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Chinese Capital Flows to African Economies and Real Bilateral Exchange Rates

Coletta Frenzel Baudisch[1]

March 15, 2019

Abstract

Since the turn of the millennium, China opened up internationally both in terms of its current account (trade) and its capital account, even though the opening of the latter happened de facto, not de jure. With respect to China being Africa's largest trading partner and developing investor in combination with its desire for African natural resources, we embark on an analysis of the impact of several categories of Chinese capital flows to African economies on the bilateral real exchange rate. We conduct a panel data analysis by means of a Hausman-Taylor-estimation over the period 2003-2016. Our results suggest that capital flows from China to Africa in the form of mainly economic cooperation projects, but also FDI contribute to an appreciation of the local currencies vis à vis the RMB, while no such effect appears for aid flows from China. The former two categories may pose a risk of Dutch Disease effects. Since many African countries have pegged their currencies to the Euro, and the Renminbi abandoned its peg to the US Dollar over the sample period, valuation effects of capital flows must be interpreted in this context.

Keywords: real bilateral exchange rates, FDI, economic cooperation, aid, trade, Sino-African economic relations.
JEL Codes: F19, F21, F35, F62.

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1 Introduction

The Chinese engagement on the African continent in terms of capital flows consisting of foreign direct investment (FDI), economic cooperation projects and aid, as well as mutual trade relations has been expanding for the most part of the current century. Both aspects influence the real bilateral exchange rates of African currencies relative to the Renminbi (RMB), while the role of the respective exchange rate regimes must neither be omitted in this context. In view of the entanglement of capital flows, trade and real exchange rates and the important role of trade for regional economic development, this analysis focuses on the determinants of Sino-African real bilateral exchange rates.

China's integration into the global economy became a national policy in the 1990s, focussing on two dimensions which were the full participation in, first, international trade and in, second, the global financial system (Yu 2014). Chinese authorities abolished exchange controls on current account transactions in 1994 to ensure current account convertibility to comply with the International Monetary Fund's article VIII (Schnabl 2017). Then, the membership in the World Trade Organization since 2001 has been an important step into the direction of the first objective. The adoption of China's Going-Global policy in 2001 facilitated access to loans and foreign exchange for Chinese firms in order to encourage foreign trade and outward FDI[1]. Part of the program has been the identification of sectors worth investing in, almost automatically turning the attention to Africa as a major provider of natural resources (Busse et al. 2016). To maintain its large domestic growth rates, China's demand for natural resources was high.

The launch of the China-Africa Cooperation Forum (FOCAC) in 2000 already illustrated the importance of Africa in China's foreign policy. In the meanwhile, various sub-forums have been established within the FOCAC framework, demonstrating the deepening of this relationship over the years. The foundation of the forum was the starting point for an

[1]Prior to the going-global-initiative, China intended to attract capital rather than to invest it abroad. Consequently, a cumbersome administrative system successfully restricted outward direct investments (Huang et al. 2011).

intensified trade between China and Africa, even surpassing trade growth rates of China's total trade (Guillaumont Jeanneney & Hua 2014).

Concerning the second objective of China's global integration, a road map for capital account liberalization had been developed around 1996. When China still had no full capital account convertibility many years later, the reiteration of this plan was necessary in the 12th Five-Year program in 2011 (He & Luk 2017). Capital flows to Africa surged substantially during the course of the current millennium, being it FDI, economic cooperation projects, or aid initiatives.

The exchange rate regimes chosen by China and by its African trading partners matter for the determination of their bilateral exchange rates, as does the bilateral trade, triggered by the availability of resources from the African part, and capital flows mainly from China to Africa. An earlier study by Guillaumont Jeanneney & Hua (2014) found pegged exchange rates, China's demand for raw materials and capital flows related to economic cooperation projects to contribute to the real appreciation of African currencies versus the RMB for the time span 2000 until 2011. Along with this appreciation goes a lack of competitiveness in exporting manufactured goods and increased demand for import goods from China, constituting an obstacle the industrial development of many African economies. Though, by adapting the observation period from 2003 until 2016, we find a real appreciation of the bilateral exchange rate only for 31% of the sample of African economies instead of 62% in the earlier and shorter observation period until 2011. Hence, an analysis of the determinants leading to this modified picture seems appropriate.

We focus on the Sino-African economic linkages because of China's role as largest developing investor in the continent and as major trading partner of Africa. With respect to the resource-orientation of Chinese FDI in Africa, Dutch Disease effects could arise with possible negative consequences of the additional financial resources in the host economies. An analysis of Sino-African economic relations should comprise of the three main channels of interaction which are trade, FDI and aid, as the three seem to complement each other

(Busse et al. 2016, Dong & Fan 2017). Yet, several studies (see Sanfilippo (2010), Busse et al. (2016)) approximate Chinese development aid by the turnover of economic cooperation projects. Chinese aid flows do not qualify as Official Development Assistance (ODA) according to the criteria of the Organisation of Economic Cooperation and Development's (OECD) Development Assistance Committee (DAC). Hence, the comparison of Chinese aid with ODA of international donors proves to be difficult. Aid programs represent a part of Chinese economic cooperation turnover, but using the latter as proxy of the former entails an overestimation of Chinese aid. Thus, the discussion about the suitability of this approach (Brautigam 2011) and the availability of a new dataset of Chinese official financial flows to Africa (Dreher et al. 2017) motivates our approach of an analysis of FDI, economic cooperation and aid flows from China to Africa and their impact on real bilateral exchange rates. With respect to China's focus on investment in resource-rich economies and the ensuing bilateral trade, we also touch upon the bilateral trade in the descriptives and employ it as a control variable in the regressions. Trade matters insofar as Dutch Disease effects may result from an extensive export of natural resources, affecting real valuation of the bilateral exchange rates.

This study contributes to the small literature on determinants of Sino-African real bilateral exchange rates in three ways. First, to the best of our knowledge, there is no study, aside from Guillaumont Jeanneney & Hua (2014), empirically investigating the determinants of Sino-African real bilateral exchange rates. More specifically, we primarily focus on the impact of Chinese capital flows to African economies on the real bilateral exchange rates, while Guillaumont Jeanneney & Hua (2014) mainly focus on the determinants of Sino-African trade, including the exchange rates as a control variable, and examining the determinants of the latter in a subsequent step. Second, in an attempt to account for the impact of as many Chinese capital flows to African economies as possible, we employ a new dataset on aid flows, provided by AidData, to capture the effect of Chinese aid. Many studies rely on the data reported officially by China as economic cooperation turnover as an indicator of foreign

aid, even though they do not necessarily coincide (Brautigam 2011). Third, the exchange rate regime chosen by the African economies has been identified as a major determinant of real Sino-African bilateral exchange rates by Guillaumont Jeanneney & Hua (2014), while they also attribute real appreciation of African currencies to the undervaluation of the RMB through the Chinese *de facto* peg to the USD. However, their sample period ends in 2011 when the RMB still was managed closely along the USD. Our sample period contains a longer time frame with a wider floating band of the RMB, even moving into the direction of a free floating exchange rate regime from 2015 onwards, hereby probably having a different effect on real bilateral exchange rates.

The paper is structured as follows: section 2 gives an overview on Sino-African economic relations, providing details on the main determinants of the real bilateral exchange rates. Section 3 explains the econometric approach of our analysis and provides details on the variables used. The results of our estimations are shown in section 4, and section 5 concludes.

2 Sino-African economic relations - an overview

The identification of three main factors determining real bilateral exchange rate movements of African currencies relative to the RMB as the exchange rate regime chosen, natural resource exports and financial assistance from international and Chinese donors by Guillaumont Jeanneney & Hua (2014) steers the focus of this overview of Sino-African economic relations. However, it reaches further with details on different kinds of capital flows from China to African economies and on bilateral trade flows as we assume these factors to play a role in the determination of bilateral exchange rates that should not be neglected.

2.1 Sino-African capital flows

FDI

China started to report its outward FDI flows in IMF-OECD format in *The Statistical Bulletin of China's Outward Foreign Direct Investment* in 2003 (Cheung et al. 2012). Various issues of the *Bulletin* are the basis for the ensuing remarks on Chinese outward FDI in total and to Africa in particular. However, the *Bulletin* probably underestimates the scale of FDI outflows of Chinese private investors, as projects worth less than US$ 10 million are not included and an arduous registration procedure with MOFCOM deters private investors from registering (Wang et al. 2014). Chinese global outward FDI flows increased almost twenty-fold within 5 years from US$ 2.9 billion in 2003 to US$ 55.9 billion in 2008. The strong increase extenuated in the immediate aftermath of the global financial crisis: while global outward FDI flows from China rose by 111% from 2007 to 2008, they increased by a mere 1% to US$ 56.5 billion in the subsequent year. Over the following 7 years, Chinas total outward FDI flows continued to rise to US$ 196.2 billion in 2016.

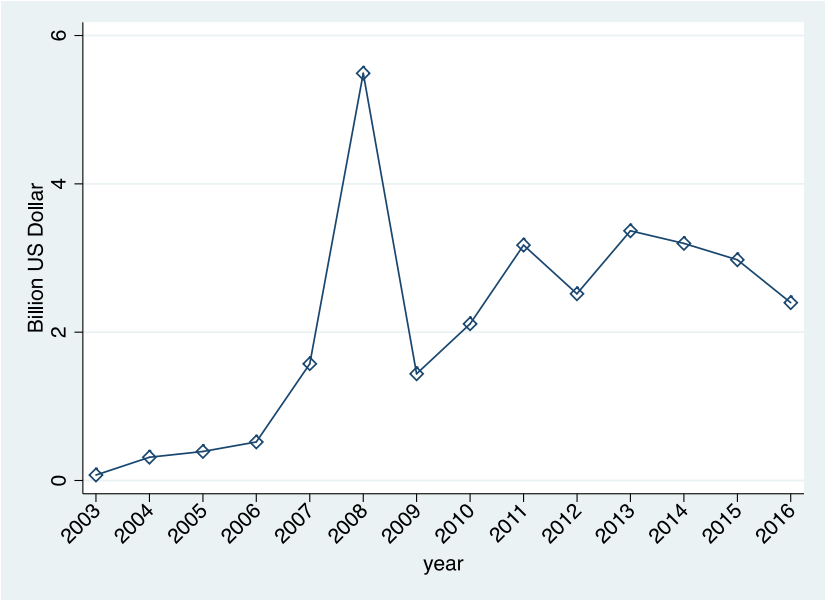
The share of FDI flows to Africa was at 2.6% of total Chinese FDI outflows in 2003, implying an absolute value of US$ 74.8 million. This amount increased 73-fold to a one-time high of FDI worth US$ 5.5 billion flowing from China to Africa in 2008 as shown in figure 1, representing a peak share of 9.8% of China's total FDI outflows. One year later, this share went down to 2.5%: while global Chinese FDI outflows still grew slightly in 2009, the opposite is true for Chinese FDI flows to Africa, which plummeted to US$ 1.4 billion or less than one third of its prior-year value. Nevertheless, it was not only the global financial crisis that led to the sharp decline of Chinese FDI in Africa in 2009 but an above-average investment in South Africa's Standard Bank in 2008 (Busse et al. 2016).[2] From 2009 to 2016, FDI flows to Africa less than doubled to US$ 2.4 billion, including a continuous decline from 2013[3] on, accounting for a share of 1.2% of total Chinese FDI outflows in 2016. Hence,

[2]Chinese FDI flows to South Africa developed from US$ 454 million in 2007 to US$ 4.8 billion in 2008 to US$ 42 million in 2009 (MOFCOM 2016).

[3]A possible explanation for the drop in FDI projects in 2014 and the subsequent years is a change in

the fraction of Chinese FDI flowing to Africa was less than half of its ratio in 2003, while the absolute value increased 32-fold over this period.

Figure 1: China's annual FDI outflows to Africa



Notes: Data from MOFCOM (2009, 2012, 2018).

African FDI inflows from China amounted on average to just 5% of total FDI flows to the continent over the period 2000-2011 (Busse et al. 2016). This ratio remained the same in 2012, approaching 6% over the course of 2013-2015 and falling to 4.1% in 2016 (UNCTAD World Investment Reports 2013-2017). However, China has been keeping its position as biggest developing country investor in Africa for several years (World Investment report 2018). Stock-wise, Chinese FDI to Africa only recently, in 2014, started to be surpassed by Chinese FDI to the United States. Therefore, China's investment focus on Africa is large when compared to its investment in other parts of the world, but its share of global FDI flows to African economies is small at the same time (Chen et al. 2018).

The rise of Chinese FDI in Africa finds local endorsement as Chinese capital helps to fi-

the administrative procedures: before 2014, the approval by MOFCOM was necessary to obtain for example clearance from customs and foreign exchange administration. A new regulation made this requirement redundant, hereby providing less incentives for investors to record their investments abroad with MOFCOM (Brautigam et al. 2018).

nance the development of African economies since it already improved the infrastructure and contributed to a rising productivity, to more exports and to a better living standard. However, it also provokes critics questioning the underlying motives and worrying for example about the impact on political reforms and governance in Africa, or about crowding-out effects on the African manufacturing industry (Cheung et al. 2012). According to Sanfilippo (2010), determinants of Chinese FDI in Africa include market seeking, access to third countries via least developed countries included in preferential trade agreements, and the availability of natural resources. The market seeking intention behind FDI in Africa is reinforced by a strong Chinese export orientation. Furthermore, using data from 1998 to 2007, the author presents evidence that economic cooperation activities have a significant, but small effect on Chinese FDI in Africa. Hence, governmental decisions concerning economic cooperation provide a basis for Chinese companies to enter the African market. Both, economic cooperation and FDI are driven by market-seeking motives and natural resources. The natural resource-seeking motivation becomes evident considering that Chinese economic cooperation, which often provides infrastructure in exchange for natural resources, is regularly directed at oil producers. However, in a recent analysis using a dataset covering the time span 1998 to 2012, Chen et al. (2018) find Chinese FDI in Africa to be not more attracted to natural resources than Western FDI in Africa. Mega deals involving state-owned enterprises (SOEs) investing in natural resource projects influence the aggregate FDI data to a large extent. Considering Chinese investment of private small and medium enterprises (SME) in Africa in terms of number of projects, their focus is on the service sector supporting the global trend towards a dominance of FDI in the tertiary sector: 72% of the projects in the dataset of Chen et al. (2018) are assigned to the service sector, 15% to manufacturing and the remaining share split between agriculture and mining. Private investors from China resemble investors from other regions in assessing investments by profit opportunities. Wang et al. (2014) analyse their self-compiled Chinese OFDI database to find mining to be the most relevant sector in terms of investment value: 52.4% of the investment amount of large Chinese overseas

Table 1: Top 5 sectors of China's outward FDI stock in Africa by the end of 2016

Sector	FDI Stock ($million)	% of total FDI Stock
Construction	11,300	28.3
Mining	10,410	26.1
Manufacturing	5,090	12.8
Financial Service	4,560	11.4
Science, Research and Technology Service	1,910	4.8
Total	33,270	83.4

Source: Statistical Bulletin of China's Outward Foreign Direct Investment 2016, p. 25 (MOFCOM 2017).

direct investment projects flew into the sector over the period 2003 to 2011. Manufacturing was the target of 23.2% of this investment amount over the same period. This relationship looks reverse for Chinese small and medium firms, who invest 64.4% of their investment value in manufacturing abroad and only 8% in mining. Nevertheless, exact information on sectoral FDI in Africa is difficult to seize, because the annual *Bulletin* indeed entails besides a destination-country breakdown a sectoral breakdown of FDI outflows, but there had not been a sectoral split by region. This approach changed recently with the *Bulletin 2015* publishing sectoral FDI data separately for different regions, and the subsequent *Bulletins* adopting this data preparation[4]. Accordingly, the greatest share of Chinese FDI flows to the secondary sector in Africa in 2016, as displayed in table 1: construction and manufacturing sum up to 41% of total FDI stock on the continent.

However, SOEs issue the majority of Chinese FDI in Africa in search of natural resources and often link their investment with official aid programs, particularly in politically precarious countries (Sanfilippo 2010). Political risk is no obstacle to economic cooperation projects or FDI, confirming the perception of Chinese investors to be more risk-prone than investors from developed countries. Therefore, good and poor governance countries attract Chinese FDI equally but not so Western investment, why Chinese FDI is relatively high in poor governance countries (Chen et al. 2018).

[4]The *Bulletin 2017* even entails the sectoral FDI outflow breakdown by region in English (see MOFCOM (2018), p. 111). The previous issues presented this overview in Chinese only.

Economic Cooperation and Aid

Chinese activities follow a strategic interaction of FDI, trade, and aid in terms of economic cooperation: Chinese infrastructure projects lead to increasing FDI from China in the host economy, followed or preceded by a surge in trade with the same economy (Biggeri & Sanfilippo 2009). Even though most studies find Chinese aid to focus primarily on economies with abundant natural resources, Brautigam (2011) stresses the relevance of diplomatic relations as a determinant of Chinese aid flows into African countries.

The increase of foreign aid from non-Western donors is a relatively recent phenomenon. China in particular is perceived as the most important source of development finance among non-Western donors.[5] However, the lack of non-Western participation in the existing reporting systems as the Creditor Reporting Systems (CRS) or the International Aid Transparency Initiative complicates studies about the structure or impact of theses financial flows (Strange et al. 2017). Chinese aid engagement does not fall under the categorization of ODA[6] according to the DAC of the OECD, and official data on its volume is rare. The turnover of Chinese economic cooperation projects is available, but it must not be mistaken for governmental financial flows (Brautigam 2011) even though several studies revert to this data as an indicator for Chinese aid finance (see for example Berthélemy (2009), Sanfilippo (2010), and Busse et al. (2016)). Economic cooperation covers the turnover of contracted projects and service cooperation with foreign countries, as well as overseas design and consultation service. Hence, Brautigam (2011) illustrates that all projects done by Chinese contractors in Africa count as economic cooperation independent of who pays, be it the World Bank, the Africa Development Bank, a local government, companies hiring Chinese firms or the

[5]Chinese official financial flows to developing regions of the world focus on the local economic and social infrastructure as opposed to Western donors who decreased their supply of development finance in infrastructure projects (Dollar 2008).

[6]According to the OECD definition, ODA covers concessional funding for developing countries and for multilateral institutions to promote economic development in the recipient countries, provided by official agencies, state and local governments. Each transaction needs to dispose of a grant element of at least 25 per cent.

Chinese government. Additionally, economic cooperation projects take place in countries with no diplomatic ties to China (which are identified as a prerequisite of Chinese aid) as well as in industrial economics, providing further evidence against economic cooperation as an indicator of Chinese aid. Even though the turnover of aid-financed contracts also falls under economic cooperation, the total turnover value is still not to be equated with aid as it would severely overestimate Chinese aid.

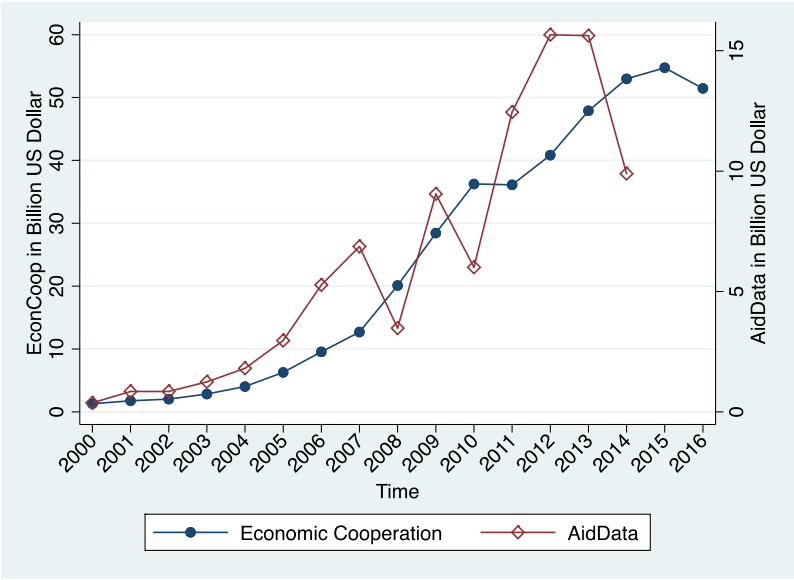
In consideration of the inaptitude of economic cooperation data as a proxy for Chinese aid flows, we turn to a new dataset of Chinese official finance covering the period 2000 to 2014, provided by AidData (Tierney et al. 2011). In its construction, news-reports in English, Chinese and local-languages, statements from Chinese official bodies, the aid and debt information management systems of ministries responsible of such registrations in counterpart countries, and case studies and field research of NGOs or scholars were evaluated and connected (Dreher et al. 2017). Chinese official financial flows to Africa, excluding non-binding pledges and counting only committed projects, amounted to US$ 73 billion over the 2000-2011 period.[7] Hereby, China's commitment approaches the North-American one, which comes to US$ 83 billion over the same period, and exceeds a fifth of the total OECD-DAC flows with US$ 361 billion (Strange et al. 2017). Mostly because of so-called megadeals, the relation between US-American, OECD-DAC and Chinese flows to Africa varied strongly over this period.[8] These official financial flows must not be taken for ODA, as ODA-like flows represent only a minor part of Chinese official finance in financial terms, not in the number of projects. Export credits and almost-market rate loans constitute the main share of China's financial support to developing economies (Dreher et al. 2017). The difficult differentiation within Chinese official finance to Africa as ODA or other official finance, short OOF, leads

[7] A previous dataset compiled using the same TUFF methodology, which stands for Tracking Under-reported Financial Flows, covered Chinese official financial flows over the period 2000-2011 to Africa in particular. Hence, corresponding analyses refer to this shorter sample period (Strange et al. 2017). In the dataset extended until 2014, five regions of the world represent financial flow destinations, namely Africa, the Middle East, Asia and the Pacific, Latin America and the Caribbean, and Central and Eastern Europe.

[8] For example, in 2007, China committed itself to almost twice the amount of the US ODA and OOF, which was caused by two megadeals (project size of US$ 1 billion) with large loans to the Democratic Republic of Congo and Sudan (Strange et al. 2017)

to a great proportion of projects classified as Vague Official Finance, i.e. the open-source information available is insufficient for a clear classification of a project as ODA or OFF, hereby probably devaluing Chinese ODA (Strange et al. 2017).

Figure 2: China's Economic Cooperation and Aid in Africa



Notes: Data of Economic cooperation turnover from NBS (n.d.). Data of aid turnover from Tierney et al. (2011).

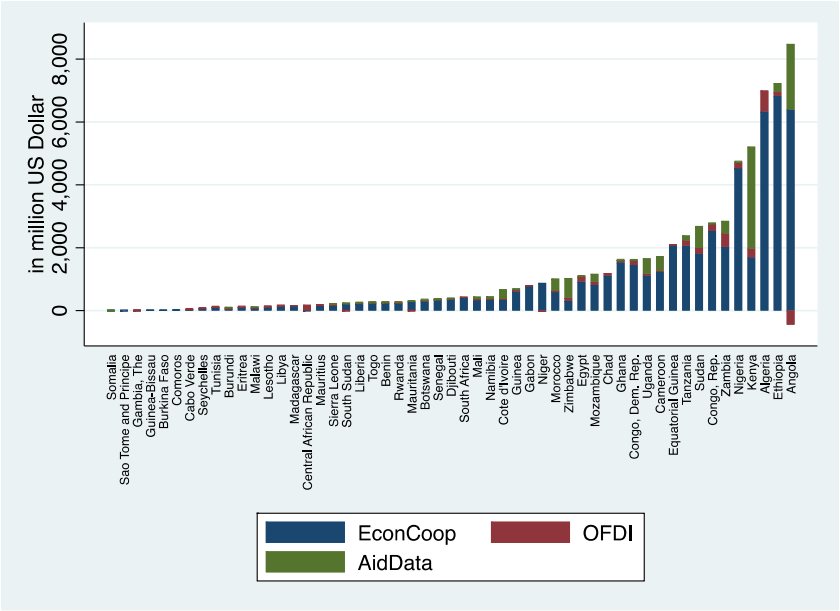
Figure 2 presents the development of both, China's economic cooperation turnover and its aid flows to Africa. Economic cooperation projects expand strongly over the period considered with the exemption of a short stagnation in 2011. Their value in 2000 is only 2% of their peak value of about US$ 54.8 billion in 2015. However, the continuous upward trend came to an end in 2016 with a moderate decline of economic cooperation turnover in Africa by 6% to US$ 51.5 billion. An analysis of the new AidData dataset shows that Chinese total official financial flows to Africa start at US$ 0.4 billion in 2000 and amount to US$ 16 billion in 2013, followed by a sharp decline to US$ 9.9 billion in 2014.

Cumulating the three different kinds of capital flows from China to African economies in figure 3 for the year 2014[9], we find Angola, Ethiopia and Algeria to be the three main des-

[9]We choose 2014 for an overview of cumulated capital flows froM China to Africa because it is the last

tination countries. When relating the capital inflows to the domestic GDP of the recipients, Djibouti ranks first before the Republic of Congo and Ethiopia in 2014.

Figure 3: Cumulated Capital Flows from China to African economies in 2014



Notes: The data sources for the different kinds of capital flows are the folloewing: NBS (n.d.) for economic cooperation turnover from, aid turnover from, and FDI stem from MOFCOM (2009, 2012, 2018).

The entanglement of FDI, aid and trade in the Sino-African relations also becomes evident in an analysis of the impact of aid and trade on Chinese FDI in Africa (Dong & Fan 2017). The authors use AidData and find aggregate aid not to have any significant effect on Chinese outward direct investment (ODI), whereas aid invested in social and economic infrastructure increases Chinese ODI and aid invested in productive sectors and the government decreases Chinese ODI. Hence, aid inflows into productive sectors apparently crowd out private investment. In terms of trade, especially African natural resource exports to China positively affect Chinese ODI.

year covered by the AidData dataset.

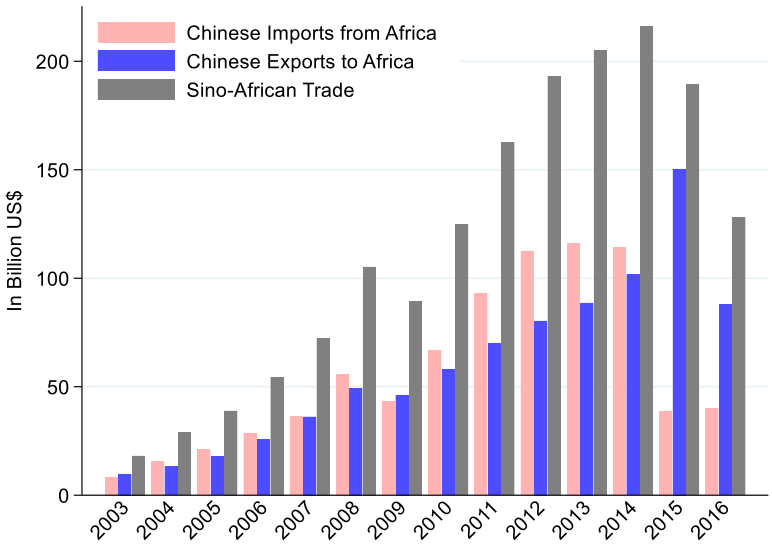
2.2 Trade

Since the turn of the millennium, China's trade with Africa has grown faster than China's total trade (Guillaumont Jeanneney & Hua 2014). While Sino-African trade defined as exports plus imports ranged between US$ 1.6 billion and US$ 4.6 billion from 1992 until 1999, it surged considerably from US$ 10.4 billion in 2000 to a peak of US$ 215.9 billion in 2014, to subsequently fall to US$ 128 billion in 2016 (UNComtrade 2017*a*,*b*).

Even though China imports natural resources from African economies, it exported approximately as much manufactured goods to Africa until 2010, why these trade links may present an obstacle to a growth-promoting diversification of African exports. However, the trade structure between China and Africa follows a text book version of the conventional trade model driven by comparative advantage, the Heckscher-Ohlin-type trade pattern. Starting in the present decade, the Sino-African trade imbalances grew significantly: China had a trade deficit vis à vis Africa from 2010 until 2014 with a maximum of US$ 32.3 billion in 2012, replaced by a trade surplus amounting up to US$ 111.6 billion in 2015 (UNComtrade 2017*a*,*b*). As notable from figure 4, total Sino-African trade has been on the decline since the change of the trade imbalance at the benefit of China in 2015. Several reasons can explain this downward trend. First, China's growth is slowing down from 14% in 2007 and an average growth rate above 10% between 1980 and 2010, to around 7% in 2016 and remaining at that rate in the current decade according to forecasters (Dieppe et al. 2018). The reduced growth is accompanied by less demand for natural resources, that China imports from African economies. Second, Chinese growth has been more driven by consumption than by investment in the most recent past, constituting a change in the earlier pattern. This development reinforces the reduced demand for natural resources, as the service sector plays a more important role and less so heavy industries. Third, considering the sharp decline of the oil price after 2014, trade volumes at current market prices are expected to decline.

African countries with bad governance export more to China than others. Possible explanations state difficulties of China in buying raw materials from the main producers who

Figure 4: Sino-African trade relations 2003-2016



Notes: Date is taken from the China Africa Research Initiative, of the John Hopkins School of International Studies, based on data from UN Comtrade.

traditionally are already linked to developed economies, or the tendency of resource-rich African economies to have bad governance (Guillaumont Jeanneney & Hua 2014). In addition, the concentration on the primary sector of African exports to China could facilitate the incidence or worsening of the resource curse, which already tends to be more likely in countries with weak institutions. Hence, the combination of increasing exports of raw material and the level of institutional quality in many Chinese trade partner countries poses a risk to these African partners, aggravated by China's non-interference policy, according to which trade and investment is not tied to any reform conditions (Busse et al. 2016).

2.3 Exchange rates and exchange rate regimes

Renminbi (RMB)

Despite a road map for capital account liberalization set up in the 1990s, the RMB was repegged to the USD and capital controls were intensified during the Asian financial crisis

(Yu 2014).[10] In the first decade of the current millennium, China's main policy objective was the maintenance of an annual growth rate above 8%, supported by keeping an internationally competitive exchange rate to promote exports. The tight peg of the RMB to the US Dollar (USD) until 2004 provided macroeconomic stability, supporting the exceptional export and economic growth performance of China (McKinnon & Schnabl 2009). Beginning in 2005, Chinas central bank, the PBC started to increasingly loosen the strict peg to the USD, hereby initiating a continuous nominal appreciation of the RMB. Large current and capital account surpluses led to appreciation pressure on the RMB that the PBC responded to with enhanced capital controls on capital inflows and intervention in the foreign exchange market, hereby accumulating foreign exchange reserves. By the onset of the financial crisis in 2008, Chinese reserves amounted to US$ 2 trillion, and they continued to grow to a peak of US$ 3.99 trillion in June 2014 despite a declining trade surplus due to a global recession in the aftermath of the financial crisis (Prasad 2017). Subsequently, foreign exchange reserves fell because of valuation effects. In addition, depreciation pressure on the RMB due to increasing capital outflows and decreasing capital inflows because of concerns of investors led the PBC to sell reserves to preserve the value of the RMB relative to the USD. However, the continuous appreciation of the USD relative to virtually all major currencies rendered its role as main benchmark for managing the RMB unsustainable, especially with regard to slowing economic growth in China. In 2015, the PBC announced a change in its managed floating exchange rate regime by using the closing market rate of the previous day as a reference to set the midpoint of the fluctuation band, hereby moving into the direction of a free floating exchange rate regime (Kwan 2015). By the steps taken, trade advantages and the distortion of international competition through the maintenance of an undervalued currency should dissipate.

[10] When the currencies of the so-called Asian-tigers depreciated against the USD during the Asian financial crisis in 1997, their debts in USDs blew up. Against the risk of losing the export market to the economies whose currencies depreciated, China chose not to devalue the RMB. This decision contributed to the economic stabilization of the region (Prasad 2017).

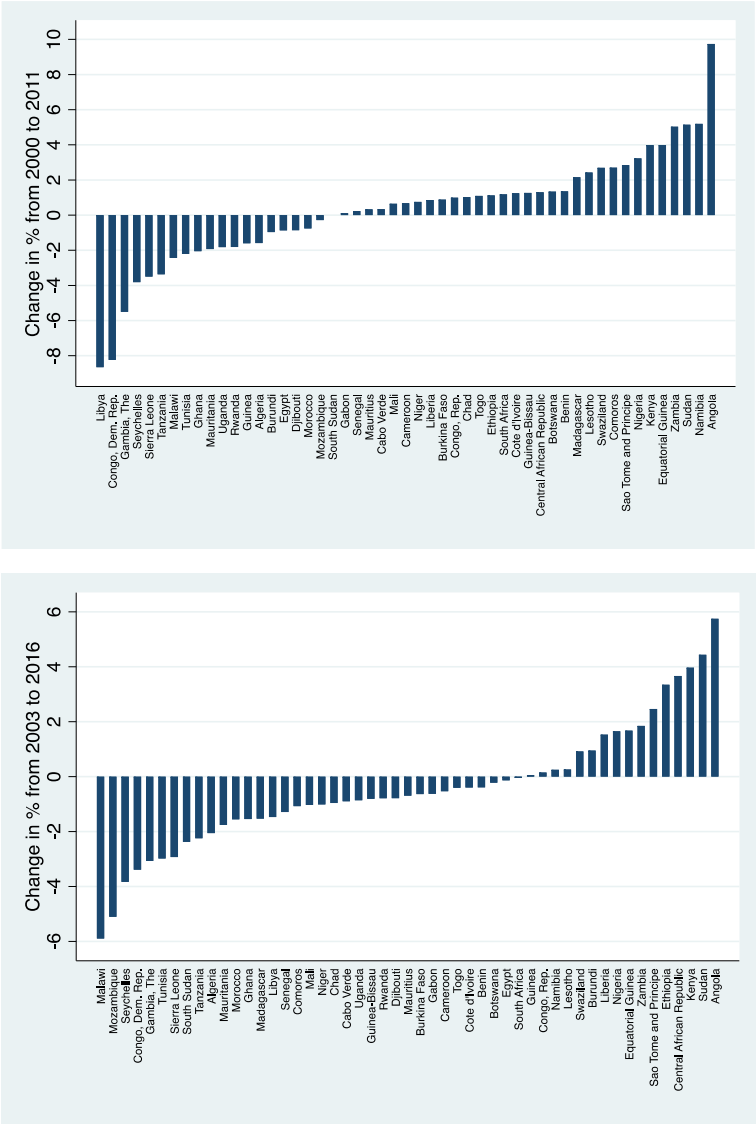
African currencies

The CFA[11] franc is the name of both the currency of the Economic and Monetary Union of West Africa (WAEMU) and the currency of the Economic and Monetary Union of Central Africa (CEMAC). Even though in theory, they are two separate currencies, they are interchangeably one-to-one through the Euro (EUR) because their peg to the French Franc was replaced by their peg to the EUR after the introduction of the EUR in 1999 (Martínez-Zarzoso 2017). Surpassing regular features of a currency union, a gradual implementation of macroeconomic surveillance rules, that resembled those of the European Union, took effect when the CFA franc was devalued in 1994. The main convergence criteria consist of a balanced budget, a debt-to-GDP ratio below 70% and an inflation rate below 3% (Hallet et al. 2008). The eight countries of the WAEMU are Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. The CEMAC consists of six countries, namely Cameroon, Central African Republic, Chad, Republic of Congo, Equatorial Guinea and Gabon. In addition, Comoros' Franc is pegged to the Euro. All countries listed had a relative stable inflation and experienced a real appreciation of their exchange rates relative to China over the period 2000-2011 (Guillaumont Jeanneney & Hua 2014). When modifying this observation period to our sample period from 2003 until 2016 and also considering Cabo Verde and Morocco who peg their currencies to the EUR as well, we find a real appreciation relative to the RMB only for 3 of these 17 countries considered, while most countries with a Euro-peg experience a real depreciation relative to the RMB. This development can be read from figure 5: while the upper panel in the figure replicates the findings of Guillaumont Jeanneney & Hua (2014), the bottom panel shows the change of bilateral exchange rates for the modified period from 2003 until 2016. A changed pattern becomes obvious: while the median of the indicator is positive in the earlier period, it turns negative in the more recent period. From 2000 until 2011, 62% of the national currencies in the sample annually appreciated against the RMB in real terms on average. This share turns to 31% in the time span 2003 until 2016. Possible

[11] CFA stands for the Communaut Financire Africaine (African Financial Community).

reasons for the appreciating trend of the RMB towards African currencies lie in the modified exchange rate regime of the PBC and in the dollar appreciation during recent years.

Figure 5: Change of Chinese-African real bilateral exchange rates



Notes: The graphs show the annual average percentage change of real bilateral exchange rates between African currencies and the RMB over two different time periods. A real appreciation of African currencies against the Chinese currency is shown by positive values. Indicator calculated by the author with data from IMF International Financial Statistics.

Since China adopted a managed floating exchange rate regime in 2005 with decisions

to increasingly widen the floating band in 2012 and again in 2014, the RMB appreciated continuously versus the dollar as expected. Additionally, its main benchmark currency appreciated as well, reinforcing this trend. As a consequence, the EUR depreciated against the RMB until 2015. Common to both observation periods is that all countries whose currencies appreciated versus the RMB in real terms are located in Sub-Saharan Africa.

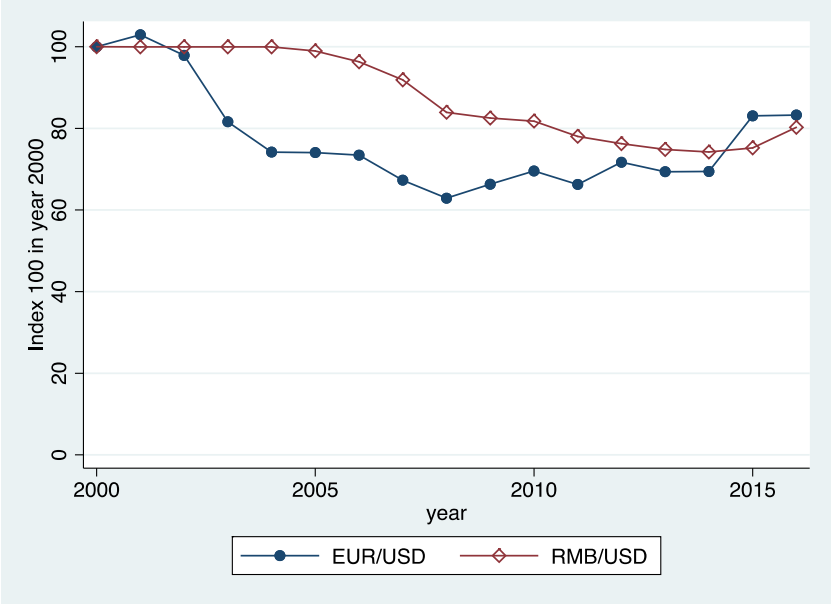
There are only four countries in the sample that have pegged their currencies to the USD, and not all of them did so for the complete sample period. This is unsurprising since the Djiboutian franc is the only African currency strictly and steadily pegged to the dollar. Other countries choose to peg their currency to the USD merely for some years, sometimes with the intention to control high inflation rates (Guillaumont Jeanneney & Hua 2014). Hence, besides Djibouti, Angola (peg from 2005 to 2010), the Democratic Republic of Congo (since 2010) and Eritrea (since 2003) have dollar-pegs in our dataset (Ilzetzki et al. 2017). The exchange rate of the South African Rand versus the USD is relatively stable, applying a floating exchange rate regime. However, the appreciation of the USD also became noticeable in this relationship as the Rand has been depreciating from 2011 until 2016 against the Dollar. Lesotho, Swaziland and Namibia pegged their currencies to the rand (IMF 2016), which all appreciated in real terms against the RMB from 2003 until 2016 according to figure 5. This picture is less distinct for the African currencies temporarily pegged to the USD.

Nominal exchange rates of anchor currencies

Figure 6 shows the development of the nominal exchange rates of the USD expressed in terms of the EUR and in terms of the RMB which are both indexed to 100 in 2000. An increase of the index implies an appreciation of the dollar in this quotation. After the hard peg period of the RMB to the USD until 2004, the Chinese currency appreciated versus the USD by 35% until 2014. Subsequently, the RMB depreciated by 7% relative to the dollar until 2016, hereby ending the phase of continuous appreciation. The valuation effect for the whole observation period therefore was an appreciation by 25% of the RMB versus the USD.

From 2000 until 2008, the EUR appreciated by 60% against the dollar. This strong development was mitigated during the following years with a EUR depreciation by 24% versus the USD from 2008 until 2016, rendering the total valuation effect over the period considered to a EUR appreciation of 20%. Hence, the EUR/USD rate exceeds the RMB/USD rate in 2015 for the first time since 2001 in the observation period. This recent development constitutes a major change from earlier studies on this relationship: from 2000 to 2011, the appreciation of the EUR versus the USD was 51%, while the RMB appreciated by 28% relative to the same base currency (Guillaumont Jeanneney & Hua 2014). The reversal of this relationship is only a recent phenomenon, rendering a renewed examination of the exchange rate's determinant important.

Figure 6: Nominal exchange rates 2000-2016



Notes: Nominal exchange rates, indexed to 100 in 2000. A rise in the index implies a dollar appreciation. Data from IMF's International Financial Statistics database.

3 Empirical Approach and Data

We model the impact of various factors to be presented subsequently in detail on real bilateral exchange rates between the RMB and African currencies by a regression model with log-log specification to enable an interpretation in terms of elasticities. The basic model reads as follows:

$$\begin{aligned} lnRBER_{ijt} &= \alpha_0 + \alpha_1 dollarpeg_{jt} + \alpha_2 europeg_{jt} + \alpha_3 NER€\$ \\ &+ \alpha_4 lnEconCoop_{ijt} + \alpha_5 lnOFDI_{ijt} + \alpha_6 lnAidData_{ijt} + \alpha_7 lnTDF_{ijt} \\ &+ \alpha_8 lnTrade_{ijt} + \alpha_9 lnToT_{jt} + \alpha_{10} lnYK_{jit} + \alpha_{11} RES + \nu_{jt} \end{aligned} \tag{1}$$

$$with \quad \nu_{jt} = \mu_j + \lambda_t + v_{jt} \tag{2}$$

The total sample period T comprises of 14 years. Data availability restricts the number of African economies in the sample which amounts to a maximum of 45 countries. Table A in the appendix has a complete list of all countries included in the estimations.

The dependent variable $RBER_{ijt}$ signifies the real bilateral exchange rate of African countries j relative to China i at time t. The IMF's International Financial Statistics (IFS) database is the source of the annual data on nominal exchange rates of domestic currency of African economies per USD entailing period averages. Data on consumer price indices (CPIs) are also taken from the IFS database with 2010 being the base year. The nominal bilateral exchange rate is the ratio of RMB per USD over the respective African currency per USD. Hereby, the RMB is expressed per unit of African currency, corresponding to the indirect quotation. Hence, an increase of the indicator represents a real exchange rate appreciation of the African currency vis à vis the RMB. Then, the ratio of the respective African CPI over the Chinese CPI delivers the relative price between China and the African economy. The product of the nominal bilateral exchange rate and the relative price is the real bilateral exchange rate. The dummy variables dollarpeg and europeg take the value 1 for currencies

pegged to the dollar or the EUR respectively at time t. They both illustrate the exchange rate regime chosen by the African economies and are compiled using the database of Ilzetzki et al. (2017). Note that both variables are not necessarily constant over time for any country j. $NER€\$$ is taken from the IFS database and represents the nominal exchange rate of the EUR relative to the USD. Hence, its rise signifies the appreciation of the dollar against the euro. $EconCoop_{ijt}$, $OFDI_{ijt}$, and $AidData_{ijt}$ are Chinese capital flows to African countries in the form of economic cooperation activities, outward FDI, and aid projects respectively. The data of $EconCoop_{ijt}$ is taken from various issues of the China Statistical Yearbook. Three issues of the *Statistical Bulletin of China's Outward Foreign Direct Investment* serve as the source for data on Chinese outward FDI (MOFCOM 2009, 2012, 2017). In order not to lose negative FDI values through the log-transformation, we added the maximum negative value of all FDI observations plus 1 before taking the log. AidDatas Core Research Release (Tierney et al. 2011) provides data on official financial flows, i.e. aid. TDF_{ijt} stands for total development finance from international donors and stems from the OECD. All capital flow variables are stated in current levels. Following other studies on the effect of capital flows on the real exchange rate (see Saborowski (2011), Combes et al. (2012), Magud et al. (2014)) but opposed to Guillaumont Jeanneney & Hua (2014)[12], we control for trade. $Trade_{ijt}$ captures the volume of imports and exports between China and the African country j. Its data source is the UNComtrade database. The African countries' international terms of trade are stated by ToT_{jt}. YK_{jit} incorporates the real GDP per capita of the African countries relative to the real GDP per capita of China. The latter two variables are taken from the World Development Indicator (WDI) database of the World Bank. Finally, RES is a dummy variable taking the value 1 for resource-rich economies. The classification of a country as resource-rich is based on its share of fuel and metal exports within the merchandising exports

[12]Guillaumont Jeanneney & Hua (2014) analyze the impact of real exchange rates on Sino-African trade, and thus cannot apply trade to explain real exchange rate movements in a second step without concerns of reverse causality. Nevertheless, the feedback relationship between the trade balance and real exchange rates has to be taken into account in studies on the determinants of trade as well as on the determinants of real exchange rates.

over the sampled period, which we obtain from WDI database. Following IMF (2012), the threshold is set at 20%. In addition to the economies complying with this requirement, 4 of 6 economies identified as resource-rich by Venables (2016) are classified alike in the panel even though they do not meet the threshold in our data. Since 2 (Botswana and Mali) of these 6 economies are rich in diamonds and gold, which is not the kind of resource-abundance we want to track, their resource dummy remained at 0.

Finally, the error term ν_{jt} is composed of the unobserved, time-invariant (fix) country effects μ_j and the cross-sectionally invariant effects λ_t, supplemented by the idiosyncratic error term v_{jt}.

4 Results

In a first step, we estimate the econometric model stated above with three different estimation methods, namely fixed effects, random effects and Hausman-Taylor. The inclusion of time-invariant individual (fix) effects per country in the panel is of distinctive importance, as the levels of the real exchange rates cannot be compared across countries because the over- or undervaluation may have varied in the base year (2010) in the different countries (Guillaumont Jeanneney & Hua 2014). Table 2 reports the results. The coefficients of all variables except for the dummy of resource-richness keep the same sign and approximately the same magnitude across the six specifications.

African currencies pegged to the EUR depreciate around three times more strongly than those pegged to the Dollar, which can be read from the corresponding coefficients ranging significantly from 0.04 to 0.08 for the variable dollarpeg and from 0.20 to 0.24 for the variable europeg. These values resemble strongly those found by Guillaumont Jeanneney & Hua (2014) but with opposing signs. This turn of direction may probably be imputed to the development of the anchor currencies in the years following the sample period of Guillaumont Jeanneney & Hua (2014). $NER€\$$ significantly affects the real bilateral exchange

Table 2: Determinants of real bilateral exchange rates between the RMB and 44 African currencies from 2003-2016

	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed effects		Random effects		Hausman-Taylor	
	dependent variable: log(real bilateral exchange rate)					
dollarpeg	-0.036	-0.073***	-0.042**	-0.077***	-0.035	-0.074
	(0.022)	(0.025)	(0.021)	(0.025)	(0.061)	(0.060)
europeg	-0.219***	-0.203***	-0.244***	-0.236***	-0.220**	-0.208**
	(0.036)	(0.034)	(0.049)	(0.048)	(0.087)	(0.085)
NER€$	-0.936***	-1.395	-0.939***	-1.692*	-0.937***	
	(0.181)	(1.009)	(0.181)	(0.959)	(0.153)	
log(EconCoop)	0.028	0.028	0.031*	0.027	0.028***	0.028**
	(0.019)	(0.018)	(0.018)	(0.018)	(0.009)	(0.011)
log(OFDI)	0.105	0.105	0.109	0.104	0.105	0.104
	(0.109)	(0.121)	(0.111)	(0.119)	(0.066)	(0.065)
log(AidData)	0.003	0.002	0.003	0.002	0.003	0.002
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
log(TDF)	-0.004	-0.006	-0.002	-0.005	-0.004	-0.006
	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)
log(trade)	-0.097***	-0.104***	-0.095***	-0.104***	-0.097***	-0.104***
	(0.028)	(0.031)	(0.027)	(0.030)	(0.015)	(0.016)
log(ToT)	0.090	0.035	0.092	0.036	0.089**	0.035
	(0.081)	(0.071)	(0.080)	(0.070)	(0.040)	(0.041)
log(YK)	0.302***	0.265*	0.331***	0.330**	0.301***	0.280***
	(0.091)	(0.157)	(0.087)	(0.147)	(0.050)	(0.074)
resourcerich	0.000	0.000	-0.029	0.006	0.124	0.141
	(.)	(.)	(0.617)	(0.628)	(0.747)	(0.756)
Constant	-3.519***	-2.940*	-3.497***	-2.582*	-3.548***	-4.200***
	(0.660)	(1.540)	(0.784)	(1.483)	(0.738)	(0.741)
Observations	314	314	314	314	314	314
Countries	44	44	44	44	44	44
R2	0.391	0.447	0.359	0.355		
Time FE	no	yes	no	yes	no	yes

Notes: In the Hausman-Taylor estimations, the following variables are taken as endogenous: europeg, EconCoop, YK.
The symbols ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively. Standard errors in parentheses.

rates between the African currencies and the RMB in a negative way, indicated by a significant coefficient of -0.94. Considering the appreciation of the dollar against the EUR since 2009 and its companionship by an appreciation of the RMB, the depreciating effect of this variable on the real bilateral exchange rates seems consistent.

Turning to the capital flows from China to Africa and their impact on the real bilateral exchange rates, we find only China's economic cooperation activities to significantly increase, hence appreciate them. Again comparing the empirical evidence with the results of Guillaumont Jeanneney & Hua (2014), the elasticity of the real bilateral exchange rates to the inflows of economic cooperation projects of 0.03 slightly exceeds their estimations. Considering the growth rate of China's economic cooperation turnover of 27.72% annually in the time span 2003 until 2016, the moderate statistical impact of this variable turns economically significant with an increase by $0.83\% = 27.72\% * 0.03$ of the real bilateral exchange rates. Translated into the total appreciation seemingly attributable to capital inflows from economic cooperation projects over the sample period, they contributed to real appreciation with 11.64%. While the coefficient for Chinese FDI to Africa remains quite stable around 0.11 throughout all specifications, we find no sign of its statistical significance. Yet, if applied to the the growth rates of FDI flows to Africa of on average 64% annually over the sample period, this value would translate to an increase of the real bilateral exchange rates by 7% in case of significance. The capital flows related to Chinese aid projects in Africa, pictured by the variable AidData, do not reveal a significant impact on the exchange rates with a constantly small coefficient between 0.002 and 0.003, neither do aid inflows from international donors with a small negative coefficient ranging from -0.002 to -0.006.

Openness to trade emerges as highly significant throughout all specifications at a constant level: an increase of the trade volume between China and the African economies in the panel by 1% appears to be associated with a real depreciation by 0.1%. This result corresponds to the theoretical nexus of barriers to trade, i.e. less trade openness, increasing domestic prices and hereby causing a real appreciation. The terms of trade show a positive sign, but

stay insignificant in most regressions. The ratio of GDP per capita of the African countries relative to the Chinese GDP per capita significantly appreciates the real bilateral exchange rates, indicating the Balassa-Samuelson effect.

The time-invariant dummy for resource-richness disappears in the fixed effects regression, which explains the preference for an application of random effects and Hausman-Taylor methods of estimation (Hausman & Taylor 1981). We apply the latter approach which takes the dependency between the country effect and the dependent variable into account. The estimator offers a combination of preferable properties of fixed effects and random effects approaches. Parameters of time-invariant, but country-specific variables can be estimated, and additionally it allows for the consistent and efficient estimation of variables correlated with the specific effects. It does so by using instrumental variables for the endogenous variables and it requires at least one variable to be time-invariant. Deviations from individual means of time-varying variables, individual means of exogenous time-varying variables and levels of exogenous time-invariant variables form the set of instruments (Gardebroek & Lansink 2003).

Accordingly, table 3 reports as initial estimation in column (1) the output already shown in column (6) of table 2 with all capital flows simultaneously. The subsequent columns (2) to (4) contain the results of estimations each including only one kind of capital flow variable at a time, based on the same sample size. Significance and magnitude of the impact of economic cooperation activities, Chinese FDI outflows and Chinese aid flows to Africa remain unchanged. However, OFDI's p-value of 0.11 just misses the significance-threshold why we choose to keep the variable incorporated in the following specifications, but let go of AidData.

In table 4, we present the estimation results for the adapted model specification for different sample variations (see Busse et al. (2016) for a similar approach). The complete sample in column (1) consists of 45 countries in the period 2003 to 2016 with economic cooperation activities as the only capital flow variable to significantly affect the real bilateral

Table 3: Impact of different kinds of capital flows on the real bilateral exchange rates

	(1)	(2)	(3)	(4)
	dependent variable: log(real bilateral exchange rate)			
dollarpeg	-0.074	-0.066	-0.061	-0.056
	(0.060)	(0.060)	(0.060)	(0.060)
europeg	-0.208**	-0.208**	-0.218**	-0.225***
	(0.085)	(0.085)	(0.086)	(0.086)
log(Econ_Coop)	0.028**	0.029***		
	(0.011)	(0.011)		
log(OFDI)	0.104		0.104	
	(0.065)		(0.065)	
log(AidData)	0.002			0.002
	(0.003)			(0.003)
log(TDF)	-0.006	-0.008	-0.009	-0.010
	(0.010)	(0.010)	(0.010)	(0.010)
log(trade)	-0.104***	-0.103***	-0.100***	-0.099***
	(0.016)	(0.016)	(0.016)	(0.016)
log(ToT)	0.035	0.037	0.056	0.055
	(0.041)	(0.041)	(0.041)	(0.041)
log(YK)	0.280***	0.281***	0.308***	0.313***
	(0.074)	(0.074)	(0.074)	(0.074)
resourcerich	0.141	0.137	0.151	0.157
	(0.756)	(0.754)	(0.752)	(0.752)
Constant	-4.200***	-3.266***	-3.692***	-2.999***
	(0.741)	(0.606)	(0.746)	(0.596)
Observations	314	314	314	314
Countries	44	44	44	44
Time FE	yes	yes	yes	yes

Notes: All regressions are estimated with the Hausman-Taylor approach. The following variables are taken as endogenous: europeg, EconCoop, YK.
The symbols ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively. Standard errors in parentheses.

Table 4: Determinants of real bilateral exchange rates, different samples

	(1)	(2)	(3)	(4)
	Complete Sample	Excl South Africa	Sub-Sahara Africa excl. South Africa	Excl Islands
	dependent variable: log(real bilateral exchange rate)			
dollarpeg	-0.142***	-0.146***	-0.155***	-0.146***
	(0.052)	(0.051)	(0.051)	(0.053)
europeg	-0.173***	-0.171***	-0.845	-0.167***
	(0.061)	(0.060)	(0.901)	(0.063)
log(EconCoop)	0.018**	0.017**	0.011	0.019**
	(0.008)	(0.008)	(0.009)	(0.009)
log(OFDI)	-0.007	0.153**	0.140**	-0.007
	(0.015)	(0.062)	(0.066)	(0.015)
log(TDF)	0.008	0.008	0.003	0.013
	(0.008)	(0.008)	(0.009)	(0.009)
log(trade)	-0.072***	-0.073***	-0.075***	-0.071***
	(0.013)	(0.013)	(0.013)	(0.014)
log(ToT)	0.018	0.015	0.016	0.017
	(0.033)	(0.032)	(0.034)	(0.035)
log(YK)	0.215***	0.188***	0.282***	0.235***
	(0.057)	(0.056)	(0.065)	(0.061)
resourcerich	0.000	-0.103	0.000	-0.171
	(0.684)	(0.692)	(0.666)	(0.712)
Constant	-3.154***	-4.157***	-3.998***	-3.014***
	(0.537)	(0.679)	(0.740)	(0.583)
Observations	488	474	412	453
Countries	45	44	38	41
Time FE	yes	yes	yes	yes

Notes: All regressions are estimated with the Hausman-Taylor approach. The following variables are taken as endogenous: europeg, EconCoop, YK.
The symbols ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively. Standard errors in parentheses.

exchange rates. In column (2), we exclude South Africa from the sample. China's motives to trade with and to invest in South Africa diverge from their motives for engagement in other African economies. The bilateral trade between China and South Africa concentrates on non-resource goods. Even though South Africa is one of the main African providers of natural resources for China, non-resource exports predominate with 72% of total exports in 2012 (Busse et al. 2016). Similarly, Chinese FDI in South Africa seem to be less driven by vertical but rather by horizontal motives. Market seeking serves as motivation for Chinese private investors which comes into effect in large markets particularly with relatively high costs of international trade. The results show a significantly positive effect of FDI flows on bilateral exchange rates, surpassing the effect of economic cooperation activities. Particularly Chinese private FDI seem to be more directed towards the service sector than towards natural resources and South Africa ranks second in terms of project numbers among the African host countries for this kind of investment (Chen et al. 2018). Therefore, the exclusion of South Africa from the estimation could increase the share of primary sector FDI in the remaining sample, also considering that the stock of Chinese FDI in South Africa is the highest on the continent with 6.5 billion USD of 39.9 billion USD in Africa (MOFCOM 2017). The share of China's outward FDI stock in the primary sector in Africa was at 26% by the end of 2016 (see table 1). Hence, the empirical evidence may point at appreciation effects of FDI directed at the primary sector which would support the Dutch Disease hypothesis (Botta 2015).

The sample variation confirms the effect of the other variables exhibiting statistical significance as the peg to the EUR, trade openness and the ratio of GDP per capita of the African countries relative to the Chinese one. Surprisingly, by extending the observation period until 2016 by omitting Chinese aid flows (the AidData dataset ends in 2014) in the regressions, the variable dollarpeg approaches the variable europeg in terms of magnitude and significance. This is counterintuitive at fist since the USD started to appreciate nominally against the RMB in 2014 and continued this development until 2016. However, the relative prices

between China and the African economies have to be added to the picture to explain changes in real bilateral exchange rates. In a next step, we restrict our sample to Sub-Saharan Africa without South Africa, excluding 6 North-African economies.[13] Even though the countries North of the Sahara attract Chinese investment and have trade links with China, they differ from those South of the Sahara. Column (3) has the results with outward FDI significantly appreciating the real bilateral exchange rates, while economic cooperation loses its significant effect, as does the variable europeg. Finally, we exclude the islands[14] from the complete sample. Again, the deviation of their economies from the Sub-Saharan economies serves as rationale, especially with respect to their different trade composition (Busse et al. 2016). The corresponding results in column (4) confirm the initial results in column (1).

To verify the results obtained we repeat the estimations in tables 3 and 4 with modified capital flow variables. Following Guillaumont Jeanneney & Hua (2014), we deflate them by import unit values which we obtain from UNCTADstat. Section B in the appendix has the corresponding results in tables 5 and 6. Signs and significance of the capital flows are confirmed with the exception of FDI missing the significance threshold in the Sub-Saharan sample withour Sout-Africa. Hence, we can rule out the possibility of the effects to be only driven by price effects.

5 Conclusion

This paper contributes to the small literature on the determinants of Sino-African real bilateral exchange rates with a special focus on Chinese capital flows to African economies. To this end, we take three different forms of capital flows into account, namely FDI, economic cooperation projects, and foreign aid. Opposed to many existing studies on the effects of Chinese aid flows to Africa (see for example Sanfilippo (2010), Guillaumont Jeanneney & Hua (2014), Busse et al. (2016)), we do not approximate aid with economic cooperation

[13]The North-African economies excluded from the sample are Algeria, Djibouti, Egypt, Libya, Morocco, and Tunisia.

[14]The four African islands in our sample comprise of Cabo Verde, Comoros, Madagascar and Mauritius.

because of concerns regarding its suitability (Brautigam 2011). Therefore, we use a new dataset provided by AidData to incorporate foreign aid in our estimations in addition to capital flows out of economic cooperation projects. To complete the picture, we add the third main channel of China's activities in Africa besides FDI and aid to the regressions as a control variable, which is bilateral trade.

Our empirical findings indicate that Sino-African capital flows out of economic cooperation projects contribute to a real appreciation of African currencies relative to the RMB. This effect is surpassed by FDI flows to the panel of African economies only when South Africa is excluded. Otherwise, neither FDI flows, nor aid flows from China to African economies significantly affect real bilateral exchange rates. The decision of some African economies to peg the domestic currency to the EUR also impacts real bilateral exchange rates, but in the direction of depreciation. This constitutes a major change to the study by Guillaumont Jeanneney & Hua (2014) who find a EUR-peg to contribute to a real appreciation of bilateral exchange rates in a panel covering the period 2000-2011. The continuous appreciation of the USD against all major currencies towards the end of our observation period together with the role of the USD as main benchmark currency for the management of the RMB until mid 2015 could provide an explanation for this changed pattern. Hence, the EUR-peg is not necessarily any longer an obstacle in the competition with China on manufactured goods as identified as such by Guillaumont Jeanneney & Hua (2014). The valuation of the USD to the EUR is now less decisive for the competitive position of African economies relative to China via the RMB.

Bilateral trade volume also contributes to a depreciation of the real bilateral exchange rates as theoretically expected, while the difference in productivity between African economies and China contributes to a real appreciation. The appreciation following economic cooperation activities of China in Africa may deteriorate the trade balance of African countries with China since imports become cheaper. Therefore, even though the improvement in infrastructure through economic cooperation provides growth opportunities for African countries

(Guillaumont Jeanneney & Hua 2014), its effect on trade via the exchange rate may obstruct growth by limited possibilities to diversify domestic production and export structure.

The appreciative effect of Chinese FDI flows to African economies under the exclusion of South Africa could be a hint at symptoms of financial Dutch Disease as described by Botta (2015). Accordingly, mounting FDI into the primary sector of a small developing, resource-rich country leads to a real appreciation as a first step. Next, further capital inflows are attracted and sudden-stops become more likely, causing macroeconomic instability. While no real appreciation in reaction to primary sector FDI could be found in a mixed panel of developing and developed, as well as resource-rich and resource-poor countries in a previous study (Frenzel Baudisch 2018), the panel of the present study is more likely to meet the preconditions of a financial Durch Disease. However, sectoral data of Sino-African FDI flows on country-level are needed to investigate these effects more thoroughly.

These conclusions bear political implications for the recipient economies of Chinese capital flows. To diminish the appreciative effect, a contribution of the inflowing capital to the local industrial sector is critical. Hereby, an increase of capital is accompanied by an increase in productivity and the impact on the real exchange rate diminishes, reducing the risk of Dutch Disease. This does not necessarily coincide with the interests of China as investment in the domestic industrial sector of African host economies comes along with a more diversified traded goods structure and less need for Chinese manufactured imports. However, African economies facing the risk of a recession as a consequence of real appreciation do not necessarily sustain the import quantities of the past, which should be weighed against these possible concerns.

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Appendix

A List of countries in the sample

Algeria (2003, 2007-2016), Angola (2006-2016), Benin (2006-2015), Botswana (2006-2014, 2016), Burundi (2009, 2012-2015), Cabo Verde (2005-2008, 2010, 2013-2014, 2016), Cameroon (2003-2015), Central African Rep. (2010-2011, 2013-2016), Chad (2005- 2015), Comoros (2010, 2012), Congo, Dem. Rep. (2003-2013), Congo, Rep. (2004-2015), Côte d'Ivoire (2003-2015), Djibouti (2007, 2009-2011, 2013-2015), Egypt (2003-2015), Equatorial Guinea (2003-2012, 2016), Ethiopia (2003-2015), Gabon (2004-2005, 2009-2016), Gambia, The (2003, 2014), Guinea (2004-2016), Kenya (2003-2015), Lesotho (2004-2005, 2008-2012, 2014-2015), Liberia (2003-2006, 2008-2015), Libya (2005-2011), Madagascar (2003-2015), Malawi (2007-2008, 2010-2015), Mali (2003, 2006-2015), Mauritania (2003, 2005-2015), Mauritius (2004-2005, 2007-2016), Morocco (2004-2016), Mozambique (2007-2015), Namibia (2003-2016), Niger (2004-2016), Nigeria (2003-2016), Rwanda (2005-2016), Senegal (2003, 2007-2015), Seychelles (2005, 2007-2016), Sierra Leone (2006-2009, 2011-2016), South Africa (2003-2016), Sudan (2004-2011), Tanzania (2004-2015), Togo (2003-2015), Tunisia (2006-2007, 2009-2016), Uganda (2003-2016), Zambia (2003-2015).

B Robustness Tests

Table 5: Impact of different kinds of deflated capital flows on the real bilateral exchange rates

	(1)	(2)	(3)	(4)
dependent variable: log(real bilateral exchange rate)				
dollarpeg	-0.071	-0.065	-0.060	-0.057
	(0.060)	(0.060)	(0.061)	(0.060)
europeg	-0.212**	-0.210**	-0.219**	-0.223***
	(0.086)	(0.085)	(0.086)	(0.086)
log(Econ_Coop_deflated)	0.024**	0.024**		
	(0.011)	(0.011)		
log(OFDI_deflated)	0.037		0.037	
	(0.054)		(0.054)	
log(AidData_deflated)	0.002			0.002
	(0.003)			(0.003)
log(TDF_deflated)	-0.011	-0.012	-0.013	-0.014
	(0.010)	(0.010)	(0.010)	(0.010)
log(trade)	-0.103***	-0.103***	-0.100***	-0.099***
	(0.016)	(0.016)	(0.016)	(0.016)
log(ToT)	0.033	0.035	0.060	0.058
	(0.042)	(0.042)	(0.040)	(0.041)
log(YK)	0.283***	0.280***	0.306***	0.308***
	(0.074)	(0.074)	(0.074)	(0.074)
resourcerich	0.151	0.148	0.161	0.165
	(0.756)	(0.754)	(0.752)	(0.753)
Constant	-3.428***	-3.184***	-3.219***	-3.004***
	(0.692)	(0.601)	(0.683)	(0.594)
Observations	314	314	314	314
Countries	44	44	44	44
Time FE	yes	yes	yes	yes

Notes: All regressions are estimated with the Hausman-Taylor approach. The following variables are taken as endogenous: europeg, EconCoop, YK. The symbols ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively. Standard errors in parentheses.

Table 6: Impact of deflated capital flows on real bilateral exchange rates, different samples

	(1)	(2)	(3)	(4)
	Complete Sample	Excl South Africa	Sub-Sahara Africa excl. South Africa	Excl Islands
dependent variable: log(real bilateral exchange rate)				
dollarpeg	-0.141***	-0.146***	-0.155***	-0.144***
	(0.052)	(0.051)	(0.051)	(0.053)
europeg	-0.175***	-0.176***	-0.853	-0.170***
	(0.061)	(0.060)	(0.888)	(0.063)
log(EconCoop_deflated)	0.016**	0.016**	0.011	0.016*
	(0.008)	(0.008)	(0.009)	(0.009)
log(OFDI_deflated)	-0.011	0.083*	0.073	-0.010
	(0.016)	(0.050)	(0.055)	(0.016)
log(TDF_deflated)	0.005	0.006	0.001	0.010
	(0.008)	(0.008)	(0.009)	(0.009)
log(trade)	-0.071***	-0.072***	-0.074***	-0.070***
	(0.013)	(0.013)	(0.013)	(0.014)
log(ToT)	0.013	0.011	0.015	0.010
	(0.033)	(0.033)	(0.034)	(0.036)
log(YK)	0.215***	0.192***	0.290***	0.236***
	(0.057)	(0.057)	(0.065)	(0.061)
resourcerich	0.005	-0.009	0.000	-0.168
	(0.684)	(0.692)	(0.664)	(0.711)
Constant	-2.992***	-3.585***	-3.627***	-2.923***
	(0.544)	(0.618)	(0.660)	(0.580)
Observations	488	474	412	453
Countries	45	44	38	41
Time FE	yes	yes	yes	yes

Notes: All regressions are estimated with the Hausman-Taylor approach. The following variables are taken as endogenous: europeg, EconCoop, YK.
The symbols ***, ** and * denote statistical significance at the 1, 5 and 10 per cent level respectively. Standard errors in parentheses.