it-1}) + \alpha_6 \ln(Technology_{it-1}) + \varepsilon_{it} \tag{5}$$

This model augments Eq. (4) with China's FDI as the variable of interest among the regressors and U.S. FDI as the dependent variable. Our interest is on the coefficient α_1. Following the literature highlighted in this section, we expect $\alpha_1 < 0$. The lags on FDI_{CHINA}, *MKT*, *ECI*, and *NTR* is to mitigate reverse causality issues. Like Cheung et al. (2012), we measure *MKT*, the market-seeking factor, by the host country's GDP (*GDP*) that proxies for market size and the host country's per capita real GDP (*GDP per capita*) that proxies for market opportunities. Both variables are expected to have a positive impact. We measure *ECI*, the trade intensity, by the host country's openness to trade (*Openness*). Everything being the same, a country more open to trade is likely to attract foreign investors. Openness to trade is, there-

fore, expected to have a positive effect. The risk factor (*RISK*) is proxied by corruption (*Corruption*) and government effectiveness (*Governance*). The risk factor variables measure the quality of the host country's institutions. A lower risk is expected to increase foreign investments in the host country. *NTR*, the natural resource, is measured by *Natural gas* and *Oil*. More natural resources are expected to attract foreign investors. Lastly, Eq. (5) controls for the technology level (*Technology*) of the host country. Yao and Wang (2014) also control for the technology level, albeit in a gravity model. The host country's technology level would play an important role in foreign investment decisions although technology can also be imported. In the last case scenario, it would be more expensive without the basics of local technology. In Appendix, we provide more details about these variables.

3.2. Estimation procedure

We estimate models (2) and (3) using the fixed-effects (OLS) method. We apply the cluster-robust estimator that allows the observations to be independent across groups (clusters), but not necessarily within groups. Following Kolstad and Wiig (2011), Chinese FDI is not determined by GDP in Africa, particularly when South Africa is dropped from the sample. Instead, they find that Chinese FDI is attracted to countries with large natural resources, and more so the worse the institutional environment of the host country. Similar findings were highlighted in the literature above. As a consequence, we take Chinese FDI – the variable of interest – as exogenous to GDP in Africa, which justifies our OLS regressions.

However, the fixed-effects regressions are likely to be inconsistent given the probable endogeneity between output and foreign capital (FDI). That is, there is a reverse causality problem. Maybe foreign investors (Americans, Chinese, or Europeans) are attracted by good economic performances – economic growth – of the host country. Thus, we take our main variable, FDI, as endogenous and instrument for it. Gohou and Soumare (2012) have used the first three lags of FDI to identify their model. We will adopt this technique. In addition, we will also report the Sargan-Hansen test of overidentifying restrictions to gauge the validity of the instruments, along with the test for endogeneity.

Eq. (5) is also estimated using the fixed-effects techniques. The lagged independent variables are intended to mitigate the reverse causality. More importantly, U.S. and China may be competing against each other over controlling more markets in Africa.

3.3. Data

The sample data consists of 36 countries in Africa over the period 2001–2012. Foreign direct investment data come from the United Nations Conference on Trade and Development (UNCTAD) FDI/TNC database. It is an online database that reports Bilateral FDI Statistics. Our data are retrieved on December 1st, 2016. All other variables, namely GDP per capita, PPP (constant 2011 international $) for China, United States, and African countries, secondary school enrollment (% gross), consumer price index based on 2010 prices, trade openness (% of GDP), private credit (% of GDP), investment (% of GDP), coal rents (% of GDP), total natural resources rents (% of GDP), and high-technology exports (% of manufactured exports) come from the World Development Indicators (Online database, last update 11/17/2016). Regulatory quality (percentile rank), government effectiveness (percentile rank), and control of corruption (percentile rank) come from the Worldwide Governance Indicators (Online database, last update 10/19/2016).

Both the stock and flow of FDI reported by UNCTAD are nominal values that we deflate using the Federal Reserve Bank of Dallas deflation method given by the nominal value divided by the price index in decimal form. Although the popular consumer price index can be used to get the real values of FDI, we instead use price level of the capital stock provided by the St. Louis Fed (see Appendix for more details). However, one must choose between the home country's price index (China or U.S. for example) and the host country's price index (Togo or Nigeria, for example). We consider the home country's price index given the technological gap between the two groups of countries which might require foreign investors to import the fixed assets from home, at least most of them.

The summary statistics are reported in Table 2. These statistics mainly show that, on average, the flows of FDI to Africa for China and U.S. are almost the same, while the U.S. stock of FDI is about two times that of China.

4. Results

We examine the growth effects of Chinese FDI and U.S. FDI in Africa for a period spanning 2003–2012. We use both the flow and the stock of FDI from both countries. The effects are examined separately in growth regressions that employ fixed-effects techniques as specified in Eq. (2). Table 3 shows the results.

First, the regressions are run for Chinese FDI. Without controls, the coefficient for the flow of Chinese FDI in Africa shows a positive, statistically significant effect at the 99% confidence interval. The significance remains strong even after we add school, investment, openness, credit, and regulation in the equation. The result shows that a 1% increase in the flow of Chinese FDI raises income per person by 0.03%. When the FDI stock instead of the flow variable is used in the regressions, the results show a larger magnitude of this effect. A 1% increase in the stock of Chinese FDI raises income per person by 0.05%. Moreover, the result also shows the importance of financial development on per capita income in this region.

Next, the same regressions are run for the U.S. FDI. Without any controls, the result shows that the coefficient for the U.S. FDI flow is positive and statistically significant at the 95% confidence interval. However, when control variables are added, the coefficient turns insignificant. It is also important to note that there is a smaller sample size for the U.S. FDI and this sample drops by half when the control variables are added. The results for the stock of U.S. FDI is more interesting. The coefficients for the effect of U.S. FDI stock are positive and statistically signifi-

Table 2
Summary statistics.

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Chinese FDI flow	$ Millions	360	125	718	−1811	12,896
Chinese FDI stock	$ Millions	360	532	1239	0	10,686
U.S. FDI flow	$ Millions	376	128	497	−950	5169
U.S. FDI stock	$ Millions	392	1028	2194	−1633	16,824
Germany FDI flow	$ Millions	227	29.25	190.50	−1396.27	759.06
Germany FDI stock	$ Millions	137	671.20	1559.97	3.61	8446.56
France FDI flow	$ Millions	244	50.17	178.07	−1393.29	1043.18
France FDI stock	$ Millions	203	1635.34	2472.50	2.50	13140.64
GDP per capita	2011 PPP International $	359	6316	7939	504	42,957
GDP	2011 PPP International $B.	359	109	188	1	893
Openness	% of GDP	349	83.657	47.425	26.865	321.632
Credit	% of GDP	339	23.215	27.364	0.796	160.125
Investment	% of GDP	336	22.747	10.954	2.000	114.725
School	Primary school enrollment	294	100	21	43	150
Governance	Index	341	28.997	20.965	0.948	78.199
Regulation	Index	341	30.317	19.626	0.948	79.621
Oil	% of GDP	352	9.557	17.987	0	74.023
Natural gas	% of GDP	352	1.135	2.969	0	21.259
Technology	High-technology exports	261	5.232	6.166	0	33.756

Table 3
Effect of Chinese FDI and U.S. FDI on income in Africa.

	Dependent variable: GDP per capita							
	China				U.S.			
	Flow of Chinese FDI		Stock of Chinese FDI		Flow of U.S. FDI		Stock of U.S. FDI	
FDI	0.041***	0.028***	0.065***	0.050***	0.025**	−0.003	0.049***	0.042***
	(0.007)	(0.005)	(0.008)	(0.009)	(0.010)	(0.056)	(0.015)	(0.009)
School		0.166		0.099		0.113		0.075
		(0.190)		(0.139)		(0.406)		(0.178)
Investment		0.022		−0.015		0.022		−0.022
		(0.048)		(0.047)		(0.133)		(0.082)
Openness		−0.038		−0.076		−0.227*		−0.061
		(0.064)		(0.082)		(0.110)		(0.101)
Credit		0.093***		0.057*		0.175***		0.172***
		(0.024)		(0.031)		(0.054)		(0.041)
Regulation		0.047		0.064		0.000		0.018
		(0.039)		(0.042)		(0.079)		(0.029)
Constant	7.968***	6.852***	7.787***	7.274***	8.320***	8.293***	7.989***	7.389***
	(0.028)	(0.940)	(0.040)	(0.744)	(0.040)	(2.423)	(0.075)	(1.050)
Countries	36	29	36	30	30	22	35	26
Obs	263	158	349	215	133	66	260	140
R^2	0.226	0.438	0.424	0.552	0.052	0.324	0.105	0.500

Note: robust standard errors are in parentheses. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively.

cant at the 99% confidence interval. However, these coefficients are smaller than those of Chinese FDI. A 1% rise in the stock of U.S. FDI raises income per person by 0.042%. This difference (0.05% vs. 0.042%) implies that Chinese FDI would improve the standard of living in Africa more than U.S. FDI.

Following Eq. (3), we include the two FDIs in the same equation and conduct an *F*-test. The results from the regressions and the *F*-statistics are reported in Table 4. Again, the regressions are first run without any control variables and then with control variables. When the flows of FDI are used, the results show that the coefficient of Chinese FDI is positive and statistically significant at 1% level, while that of U.S. FDI is not significantly different from zero – the result without controls shows that U.S. FDI is significant, however, albeit quantitatively smaller and qualitatively less stronger. The *F*-test also shows that the effect of Chinese FDI is significantly larger. The results still hold the same when we use the stock of FDI instead, even though the effect of U.S. FDI turns significant. Overall, we find evidence that Chinese FDI improves standard of living more, and the results indicate that the effect of Chinese FDI on income in Africa is about twice as large as that of U.S. FDI.

Because of concerns of endogeneity, we also use the 2SLS estimation method. As described in the methodology, we use the first three lags of the FDI variables as instruments for the

Table 4
Comparing the growth effects of U.S. and Chinese FDI.

	Dependent variable: GDP per capita			
	Flow of FDI		Stock of FDI	
U.S. FDI	0.014**	0.003	0.010	0.024***
	(0.007)	(0.005)	(0.012)	(0.007)
Chinese FDI	0.047***	0.019***	0.063***	0.042***
	(0.011)	(0.006)	(0.011)	(0.010)
School		0.506*		−0.138
		(0.245)		(0.188)
Investment		0.223***		−0.025
		(0.057)		(0.053)
Openness		0.011		−0.135
		(0.079)		(0.094)
Credit		0.069*		0.068***
		(0.040)		(0.024)
Regulation		0.049		0.014
		(0.033)		(0.026)
Constant	8.216***	5.009***	7.895***	8.879***
	(0.064)	(1.432)	(0.067)	(1.279)
Countries	24	17	35	26
Obs	99	49	253	137
R^2	0.352	0.688	0.436	0.676
F-Test ($FDI_{CHINA} = FDI_{US}$)	5.08**	2.46	20.48***	3.46*

Note: robust standard errors are in parentheses. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively.

Table 5
The 2SLS results with the stock of FDI.

	Dependent variable: GDP per capita		
	(1)	(2)	(3)
Stock of Chinese FDI	0.069***		0.029***
	(0.011)		(0.011)
Stock of U.S. FDI		0.111***	0.089***
		(0.019)	(0.030)
School	−0.011	0.222	0.015
	(0.103)	(0.142)	(0.115)
Investment	0.016	0.075	−0.002
	(0.028)	(0.060)	(0.060)
Openness	−0.007	0.141***	0.221***
	(0.053)	(0.050)	(0.052)
Credit	−0.014	0.022	−0.075**
	(0.030)	(0.024)	(0.037)
Regulation	0.039	0.069***	0.258***
	(0.039)	(0.027)	(0.063)
Countries	26	18	13
Obs	149	84	57
R^2	0.372	0.510	0.565
Hansen test *p*-value	0.399	0.558	0.236
Test for endogeneity *p*-value	0.002	0.001	0.006

Note: standard errors are in parentheses. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively. The test for endogeneity assumes as a null hypothesis that the endogenous regressor is exogenous. In (1) the endogenous regressor is China FDI; in (2) the endogenous regressor is US FDI; and in (3) it is both.

FDI variables (our main variables). Because of significant loss of observations when the FDI flows are used instead of stock, the latter will be used for the 2SLS analyses. For each equation, we report the Hansen test of overidentifying restrictions and, more importantly, we conduct the C test for endogeneity (Baum et al., 2007). While the Hansen test assumes as null hypothesis that the instruments are valid instruments, which means they are uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation, the C test for endogeneity assumes as null hypothesis that the endogenous regressors can be treated as exogenous. Under the null hypothesis, both test statistics are distributed as Chi-squared.

Table 5 reports the results of the fixed-effects 2SLS estimations. Column (1) reports the result for the Chinese FDI, column (2) reports the result for the U.S. FDI, and column (3) reports the result for both FDIs. The results show that the FDI coefficients are positive and statistically significant. More importantly, the results show that the magnitude of the U.S. FDI effect on income is higher than that of Chinese FDI. For instance, a 1% rise in Chinese FDI raises income per capita by 0.029%, while that of U.S. FDI raises it by 0.089% (column 3). These results imply that the stock of U.S. FDI enhances standards of living in Africa more than the stock of Chinese FDI. Across the three models, the Hansen tests indicate that the overidentifying restrictions are not rejected, while the C tests for endogeneity reject the use of OLS in favor of 2SLS.

Finally, we examine the nature of both FDIs by regressing U.S. FDI stock on Chinese FDI stock with control variables that may determine FDI (see Eq. (5)). The result is reported in Table 6. The coefficient for Chinese FDI stock is negative and statistically significant at the 95% confidence interval, indicating that the inflow of Chinese FDI crowds out U.S. FDI. A 1% increase in Chinese FDI reduces U.S. FDI by 0.86%, an economically significant magnitude. This result suggests that Chinese investment in Africa has altered the preexisting rela-

Table 6
Chinese FDI and U.S. FDI.

	Fixed-effects estimates	
	Dependent variable: Stock of U.S. FDI	
	Coefficient	Robust standard error
Stock of Chinese FDI	−0.860**	0.279
GDP per capita	−6.878	8.667
GDP	12.862	8.457
Openness	0.077**	0.024
Corruption	−0.148	0.251
Governance	−2.293	1.750
Oil	−0.497	0.388
Natural gas	−0.452	0.531
Technology	−0.179	0.216
Constant	−254.428	143.129
Countries	7	
Obs	40	
R^2	0.558	

Notes: We take the first lag for all independent variables except for the risk factors proxied by control of corruption and government effectiveness – see Eq. (5). In addition, the fixed-effects estimates are preferred to the 2SLS estimates since the C test for endogeneity fails to reject the null hypothesis that the stock of Chinese FDI is exogenous. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively.

Table 7
Comparing the growth effects of Germany and Chinese FDI.

	Dependent variable: GDP per capita			
	Flow of FDI		Stock of FDI	
German FDI	0.021	0.009	0.006	0.040**
	(0.017)	(0.016)	(0.028)	(0.015)
Chinese FDI	0.043***	0.015***	0.052***	0.030**
	(0.014)	(0.005)	(0.016)	(0.011)
School		0.346***		−0.004
		(0.115)		(0.159)
Investment		0.154**		0.128**
		(0.072)		(0.052)
Openness		−0.204***		−0.004
		(0.067)		(0.082)
Credit		0.143***		0.001
		(0.028)		(0.027)
Regulation		−0.232***		0.052
		(0.067)		(0.028)
Constant	8.081***	7.168***	8.461***	7.657***
	(0.053)	(0.739)	(0.128)	(1.108)
Countries	30	18	13	7
Obs	87	40	107	47
R^2	0.328	0.799	0.254	0.833
F-Test ($FDI_{CHINA} = FDI_{GR}$)	0.78	0.14	1.47	0.20

Note: Robust standard errors are in parentheses. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively. GR stands for Germany.

Table 8
Comparing the growth effects of France and Chinese FDI.

	Dependent variable: GDP per capita			
	Flow of FDI		Stock of FDI	
French FDI	0.019**	0.006	0.028**	−0.007
	(0.009)	(0.010)	(0.013)	(0.014)
Chinese FDI	0.029***	0.025***	0.042**	0.052**
	(0.007)	(0.008)	(0.015)	(0.017)
School		0.321		0.370
		(0.285)		(0.313)
Investment		0.100		0.042
		(0.079)		(0.083)
Openness		−0.124*		−0.045
		(0.067)		(0.059)
Credit		0.061***		0.016
		(0.014)		(0.029)
Regulation		0.044		0.064*
		(0.040)		(0.032)
Constant	8.322***	6.563***	8.174***	6.154***
	(0.028)	(1.375)	(0.074)	(1.488)
Countries	25	17	17	12
Obs	114	70	167	92
R^2	0.312	0.477	0.329	0.570
F-Test ($FDI_{CHINA} = FDI_{FR}$)	0.52	1.37	0.31	4.76*

Note: robust standard errors are in parentheses. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively. FR stands for France.

tionship between Africa and its traditional partner, the United States.

5. The case of the European Union

The European Union (EU), unlike the United States, is more heterogeneous, and getting the data for the union is more troublesome. In this section, we choose two countries in the EU: Germany and France. The choice is only motivated by the availability of data. While France has strong colonial ties with francophone countries in Africa, Germany, on the other hand, may only have economic relationship with African countries. Germany ruled over a handful of countries which ended after the First World War.

Starting with Germany, the fixed-effects results reported in Table 7 show that Chinese FDI enhances standards of living in Africa. Although German FDI has a positive effect on the standard of living in Africa, only the stock of German FDI (column 4) has a significant effect on the income per capita, and the magnitude of that effect is higher than that of China. As far as the flows are concerned, the evidence indicates that Chinese flows of FDI have significant effects on income, unlike German flows of FDI. As for France and China, the fixed-effects results in Table 8 indicate that China's contribution to the standard of living is higher than that of France in terms of flow and stock.

Turning to the 2SLS estimates, the results in Table 9 clearly indicate in columns 1 and 2 that the stock of German FDI raises the standard of living a little bit more than the stock of Chinese FDI does (columns 1 and 2). As for columns 3–5, we would refer to the fixed-effects estimates given that the C-test for endogeneity fails to reject the null hypothesis that the endogenous regressors are exogenous. Thus, the fixed-effects result in Table 7, column 4 is preferred to the 2SLS result in Table 9, column 4. This fixed-effects result, as discussed earlier, just confirms the 2SLS result (Table 9, columns 1 and 2) in that the stock of German FDI contributes a bit more to income per capita in Africa than the stock of Chinese FDI does.[3] Also, we refer to Table 8, columns 3 and 4 (fixed-effects) instead of columns 3 and 5 in Table 9 (2SLS) for the stock of French FDI. That is, the stock of Chinese FDI contributes more to the income in Africa than that the stock of French FDI does.

Lastly, we discuss whether Chinese FDI has significant crowding-out effects on German and French FDIs. Table 10 reports the results and shows that an increase in the stock of Chinese FDI by 1% increases French FDI by 0.144%. This result implies that there is a competition between Chinese FDI and French FDI. Germany, on the other hand, is negatively affected by the stock of Chinese FDI, although this effect is not statistically significant. Put differently, Chinese investment may crowd out that of Germany.

6. Concluding remarks

With the growing presence of China in Africa, this paper examines the impact of Chinese FDI on the standard of living in Africa and compares it to that of Africa's traditional partners. In

[3] The same result holds with the 2SLS method (Table 9, column 4), although both the C test for endogeneity fails to reject the null hypothesis that both the stock of Chinese FDI and that of Germany FDI are exogenous regressors.

Table 9
2SLS results with the European Union.

	1	2	3	4	5
Stock of Chinese FDI	0.069***			0.021***	0.039**
	(0.011)			(0.008)	(0.016)
Stock of German FDI		0.077***		0.044***	
		(0.010)		(0.014)	
Stock of French FDI			0.051**		0.027
			(0.024)		(0.026)
School	−0.011	0.021	0.271	−0.069	−0.019
	(0.103)	(0.165)	(0.295)	(0.119)	(0.129)
Investment	0.016	0.211***	0.075	0.128**	0.027
	(0.028)	(0.039)	(0.101)	(0.058)	(0.076)
Openness	−0.007	0.050	0.050	−0.019	−0.020
	(0.053)	(0.037)	(0.059)	(0.061)	(0.062)
Credit	−0.014	0.040	0.051**	0.033	0.027
	(0.030)	(0.027)	(0.025)	(0.033)	(0.029)
Regulation	0.039	0.022	0.032	0.038	−0.006
	(0.039)	(0.018)	(0.30)	(0.124)	(0.046)
Countries	26	5	11	5	11
Obs	149	35	83	27	65
R^2	0.372	0.795	0.386	0.784	0.421
Hansen test p-value	0.399	0.221	0.201	0.129	0.438
Test for endogeneity *p*-value	0.002	0.038	0.384	0.617	0.554

Note: standard errors are in parentheses. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively. The test for endogeneity assumes as a null hypothesis that the endogenous regressor is exogenous. In a given equation, the endogenous regressors are instrumented using their first three lags. For columns 3–5, the endogeneity test *p*-values are >0.10 implying that the fixed-effects estimates are preferred to the 2SLS estimates.

Table 10
China FDI, Germany FDI, and France FDI: fixed-effects estimates.

	Dependent variable	
	Stock of German FDI	Stock of French FDI
Stock of Chinese FDI	−0.158	0.144*
	(0.316)	(0.066)
GDP per capita	8.387	−7.157***
	(11.057)	(1.391)
GDP	−3.695	6.703***
	(8.793)	(1.428)
Openness	0.033	−0.010**
	(0.037)	(0.003)
Corruption	−0.433	0.102
	(0.445)	(0.154)
Governance	0.45	−0.149
	(0.351)	(0.178)
Oil	−0.265	−0.008
	(0.343)	(0.095)
Natural gas	−0.07	0.196
	(0.609)	(0.101)
Technology	0.088	0.015
	(0.097)	(0.09)
Constant	29.406	−100.458***
	(143.92)	(24.549)
Countries	3	6
Obs	24	42
R^2	0.489	0.855

Notes: we take the first lag for all independent variables except for the risk factors proxied by control of corruption and government effectiveness – see Eq. (5). In addition, the fixed-effects estimates are preferred to the 2SLS estimates since the C test for endogeneity fails to reject the null hypothesis that the stock of Chinese FDI is exogenous. ***, ** and * denote significance at the 99%, 95% and 90% confidence interval, respectively. Robust standard errors are in parentheses.

general, the results show that Chinese FDI plays a more important role in raising income per capita in this region. These results suggest that the win-win deal China claims when investing in Africa may hold, and Chinese investment contributes to growth in Africa. Put differently, Chinese investment is mutually beneficial for both China and Africa. However, we find evidence that U.S. and German investment, unlike French investment, raise income per capita more than that of China, especially as far as the stock of FDI is concerned. The existence of evidence that Africa's traditional partners' investments raise income suggests that U.S, Germany, and France are not purely motivated by self-interest[4] when investing in Africa. This study, therefore, demystifies to some extent the common belief that self-interest is the motivation behind Western countries' investments in Africa. Our results are robust across different tests, including the use of instrumental variable estimations.

The case of French investment in Africa is intriguing. The impact on income per capita is at best the lowest among the three countries – China, U.S., and Germany. Because of colonialism, France has lingering relationships – political, military – with many countries in our sample. To this end, we consider a sample made only of French former colonies (16 out of 36 countries). Our results, not reported here, still indicate that Chinese investment raises standard of living in the francophone countries in Africa more than French investment.

Furthermore, the result shows that German and U.S. FDI seem to be crowded out by Chinese FDI, implying that Chinese investment has altered the preexisting relationship between

[4] Foreign investors invest in Africa to only reap profits from their investment.

Africa and its traditional partners. This may be explained by the fact that Africa has diversified its economic partners. In general, this last result seems to be consistent with Yao and Wang (2014), who find that Chinese FDI has displaced OECD countries' FDI. However, as far as Africa is concerned, they find that Chinese FDI has not displaced OECD countries' FDI in resource abundant countries in Africa. Also, Yao et al. (2010) report that Chinese firms are backed by Chinese government low-cost credit that crowds Western firms from foreign markets, with the low-cost credit allowing them to take risks their Western rivals will not take. France, on the other hand, seems to be competing against China as far as the stock of investment is concerned.

A potential weakness of our study relates to the data. For many countries, data are missing, which significantly reduced the sample size in many regards and led us to prefer the stock variable to the flow variable in the 2SLS regressions. For instance, our dataset records only 48 observations for England, whether it is the flow or stock variable. To the extent data are available, one could run the same regressions with English investment and check whether China promotes growth in anglophone countries in Africa more than England. Given that England and France were the giant colonial masters in Africa, this would provide a better understanding to the legacy of colonialism in Africa and how that legacy fits in the modern vision of those countries.

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Appendix A. Countries included in the sample

Algeria	Mali
Angola	Mauritania
Botswana	Mauritius
Cameroon	Morocco
Congo	Mozambique
Congo, Democratic Rep. of	Niger
Côte d'Ivoire	Nigeria
Egypt	Rwanda
Equatorial Guinea	Senegal
Eritrea	Seychelles
Ethiopia	Sierra Leone
Gabon	South Africa
Ghana	Sudan
Kenya	Tunisia
Liberia	Uganda
Libya	United Rep. of Tanzania
Madagascar	Zambia
Malawi	Zimbabwe

Appendix B. Variable definitions and sources

Variable	Definitions	Sources
Chinese FDI flow	China FDI flows abroad in millions of US dollars divided by the price level of the capital stock for China*	UNCTAD
Chinese FDI stock	China FDI stock abroad in millions of US dollars divided by the price level of the capital stock for China*	UNCTAD
U.S. FDI flow	U.S. FDI flows abroad in millions of US dollars divided by the price level of the capital stock for US**	UNCTAD
U.S. FDI stock	U.S. FDI stock abroad in millions of US dollars divided by the price level of the capital stock for US**	UNCTAD
Germany FDI flow	Germany FDI flows abroad in millions of US dollars divided by the price level of the capital stock for Germany*	UNCTAD
Germany FDI stock	Germany FDI stock abroad in millions of US dollars divided by the price level of the capital stock for Germany*	UNCTAD
France FDI flow	France FDI flows abroad in millions of US dollars divided by the price level of the capital stock for France**	UNCTAD
France FDI stock	France FDI stock abroad in millions of US dollars divided by the price level of the capital stock for France**	UNCTAD
GDP per capita	Constant 2011 PPP International $	WDI
GDP	Constant 2011 PPP International $	WDI
Openness	% of GDP. Openness to trade is the sum of exports and imports of goods and services measured as a share of gross domestic product	WDI
Credit	Domestic credit to private sector (% of GDP)	WDI
Investment	Gross fixed capital formation (% of GDP)	WDI
School	School enrollment, primary (% gross)	WDI
Corruption	Control of Corruption: Percentile Rank. Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank	WGI
Governance	Government Effectiveness: Percentile Rank. Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank	WGI

Regulation	Regulatory Quality: Percentile Rank. Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank	WGI
Oil	% of GDP. Oil rents are the difference between the value of crude oil production at world prices and total costs of production	WDI
Natural gas	% of GDP. Natural gas rents are the difference between the value of natural gas production at world prices and total costs of production	WDI
Technology	Hi-technology exports (% of manufactured exports). High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery	WDI

Note: UNCTAD – United Nations Conference on Trade And Development; WDI – World Development Indicators; WGI – Worldwide Governance Indicators.

*Price level of the capital stock for China, price level of USA output-side GDP in 2011 = 1, annual, not seasonally adjusted (Saint Louis Fed).

**Price level of the capital stock for United States, price level of USA output-side GDP in 2011 = 1, annual, not seasonally adjusted (Saint Louis Fed).

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