China's Impact on Africa – The Role of Trade, FDI and Aid

Matthias Busse
Ruhr-University Bochum

Ceren Erdogan
Ruhr-University Bochum

Henning Mühlen
University of Hohenheim

Abstract

We investigate the impact of Chinese activities in sub-Saharan African countries 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, we find 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 does not have an impact on growth.

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

JEL Classification: F14, F23, F35, O47

Corresponding author: Matthias Busse, Ruhr-University Bochum, Faculty of Management and Economics, Chair of International Economics, GC 3/145, Universitaetsstr. 150, 44780 Bochum, Germany, e-mail matthias.busse@rub.de, Tel. +49-234-32-22902, Fax +49-234-32-14520.

1. Introduction

Over the last 15 years, China has become a major economic partner of sub-Saharan African countries.[1] Total merchandise trade between China and Africa increased from $9 billion in 2000 to $166 billion in 2012, making China Africa's largest trade partner (UN Comtrade, 2014). In terms of foreign direct investment (FDI), Chinese FDI flows to Africa increased from just $200 million in 2000 to $2.9 billion in 2011, turning China into the largest developing country investor in Africa (UNCTAD, 2013; MOFCOM). Additionally, Chinese aid 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[2] in Africa reached $29 billion in 2011 compared to $1.2 billion in 2000.

At the same time, Africa's growth performance has improved significantly. Following two decades of negative growth rates in the 1980s and 1990s, Africa's Gross Domestic Product (GDP) per capita grew by an annual average of 2.4 percent in 2000-2009, while the growth rate in 2010-2012 amounted to 1.8 percent (World Bank, 2014). Obviously, various factors have contributed to Africa's better growth performance, including a marked improvement in institutions and infrastructure and a decrease in conflicts and macroeconomic distortions (OECD *et al.*, 2013; UNECA, 2013). Further potential factors are increasing (domestic and foreign) investments, foreign aid and trade flows where all of them might also be linked to the improvements in the factors mentioned before. Still, the question arises as to whether China's engagement has contributed to economic growth in Africa. This is the main focus of this paper.

We single out the impact of Sino-African economic linkages on the African growth performance for two main reasons. Firstly, starting from a relatively low base, China has become Africa's largest trading partner and largest (developing) investor (see figures above) within only a couple of years. This acts as a classical economic shock that should have an impact on growth rates. Secondly, China's approach towards African countries differs with respect to high-income countries in terms of trade structure and technology spillovers through FDI. As a consequence, we could expect diverging economic effects. At the same time, China also differs from other developing (or emerging market) economies, such as India or Brazil,

[1] Hereafter referred to as African countries or Africa.
[2] A definition of Chinese Economic Cooperation is provided in Appendix D.

that engage in Africa. China's trading and investment links with Africa are much more intensive than those of other developing countries. Apart from a few countries, for example, in Eastern Africa, the economic activities of non-Chinese developing countries are simply not large enough to have the same potential economic impact on African countries at a macro level (Morrissey and Zgovu 2011).

In theory, China's activities in Africa could have positive or negative consequences for African countries. To begin with, 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. An expansion of international trade with a new partner like China could boost growth rates by increasing demand for African products (mainly raw materials). Also, the diversification of Africa's traditional trading partners could reduce export volatility, thereby decreasing output volatility and thus boosting long-run growth rates (Hnatkovska and Loayza, 2004). Furthermore, China's enormous demand for raw materials has led to higher world market prices for raw materials, improving the terms-of-trade of African exporters of natural resources (Zafar, 2007). Consumers in Africa could benefit from (additional) imports of manufactured goods from China, allowing them to cut their expenses by consuming low-cost Chinese products or increasing the variety of consumer goods available to them. Likewise, African producers could take advantage of low-cost Chinese inputs in their production process.

Similar to trade, foreign investment from China could also have positive growth effects. It is expected to enlarge the capital stock in African countries, to increase productivity levels through higher competition intensities, and it is associated with higher tax revenues (UNCTAD, 2006). Also, foreign investment could foster productivity spillovers to African firms. In contrast to North-South FDI, spillovers from South-South FDI could be even larger, as Chinese firms use technologies that may be more appropriate for African firms. Finally, Chinese economic cooperation projects establish and improve much needed infrastructure in Africa, which lowers transaction costs and thus enhances (internal and external) trade and growth rates.

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.

Additionally, Chinese manufactured firms could displace their African competitors in case they produce similar goods. Both exchange rate overvaluations and low-cost competition from China threaten African suppliers in manufacturing. Depending on the country considered, this applies in particular to textiles, furniture, footwear, or ceramic products (Morrissey and Zgovu, 2011). Either the home market of African suppliers could be contested by Chinese firms or African exports to third markets, for instance in Europe or America, could be displaced (Giovannetti and Sanfilippo, 2009). Summing up, 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.

Although China's engagement in Africa has received considerable attention in policy publications (Goldstein *et al.*, 2006; Broadman, 2007; Kaplinsky *et al.*, 2007, Asche and Schüller, 2008; Morrissey and Zgovu, 2011), there are very few econometric analyses on this topic. Of the existing econometric literature one strand explores the determinants, while the other studies the impact of Chinese trade, FDI and/or aid in Africa.

With regards to *determinants*, Kolstad and Wiig (2011) find that Chinese FDI predominantly flows to African countries with large natural resources endowments. Cheung *et al.* (2012) confirm China's resource-seeking investment motive and also find market potential, trade intensity and the presence of Chinese contracted projects to attract Chinese FDI to Africa. While Sanfilippo's (2010) supports market size and resource endowment to be the main drivers of Chinese FDI, he finds that these same motives attract Chinese economic cooperation projects in Africa even more. Finally, Biggeri and Sanfilippo (2009) argue that Chinese economic activities in Africa are not only driven by a country's resource endowment or market size but also by the strategic interaction of trade, FDI and aid, that is, Chinese

infrastructure projects in a particular country increase Chinese FDI to that country, while Chinese FDI in a former period increases trade with that country (or vice versa).

Considering that the studies on determinants identify strategic links between the three "channels", trade, FDI and aid, the existing studies that evaluate the *impact* of Chinese economic activities cover only one particular channel. For instance, Meyersson *et al.* (2008) study the impact of African resource exports to China on African economic and political development. The authors find that African resource exports to the world have no effect on African growth, but exporting natural resources to China as compared to the rest of the world has large positive effects on economic growth and investment in Africa. Baliamoune-Lutz (2011) also finds that African countries exporting primary products to China benefit more in terms of growth and that imports from China have a positive effect on African growth, contradicting the wide held belief of resource curse and displacement effects. On the other hand, Giovannetti and Sanfilippo (2009) do find that Chinese exports displace African exports in third markets, including the European Union and the United States. Finally, Whalley and Weisbrod (2012) analyse the impact of Chinese FDI on African growth by employing Solow growth accounting methods. Their results suggest that a significant portion of the accelerated growth in some African countries in the years immediately before and after the financial crisis can be attributed to Chinese FDI inflows.

As discussed above, many studies confirm that there is an important link between Chinese trade, FDI and aid flows to Africa. To the best of our knowledge, there has not yet been an 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, our 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 2 provides an overview of Sino-African economic relations, explaining the various changes in trade, FDI and aid with respect to China's engagement in Africa. Section 3 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 4, we show the outcome of various extensions and robustness checks in Section 5, demonstrating that our findings are robust. The last section concludes.

2. Overview of Sino-African Economic Relations

Sino-African economic relations have only surged since 2000 but the political relationship between China and Africa dates back many decades. In fact, China regaining its seat in the United Nations in 1971 is largely attributed to the strong vote of African countries that ended their diplomatic ties with Taiwan for the sake of China. During the 1980s and 1990s Sino-African relations were still mainly political, as China itself was undergoing extensive economic reform and opening up its economy to the rest of world. In the late 1990s China's remarkable growth performance made policy makers realize that in order to sustain high-level growth it needed to ensure its future supply of natural resources. In this regard, Africa became a particularly important region for China.

The importance of Africa in China's foreign policy culminated in the establishment of the Forum on China-Africa Cooperation (FOCAC) in 2000. The forum holds ministerial conferences every three years and is an important platform to implement specific economic policy programs with Africa. Moreover, China's "Going-Global" policy, announced in 2001, also contributed to the rise in Sino-African economic relations. In order to encourage foreign trade and outward FDI, the policy provides Chinese firms with easy access to loans, foreign exchange and preferential policies for taxation, imports and exports (UNCTAD and UNDP, 2007). Although the policy is not primarily targeted at Africa, it identifies key areas in which to encourage FDI, including resource exploration projects which are a particularly important Chinese activity in Africa. When analysing Sino-African economic relations, three channels of economic interaction are dominant, namely trade, FDI, and aid (economic cooperation).

Trade

While Sino-African trade volumes were negligible before 2000, bilateral trade increased significantly in the last decade and reached some $166 billion in 2012 (Figure 1). Overall, African exports to China (7.8 percent of GDP) exceeded its imports (4.8 percent of GDP) in 2012. In dollar terms, that amounts to a sizable total trade surplus of some $ 39 billion.[3]

(Figure 1 here)

[3] All trade data taken from UN Comtrade (2014); African GDP data taken from World Bank (2013).

Sino-African trade is largely concentrated on a few countries and product groups. In 2012 natural resources accounted for 66 percent of Africa's exports to China. Major resource exporters to China in 2012 were Angola, South Africa, the Republic of Congo, the Democratic Republic of Congo, and Zambia. With the exception of South Africa, resource exports accounted for well over 90 percent of the aforementioned countries total exports to China, reflecting the high concentration of trade in natural resources. When looking at African imports from China, the trade pattern is mirror-inverted, that is, African countries import mainly non-resource products from China (97 percent of total imports in 2012). In 2012 South Africa, Nigeria, and Egypt were the largest importers of non-resource goods from China.

Africa's heavy concentration on resource exports and non-resource imports reflects a traditional Heckscher-Ohlin-type trade pattern. Africa concentrates on the export of natural resources where it has a comparative advantage, and in turn imports labour-intensive manufactured goods from China which is labour-abundant. Interestingly, South Africa's trade with China differs from that of other African countries in the sense that both South African exports to and imports from China concentrate mainly on non-resource goods. Although South Africa is one of the main resource exporters to China, the share of non-resource exports in its total exports to China in 2012 was 72 percent. Overall, South Africa was China's most important trading partner in non-resource goods (40 percent of total Sino-African non-resource trade) and second most important trading partner in resource goods in 2012 (16 percent of total Sino-African resource trade). In terms of resource trade, Angola was China's most important African trading partner in 2012 (42 percent of total Sino-African resource trade).

FDI

Although Chinese FDI to Africa is low relative to FDI flows from other countries, its growth over the last decade has been remarkable. Figure 2 illustrates this upward trend of Chinese FDI to Africa since 2000.[4] However, despite the fast growth in Chinese FDI flows, the actual volumes are fairly small, both in terms of African GDP and total FDI inflows in Africa. Average Chinese FDI flows to Africa in 2000-2011 accounted for only 5 percent of total FDI inflows to Africa. Nevertheless, China is currently the biggest developing country investor in

[4] The sharp decline in 2009 may suggest that Chinese FDI may have decreased after the financial crisis. In fact, it is rather due to an exceptionally large investment in South Africa's Standard Bank in 2008 making South Africa the country with the largest Chinese FDI stock in Africa.

Africa according to the World Investment Report 2013 (UNCTAD, 2013). In fact, Chinese investment is a particularly important source of capital for certain African countries. For instance, when looking at the average share of Chinese FDI in total FDI flows in 2000-2011, Chinese FDI accounted for 52 percent of FDI inflows in Zimbabwe, 26 percent in Mauritius and 13 percent in both South Africa and Zambia.

(Figure 2 here)

Major African host countries in terms of Chinese FDI stock are South Africa, Sudan, Nigeria, and Zambia. As is the case with Sino-African trade, Chinese FDI in Africa also concentrates on resource-rich African economies with the exception of South Africa. According to Asiedu (2006) FDI to Africa is related to the host country's resource endowments, market potential and good institutions. China's investment pattern differs as China also invests heavily in African countries with weak institutions. For instance, Chinese national oil companies have major resource investments in Angola, Sudan, Nigeria, Equatorial Guinea, and Kenya (Kolstad and Wiig, 2011). Moreover, the state-owned China Nonferrous Metal Mining has a considerable investment in Zambia's copper industry and has even established a special economic zone called Zambia-China Economic and Trade Cooperation Zone. The majority of Chinese firms investing in Africa are state-owned, although FDI by private Chinese enterprises has increased notably in recent years (Gu, 2009). In addition, Chinese FDI are promoted by strategic national policy objectives, such as the Going Global Policy or the Forum on China Africa Cooperation, resulting in large and long-term oriented investments, complicating a comparison between Chinese FDI with FDI from other countries.

Economic Cooperation

The Chinese government supports economic cooperation projects in Africa and often links them with FDI and trade activities further reflecting its political objectives on the continent(Biggeri and Sanfilippo, 2009; Sanfilippo, 2010). Areas of economic cooperation where China is most active in Africa include infrastructure (railways, roads, telecommunication) and facility construction projects (government buildings, stadiums, hospitals, schools) (Biggeri and Sanfilippo, 2009). Furthermore, China provides financial aid in the form of grants, zero-interest loans, debt relief, and concessional loans as well as preferential export credits, market-rate export buyers' credits, and commercial loans from Chinese banks (Bräutigam, 2011). In addition, the China Africa Development Fund launched

by the China Development Bank in 2007 provides equity investment capital for Chinese enterprises to invest in Africa. The fund has received $3 billion in capital up until 2012 and has (co-)financed 60 projects across 30 African countries, and is expected to reach its full $5 billion capitalization in 2014 (CCS, 2013).

As most of China's financial aid does not qualify as Official Development Assistance as defined by the Organisation for Economic Cooperation and Development's (OECD) Development Assistance Committee, it is difficult to compare it with other donors' financial assistance. Furthermore, apart from a few official announcements commenting on major Sino-African projects, there is a lack of comprehensive official Chinese aid data. Nevertheless, China publishes data on the turnover of economic cooperation projects. As Bräutigam (2011) points out, economic cooperation data does not refer to something provided by the Chinese government, but rather to revenues earned by Chinese firms in contracted economic cooperation projects abroad, and should therefore not be confused with data on financial flows from the Chinese government.

On the other hand, China's main objectives in Africa are not primarily geared at financial aid but rather at a form of South-South Cooperation, particularly technical assistance. Chinese companies often work on contracted projects in Africa as a result of a greater finance or trade deal the Chinese government agreed upon with the government of a particular African country which entails some sort of economic or technical cooperation. Data on economic cooperation illustrate the level of activity of Chinese companies in African countries thereby reflecting China's emphasis on technical assistance in Africa. Therefore, we argue that data on economic cooperation may serve as an adequate proxy for the level of Chinese technical assistance to Africa. Figure 3 presents the development of China's economic cooperation turnover in Africa and its share in China's economic cooperation worldwide. During the last decade Africa's share in China's economic cooperation worldwide has nearly tripled from 10 percent in 2000 to 29 percent in 2011 showing the growing importance of China's projects in Africa.

(Figure 3 here)

Interestingly, in the period 2000-2011 the highest turnover of Chinese economic cooperation projects occurred in Angola, Sudan, and Nigeria. As stated above, China has considerable

resource investments in Sudan and Nigeria, and provided a sizeable soft loan to Angola which is repaid in oil at fixed prices. This is only one example that reflects the strategic interaction of trade, FDI, and aid in China's Africa policy.

3. 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 lny_{it} - lny_{it-1}. Essential independent variables in this growth model are initial income per capita (lny_{t-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:

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

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 (1) can then be rewritten as:

$$\ln y_{it} = \alpha + (\beta + 1) \ln y_{it-1} + \gamma \ln s_{it} + \varphi \ln(n_{it} + 0.05) + \varphi' \ln X_{it} + \lambda_t + \mu_i + \varepsilon_{it} \qquad (2)$$

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.[5] Using both education and law and order at the same time would cut the sample in half.

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 increase in the population. Changes in the terms-of-trade should have a positive impact of 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. Firstly, 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. Secondly, 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.[6] 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 normalized 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.[7] 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

[5] Note 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.
[6] See 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.
[7] For a discussion of China's FDI data, see Cheung *et al.* (2012).

add one before taking the log).[8] 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, normalized by the respective country's GDP. Data is 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

[8] We 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.

extensions and robustness checks, we both enlarge the sample by including North African countries and reduce the sample by excluding sub-Saharan African islands.[9]

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 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 our paper. 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).

4. Main Results

We begin by reporting fixed-effects regressions using five-year averages in Table 1. Column 1 presents our 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).[10] 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.

(Table 1 here)

[9] See Appendix C for the country sample.

[10] In 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, p. 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.

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 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.

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 we include 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 percent 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 percent 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.[11]

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 China, respectively, which are positive and highly significant at the one percent 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.[12]

[11] A 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.

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

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. Reverse causality is less of an issue in this case. Again, the main results are not affected by declaring all trade variables as endogenous.[13] We also treat 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 overfit 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 2, are broadly in line with the fixed-effects results. The lagged dependent variable is always significant at the one percent 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

[13] All non-reported results can be obtained from the authors upon request.

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 percent 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 2 here)

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 2, Column 6) by one percent is associated with a decrease in GDP per capita growth of 0.1 percent 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 we use a longer period of time (1991-2010 instead of 1995-2008) and a different methodology. On the other hand, our 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.

5. Extensions and Robustness Checks

In order to examine the robustness of the obtained results, we run numerous additional regressions. In terms of the methodology, we prefer to present the results for the fixed-effects estimator only. In fact, we have 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, we restrict the presentation of our extensions and robustness checks to two dimensions to save space: different country samples and different period averages. We begin with the sample variations, presented in Table 3. First, we extend our sample and add six North African countries (Columns 1 and 2).[14] This allows us to examine whether our results are sensitive to a larger sample size that includes basically all African countries for which we have data. Though North African countries differ from those below the Sahara, they have considerable trade and investment links with China as well.

[14] The included North African countries are Algeria, Djibouti, Egypt, Libya, Morocco, and Tunisia.

In Columns 3 and 4, we refer to the initial sub-Saharan Africa sample again but exclude 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 we exclude South Africa from our sub-Saharan Africa sample. As explained in Section 2, 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 3 refer to our preferred specifications, that is, Column 5 (6) in Table 1. The sample variations in Table 3 clearly confirm our baseline findings as we are able to almost replicate the results. Throughout the six regressions we have 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 3 here)

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

Similar to the different samples, we find again clear support for our main results. Sign and significance levels of all control variables are not affected much. This also applies to the variables of principle interest. We still find displacements effects as the estimated coefficients for non-resource imports from China are negative and significant at the five percent 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, we find FDI inflows from China to be positive and significant at the ten percent 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 4 here)

6. Conclusions

In this paper we investigated how Chinese trade, FDI and aid in Africa affect African economic growth. Contrary to other empirical studies in this context, we examine the impact of the three main channels of China's activities at the same time. Our empirical findings can be summarised as follows. Generally, 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 foreign direct investment, 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 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 criticized 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 utilizes 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.

References

Arellano, M. and O. Bover (1995) 'Another Look at the Instrumental Variable Estimation of Error-components Models', *Journal of Econometrics*, 68 (1): 29–51.

Asche, H. and M. Schüller, (2008) *China's Engagement in Africa: Opportunities and Risks for Development*. Gesellschaft für Technische Zusammenarbeit (GTZ).

Asiedu, E. (2006) 'Foreign Direct Investment in Africa: The Role of Natural Resources, Market Size, Government Policy, Institutions and Political Instability', *World Economy*, 29 (1): 63–77.

Baliamoune-Lutz, M. (2011) 'Growth by Destination (Where You Export Matters): Trade with China and Growth in African Countries', *African Development Review*, 23 (2): 202–218.

Barro, R.J. and J.W. Lee (2013) 'A New Data Set of Educational Attainment in the World, 1950–2010', *Journal of Development Economics*, 104 (September): 184–198.

Biggeri, M. and M. Sanfilippo (2009) 'Understanding China's Move into Africa: An Empirical Analysis', *Journal of Chinese Economic and Business Studies*, 7 (1): 31–54.

Blundell, R. and S. Bond (1998) 'Initial Conditions and Moment Restrictions in Dynamic Panel Data Models', *Journal of Econometrics*, 87 (1): 115–143.

Bräutigam, D. (2011) 'Chinese Development Aid in Africa: What, Where, Why, and How Much?' in J. Golley and L. Song (eds.), *Rising China: Global Challenges and Opportunities*, Canberra: Australia National University Press, 203–223.

Broadman, H.G. (2007) *Africa's Silk Road: China and India's New Economic Frontier*. Washington, D.C.: The World Bank.

Busse, M. and S. Gröning (2013) 'The Resource Curse Revisited: Governance and Natural Resources', *Public Choice*, 154 (1): 1–20.

Carmignani, F. and A. Chowdhury (2012) 'The Geographical Dimension of the Development Effects of Natural Resources', *Environmental and Resource Economics*, 52 (4): 479–498.

CCS (2013) The China-African Development Fund (CADFund) as a Sovereign Wealth Fund for Africa's Development?, Policy Briefing July 2013, Stellenbosch: The Centre for Chinese Studies at Stellenbosch University.

Cheung, Y.-W., J. de Haan, X. Qian and S. Yu (2012) 'China's Outward Direct Investment in Africa', *Review of International Economics*, 20 (2): 201–220.

Farooki, M. and R. Kaplinsky (2013) *The Impact of China on Global Commodity Prices: The Global Reshaping of the Resource Sector*, London: Routledge.

Giovannetti, G. and M. Sanfilippo (2009) 'Do Chinese Exports Crowd-out African Goods? An Econometric Analysis by Country and Sector', *European Journal of Development Research*, 21 (4): 506–530.

Goldstein, A., N. Pinaud, H. Reisen and X. Chen (2006) *The Rise of China and India - What's in it for Africa*, Paris: OECD.

Gu, J. (2009) 'China's Private Enterprises in Africa and the Implications for African Development', *European Journal of Development Research*, 21 (4): 570–587.

Hnatkovska, V. and N. Loayza (2004) 'Volatility and Growth'. World Bank Policy Research Working Paper Series No. 3184.

Hoeffler, A.E. (2002) 'The Augmented Solow Model and the African Growth Debate', *Oxford Bulletin of Economics and Statistics*, 64 (2): 135–158.

Islam, N. (1995) 'Growth Empirics: A Panel Data Approach', *Quarterly Journal of Economics*, 110 (4): 1127–1170.

Kaplinsky, R., D. McCormick and M. Morris (2007) 'The Impact of China on Sub-Saharan Africa'. Institute of Development Studies, Working Paper 291.

Kaplinsky, R. and M. Morris (2009) 'The Asian Drivers and SSA: Is There a Future for Export-oriented African Industrialisation?', *World Economy*, 32 (11): 1638–1655.

Kolstad, I. and A. Wiig (2011) 'Better the Devil You Know? Chinese Foreign Direct Investment in Africa', *Journal of African Business*, 12 (1): 31–50.

Mankiw, N.G., D. Romer and D.N. Weil (1992) A Contribution to the Empirics of Economic Growth', *Quarterly Journal of Economics*, 107 (2): 407–437.

McCoskey, S.K. (2002) 'Convergence in Sub-Saharan Africa: A Nonstationary Panel Data Approach', *Applied Economics*, 34(7): 819–829.

Meyersson, E., G.P. i Miquel and N. Qian (2008) 'The Rise of China and the Natural Resource Curse in Africa', London School of Economics and Political Science, Economic Organisation and Public Policy Programme, http://personal.lse.ac.uk/padro/meyersonpadroqian_20080407_all.pdf.

MOFCOM (Various years, a) *China Commerce Yearbook*. Beijing: China Commerce and Trade Press.

MOFCOM (Various years, b) *Statistical Bulletin of China's Outward Foreign Direct Investment*. Beijing: Ministry of Commerce of People's Republic of China.

MOFTEC (Various years) *Almanac of China's Foreign Economic Relations and Trade*. Hong Kong: China Foreign Economic Relations and Trade Publishing House.

Morrissey, O. and E. Zgovu (2011) *The Impact of China and India on Sub-Saharan Africa: Opportunities, Challenges and Policies*. London: Commonwealth Secretariat.

NBS (Various years) China Statistical Yearbook. Beijing: China Statistics Press.

NBS (2014) Foreign Trade & Economic Cooperation, in Classifications & Methods, www.stats.gov.cn/english./ClassificationsMethods/Definitions/index_2.html.

Nickell, S.J. (1981) 'Biases in Dynamic Models with Fixed Effects', *Econometrica*, 49 (6): 1417–1426.

OECD, AfDB, UNDP and ECA (2013) *African Economic Outlook 2013*. Paris: Organisation for Economic Co-operation and Development.

PRIO (2009) Battle Deaths Dataset Version 3.0, Peace Research Institute Oslo, first published in B. Lacina and N.P. Gleditsch (2005) 'Monitoring Trends in Global Combat: A New Dataset of Battle Deaths', *European Journal of Population*, 21 (2–3): 145–166.

PRS Group (2014) International Country Risk Guide: Political Risk, https://www.countrydata.com/index.php/products/researcher-dataset-icrg-t3b-political-risk.

Sanfilippo, M. (2010) 'Chinese FDI to Africa: What Is the Nexus with Foreign Economic Cooperation?', *African Development Review*, 22 (S1): 599–614.

Subramanian, A. (2013) 'The Mauritian Success Story and Its Lessons' in A. K. Fosu, (ed.), *Achieving Development Success: Strategies and Lessons from the Developing World.* Oxford: Oxford University Press, 204–231.

UCDP (2013) UCDP Battle-Related Deaths Dataset v.5-2013, Uppsala Conflict Data Program, www.ucdp.uu.se, Uppsala University.

UN Comtrade (2014) United Nations Commodity Trade Statistics Database, SITC Rev. 3, comtrade.un.org.

UNCTAD (2006) *World Investment Report 2006 - FDI from Developing and Transition Economies: Implications for Development.* New York and Geneva: United Nations.

UNCTAD (2010) *Economic Development in Africa: South-South Cooperation: Africa and the New Partnership for Development*. New York and Geneva: United Nations.

UNCTAD (2013) *World Investment Report 2013*. New York and Geneva: United Nations.

UNCTAD and UNDP (2007) 'Asian Foreign Direct Investment in Africa: Towards a New Era of Cooperation Among Developing Countries', *UNCTAD Current Studies on FDI and Development No. 3*. New York and Geneva: United Nations University Press.

UNCTADstat (2014) Foreign Direct Investment Flows and Stock, unctadstat.unctad.org.

UNECA (2013) *Economic Report on Africa 2013*. Addis Ababa: United Nations.

Whalley, J. and A. Weisbrod (2012) 'The Contribution of Chinese FDI to Africa's Pre Crisis Growth Surge', *Global Economy Journal*, 12 (4): 1-28.

World Bank (2013) Africa Development Indicators, http://data.worldbank.org/data-catalog/africa-development-indicators.

World Bank (2014) World Development Indicators, http://data.worldbank.org/data-catalog/world-development-indicators.

Zafar, A. (2007) 'The Growing Relationship Between China and Sub-Saharan Africa: Macroeconomic, Trade, Investment, and Aid Links', *World Bank Research Observer*, 22 (1): 103–130.

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	Chines 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 approved overseas investment flow and 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)
Total Imports from ROW	Total imports from the ROW, % of GDP	UN Comtrade (2014)
Total Imports 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 Imports from China	Total imports of natural resources from China, % of GDP	UN Comtrade (2014)
Non-resource 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 resource 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	Obser-vations	Mean	Standard Deviation	Minimum	Maximum
ln GDP per capita	147	6.42	1.02	4.82	9.51
ln Investment	147	2.91	0.49	1.56	4.45
ln Population Growth	147	-1.74	0.24	-2.75	-1.23
ln Inflation	147	2.19	1.37	-3.44	8.86
ln Battle Deaths	147	2.58	3.52	0	10.64
Terms-of-Trade Growth	147	0.01	0.26	-1.29	0.65
ln Aid ROW	147	2.07	1.11	-1.09	4.09
ln Aid China	147	-0.60	1.44	-4.95	2.24
ln FDI ROW	147	0.63	1.51	-4.42	4.39
ln FDI China	147	-4.68	2.95	-11.22	0.33
ln Total Exports to ROW	147	2.82	0.84	0.37	4.25
ln Total Exports to China	147	-1.75	2.67	-9.03	3.37
ln Total Imports from ROW	147	3.10	0.64	1.41	5.07
ln Total Imports from China	147	0.03	1.27	-2.95	3.70
ln Resource Exports to ROW	147	1.14	2.04	-4.01	4.20
ln Resource Exports to China	147	-3.29	3.76	-10.94	3.37
ln Resource Imports from ROW	147	0.58	1.13	-2.83	3.24
ln Resource Imports from China	147	-5.63	2.16	-10.94	-1.56
ln Non-resource Exports to ROW	147	2.04	0.87	-0.47	3.77
ln Non-resource Exports to China	147	-3.77	2.44	-10.31	0.88
ln Non-resource Imports from ROW	147	2.99	0.62	1.35	4.93
ln Non-resource Imports from China	147	0.02	1.27	-2.95	3.70

Notes: Descriptive statistics are calculated based upon our 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.

Table 1: Baseline Regressions (Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dep. Var.	0.868***	0.747***	0.735***	0.756***	0.755***	0.785***
	(16.34)	(9.495)	(10.54)	(11.09)	(10.69)	(11.51)
ln Investment	0.150***	0.170***	0.150**	0.135**	0.173***	0.159***
	(3.239)	(3.235)	(2.613)	(2.473)	(3.249)	(3.243)
ln Population Growth	0.056	0.044	-0.052	-0.101	-0.051	-0.074
	(0.842)	(0.477)	(-0.619)	(-1.158)	(-0.622)	(-0.847)
Terms-of-Trade Growth		0.205**	0.208**	0.176**	0.233**	0.295***
		(2.361)	(2.257)	(2.322)	(2.588)	(2.935)
ln FDI China		0.0017	0.0016	0.0014	0.0010	0.0019
		(0.428)	(0.363)	(0.285)	(0.268)	(0.541)
ln FDI ROW		0.0001	-0.005	-0.0103	-0.0040	0.0020
		(0.00841)	(-0.326)	(-0.554)	(-0.271)	(0.131)
ln Aid China		-0.0254	-0.0329	-0.0269	-0.0278	-0.0175
		(-0.803)	(-1.179)	(-0.875)	(-1.141)	(-0.705)
ln Aid ROW		-0.0689	-0.0572	-0.0703	-0.0446	-0.0437
		(-1.574)	(-1.291)	(-1.243)	(-1.190)	(-1.127)
ln Total Exports to China		0.0170	0.0171		0.0115	
		(1.476)	(1.483)		(1.243)	
ln Total Imports from China		-0.0751**	-0.0707**		-0.0674**	
		(-2.376)	(-2.186)		(-2.311)	
ln Total Exports to ROW		0.102***	0.0908**		0.0658*	
		(3.013)	(2.180)		(2.009)	
ln Total Imports from ROW		-0.0091	-0.0116		0.0081	
		(-0.217)	(-0.260)		(0.197)	
ln Inflation			-0.0018	-0.0077	0.0034	0.0018
			(-0.0870)	(-0.341)	(0.191)	(0.0981)
ln Battle Deaths			-0.0043	-0.0037	-0.00353	-0.0027
			(-1.135)	(-0.828)	(-1.111)	(-0.845)
Terms-of-Trade Growth* ln Total Exp. to China					0.0627***	
					(3.526)	
ln Non-resource Exports to China				0.0061		0.0072
				(0.785)		(1.204)
ln Non-resource Imports from China				-0.0612**		-0.0547**
				(-2.616)		(-2.407)
ln Resource Exports to China				0.0051		0.0025
				(0.658)		(0.404)
ln Resource Imports from China				0.00061		-0.0091
				(0.0478)		(-0.723)
ln Non-resource Exports to ROW				-0.0167		-0.0192
				(-0.552)		(-0.652)
ln Non-resource Imports from ROW				0.0498		0.0375
				(0.777)		(0.718)
ln Resource Exports to ROW				0.0082		0.0090
				(0.526)		(0.537)
ln Resource Imports from ROW				-0.0322		-0.0166
				(-1.464)		(-0.761)
Terms-of-Trade Growth* ln Res. Exp. to China						0.0557***
						(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	0.84	0.87	0.87

Notes: The dependent variable is always ln 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.

Table 2: System GMM

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dep. Var.	1.060***	1.015***	0.964***	0.988***	0.960***	0.955***
	(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 Growth	0.148	-0.129	0.010	0.022	-0.032	-0.095
	(0.876)	(-1.070)	(0.0738)	(0.0915)	(-0.256)	(-0.534)
Terms-of-Trade Growth		0.089	0.050	0.018	0.151*	0.124
		(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 to China		0.0123	0.0069		-0.0005	
		(0.719)	(0.601)		(-0.0389)	
ln Total Imports from China		-0.162**	-0.102*		-0.0315	
		(-2.323)	(-1.745)		(-0.557)	
ln Total Exports to ROW		-0.0677	0.0163		-0.0372	
		(-0.718)	(0.209)		(-0.460)	
ln Total Imports from ROW		0.119	0.0467		-0.0087	
		(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 Growth* ln Total Exp. to China					0.111**	
					(2.119)	
ln Non-resource Exports to China				0.0101		-0.0081
				(0.285)		(-0.215)
ln Non-resource Imports from China				-0.130**		-0.0937*
				(-2.019)		(-1.723)
ln Resource Exports to China				0.0020		0.0074
				(0.0964)		(0.316)
ln Resource Imports from China				0.0145		0.0066
				(0.620)		(0.286)
ln Non-resource Exports to ROW				-0.0120		-0.0171
				(-0.195)		(-0.273)
ln Non-resource Imports from ROW				0.173		0.147
				(1.140)		(1.223)
ln Resource Exports to ROW				0.0020		-0.0083
				(0.0889)		(-0.302)
ln Resource Imports from ROW				-0.0323		-0.0293
				(-0.729)		(-0.595)
Terms-of-Trade Growth* ln Res. Exp. to China						0.0383*
						(1.814)
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 reported for AR(1) and AR(2) refer to first- and second-order autocorrelated disturbances in the first differences equations. See Table 1 for further notes.

Table 3: Sample Variations (Fixed Effects)

	(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***	0.792***	0.726***	0.756***	0.755***	0.785***
	(11.40)	(12.31)	(10.26)	(11.76)	(10.67)	(11.30)
ln Investment	0.173***	0.158***	0.167***	0.153***	0.173***	0.160***
	(3.321)	(3.377)	(3.069)	(2.986)	(3.213)	(3.177)
ln Population Growth	-0.075	-0.091	-0.002	-0.023	-0.050	-0.075
	(-1.020)	(-1.166)	(-0.0242)	(-0.251)	(-0.583)	(-0.812)
Terms-of-Trade Growth	0.228**	0.288***	0.240**	0.310***	0.233**	0.295***
	(2.608)	(2.890)	(2.520)	(3.039)	(2.582)	(2.937)
ln FDI China	0.0007	0.0013	0.0023	0.0030	0.0010	0.0020
	(0.220)	(0.448)	(0.586)	(0.746)	(0.264)	(0.546)
ln FDI ROW	-0.0035	0.0021	-0.0060	-0.0020	-0.0039	0.0018
	(-0.251)	(0.137)	(-0.371)	(-0.113)	(-0.261)	(0.111)
ln Aid China	-0.0252	-0.0164	-0.0243	-0.0139	-0.0278	-0.0174
	(-1.132)	(-0.720)	(-1.066)	(-0.588)	(-1.140)	(-0.700)
ln Aid ROW	-0.0374	-0.0356	-0.0578	-0.0592	-0.0445	-0.0438
	(-1.093)	(-1.017)	(-1.302)	(-1.287)	(-1.188)	(-1.125)
ln Total Exports to China	0.0097		0.0147		0.0115	
	(1.139)		(1.455)		(1.242)	
ln Total Imports from China	-0.0652**		-0.0785**		-0.0673**	
	(-2.295)		(-2.327)		(-2.294)	
ln Total Exports to ROW	0.0646*		0.0672*		0.0658*	
	(2.011)		(1.905)		(2.006)	
ln Total Imports from ROW	0.0017		0.0173		0.0081	
	(0.0442)		(0.364)		(0.196)	
ln Inflation	0.0039	0.0024	0.0054	0.0039	0.0034	0.0018
	(0.224)	(0.135)	(0.294)	(0.209)	(0.188)	(0.0993)
ln Battle Deaths	-0.0033	-0.0023	-0.0026	-0.0015	-0.0035	-0.0027
	(-1.067)	(-0.743)	(-0.748)	(-0.432)	(-1.108)	(-0.845)
Terms-of-Trade Growth* ln Total Exp. to China	0.0633***		0.0635***		0.0627***	
	(3.452)		(3.511)		(3.521)	
ln Non-resource Exports to China		0.0055		0.0086		0.0072
		(0.992)		(1.408)		(1.149)
ln Non-resource Imports from China		-0.0510**		-0.0657**		-0.0546**
		(-2.414)		(-2.330)		(-2.400)
ln Resource Exports to China		0.0019		0.0066		0.0025
		(0.347)		(0.919)		(0.404)
ln Resource Imports from China		-0.0105		-0.0134		-0.0093
		(-0.822)		(-1.015)		(-0.703)
ln Non-resource Exports to ROW		-0.0177		-0.0207		-0.0192
		(-0.677)		(-0.689)		(-0.654)
ln Non-resource Imports from ROW		0.0360		0.0559		0.0374
		(0.694)		(0.877)		(0.715)
ln Resource Exports to ROW		0.0091		0.0086		0.0091
		(0.555)		(0.502)		(0.536)
ln Resource Imports from ROW		-0.0192		-0.0144		-0.0166
		(-0.951)		(-0.618)		(-0.761)
Terms-of-Trade Growth* ln Res. Exp. to China		0.0555***		0.0546***		0.0558***
		(3.003)		(3.089)		(2.985)
Observations	165	165	133	133	144	144
Countries	49	49	39	39	42	42
R-squared (within)	0.88	0.88	0.87	0.87	0.87	0.87

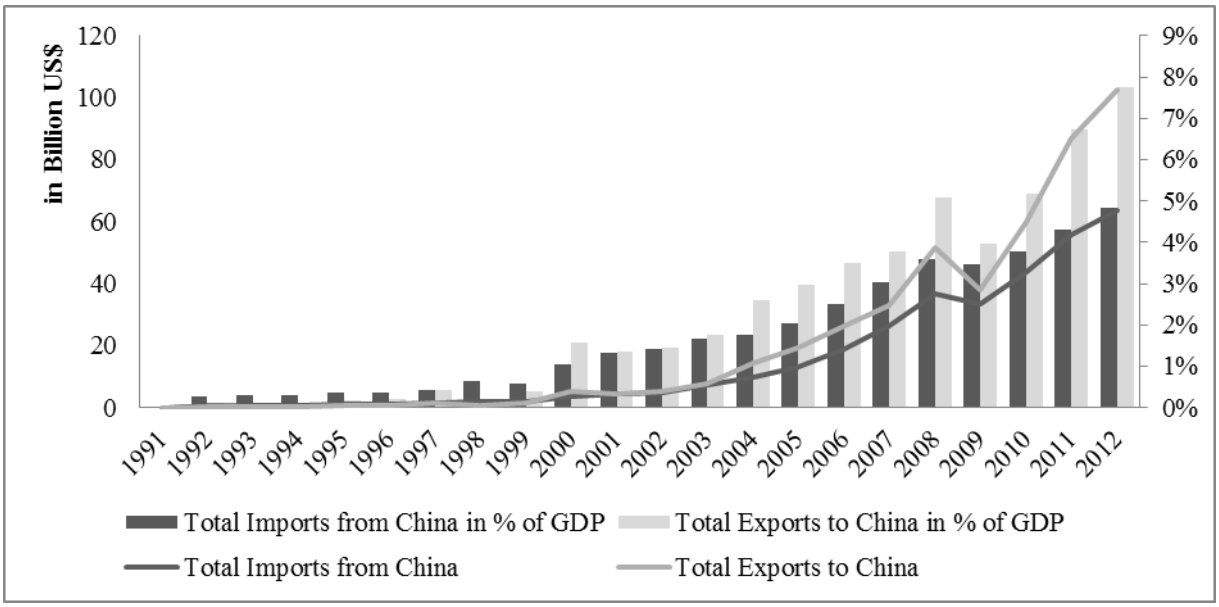
Notes: See Table 1.

Table 4: Different Period Averages (Fixed Effects)

	(1) 4-year-averages	(2) 4-year-averages	(3) 3-year-averages	(4) 3-year-averages
Lagged Dep. Var.	0.827***	0.852***	0.834***	0.850***
	(25.32)	(30.56)	(24.52)	(25.29)
ln Investment	0.125***	0.119***	0.107***	0.097***
	(3.763)	(4.314)	(3.760)	(4.366)
ln Population Growth	0.009	-0.014	-0.044	-0.053
	(0.121)	(-0.168)	(-0.594)	(-0.790)
Terms-of-Trade Growth	0.209***	0.256***	0.125***	0.142***
	(3.190)	(3.177)	(3.032)	(2.908)
ln FDI China	0.0033	0.0055*	0.0017	0.0029
	(1.256)	(1.795)	(0.824)	(1.482)
ln FDI ROW	0.0065	0.0080	-0.0056	-0.0055
	(0.719)	(0.832)	(-0.651)	(-0.666)
ln Aid China	-0.0137	-0.0189	0.0021	-0.0038
	(-1.080)	(-1.230)	(0.199)	(-0.307)
ln Aid ROW	-0.0238	-0.0217	-0.0276	-0.0288
	(-0.957)	(-0.900)	(-1.117)	(-1.114)
ln Total Exports to China	0.0104		0.0095	
	(1.137)		(1.452)	
ln Total Imports from China	-0.0556***		-0.0485*	
	(-2.975)		(-1.927)	
ln Total Exports to ROW	0.0246		0.0163	
	(0.807)		(0.749)	
ln Total Imports from ROW	-0.0168		-0.0338	
	(-0.520)		(-1.218)	
ln Inflation	-0.0258**	-0.0251**	-0.0125	-0.0140
	(-2.421)	(-2.477)	(-1.065)	(-1.207)
ln Battle Deaths	-0.0019	-0.0034	-0.0037	-0.0032
	(-0.601)	(-1.380)	(-1.436)	(-1.192)
Terms-of-Trade Growth* ln Total Exp. to China	0.0662***		0.0312***	
	(4.306)		(3.476)	
ln Non-resource Exports to China		-0.0005		-0.0010
		(-0.135)		(-0.275)
ln Non-resource Imports from China		-0.0431**		-0.0378**
		(-2.310)		(-2.210)
ln Resource Exports to China		0.0068		0.0077
		(1.093)		(1.400)
ln Resource Imports from China		-0.0109		-0.0024
		(-1.168)		(-0.451)
ln Non-resource Exports to ROW		-0.0187		-0.0183
		(-0.689)		(-0.997)
ln Non-resource Imports from ROW		0.0357		0.0018
		(0.665)		(0.0455)
ln Resource Exports to ROW		-0.0183		-0.0135
		(-1.377)		(-1.502)
ln Resource Imports from ROW		-0.0218		-0.0178**
		(-1.573)		(-2.079)
Terms-of-Trade Growth* ln Res. Exp. to China		0.0503***		0.0246**
		(3.677)		(2.684)
Observations	174	174	235	235
Countries	43	43	43	43
R-squared (within)	0.90	0.91	0.91	0.91

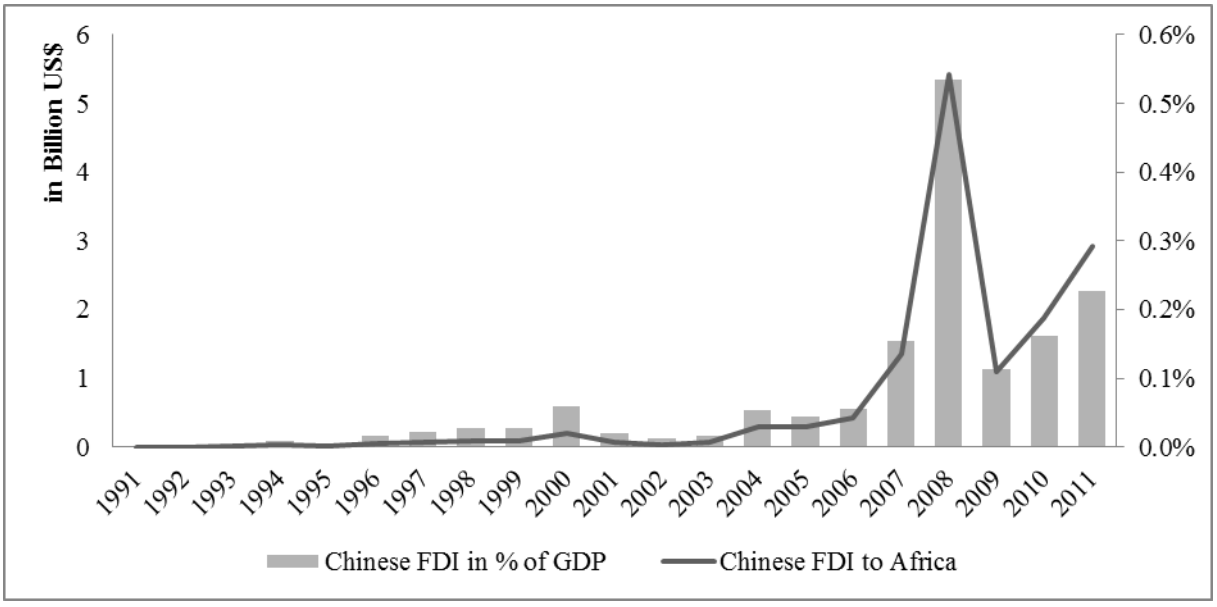
Notes: See Table 1.

Figure 1: Africa's Trade with China



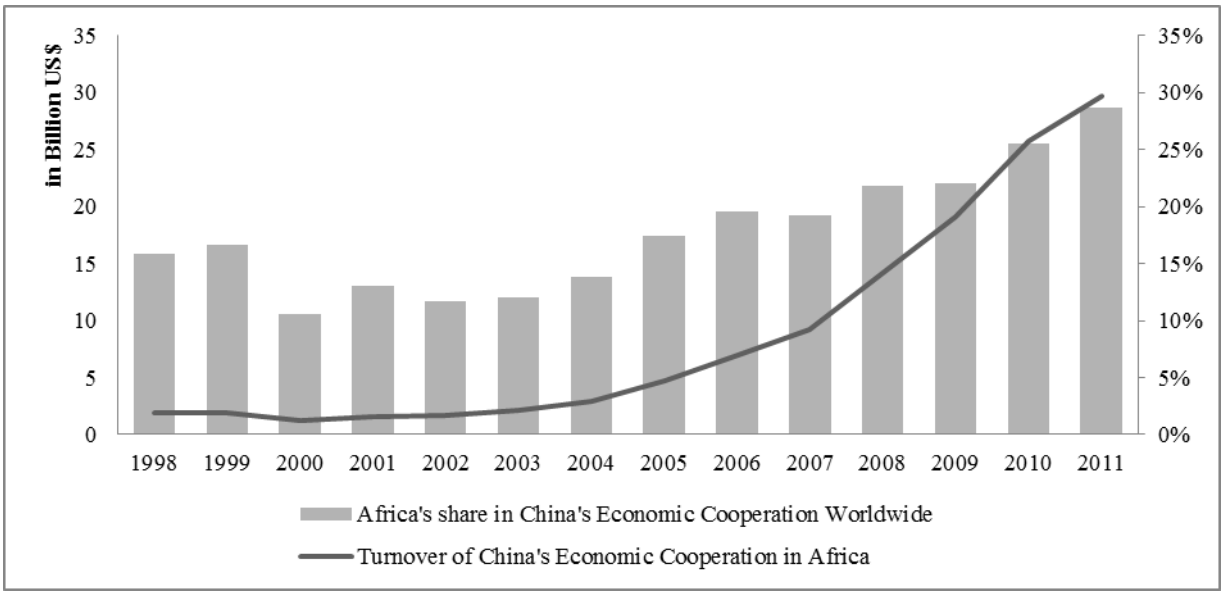
Notes: Figures refer to trade in goods only. Africa's imports from and exports to China in billion US$ (left-hand scale) and as a percentage of African GDP in the respective year (right-hand scale). Data sources: UN Comtrade (2014); World Bank (2013).

Figure 2: Chinese FDI to Africa



Note: Chinese FDI flows into Africa in billion US$ (left-hand scale) and as a percentage of African GDP in the respective year (right-hand scale). Data sources: MOFCOM (Various years); World Bank (2013).

Figure 3: China's Economic Cooperation in Africa



Note: Turnover of China's Economic Cooperation in Africa in billion US$ (left-hand scale); Africa's share in China's Economic Cooperation worldwide in percent (right-hand scale). Data source: NBS (Various years).