

The Impact of China's Economic Activities in Africa on Economic Growth of African Countries

MICHALE EHIZUELEN MITCHELL OMORUYI*

Narrowing development gaps has been a critical issue globally. This paper aims to investigate the role of Chinese FDI, trade and aid in narrowing development gaps with respect to the growth performance of economies in that region. Using a Solow-type growth model and panel data for the period 1991 to 2011, this paper reveals that African economies that export natural resources have benefited from positive terms-of-trade effects. In addition, there is evidence for displacement effects of African firms due to competition from China. Chinese foreign investment and aid in Africa do not seem to have an impact on growth.

Keywords: Africa, Aid, China, Economic Growth, FDI, Trade, South-South Cooperation

JEL Classification: F14, F23, O47

I. INTRODUCTION

Narrowing development gaps has been a critical issue for both developing and developed countries under the structural changes caused by the surge of globalisation. In the case of Africa, “narrowing development gaps” has been regarded as one of the most significant challenges. China believes that supporting Africa nations in coping with this gap issue is important for the future of Africa. In line with this aim, China cooperation with an effective FDI, trade and utilisation of aid, should contribute towards narrowing these development gaps. Over the last 15 years, China has become a major economic partner of sub-Saharan African countries. Total merchandise trade between China and Africa increased from US\$9 billion in 2000 to US\$222 billion in 2014, making China Africa's largest trade partner (UN Comtrade 2014, CDB 2015). In terms of foreign direct investment (FDI), Chinese FDI flows to Africa increased from just US\$200 million in 2000 to US\$2.9 billion in 2011, and increased to US\$4 billion in 2014 turning China into the largest developing country investor in Africa (UNCTAD 2013, MoFCoM 2014, CDB 2015). Additionally, Chinese aid

*Institute of African Studies, Zhejiang Normal University, Jinhua, China.

initiatives in Africa in the form of economic or technical cooperation have also increased remarkably in the last decade. According to China's National Bureau of Statistics (NBS), the turnover on economic cooperation projects in Africa reached US\$29 billion in 2011 compared to US\$1.2 billion in 2000. During Chinese President XI Jinping's first overseas trip to Africa in March 2013, he doubled this commitment to US\$20 billion from 2013 to 2015. In addition, the head of sovereign risk analyst of Export-Import Bank of China announced in November 2013 that by 2025, China will have provided Africa with US\$1 trillion in financing, including direct investment, soft loans and commercial loans. Since 1956, China has provided over 900 aid projects to African countries, including assistance supporting textile factories, hydropower stations, stadiums, hospitals and schools.

At the same time, sub-Saharan Africa's growth performance has improved significantly. Sub-Saharan Africa growth improved for the second consecutive year, to 4.5 per cent in 2014. Despite headwinds, growth is projected to pick up to 5.1 per cent by 2017. In view of this development, the question arises as to whether China's engagement has contributed to this economic growth in Africa; this is the main focus of this paper. Obviously, various factors have contributed to Africa's better growth performance, including a marked improvement in institutions, infrastructure investment, increased agriculture productions, buoyant services, decrease in conflicts and macroeconomic distortions (OECD *et al.* 2013; UNECA 2013), all of which have to be controlled for in an empirical investigation. Due to the intensity of Sino-African economic linkages an empirical assessment of the impact of one country (China) on African growth seems appropriate.

When assessing the economic impact on Africa, it is important to note that China's economic activities have resulted in an overall increase of trade, FDI, and aid in Africa rather than a diversion of existing flows from third countries. In principle, this should have positive effects. The changes impacting Chinese domestic economy hold out a new promise for aspirational Africa economies. The rising cost pressures on China's light industrial manufacturing sector will increasingly lead to manufacturing capacity to relocate to lower-cost foreign economies over the long term. This trend of Chinese "hollowing out" of low-end manufacturing and offshoring to Africa is likely to be the next driving force of the relationship. This form part of what is often referred to as China's "economic rebalancing." If this opportunity is seized by progressively reformist African states, they could well be on the cusp of a 19th-century style industrial-revolution – generating jobs and creating new industries.

In contrast to these positive effects, China's engagement in Africa could have negative consequences for economic growth as well. Partly due to China's strong demand for raw materials, African exports are more and more concentrated in the primary sector. This enhances the risk of encountering (or deepening) the resource curse in African countries (Carmignani and Chowdhury 2012). An exchange rate overvaluation due to increasing exports of natural resources could crowd out manufacturing products. Extracting and exporting natural resources could lead to rent-seeking and corruption (Busse and Gröning 2013). This matters as most African countries have already weak institutions and China, bound by its "non-interference" policy, does not tie trade and investment to any reform conditions. There are opportunities and risks that arise from China's various activities in Africa. This calls for an empirical analysis of the growth effects in African countries.

Several studies (Morrissey and Zgovu 2011, Kolstad and Wiig 2011, Sanfilippo's 2010, Whalley and Weisbrod 2012) confirm that there is an important link between Chinese trade, FDI and aid flows to Africa. There have not been many econometric analysis on the impact of China's activities on African growth including the three main channels, trade, FDI and aid, at the same time. Consequently, the study analysis accounts for all three channels of interaction in order to obtain a comprehensive picture of China's impact on Africa. In terms of methodology, we use panel data for 43 sub-Saharan African countries, the period 1991-2011, a simple Solow-type growth model and two different econometric methods, including an instrumental variable approach.

The paper is structured in the following way. Section II provides the current nature of China's economic involvement in Africa, explaining various changes in trade, FDI and aid. Section III explains the methodology employed in our empirical analysis in more detail and introduces the variables and the data used. While the main results are displayed in Section IV, the outcome of various extensions and robustness checks are shown in Section V, demonstrating that our findings are robust. The last section concludes.

II. CURRENT NATURE OF CHINA'S ECONOMIC INVOLVEMENT IN AFRICA

China's "new normal" growth era is, however, now ending the decade-long China-led commodities price boom (Garnaut 2012), which in turn will affect China-Africa economic ties. The majority of Africa's exports to China are raw commodities, especially oil. Visiting Africa in early 2015, International

Monetary Fund (IMF) Managing Director Christine Lagarde warned, momentum is slowing in many advanced and emerging economies, including in China — one of Africa's main trading partners' (Ochelle 2015). The effects for Africa's commodity and non-commodity exporters alike could be extensive. Dramatic falls in the iron ore price, for example, are a significant factor in the IMF in April 2015 lowering its annual growth forecasts for Guinea, Liberia and Sierra Leone—from 6 to 1 per cent, from 11 to 6 per cent and from 5.4 per cent to 1 per cent respectively (IMF 2015b). The falling iron ore price has delivered an especially harsh blow to the fiscal positions of the three least-developed countries (LDCs) that are battling the aftermath of the worst-ever Ebola virus outbreak. In spite of this, China's increased engagement with Africa could generate significant gains for African economies. However, analysis is required to quantify the advantages and disadvantages, and to design the policies necessary to maximise the development impact of China. So, when analysing Sino-African economic relations, three channels of economic interaction are dominant, namely trade, FDI, and aid (economic cooperation).

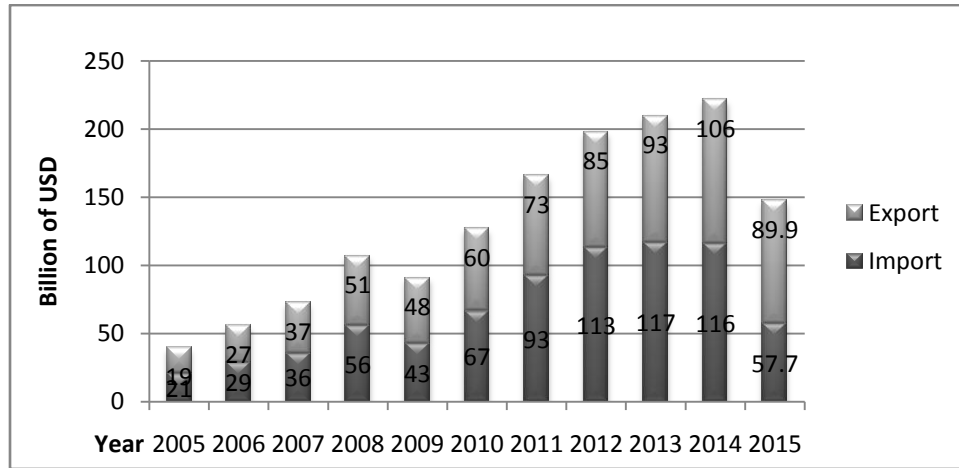
Trade

While Chinese FDI in Africa is expected to rise rapidly, presently China–Africa trade levels dwarf those of aid and FDI combined. When China established diplomatic ties with Egypt in 1956, the trade volume between China and Africa stood at roughly US\$12 million, while by 2014, it already reached US\$222 billion (Figure 1), going up 5.4 per cent year on year. Among others, China's export to Africa saw a robust growth, up 13.2 per cent year-on-year, 8.3 per cent points which is higher than China's export growth over the same period (MoFCoM 2014). This comprised Chinese imports of US\$111 billion from Africa and exports of US\$81 billion—a figure more than 10 times higher than the US\$10 billion value of trade in 2000 (IMF 2015a). Aggregated African data, however, report a lower total trade level for 2013, of US\$146.1 billion.

Sino–African trade is proportionately more important to Africa than to China. Trade with China made up 14 per cent of total African reported trade in 2013. China's trade with Africa, however, made up just 4.6 per cent of total reported Chinese trade that year (IMF 2015a). African data point to a trade deficit with China of US\$15.2 billion in 2013. That year, China reported a deficit in trade with Africa, of US\$29.4 billion (IMF 2015a). Oil makes Chinese imports larger than exports in trade with Africa (Ademola *et al.* 2009, Thomson and Horii 2009). Oil imports have risen significantly in recent years. In 1990, China

imported no oil from Africa. By 2010, roughly one-quarter of its foreign oil supply was being sourced from the continent (Thompson and Horii 2009: 648).

Figure 1: 2005-2015 China-Africa Trade Volume



Source: UN COMTRADE 2015, China Custom 2015, MoFCoM 2016.

However, the developing tale of increase in trade between China and Africa changed in 2015; from January to October 2015 the trade between both parties' decrease to US\$147.6 billion. The trade volume decrease by 18 per cent year-on-year, but the amount of exports from China to Africa displayed a contrarian soar, climbing to US\$89.9 billion (see figure 1), with an increase of 5 per cent, 7 per cent points higher than the general growth of the export in the same period. The electrical and mechanical merchandises turned out to be a significant driving force of China's exports to Africa. Meanwhile, the products mineral energy resources and the distinctive agricultural products imported from Africa did not decrease in quantitative terms and certain goods even augmented.

Data in Table I make the point that of China's top-10 African exporters, half have oil as the main export—Angola, Republic of the Congo, Ghana, Nigeria and Gabon. The remainders of the top 10 are minerals exporters. Countries in Africa with fewer minerals and fuel exports have much less favourable trade complementarities and thus lower export intensities with China. Countries exporting less than 1 per cent of their total exports to China in 2013 include Kenya, Senegal, Tunisia, Morocco, Djibouti and the island nations of Mauritius, São Tomé and Príncipe, Comoros and Cape Verde (IMF 2015a).

These trade tendencies are congruent with old trade theory. A condition of trade under the Heckscher-Ohlin (1991) model is that trade should arise between two countries that differ with respect to their relative factor endowments — primarily labour, capital and natural resources. The model demonstrates that the gains to trade around specialisation are greatest when the country with abundant capital and scarce labour specialises in the production of goods that utilise capital most intensively, and vice versa.

Accordingly, China is not alone in having imports from Africa dominated by fuels and minerals. Even where oil and gas-rich North African countries are excluded, imports to the European Union and the United States from sub-Saharan Africa are still dominated by minerals and fuels (see Gualberti *et al.* 2014). According to the study by Gualberti *et al.* (2014), in 2012 fuel represented some 76 per cent of the United States' imports from SSA — more than China's 72 per cent. Africa's imports from China, in contrast, are driven mainly by machinery, chemicals and manufactured goods, though patterns vary somewhat among importers (Drummond and Liu 2013).

TABLE I
SELECTIVE 'TOP-10' AFRICA–CHINA EXPORT INDICATORS, 2013

Country	Export volume (US\$b)	Country	Export intensity (%)
Angola	29.0	Sierra Leone	78.1
South Africa	11.8	Gambia	57.0*
Congo Republic	5.2	Mauritania	55.5
Congo, DR	2.5	Congo Republic	53.5
Zambia	2.4	Angola	45.9
Mauritania	1.6	Congo, DR	42.2
Nigeria	1.4	Mali	30.1
Sierra Leone	1.3	Zambia	25.5
Gabon	0.8	Burkina Faso	24.8
Ghana	0.7	Rwanda	24.3
Zimbabwe	0.6	Zimbabwe	23.6
Egypt	0.6	Benin	21.2
Africa	65.4	Africa	14.3

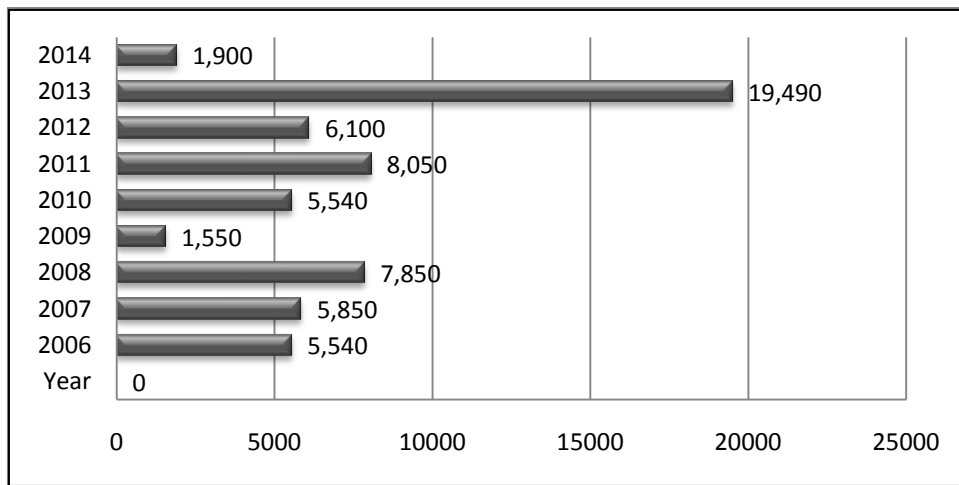
Source: IMF (2015a), where export intensity is defined as the ratio of exports to China over a country's total exports.

Note: Author's own calculations, and where export intensity is weighted by country, not by travel level. * A significant share of which are re-exports from other West African countries.

FDI

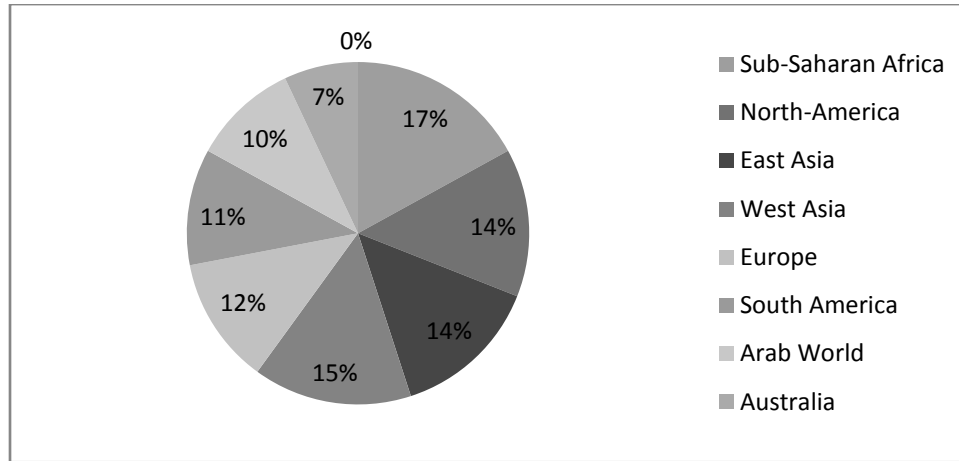
China is the largest developing country foreign investor in Africa (UNCTAD 2013). Chinese FDI in Africa surged during and in the wake of the global financial crisis and continues to diversify. FDI flows from China to Africa rose from next to nothing a decade ago to US\$3.1 billion in 2013, representing 7 percent of global flows. China's FDI stock in Africa reached nearly US\$24 billion in 2013, reflecting an annual growth rate of 50 percent between 2004 and 2013 (MoFCoM 2003-2014, Copley, Maret-Rakotondrazaka and Sy 2014). On the other hand, investment flows (excluding contracts) amounted to US\$19.49 billion in 2013, compared with US\$5.54 billion in 2006 — a substantial increase (Figure 2). Three large transactions inflated the figure in 2013: China National Petroleum Corporation's US\$4.2 billion purchase of oil and gas assets in Mozambique; China Aluminium Corporation's US\$2.1 billion acquisition of Chalco Iron Ore in Guinea, and China Petrochemical Corporation's purchase of Angolan oil and gas assets for US\$1.5 billion (see Table II). But there is no doubt about the overall trend: by July 2014 China's committed investment in Africa since 2006 was US\$150.4 billion according to this dataset — which was more than for any other global region (Figure 3). By this reckoning Africa stands as the most significant location for Chinese outbound investment.

Figure 2: Chinese FDI Flow to Africa 2006-2014 (July), Investments Only



Source: The American Enterprise Institute and The Heritage Foundation, China Global Investment Tracker.

Figure 3: Chinese Global Investment since 2006-2014 (Including Contracts)



Source: The American Enterprise Institute and The Heritage Foundation, China Global Investment Tracker.

TABLE II
TOP 10 CHINA M&A INTO SUB -SAHARA N AFRICA SINCE 2008

Announced Date	Target	Target Country	Industry	Acquirer	Deal Value (US\$m)
14 th March 2013	Oil Gas Assets (Area 4 Gas Block in Mozambique)	Mozambique	Oil & Gas	China National Petroleum Corp CNPC	4,210
21 st October 2013	Chalco Iron Ore Holding Ltd (65%)	Guinea	Mining	Aluminium Corp of China-CHINACO	2,067
24 th June 2013	Oil & Gas Assets (Oil field, Block 31)	Angola	Oil & Gas	China Petrochemical Corp	1,520
30 th March 2011	Oil & Gas Assets (Exploration areas 1,2 and 3A in Uganda)	Uganda	Oil & Gas	China National Offshore Oil Corp -CNOOC	1,467
5 th July 2011	Metorex Ltd (Bid No 2)	South Africa	Mining	Jinchuan Group	1,416
19 th March 2010	Mining Assets (Simandou iron ore project in Guinea)	Guinea	Mining	Aluminum Corp of China - CHALCO	1,350
26 th September 2013	Mining Assets (Iron ore project, Tonklili, Sierra Leone)	Sierra Leone	Mining	Tianjin Materials & Equipment Group Corp – Tewoo Group	990
1 st August 2011	Tonklili Iron Ore Ltd (13.3%) African Power Ltd; African Railway & Port Services Ltd	Sierra Leone	Mining	Shandong Iron & Steel Group	800
2 nd November 2011	Pecten Cameroon Co LLC (80%)	Cameroon	Oil & gas	China Petroleum & Chemical Corp - SINOPEC	538
27 th August 2013	Metorex (Pty) Ltd (39.4839%)	South Africa	Mining	Jinchuan Group International Resources	509

Source: Dealogic.

TABLE III
BILATERAL CHINESE FDI INTO AFRICA, 2013 (US\$ MILLION)

Country	Flow	Stock	Country	Flow	Stock
Algeria	191.3	1,497.2	Libya	0.5	108.8
Angola	224.5	1,634.7	Madagascar	15.5	286.1
Benin	8.4	49.9	Malawi	8.3	253.8
Botswana	10.2	230.9	Mali	108.1	316.7
Burkina Faso	4.3	4.3	Mauritania	15.3	108.3
Burundi	1.1	9.8	Mauritius	61.1	850.0
Cameroon	57.2	148.4	Morocco	7.7	103.1
Cape Verde	0.1	15.2	Mozambique	131.9	508.1
Central African Republic	1.3	60.4	Namibia	7.1	349.5
Chad	121.0	321.3	Niger	116.4	241.9
Comoros	-	4.5	Nigeria	209.1	2,146.1
Congo Republic	110.0	695.4	Rwanda	-6.0	73.3
Congo, DR	121.3	1,091.8	São Tomé and Príncipe	-	0.4
Côte d'Ivoire	-4.8	35.0	Senegal	10.4	83.3
Djibouti	2.0	30.6	Seychelles	17.7	103.5
Egypt	23.2	511.1	Sierra Leone	40.0	108.4
Equatorial Guinea	22.4	260.9	South Africa	-89.2	4,400.4
Eritrea	0.9	104.6	South Sudan	11.5	26.5
Ethiopia	102.5	771.8	Sudan	140.9	1,507.0
Gabon	32.1	168.5	Tanzania	150.6	716.5
Gambia	-	1.2	Togo	23.6	123.1
Ghana	122.5	834.8	Tunisia	7.1	13.9
Guinea	100.1	338.6	Uganda	60.6	383.8
Guinea-Bissau	-	27.0	Zambia	292.9	2,164.3
Kenya	230.5	636.0	Zimbabwe	517.5	1,520.8
Lesotho	-	9.1	Africa total	3,370.6	26,185.8
Liberia	30.3	196.1			

Source: MoFCoM (2014).

Lumpy across time and countries, official Chinese FDI data (Table III) for 2013 reveal the consistent recent tendency for fuel and metal suppliers to receive the lion's share of China's Africa-bound FDI. Across the past decade, the largest annual recipients of Chinese FDI in Africa were Nigeria in 2003; Sudan in 2004, 2005 and 2011; Algeria in 2006, 2009 and 2012; South Africa in 2007, 2008 and 2010; and Zimbabwe in 2013. Countries in recent years that have received more than 5 per cent of total Chinese FDI into Africa include Kenya, Angola and Sudan — the last two being China's most important African oil suppliers.

Despite this prominence of commodities in China–Africa ties, neither of the largest two single investments by China in Africa arose within the commodities sector; they were in finance and infrastructure. In 2008 the Industrial and Commercial Bank of China (ICBC) acquired 20 per cent of South Africa's Standard Bank for US\$5.6 billion (Standard Bank 2011), while in November 2014, Africa became home to China's largest-ever outbound FDI transaction.

TABLE IV
GEOGRAPHIC DISTRIBUTION OF CHINA'S OUTBOUND FDI FLOWS, 2013

Continent	Amount	Share (%)	Annual growth
Asia*	75.60	70.1	16.7
Europe	5.95	5.5	-15.4
Latin America	14.36	13.3	132.7
North America	4.90	4.5	0.4
Africa	3.37	3.2	33.9
Oceania	3.66	3.4	51.6
Total	107.84	100.0	22.8

Source: NBS (2014: 85).

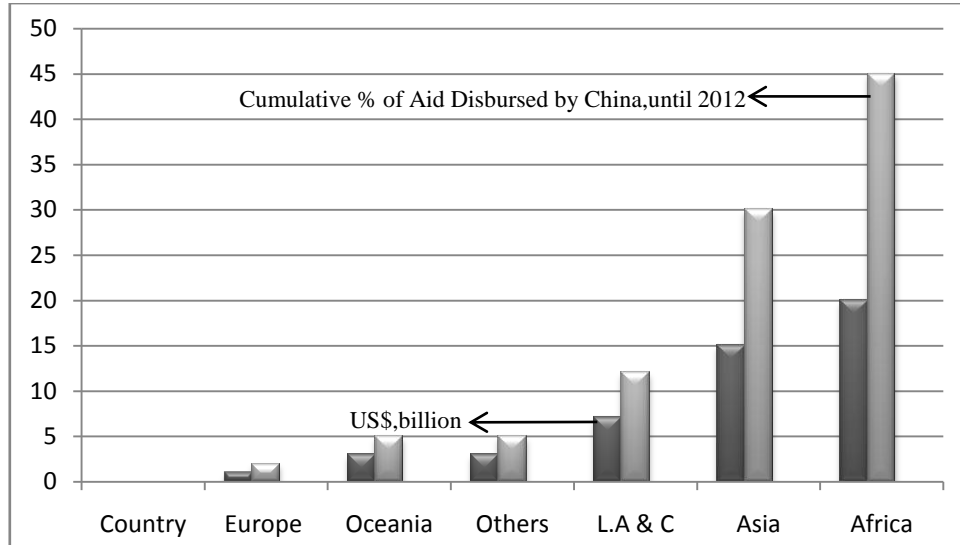
Note:* Includes investment channelled through Hong Kong to third destinations.

Despite an ever-increasing number of such investment projects, China's outbound FDI to African destinations is small relative to China's total outbound FDI and to total inbound FDI into Africa. In 2013 Africa attracted just 3.2 per cent of total Chinese outbound FDI (Table IV). And yet, few topics in applied development economics attract more media scrutiny, and less attention from empirical economists.

AID

Africa is the largest recipient of Chinese development financing and its share is increasing. Africa received nearly half of the cumulative US\$54 billion provided by China in global foreign aid through 2012 (Figure 4), significantly more than any other region (Government of China 2014). Chinese official development assistance has been, by and large, complementary to aid from Organization for Economic Co-operation and Development (OECD) countries. Chinese and OECD official development assistance differ substantially in scale, nature, and degree of concessionality (Bräutigam 2011b, Strange *et al.* 2013).¹

Figure 4: **Distribution of Aid and Development Financing Flows from China**



Source: Government of China 2011, 2014.

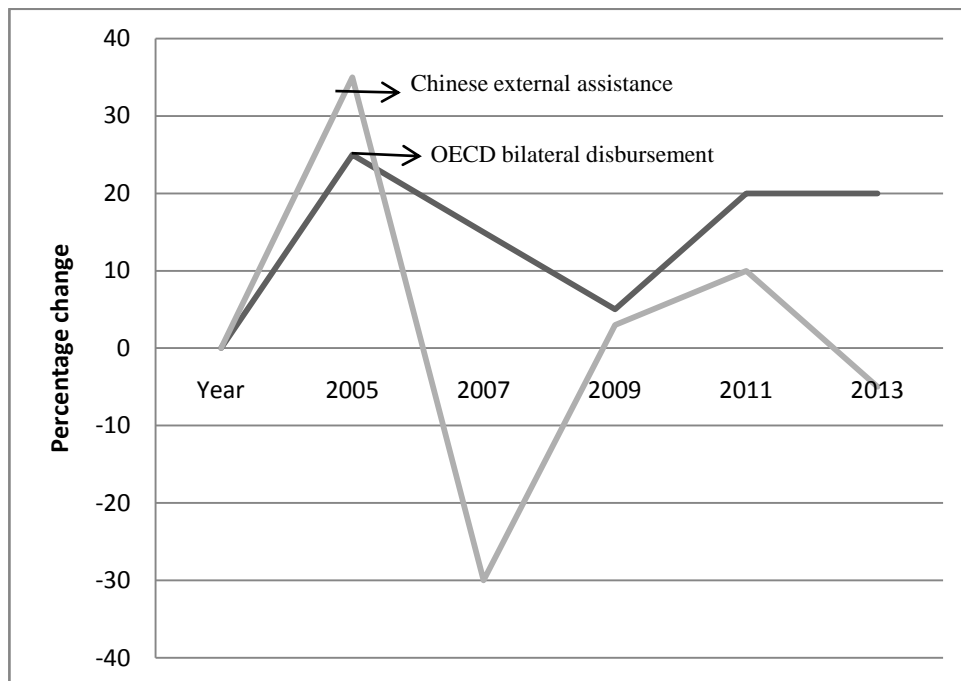
Note: Africa is one of the largest recipients of Chinese aid. *L.A & C in the graph represents Latin America and the Caribbean.

Although Chinese assistance increased rapidly as OECD disbursements declined (Figure 5), Chinese aid remains well below the OECD's, amounting to US\$3.2 billion in 2013 compared with the US\$26 billion disbursed by OECD

¹Key differences include definitions, the degree of concessionality, and conditionalities. Official development assistance is defined by the OECD as concessional funding given to developing countries and to multilateral institutions primarily for the purpose of promoting welfare and economic development in the recipient country. China is not a member of the OECD and does not follow its definition or practice on development aid. By this measure, the bulk of Chinese financing in Africa falls under the category of development finance, but not aid (Strange *et al.* 2013).

countries in the same year (Figure 6). China's aid data are presented using a different methodology to that of the OECD. This makes it difficult to draw international comparisons (Brautigam 2011a: 203–22, Brandt 2013). According to the *2014 China White Paper on Foreign Aid*, from 2010 to 2012, China provided RMB89.3 billion (US\$13.4 billion) in foreign aid, through grants, interest-free loans (8.1 per cent of total foreign aid) and concessional loans (55.7 per cent of total foreign aid). This three-year sum is equivalent to about one-third of China's entire pre-2009 foreign aid to all countries, according to figures in the first aid white paper of 2011 (Zhou 2014). The amount suggests annual foreign aid of about US\$5 billion, making China the world's tenth-largest provider of foreign aid (Zhou 2014).

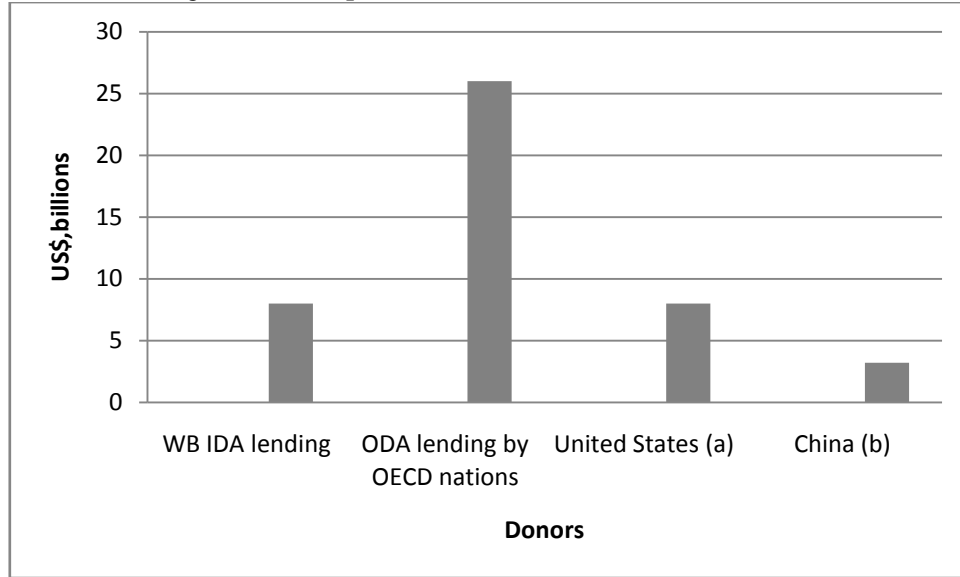
Figure 5: **Chinese Development Assistance and Bilateral Aid from OECD Countries to Sub-Saharan Africa**



Sources: OECD; *Chinese Statistical Yearbook*; MoFCoM. Cited from <http://www.chinaafricarealstory.com/p/chinese-aid.html>.

Note: *Chinese assistance has grown at a faster pace than bilateral aid from the OECD in recent years.

Figure 6: Development Assistance to Sub-Saharan Africa



Source: World Bank 2013 Annual Report. a. 2012 OECD Development Assistance Committee statistics. b. Chinese Statistical Yearbook and MoFCoM. Cited from <http://www.chinaafricarealstory.com/p/chinese-aid.html>.

Note:*China's aid is much smaller in size.

The white paper also reveals that about half of China's foreign aid goes to countries in Africa (MoFCoM 2011, 2013). That aid prioritises agricultural development, followed by infrastructure, health, capacity building (education) and climate change (MoFCoM 2011,2013). There were 86 aid-related infrastructure projects under way that seek to better integrate domestic and regional economies (MoFCoM 2011, 2013). Towards mitigating and adjusting to climate change, China has built several meteorological monitoring stations in African countries, and is active in supporting the development and utilisation of new energy on the continent. Recent projects receiving Chinese state financial support include a 400-megawatt solar power plant in Ghana at a cost of US\$1 billion. Negotiations are in progress around a US\$140 million solar power station in Garissa, Kenya (Tsagas 2013), and a US\$132 million wind farm in Tanzania. Such investments help to address Africa's power gap in a more sustainable way than via old energy models. They also create an international market for Chinese new energy companies. This type of exchange reflects the principle of mutual development that is an explicit founding principle of China's foreign aid programme.

III. EMPIRICAL APPROACH AND DATA

To assess the impact of various Chinese activities on economic growth in Africa, we use a simple Solow-type growth model. We exploit the times-series dimension in the data by using a panel data approach. In line with large parts of the relevant literature, for example, Mankiw *et al.* (1992), Islam (1995) and Hoeffler (2002), we use real GDP per capita growth rates as our dependent variable, that is, changes in the log of real income per capita y in country i over time t , or $\ln y_{it} - \ln y_{it-1}$. Essential independent variables in this growth model are initial income per capita ($\ln y_{it-1}$), the population growth rate n , changes in technology g , the depreciation rate of the capital stock δ , and the savings rate s . We add further control variables and the variables of interest X_{it} explained below. The basic model reads as follows:

$$\ln y_{it} - \ln y_{it-1} = \alpha + \beta \ln y_{it-1} + \gamma \ln s_{it} + \phi \ln(n_{it} + g + \delta) + \varphi' \ln X_{it} + \lambda_t + \mu_i + \varepsilon_{it} \dots \dots \dots (i)$$

The model includes period-specific effects λ_t affecting all countries, for example, technology shocks, country-specific fixed-effects μ_i and an independent and identically distributed error term ε_{it} . In line with Mankiw *et al.* (1992), we assume that changes in technology and the depreciation rate of the capital stock are constant over time and are equal to 0.05. Equation (i) can then be rewritten as:

$$\ln y_{it} = \alpha + (\beta + 1) \ln y_{it-1} + \gamma \ln s_{it} + \phi \ln(n_{it} + 0.05) + \varphi' \ln X_{it} + \lambda_t + \mu_i + \varepsilon_{it} \dots \dots \dots (ii)$$

To test this model empirically, we use GDP per capita for income levels and the share of investment in GDP for the savings rate. As stated above, we add 0.05 to the population growth rate before taking logs. The additional control variables include changes in the terms-of-trade, the inflation rate for macroeconomic distortions, and the number of battle deaths for the occurrence and intensity of conflicts. The latter variable has been included to control for the relatively high conflict intensity in sub-Saharan Africa. We take logs of all variables but changes in the terms-of-trade, as there are many negative observations for this variable. Due to lack of adequate data for many African countries, measures for educational attainment and institutional quality are not included. In fact, the sample would decline by more than one third if we include, for instance, either the Barro and Lee (2013) educational attainment variables or law and order (PRS Group 2014) for institutional quality.² Using both education and law and order at the same time would cut the sample in half.

²Note that educational variables of high quality are not available at an annual level. Gross or net school enrolment ratios are fairly incomplete and of heterogeneous quality for African countries.

In line with the predictions of the Solow model and the results of previous empirical growth papers, we expect a negative impact of income levels in the previous period on growth rates (due to convergence effects), a positive impact of investment and a negative effect of an ³increase in the population. Changes in the terms-of-trade should have a positive impact on growth, whereas the opposite is expected for the inflation rate and conflict intensity.

For Sino-African trade flows, we use two different sets of variables. First, we employ total African exports to (and imports from) China and control for respective African trade with the rest of the world (ROW). These variables are meant to capture the effects of total African trade with China, though we distinguish between imports and exports, which can have different effects. Second, we differentiate between natural resource exports and imports, and non-resource exports and imports. Due to the importance of natural resources in Sino-African trade, we are interested in the effects of trade in different commodities. Natural resource exports comprise, among others, fuel, various mineral products and non-ferrous metals. We normalised all trade variables by the GDP of the respective African country.

For foreign investment, we again differentiate between Chinese FDI and FDI from the ROW to African countries, both normalised by the host country's GDP. Chinese outward FDI data at the country-level is available from 1991. There are two sets of Chinese FDI data: (1) Chinese Approved Overseas Investment data for 1991-2005, and (2) Chinese Outward FDI data reported in IMF-OECD format since 2003.⁴ We combine the two sets of data by using the first set for the years 1991-2002 and the second set for the years 2003-2011. Even though the data in the two datasets could differ at a country level, the deviations are fairly small. This allows us to exploit a longer time series since 1991. To include as many observations as possible, we fill missing values with zero assuming that there was no FDI in that case (and add one before taking the log).⁵ To control for FDI from the ROW, we subtract Chinese FDI flows from total FDI flows to African countries.

Finally, we test for the effects of Chinese economic cooperation projects in African countries, again, normalised by the respective country's GDP. Data is

³See Appendix A for an exact definition of natural resource trade and all other variables as well as data sources. Descriptive statistics are displayed in Appendix B.

⁴For a discussion of China's FDI data, see Cheung *et al.* (2012).

⁵We inserted a zero in 47 out of 151 observations. While excluding the zero observations does not affect the results reported below, it would reduce the sample significantly.

taken from various issues of the China Statistical Yearbook published by China's National Bureau of Statistics. Following Biggeri and Sanfilippo (2009) and Sanfilippo (2010), we use data on economic cooperation as a proxy for Chinese aid due to the lack of other official data. Although there have been Chinese economic cooperation projects in Africa for several decades, country-level data on economic cooperation has only been published since 1998. In order to keep the time frame of our analysis as long as possible, we computed data at a country level for 1991-1997. More specifically, we assume that the country breakdown of China's total economic cooperation before 1998 is similar to that in the period 1998-2001. As China's economic cooperation projects started soaring after the Going Global Policy in 2001, we find it reasonable to assume that in the years before 2002 the level of economic cooperation in Africa as compared to the ROW was more or less constant. Importantly, this procedure does not affect the main results reported below. If we exclude the years before 1998, the results do not change much in terms of the sign and significance of the main variables of interest. Besides China's economic cooperation, we control for foreign aid received by African countries from the ROW.

The period under consideration is restricted by the availability of Chinese investment and economic cooperation data, that is, we have data from 1991 to 2011. To control for business cycle effects, we compute five-year averages for all variables, which results to four observations for the period 1991 to 2010. For the lagged dependent variable, we also use information for the previous period 1986 to 1990. In further regressions, we use four-year averages (five observations for 1991 to 2010) and three-year averages (seven observations for 1991 to 2011). The sample consists of 43 sub-Saharan African countries, that is, all 48 countries in that region apart from Liberia, Sao Tome and Principe, Seychelles, Somalia, and South Sudan. Whereas trade figures for Liberia are highly distorted, the last four had to be excluded due to missing data for key variables such as GDP per capita or investment, or simply did not exist as a country for the larger part of the period under consideration. In extensions and robustness checks, we both enlarge the sample by including North African countries and reduce the sample by excluding sub-Saharan African islands.⁶

In terms of the methodology, we use a standard OLS fixed-effects model. This approach allows a robust estimation of the various linkages and ensures to control for unobserved time-invariant country fixed-effects. In a dynamic fixed-effects model, it is well known that the inclusion of the lagged dependent

⁶ See Appendix C for the country sample.

variable can lead to biased estimates (Nickell 1981). This bias mainly affects the lagged income per capita variable, which is not the variable of principle interest in this study. Still, the size of the impact of the various trade, FDI and aid variables of main interest could be affected, for example, by using the lagged dependent variable to calculate the long-run effects. More worryingly, there might be another bias due to the endogeneity of some of the explanatory variables. Depending on the partner country or product type, trade, FDI and aid are likely to be endogenous with respect to economic growth. To mitigate both concerns, we also use the system Generalized Methods of Moments (GMM) estimator, introduced by Arellano and Bover (1995) and Blundell and Bond (1998).

IV. MAIN RESULTS

The study begins by reporting fixed-effects regressions using five-year averages in Table V. Column 1 presents the study baseline specification including only the basic Solow model variables. The results are predominantly in line with the theoretical model predictions suggesting that the Solow model fits well for the employed African economies' dataset. The lagged dependent variable has a positive and highly significant coefficient of 0.868. Our estimate is close to other findings of Solow growth regressions where African countries are explicitly included, for example, Hoeffler (2002).⁷ As expected, the investment variable is positive and highly significant. Contrary to the theory, the estimate for population growth is positive, albeit, not significant and relatively small in size. Finally, regarding the within R-squared (which is at 0.75), we find that the regressors explain a high portion of the within country variation in GDP per capita growth – meaning that the model fits relatively well.

In the next step, we extend our model by including the variables of principle interest in Column 2. Namely, the specification includes the terms-of-trade growth rate of African countries, FDI flows from China and the ROW, the presence of Chinese economic cooperation projects, aid flows from the ROW as well as total imports from and total exports to China and the ROW, respectively. By including these additional variables, we lose 18 observations due to missing

⁷In order to assess the effect of the lagged GDP per capita variable on GDP per capita growth, we have to correct the estimated coefficient by subtracting 1 and obtain -0.132. In a corresponding fixed-effects regression, Hoeffler (2002:147) finds a coefficient which is equal to -0.230. The difference in magnitude is likely to be due to the fact that her study includes 85 developing countries including also a set of non-African countries.

data for these measures. Nevertheless, the data loss is marginal, the sign and significance levels of the main controls do not change much and the model fit increases to 0.85 for the within R-squared.

TABLE V
CHINA'S IMPACT ON AFRICA ECONOMIC GROWTH, BASELINE
REGRESSIONS (FIXED EFFECTS AND FIVE-YEAR AVERAGES)

Independent Variables	Dependent Variables: ln GDP per capita					
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dep.Var	0.868*** (16.34)	0.747*** (9.495)	0.735*** (10.54)	0.756*** (11.09)	0.755*** (10.69)	0.785*** (11.51)
ln Investment	0.150*** (3.239)	0.170*** (3.235)	0.150** (2.613)	0.135** (2.473)	0.173*** (3.249)	0.159*** (3.243)
ln Population Growth	0.056 (0.842)	0.044 (0.477)	-0.052 (-0.619)	-0.101 (-1.158)	-0.051 (-0.622)	-0.074 (-0.847)
Terms-of-Trade Growth		0.205** (2.361)	0.208** (2.257)	0.176** (2.322)	0.233** (2.588)	0.295*** (2.935)
ln FDI China		0.0017 (0.428)	0.0016 (0.363)	0.0014 (0.285)	0.0010 (0.268)	0.0019 (0.541)
ln FDI ROW		0.0001 (0.00841)	-0.005 (-0.326)	-0.0103 (-0.554)	-0.0040 (-0.271)	0.0020 (0.131)
ln Aid China		-0.0254 (-0.803)	-0.0329 (-1.179)	-0.0269 (-0.875)	-0.0278 (-1.141)	-0.0175 (-0.705)
ln Aid ROW		-0.0689 (-1.574)	-0.0572 (-1.291)	-0.0703 (-1.243)	-0.0446 (-1.190)	-0.0437 (-1.127)
ln Total Exports to China		0.0170 (1.476)	0.0171 (1.483)		0.0115 (1.243)	
ln Total Imports from China		-0.0751** (-2.376)	- (-2.186)		-0.074** (-2.311)	
ln Total Exports to ROW		0.102*** (3.013)	0.0908** (2.180)		0.0658* (2.009)	
ln Total Imports from ROW		-0.0091 (-0.217)	-0.0116 (-0.260)		0.0081 (0.197)	
ln Inflation			-0.0018 (-0.0870)	-0.0077 (-0.341)	0.0034 (0.191)	0.0018 (0.0981)
ln Battle Deaths			-0.0043 (-1.135)	-0.0037 (-0.828)	-0.00353 (-1.111)	-0.0027 (-0.845)
Terms-of-Trade Growth*					0.0627*** (3.526)	
ln Total Export To China						
ln Non-resource Exports to China				0.0061 (0.785)		0.0072 (1.204)
ln Non-resource Imports from China				- (-2.616)		-0.0547** (-2.407)
ln Resource Exports to China				0.0051 (0.658)		0.0025 (0.404)

(Contd. Table V)

Independent Variables	Dependent Variables: In GDP per capita					
	(1)	(2)	(3)	(4)	(5)	(6)
In Resource Imports from China				0.00061 (0.0478)		-0.0091 (-0.723)
In Non-resource Exports to ROW				-0.0167 (-0.552)		-0.0192 (-0.652)
In Non-resource Imports from ROW				0.0498 (0.777)		0.0375 (0.718)
In Resource Exports to ROW				0.0082 (0.526)		0.0090 (0.537)
In Resource Imports from ROW				-0.0322 (-1.464)		-0.0166 (-0.761)
Terms-of-Trade Growth*						0.0557***
In Resource Exports to China						(3.000)
Observations	169	151	147	147	147	147
Countries	43	43	43	43	43	43
R-squared (within)	0.75	0.85	0.85	0.85	0.84	0.87

Notes: The dependent variable is always In GDP per capita. All regressions include period-specific dummies *t*-values obtained from robust standard errors in parentheses. * Significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Both estimates for FDI have a positive sign while those for foreign aid from the ROW and Chinese economic cooperation have a negative sign. Yet all four coefficients are insignificant, indicating that these factors do not play a big role in explaining the within variation of African countries growth rates. Turning towards the trade measures, we find effects that matter for economic growth. While the coefficient of Africa's total exports to China is positive but insignificant, total imports from China have a significant and negative impact on growth rates. At the same time, we analyse the trade relations with the ROW. The effects are somehow contrary to those with China. Again, the exports' estimate has a positive sign and the imports' coefficient has a negative sign, but the statistical significance has changed. Total African exports to the ROW are significant, whereas total imports from the ROW are insignificant, indicating that exports to the ROW might foster economic growth in Africa. For the moment, however, these results should be treated as correlations rather than causations.

In Column 3 the study includes further variables to control for macroeconomic distortions as well as for the occurrence and intensity of conflicts. The estimates of the two measures enter with the expected negative sign in our specification, but they are statistically insignificant. Most notably

regarding this regression, the outcome for the other estimates – in particular those for our variables of principle interest – are not affected by including the inflation rate and the number of battle deaths although we lose four further observations.

Finding evidence for potential growth effects related to our trade measures, we next differentiate between resource and non-resource trade (Column 4). We replace the four total trade variables by eight disaggregated imports/exports variables for resource and non-resource trade. Only one of the eight coefficients is statistically significant, indicating a correlation with economic growth, that is, non-resource imports from China which has a negative sign. The negative correlation between total imports from China and economic growth across Africa, as shown in Columns 2 and 3, seems to arise from imports in non-resource sectors. Given the dominance of non-resource goods in total imports from China (97 per cent in 2012), this result is hardly surprising. Still it points to potential displacement effects of African firms by their Chinese competitors. Though the findings in Columns 2 and 3 indicate a significant positive effect of total exports to the ROW, the disaggregated results for resource and non-resource exports to the ROW are not significant.

The terms-of-trade growth's estimate is positive and significant at the five per cent level (or better), indicating that African exporters of natural resources have benefited from higher world market prices for their export products. This outcome is in line with the results of Zafar (2007) who showed that demand from China has contributed considerably to the increase in prices of raw materials, particularly for oil and metals from Africa, which then led to an increase in the terms-of-trade. This result is supported by Farooki and Kaplinsky (2013), who also analysed the (positive) impact of China on various commodity prices. At the same time, the improvements in the terms-of-trade of African countries could also arise from lower import prices, for example, from low-cost Chinese manufactured goods, as imports of these goods increased significantly over the last 15 years. What matters is the positive correlation of changes in the terms-of-trade and economic growth in African countries.⁸

To analyse the terms-of-trade effects in more detail, we computed interaction terms, that is, we multiply changes in the terms-of-trade with all respective trade variables, to examine non-linear effects. While most interaction terms, whether at an aggregated or disaggregated level, are not significant, two exceptions stand out: the interaction terms with total exports to China and resource exports to

⁸A comprehensive analysis of the impact of Chinese demand for raw materials on African terms-of-trade is beyond the scope of this paper, as we focus on the growth effects.

China, respectively, which are positive and highly significant at the one per cent level (Columns 5 and 6). This outcome is robust to including all respective interaction terms at the same time (not reported) and indicates that exporting natural resources to China indeed is associated with higher growth rates. But this result shows up either directly through changes in the terms-of-trade or indirectly through the interaction term.⁹

In order to further assess trade the study delves into the global value chains (GVCs) along with flow of exports and imports. Despite strong growth in trade flows, sub-Saharan Africa's trade has barely kept pace with the expansion of global trade, even as other regions managed to increase their weight in the global trade network over the same period. Indeed, even after accounting for lower levels of income and economic size, generally longer distances between countries and a large number of landlocked countries, levels of trade flows emanating from sub-Saharan Africa are found to be only half the magnitude of those experienced elsewhere in the world.

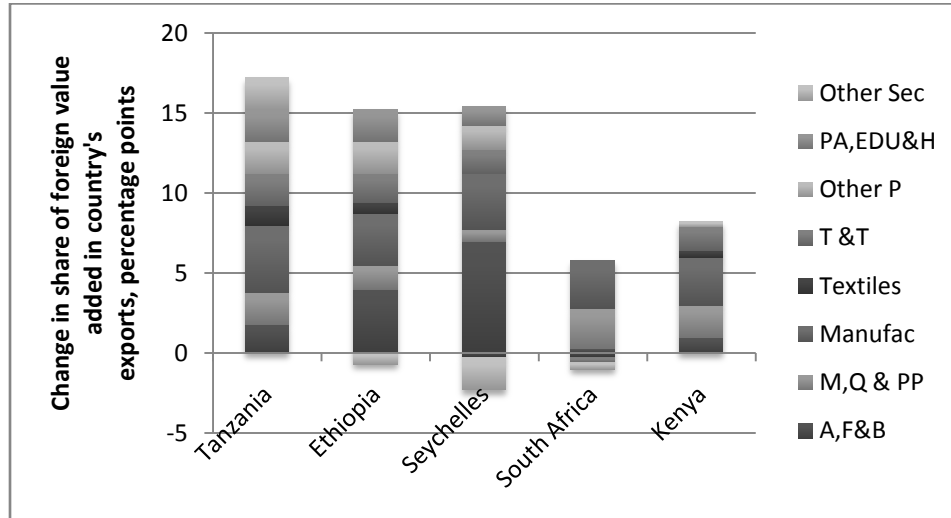
Likewise, the region still has ways to go to better integrate in GVCs — a process that has consistently been associated with higher levels of activity and income growth over time — as has happened in South and East Asia or Eastern Europe. However, while oil-exporting countries are clearly lagging behind, many other countries — both commodity and non-commodity exporters — are showing progress, even if from very low starting points, with the East African Community (EAC) and the Southern African Customs Union (SACU) particular bright spots. In countries that have made the largest strides into GVCs — such as Ethiopia, Kenya, Seychelles, South Africa, or Tanzania — manufacturing, agriculture, and agro-business — and, to a lesser extent, transport, tourism, and textile — have benefited the most from deeper integration.

These above five countries in particular stand out, having seen the share of foreign value added (FVA) in their exports increase by 5 percentage points or more in the past two decades (Figure 7). In these countries, the sectors that have benefited the most from the deepening of integration include agriculture and agro-business (especially in Ethiopia and Seychelles), and manufacturing (particularly in Tanzania), but also textiles, transport and tourism, although to a lesser extent. These experiences bode well for the region: for one, the increase in depth of integration in some of these countries, at 10 percentage points or more,

⁹Columns 5 and 6 are our preferred model specifications. Because they include all controls, the various aggregated and disaggregated trade variables and the two interaction terms.

is of a similar magnitude to that experienced by countries such as Poland or Vietnam that are now success stories within large GVCs. The examples also highlight the sectors – agro-business, light manufacturing, tourism and textile – in which sub-Saharan Africa has the potential to leverage its comparative advantages.

Figure 7: Sub-Saharan African Selected Countries: Decomposition of Change in Depth of Integration in Global Value Chains, Average 1991-95 to 2008-12



Sources: EORA database, and author's calculations.

Note: *Other Sec* represents Other Sectors; *PA, EDU & H* represents Public Administration, Education, and Health; *Other P* represents Other Private Services;¹⁰ *T&T* represents Textile and Tourism; *Manufac.* represents Manufacturing excluding textiles;¹¹ *M,Q&PP* represents Mining, Quarrying, and Petroleum Products; *A,F&B* represents Agriculture, Food and Beverages.

These results highlight the potential sectors where the region could build on its comparative advantages, provided the business environment is sufficiently conducive.

In that respect, the study analysis suggests that, to leverage the region's trade potential and ensure strong job creation and durable growth in the process — especially at a juncture when external demand for commodities is far less

¹⁰Includes construction, telecommunications, wholesale trade, and maintenance and repair.

¹¹Includes electrical and machinery, metal products, wood and paper, transport equipment, and other manufacturing.

supportive — it is more critical than ever to make progress in filling the infrastructure gap, lowering tariff and non-tariff barriers, and improving the business climate and access to credit, while continuing to enhance education outcomes.

Next, we replicate all six specifications using system GMM regressions in order to address endogeneity concerns (and the bias due to the inclusion of the lagged dependent variable). In these regressions we treat the lagged dependent variable, investment, population growth, inflation, all four total import and export variables, all non-resource import and export variables, as well as FDI and aid from the ROW as endogenous. To reduce the number of endogenous variables (and thus the number of instruments used), we set changes in the terms-of-trade, battle deaths, and all natural resource export variables as exogenous. We assume that African countries are too small to have an impact on world market prices (that is, their terms-of-trade) and that conflicts mainly have an impact on economic growth but not vice versa. Yet switching the status of both variables from exogenous to endogenous hardly affects the results. Natural resource exports are mainly driven by the fact whether a country has natural resource endowments or not. The study also treats Chinese aid and FDI to Africa as exogenous. As pointed out by Kolstad and Wiig (2011), Chinese FDI to Africa is not attracted by GDP as soon as South Africa is excluded from the sample. Predominately, Chinese FDI (and aid) is concentrated in African countries with large resource endowments, which is exogenous.

Using a large number of instruments may over fit endogenous variables and may weaken the Hansen *J*-test of the instruments' joint validity. To keep the number of instruments at a minimum, we use the collapse option in STATA in all regressions. This ensures that the number of instruments is always well below the number of countries. Overall, the results, reported in Table III, are broadly in line with the fixed-effects results. The lagged dependent variable is always significant at the one per cent level. Depending on the model specification, the estimated coefficient is slightly above or below one, implying no strong evidence for convergence in sub-Saharan African countries. This finding is in line with the results of McCoskey (2002), who also found no convergence for economic growth in sub-Saharan Africa, although smaller “convergence clubs” do exist.

In five out of six model specifications, investment has a positive and significant impact on economic growth. In contrast to the fixed effects results, total African exports to the ROW are not significant. Importantly, total imports from China and non-resource imports from China have – as before – a negative and significant impact on growth. This implies that we do observe displacement

effects of African products by Chinese imports, even if we control for endogeneity. While changes in the terms-of-trade are no longer positively associated with growth (apart from one model specification), both interaction terms with terms-of-trade growth are positive and significant at the five or ten per cent level. This result underlines the importance of changes in the terms-of-trade with respect to economic growth when looking at African exports of natural resources to China.

TABLE VI
SYSTEM GENERALISED METHODS OF MOMENTS (GMM)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged	1.060***	1.015***	0.964***	0.988***	0.960***	0.955***
Dep.Var	(18.22)	(13.18)	(12.01)	(6.657)	(11.27)	(5.838)
ln Investment	0.313***	0.101	0.236**	0.230**	0.268***	0.217**
	(3.048)	(0.841)	(1.995)	(2.412)	(3.563)	(2.440)
ln Population	0.148	-0.129	0.010	0.022	-0.032	-0.095
Growth	(0.876)	(-1.070)	(0.0738)	(0.0915)	(-0.256)	(-0.534)
Terms-of-Trade		0.089	0.050	0.018	0.151*	0.124
Growth		(1.039)	(0.635)	(0.144)	(1.691)	(1.064)
ln FDI China		0.0603	0.0347	0.0009	0.0134	0.0144
		(1.172)	(0.716)	(0.0264)	(0.425)	(0.402)
ln FDI ROW		-0.0508	-0.0682	-0.0872	-0.0666	-0.0636
		(-0.783)	(-1.430)	(-0.957)	(-1.099)	(-0.618)
ln Aid China		0.0086	-0.0004	0.0020	0.0030	0.0037
		(0.904)	(-0.0250)	(0.297)	(0.289)	(0.427)
ln Aid ROW		0.0361	0.0255	0.0330	0.0047	0.0222
		(1.569)	(1.614)	(1.157)	(0.301)	(1.063)
ln Total Exports		0.0123	0.0069		-0.0005	
to China		(0.719)	(0.601)		(-0.0389)	
ln Total Imports		-0.162**	-0.102*		-0.0315	
from China		(-2.323)	(-1.745)		(-0.557)	
ln Total Exports		-0.0677	0.0163		-0.0372	
to ROW		(-0.718)	(0.209)		(-0.460)	
ln Total Imports		0.119	0.0467		-0.0087	
from ROW		(1.553)	(0.698)		(-0.158)	
ln Inflation			-0.0125	-0.0243	-0.0009	-0.0463
			(-0.379)	(-0.700)	(-0.0280)	(-1.386)
ln Battle Deaths			-0.0037	0.0035	-0.0071	-0.0015
			(-0.586)	(0.252)	(-0.978)	(-0.0971)
Terms-of-Trade					0.111**	
Growth *					(2.119)	
ln Total Exports						
to China						
ln Non-resource				0.0101		-0.0081
Exports to				(0.285)		(-0.215)
China						

(Contd. Table VI)

	(1)	(2)	(3)	(4)	(5)	(6)
In Non-resource Imports from China				-0.130** (-2.019)		-0.0937* (-1.723)
In Resource Exports to China				0.0020 (0.0964)		0.0074 (0.316)
In Resource Imports from China				0.0145 (0.620)		0.0066 (0.286)
In Non-resource Exports to ROW				-0.0120 (-0.195)		-0.0171 (-0.273)
In Non-resource Imports from ROW				0.173 (1.140)		0.147 (1.223)
In Resource Exports to ROW				0.0020 (0.0889)		-0.0083 (-0.302)
In Resource Imports from ROW				-0.0323 (-0.729)		-0.0293 (-0.595)
Terms-of-Trade Growth *						0.0383* (1.814)
In Resource Exports to China						
Observations	169	151	147	147	147	147
Countries	43	43	43	43	43	43
Instruments	8	21	24	24	26	24
AR (1), p-value	0.09	0.21	0.11	0.12	0.01	0.09
AR (2),p-value	0.29	0.41	0.40	0.41	0.40	0.41
Hansen J-test, p-value	0.21	0.68	0.39	0.58	0.39	0.68

Notes: The p-values for AR (1) refer to the first- and second-order autocorrelated disturbances in the first differences equations. See Table V for further notes

The test statistics for the system GMM estimator (Hansen *J*-test) indicate that the instruments used are valid. However, we do have econometric problems regarding autocorrelation. The system GMM estimator requires high first-order but no second-order autocorrelation. While the p-values for the AR (2) indicate that, indeed, we do not have second-order autocorrelation, the corresponding p-values for the AR (1) show that we cannot reject the null hypothesis, in three out of six model specifications, though the p-values are only slightly above 0.10 in two model specifications. These results thus have to be viewed with caution.

Still, all test statistics for our preferred model specifications (Columns 5 and 6) indicate that the estimations are valid.

By using the system GMM technique, we can calculate the size of the impact of our variables of principal interest on economic growth. For example, an increase in the volume of non-resource imports from China divided by total GDP (Table VI, Column 6) by one per cent is associated with a decrease in GDP per capita growth of 0.1 per cent over a period of five years across countries. The quantitative effect of importing more non-resource goods from China on economic growth is thus modest but by no means negligible.

Our results for a negative impact of non-resource imports from China are at odds with those reported by Baliamoune-Lutz (2011) who found a positive impact of imports from China on African growth. We believe that this can be partly explained by the fact that Baliamoune-Lutz (2011) does not distinguish between resource and non-resource goods. At the same time, the study employs a longer period of time (1991-2010 instead of 1995-2008) and a different methodology. On the other hand, the study results for displacement effects are more in line with those of Giovannetti and Sanfilippo (2009). Yet they concentrate on displacement effects for African exports in third markets but do not investigate these effects in African countries' domestic markets.

For the growth effects of foreign investment, we cannot confirm the positive effects found by Whalley and Weisbrod (2012). Again, this can be explained by the different methodologies employed. Since they use Solow growth accounting methods to analyse the impact of Chinese FDI on African economic growth, they are more likely to investigate (and find evidence for) the short-run growth impact of Chinese investment. Also, their methodology allows them to account for the impact of even relatively small changes in FDI and its impact on economic growth.

V. EXTENSIONS AND ROBUSTNESS CHECKS

In order to examine the robustness of the obtained results, the study runs numerous additional regressions. In terms of the methodology, the study prefers to present the results for the fixed-effects estimator only. In fact, the study has tested the validity of the system GMM estimator in numerous additional regressions. Using different model specifications, different lag structures, taking different time periods or annual averages, the test statistics never ensure a proper specification in all six models at the same time. Partly, this is due to the relatively small number of countries as well as the short time period. While the results for

the principle variables of interest are not much affected, the fixed-effects model seems to be more robust than the GMM estimator. Still, the fixed-effects estimator does not control for the potential endogeneity of some of the explanatory variables. But since the GMM estimations support the basic outcome for the various trade variables, we are still convinced that endogeneity issues are not a major problem and that our findings can be viewed as causal effects as well.

In the following, the study restricts the presentation of the extensions and robustness checks to two dimensions to save space: different country samples and different period averages. The study begins with the sample variations, presented in Table VI. First, the study extends the sample and adds six North African countries (Columns 1 and 2).¹² This allows us to examine whether the results are sensitive to a larger sample size that includes basically all African countries for which the study has data. Though North African countries differ from those below the Sahara, they have considerable trade and investment links with China as well.

In Columns 3 and 4, the study refers to the initial sub-Saharan Africa sample again but excludes all four African islands. It can be argued that small islands, such as Cape Verde, the Comoros or Mauritius, differ from the sub-Saharan African mainland. Arguably, this may apply to Madagascar as well. Historically, Madagascar and Mauritius have had a large Asian diaspora which may influence the effect of Chinese economic interactions in the present. What is more, the island economies' trade composition is very different from mainland Africa. For example, Mauritius has higher trade/GDP levels and exports much more manufactured goods than the rest of sub-Saharan Africa (Subramanian 2013).

Finally, in Columns 5 and 6 the study excludes South Africa from the sub-Saharan Africa sample. As explained in Section II, China's motives for trade and investment in South Africa differ compared to other Chinese trading partners and investment destinations in Africa. Partly due to higher income levels, South Africa is a larger market for Chinese exports of manufacturing products. This may affect our results, in particular the trade variables. Moreover, Chinese decisions to invest in South Africa are also more likely to be driven by horizontal motives in contrast to other African countries.

To facilitate a comparison of the results, Columns 1, 3 and 5 (2, 4 and 6) in Table VII refer to the preferred specifications, that is, Column 5 (6) in Table V. The sample variations in Table IV clearly confirm the baseline findings as the

¹²The included North African countries are Algeria, Djibouti, Egypt, Libya, Morocco and Tunisia.

study is able to almost replicate the results. Throughout the six regressions the study has the same qualitative outcome for all significant measures. This applies to the various trade variables as well as the two interaction terms with changes in the terms-of-trade. Furthermore, not only are the same variables significant on a comparable level, the magnitude of these estimates is also similar.

TABLE VII
CHINA'S IMPACT ON AFRICAN ECONOMIC GROWTH, SAMPLE
VARIATIONS (Fixed Effects and Five-year Averages)

Independent Variables	Dependent Variables: In GDP per capita					
	(1) Total Africa	(2) Total Africa	(3) Excl. Islands	(4) Excl. Islands	(5) Excl. South Africa	(6) Excl. South Africa
Lagged Dep.Var	0.764*** (11.40)	0.792*** (12.31)	0.726*** (10.26)	0.756*** (11.76)	0.755*** (10.67)	0.785*** (11.30)
In Investment	0.173*** (3.321)	0.158*** (3.377)	0.167*** (3.069)	0.153*** (2.986)	0.173*** (3.213)	0.160*** (3.177)
In Population Growth	-0.075 (-1.020)	-0.091 (-1.166)	-0.002 (-0.0242)	-0.023 (-0.251)	-0.050 (-0.583)	-0.075 (-0.812)
Terms-of-Trade Growth	0.228** (2.608)	0.288*** (2.890)	0.240** (2.520)	0.310** (3.039)	0.233** (2.582)	0.295*** (2.937)
In FDI China	0.0007 (0.220)	0.0013 (0.448)	0.0023 (0.586)	0.0030 (0.746)	0.0010 (0.264)	0.0020 (0.546)
In FDI ROW	-0.0035 (-0.251)	0.0021 (0.137)	-0.0060 (-0.371)	-0.0020 (-0.113)	-0.0039 (-0.261)	0.0018 (0.111)
In Aid China	-0.0252 (-1.132)	-0.0164 (-0.720)	-0.0243 (-1.066)	-0.0139 (-0.588)	-0.0278 (-1.140)	-0.0174 (-0.700)
In Aid ROW	-0.0374 (-1.093)	-0.0356 (-1.017)	-0.0578 (-1.302)	-0.0592 (-1.287)	-0.0445 (-1.188)	-0.0438 (-1.125)
In Total Exports to China	0.0097 (1.139)		0.0147 (1.455)		0.0115 (1.242)	
In Total Imports from China	-0.0652** (-2.295)		-0.0785 (-2.327)		-0.0673** (-2.294)	
In Total Exports to ROW	0.0646* (2.011)		0.0672* (1.905)		0.0658* (2.006)	
In Total Imports from ROW	0.0017 (0.0442)		0.0173 (0.364)		0.0081 (0.196)	
In Inflation	0.0039 (0.224)	0.0024 (0.135)	0.0054 (0.294)	0.0039 (0.209)	0.0034 (0.188)	0.0018 (0.0993)
In Battle Deaths	-0.0033 (-1.067)	-0.0023 (-0.743)	-0.0026 (-0.748)	-0.0015 (-0.432)	-0.0035 (-1.108)	-0.0027 (-0.845)

(Contd. Table VII)

Independent Variables	Dependent Variables: In GDP per capita					
	(1) Total Africa	(2) Total Africa	(3) Excl. Islands	(4) Excl. Islands	(5) Excl. South Africa	(6) Excl. South Africa
Terms-of-Trade Growth *	0.0633***		0.0635***		0.0627***	
In Total Export to China	(3.452)		(3.511)		(3.521)	
In Non-resource Exports to China		0.0055 (0.992)		0.0086 (1.408)		0.0072 (1.149)
In Non-resource Imports from China		-0.0510** (-2.414)		-0.0657** (-2.330)		-0.0546** (-2.400)
In Resource Exports to China		0.0019 (0.347)		0.0066 (0.919)		0.0025 (0.404)
In Resource Imports from China		-0.0105 (-0.822)		-0.0134 (-1.015)		-0.0093 (-0.703)
In Non-resource Exports to ROW		-0.0177 (-0.677)		-0.0207 (-0.689)		-0.0192 (-0.654)
In Non-resource Imports from ROW		0.0360 (0.694)		0.0559 (0.877)		0.0374 (0.715)
In Resource Exports to ROW		0.0091 (0.555)		0.0086 (0.502)		0.0091 (0.536)
In Resource Imports from ROW		-0.0192 (-0.951)		-0.0144 (-0.618)		-0.0166 (-0.761)
Terms-of-Trade Growth * In Resource Exports to China		0.0555*** (3.003)		0.0546*** (3.089)		-0.0558*** (2.985)
Observations	165	165	133	133	133	144
Countries	49	49	39	39	39	42
R-squared (within)	0.88	0.88	0.87	0.87	0.87	0.87

Note: All regressions include country and period – specific dummies. t-values are obtained from (cluster-) robust standard errors in parentheses.*significant at the 10% level;**significant at the 5% level;***significant at the 1% level.

Turning towards the robustness checks with different period averages, we present the study findings in Table VIII. Again, the regressions for the two preferred specifications were re-run, using four- year-averages (Columns 1 and 2) and three-year-averages (Columns 3 and 4). While this procedure allows the study to exploit more variation in the data over time, the study may not be able to fully control for business cycle effects.

Similar to the different samples, the study finds again clear support for the main results. Sign and significance levels of all control variables are not affected much. This also applies to the variables of principle interest. The study still find displacement effects as the estimated coefficients for non-resource imports from China are negative and significant at the five per cent level or better. Also, total imports from China are negatively associated with economic growth. Yet total exports to the rest of the world are no longer positively correlated with growth. In contrast to the previous section, the study finds FDI inflows from China to be positive and significant at the ten per cent level when including disaggregated trade variables and using four-year averages (Column 2). Yet this result is not robust if we use more aggregated trade variables or three-year averages.

TABLE VIII
CHINA'S IMPACT ON AFRICAN ECONOMIC GROWTH, FIXED EFFECTS
AND FOUR-YEAR AVERAGES

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline Specifications		Lagged FDI and Aid		Institutional Quality	
Lagged Dep.Var.	0.827*** (25.32)	0.852*** (30.56)	0.776*** (16.02)	0.770*** (17.14)	0.692*** (25.82)	0.724*** (32.00)
ln Investment	0.125*** (3.763)	0.119*** (4.314)	0.0635** (2.360)	0.0665** (2.540)	0.0542** (2.024)	0.0410* (1.763)
ln Population Growth	0.00854 (0.121)	-0.014 (-0.168)	0.0948 (1.606)	0.103 (1.659)	0.0976* (-1.707)	-0.0832 (-1.284)
Terms-of-Trade Growth	0.209*** (3.190)	0.256*** (3.177)	0.174*** (4.083)	0.205*** (3.698)	0.194*** (3.375)	0.187*** (3.503)
ln FDI China	0.0033 (1.256)	0.0055* (1.795)	-0.0004 (-0.124)	0.0001 (0.0395)	0.0037 (1.378)	-0.0165** (-2.065)
ln FDI ROW	0.0065 (0.719)	0.008 (0.832)	0.004 (0.626)	0.0075 (1.116)	0.0015 (0.217)	-0.0008 (-0.0769)
ln Aid China	-0.0137 (-1.080)	-0.0189 (-1.230)	0.0303* (1.811)	0.0301 (1.549)	-0.0036 (-0.130)	-0.0008 (-0.0769)
ln Aid ROW	-0.0238 (-0.957)	-0.0217 (-0.900)	-0.0015 (-0.104)	-0.0153 (-0.896)	-0.0790* (-1.847)	-0.0034 (-0.200)
ln Total Exp.to China	0.0104 (1.137)		0.0018 (0.314)			
ln Total Imp. from China	-0.0556*** (-2.975)		-0.0553* (-1.892)			
ln Total Exp. to ROW	0.0246 (0.807)		-0.0165 (-0.550)			

(Contd. Table VIII)

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline Specifications		Lagged FDI and Aid		Institutional Quality	
In Total Imp. from ROW	-0.0168 (-0.520)		-0.0578 (-1.483)			
In Inflation	-0.0258** (-2.421)	-0.0251** (-2.477)	-0.0336** (-2.451)	-0.0289** (-2.085)	-0.023*** (-3.016)	-0.0161** (-2.092)
In Battle Deaths	-0.0019 (-0.601)	-0.0034 (-1.380)	-0.0004 (-0.132)	-0.00017 (-0.0391)	0.00001 (0.0293)	0.0007 (0.202)
Terms-of-Trade Growth	0.0662*** (4.306)		0.0496*** (3.522)			
In Total Exp. to China						
In Non-resources Exports to China		-0.0005 (-0.135)		0.0049 (1.035)	0.0009 (0.210)	-0.0004 (-0.0878)
In Non-resources Imports from China	-0.0431** (-2.310)			-0.0627** (-2.094)	-0.084*** (-2.743)	-0.076*** (-2.734)
In Resource Exports to China	0.0068 (1.093)			-0.0034 (-0.691)	-0.0013 (-0.343)	0.0002 (0.0460)
In Resource Imports from China	-0.0109 (-1.168)			-0.0085 (-1.167)	-0.009* (-1.740)	-0.0059 (-1.016)
In Non-resource Exports to ROW	-0.0187 (-0.689)			-0.0241 (-1.133)	0.0042 (0.198)	0.001 (0.0482)
In Non-resources Imports from ROW	0.0357 (0.665)			-0.0036 (-0.0793)	0.0313 (0.711)	0.0361 (0.797)
In Resource Exports to ROW	-0.0183 (-1.377)			-0.0128 (-1.259)	-0.0103 (-1.415)	-0.0143 (-1.527)
In Resource Imports from ROW	-0.0218 (-1.573)			-0.0128 (-1.082)	-0.0105 (-1.033)	-0.0127 (-1.221)
Terms-of-Trade Growth	0.0503*** (3.677)			0.0384*** (3.654)	0.0387*** (3.749)	0.0376*** (3.785)
In Res.Exp.to China					0.0502 (1.155)	0.147*** (5.310)
In Rule of law					0.0017 (0.221)	
In Rule of law*						
In Aid ROW					0.0266** (2.098)	
In Rule of law*						
In FDI China						0.0058** (2.507)
In Rule of law*						
In FDI ROW						-0.0097 (-1.565)
Observations	174	174	143	143	146	146
Countries	43	43	43	43	43	43
R-squared (within)	0.90	0.91	0.92	0.92	0.94	0.94

Notes: All regressions include country- and period-specific dummies. *t* values obtained from (cluster-) robust standard errors in parentheses. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. In Columns 3 and 4 the variables *In FDI China*, *In FDI ROW*, *In Aid China* and *In Aid ROW* are lagged by one period. Institutional quality in Column 5 and 6 is proxied by the rule of law.

VI. CONCLUSIONS

This paper investigates how Chinese trade, FDI and aid in Africa affect African economic growth. Contrary to other empirical studies in this context, the study examines the impact of the three main channels of China's activities at the same time. The study empirical findings can be summarised as follows. In general, FDI flows from China and the rest of the world as well as Chinese economic cooperation and foreign aid from other countries seem to play no major role for African countries' economic development. Sino-African trade, however, has an impact. Our results indicate that African imports from China, particularly non-resource imports, have a negative impact on economic growth in Africa. This finding is robust to using different samples and period averages as well as an instrumental variable approach. Although not robust in all specifications, African exports to the world (excluding China) are positively associated with growth in Africa. And, finally, we find that African economies that export natural resources benefit from China's rising demand for raw materials due to both positive changes in their terms-of-trade and increasing exports of natural resources to China, when using interaction terms.

In terms of policy implications, these results clearly demonstrate the opportunities and challenges that African countries are facing when dealing with a new partner like China. African exports of natural resources are an obvious example for both. The opportunities arise due to higher (total) export earnings of resource-rich African countries. These additional funds have to be spent well, for example, on development purposes, such as improvements in infrastructure or education. The downside and thus the main challenge is to escape the resource curse that arises too often in African countries with weak institutions (Carmignani and Chowdhury 2012).

Likewise, African consumers benefit from low-cost imports of non-resource goods from China. This applies to African producers importing low-cost intermediate goods from China as well. Therefore, welfare levels of consumers rise and producers can be more competitive. In contrast, we find strong evidence for displacement effects as African producers might not be able to compete with their Chinese counterparts. This applies in particular to specific labour-intensive manufactured goods, such as textiles, footwear or furniture, where African producers have had a considerable market share in local markets so far (Morrissey and Zgovu 2011). While a temporary increase in trade protection levels (tariffs and non-tariff trade barriers) levels could allow African producers to keep market shares, a suitable (long-run) policy option must be grounded on an increase in competitiveness levels. In this regard, African firms are far behind their Chinese competitors.

These displacement effects have to be seen in perspective as Chinese firms dominate many sectors/product categories where there are no African competitors. Still, the question arises whether China's rise on world markets may obstruct export opportunities for African firms in (other) labour-intensive products, partly by export diversification or by moving up the value chain. So far, the evidence is not that favourable for African countries, as China (and other Asian countries) may block that market segment (Kaplinsky and Morris 2009).

In terms of FDI, many developing countries have benefited greatly from FDI, especially China. The insignificant results from our regressions concerning FDI from both China and the rest of the world may point to an insufficient FDI environment in African countries rather than a display of FDI not playing a role for African growth. So far, most foreign investment in African has been resource-seeking FDI with few linkages with other sectors. African governments should thus focus on attracting efficiency-seeking (or vertical) FDI by creating a better environment for the private sector. This could be achieved by providing a simpler and more transparent regulatory environment, building and upgrading infrastructure, enhancing educational levels and/or offering investment incentives, such as tax exemptions or the establishment of more Special Economic Zones that have worked in other developing countries, most notably China.

African governments have to ensure that they do harness the potentially positive effects of foreign investment. So far, Chinese investment is often isolated from the rest of the local economy. Improving linkages between foreign firms and the domestic economy is thus vital to improve the growth effects of foreign investment. This could improve technology spillovers to domestic firms. Similar to trade, African governments should target specific sectors that are important for economic development and then direct foreign investment to these sectors. This could enhance productive capacity and domestic investment, boost local employment levels and foster the integration of African firms into the global economy (UNCTAD 2010). Importantly, a coherent regional integration policy and framework would be highly important to both increase FDI flows and enhance the spillover effects.

Although we could not find any significant growth effects of Chinese aid to Africa, it is nevertheless an important part of China's Africa Policy and its "package deals" to Africa. Chinese economic cooperation projects in Africa are steadily growing, particularly in the field of infrastructure, but its effects on African growth may still need some years to emerge. Although widely criticised by Western donors for its aid practices in African countries (with poor human rights and/or governance records), China's economic cooperation projects

provide a viable alternative for many African countries. This implies that Western donors may have to adjust their aid policies in Africa to a growing Chinese presence on the continent. For African policymakers, on the other hand, it implies that they could be less dependent on Western aid and the conditions attached. No matter the source, in general the effect of aid on economic growth is controversial and depends a great deal on how the host country utilises it. Up to now, most African governments lack a clear and coherent strategy when dealing with a new partner such as China. Unfortunately, that implies that they are not taking full advantage of the opportunities that arise from China's activities in Africa.

6.1 Policy Suggestions for Resource Curse Countries

An important policy question is how to establish effective natural resource management mechanisms that will assist developing countries to escape from resource curse. From a policy viewpoint, IMF (2005) points out that it is important to introduce explicit fiscal rules for the treatment of mineral revenues. Any windfall should be deposited in a special account and used for designated economic and social development. Chad has actually passed a law to earmark oil revenue for debt service and spending in priority sectors. This type of political step may become a credible and irreversible commitment of the government. Similarly, disclosure of the terms of contracts and profit-sharing arrangements with natural resource developers and publication of independent external audits have the same effects for increasing transparency in natural resource management. Further, if resource-developing enterprises are privatised, resource extraction must be strictly regulated. Ahmad and Mottu (2002) emphasize the necessity of centralising resource revenue control and supplementing it with predictable and transparent transfers from the centre. Decentralised resource management reduces the capacity of the central government to run countercyclical fiscal policies and to arrange equalisation transfers among regions. In order to increase transparency, accountability and predictability in natural resource management, it is in general useful to establish an independent mineral regulatory agency and to disclose and monitor the terms of reference for mining extraction and revenue sharing.

In addition to the above suggestions, we do not necessarily need to settle these questions. It is clear that some resource-rich countries do surprisingly poorly economically, while others do well. We have noted examples of both sorts: Norway, Botswana and Chile, which have done very well with their endowments (oil, diamonds and copper, respectively), versus Sudan, Bolivia and the Congo which have done much less well. The Natural Resource Curse should not be interpreted as a rule that resource-rich countries are doomed to failure. The

question is what policies to adopt to increase the chances of prospering. It is safe to say that destruction or renunciation of resource endowments, to avoid dangers such as the corruption of leaders, will not be one of these policies. Even if such a drastic action would on average leave the country better off, which seems unlikely, who would be the policymaker to whom one would deliver such advice?

The paper concludes with a list of ideas for institutions designed to address aspects of the resource curse and thereby increase the chance of economic success. Some of the ideas that most merit consideration by countries rich in oil or other natural resources are as follows:

1. Include in contracts with foreign purchasers clauses for automatic adjustment of the price if world market conditions change.
2. Hedge export proceeds in commodity futures markets.
3. Denominate debt in terms of commodity prices.
4. Allow some nominal currency appreciation in response to an increase in world prices of the commodity, but also add to foreign exchange reserves, especially at the early stages of the boom when it may prove to be transitory.
5. If the monetary regime is to be Inflation Targeting, consider using as the target, in place of the standard CPI, a price measure that puts greater weight on the export commodity, such as an index of export prices or producer prices.
6. Emulate Chile: to avoid excessive spending in boom times, allow deviations from a target surplus only in response to output gaps and long-lasting commodity price increases, as judged by independent panels of experts rather than politicians.
7. Commodity Funds should be transparently and professionally run, with rules to govern the payout rate and with insulation of the managers from political pressure in their pursuit of the financial wellbeing of the country.
8. When spending oil wealth, consider lump-sum distribution on an equal per capita basis.
9. An external agent, for example a financial institution that houses the Commodity Fund, could be mandated to provide transparency and to freeze accounts in the event of a coup.

Needless to say, policies and institutions have to be tailored to local circumstances, country by country. However, with good intentions and innovative thinking, there is no reason why resource-rich countries need fall prey to the curse.

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APPENDIX A
DEFINITION OF VARIABLES AND DATA SOURCES

Variable	Definition	Source
GDP per capita	Gross Domestic Product (GDP) per capita, const. US\$ 2005	World Bank (2014)
Investment	Gross capital formation, % of GDP	World Bank (2014)
Population Growth	Population growth rate in %	World Bank (2014)
Terms of Trade Growth	Changes in the terms-of-trade in % based on an index 2000 = 100	World Bank (2014)
Battle Deaths	Number of Battle Deaths	PRIO (2009) for the years 1991-2008;UCDP (2013) for the years 2009-2011
Inflation	GDP deflator, annual change in %	World Bank (2014)
Aid ROW	Total official development assistance (ODA) from the rest of the world (non-Chinese sources), % of GDP	World Bank (2014)
Aid China	Chinese economic cooperation with foreign countries, % of GDP	China Statistical Yearbook (1999-2011)
FDI ROW	Inflows of Foreign Direct Investment from the rest of the world (total FDI inflows less inflows of FDI from China), % of GDP	UNCTADstat (2014)
FDI China	Inflows of FDI from China, measured as China's outward FDI flow, % of GDP	MOFTEC: Almanac of China's Foreign Economic Relations and Trade; MOFCOM (a): China Commerce Yearbook (1991-2002); MOFCOM (b): Statistical Bulletin of China's Outward Direct Investment (2003-2011)
Total Exports to ROW	Total exports to the ROW,% of GDP	UN Comtrade (2014)
Total Exports to China	Total exports to China,% of GDP	UN Comtrade (2014)

(Contd. Appendix A)

Variable	Definition	Source
Total Imports from ROW	Total imports from the ROW, % of GDP	UN Comtrade (2014)
Total Import from China	Total imports from China, % of GDP	UN Comtrade (2014)
Resource Exports to ROW	Total exports of natural resources to the ROW, % of GDP	UN Comtrade (2014)
Resource Exports to China	Total exports of natural resources to China, % of GDP	UN Comtrade (2014)
Resource Imports from ROW	Total imports of natural resources from the ROW, % of GDP	UN Comtrade (2014)
Resource Import from China	Total imports of natural resources from China % of GDP	UN Comtrade (2014)
Non-resources Exports to ROW	Total exports minus natural resource exports to the ROW, % of GDP	UN Comtrade (2014)
Non-resource Exports to China	Total exports minus natural exports to China, % of GDP	UN Comtrade (2014)
Non-resource Imports from ROW	Total imports minus natural resource imports from the ROW, % of GDP	UN Comtrade (2014)
Non-resource Imports from China	Total imports minus natural resource imports from China, % of GDP	UN Comtrade (2014)

APPENDIX B
DESCRIPTIVE STATISTICS

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
In GDP per capita	147	6.42	1.02	4.82	9.51
In Investment	147	2.91	0.49	1.56	4.45
In Population Growth	147	-1.74	0.24	-2.75	-1.23
In Inflation	147	2.19	1.37	-3.44	8.86
In Battle Deaths	147	2.58	3.52	0	10.64
Terms-of-Trade Growth	147	0.01	0.26	-1.29	0.65
In Aid ROW	147	2.07	1.11	-1.09	4.09
In Aid China	147	-0.60	1.44	-4.95	2.24
In FDI ROW	147	0.63	1.51	-4.42	4.39
In FDI China	147	-4.68	2.95	-11.22	0.33
In Total Exports to ROW	147	2.82	0.84	0.37	4.25
In Total Exports to China	147	-1.75	2.67	-9.03	3.37
In Total Imports from ROW	147	3.10	0.64	1.41	5.07
In Total Imports from China	147	0.03	1.27	-2.95	3.70
In Resource Exports to ROW	147	1.14	2.04	-4.01	4.20
In Resource Exports to China	147	-3.29	3.76	-10.94	3.37
In Resource Imports from ROW	147	0.58	1.13	-2.83	3.24
In Resource Imports from China	147	-5.63	2.16	-10.94	-1.56

(Contd. Appendix B)

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
In Non-resource Exports to ROW	147	2.04	0.87	-0.47	3.77
In Non-resource Exports to China	147	-3.77	2.44	-10.31	0.88
In Non-resource Imports from ROW	147	2.99	0.62	1.35	4.93
In Non-resource Imports from China	147	0.02	1.27	-2.95	3.70

Notes: Descriptive statistics are calculated based upon the study preferred specifications (Columns 5 and 6, Table 1) for the sample of 43 Sub-Saharan African countries.

APPENDIX C
COUNTRY SAMPLE

Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, *Cape Verde*, Central African Republic, Chad, *Comoros*, Dem. Rep. of Congo, Rep. of Congo, Cote d'Ivoire, **Djibouti**, **Egypt**, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, **Libya**, *Madagascar*, Malawi, Mali, Mauritania, *Mauritius*, **Morocco**, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, **Tunisia**, Uganda, Zambia, Zimbabwe

Note: Island countries in italics, North African countries in **bold**.

APPENDIX D
DEFINITION OF ECONOMIC COOPERATION

The National Bureau of Statistics of China (NBS 2014) defines “Turnover of Economic Cooperation” as the sum of turnover generated in three fields of economic cooperation with foreign countries or regions:

- *Contracted Projects with Foreign Countries* refer to projects undertaken by Chinese contractors (project contracting companies) through bidding process. They include: (1) overseas civil engineering construction projects financed by foreign investors; (2) overseas projects financed by the Chinese government through its foreign aid programs; (3) construction projects of Chinese diplomatic missions, trade offices and other institutions stationed abroad; (4) construction projects in China financed by foreign investment; (5) sub-contracted projects to be taken by Chinese contractors through a joint umbrella project with foreign contractor(s); and (6) housing development projects. The business income from international contracted projects is the work volume of contracted projects completed during the reference period, expressed in monetary terms, including completed work on projects signed in previous years.
- *Service Cooperation with Foreign Countries* refers to the activities of providing technology and labour services to employers or contractors in the forms of receiving salaries and wages. Labour services providing by contractual joint ventures of Chinese international contracting corporations should be included in the statistics of service co-operation with foreign countries. The business income of labour service cooperation is the income in the form of wages and salaries, overtime pay, bonuses and other remuneration received from the employers during the reference period.
- *Overseas Design and Consultation Service* refers to projects with charges for technical services from overseas operators. It includes geographic and topographic mapping, geological resource prospecting and survey, planning of construction areas, provision of design documents, blueprints, materials on production process and techniques, as well as engineering, technical and economic consultation, and feasibility study, research and evaluation of projects. Also included under this category are the above-mentioned services of foreign-financed projects in China that are paid in foreign currencies.