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US and China Aid to Africa: Impact on the Donor-Recipient Trade Relations

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US and China Aid to Africa: Impact on the Donor-Recipient Trade Relations*

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Abstract

This paper investigates the impact of the US and China's foreign aids to Africa on trade flows between donor and recipient countries. Evidence from the gravity model estimates reveals that the two donors' exports are strengthened by their aids to African partners. Interestingly, China's aid shows a positive effect on its total volume of trade and imports from Africa, while the aid from the US exhibits little impact on the US-Africa total trade and its imports from Africa. A possible explanation for such a difference could be due to the dissimilar national interests of donors in Africa. This study finally suggests that African countries should accelerate the pace of advancing domestic economies and rely less on foreign assistance, in order to establish a fairer and more equal international economic order.

JEL Classification: F35, P33

Keywords: Foreign aid, Aid-trade relations, Gravity model

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1. Introduction

The literature on aid-trade relationship shows that foreign aid promotes bilateral trade flows between donor and recipient countries, with effects vary over time but also depending on the national interests of the donor (Chenery and Strout, 1966; Nowak-Lehmann D et al., 2009; Osei et al., 2004; Pettersson and Johansson, 2013). Continuous inflow of foreign aid improves the donor-recipient bilateral economic relationship that may help accelerate trade flows between the two sides. However, there are still many underlying factors that account for such kind of effect. One would like to explore further if foreign aid boosts the overall trade or there are different impact on the donor-recipient's inflow and outflow of goods and services. The objective of this paper is therefore to investigate the impact of foreign aid on different trade flows between donor and recipient countries.

Since the Official Development Assistance (ODA) was coined by the Development Assistance Committee (DAC) of the Organization for Economic Co-operation and Development (OECD) in 1969, African countries have received a large share of the total ODA disbursement owing to their persistently disappointing economic performance. As the largest donor in the global aid market, the US aid policy in Africa is well known for its conditionality¹ and selectivity (Burnside and Dollar, 2000). By contrast, China, the largest emerging competitor to traditional donors, always offers unconditional aid to African partners and pursues mutual benefits based on the framework of South-South cooperation. The US aid to Africa increased by appropriately four folds in the past two decades, see Figure 1. The cumulative Chinese foreign aid to Africa reached 130 billion USD during 2000-2013.² But there are criticisms about China's unconditional aid to Africa, which is seen as the resistance to the Western countries' work on the improvement of governance and democracy in Africa. Moreover, China is often accused of despoiling natural resources from Africa for its growing influence in Africa. In the context of an ever-increasing China's presence in Africa, the US-China contest in the African continent is becoming increasingly intense. On such an occasion, this paper is therefore interested in the impact of the US and China's aid to Africa on different bilateral trade flows between US/China and African countries.

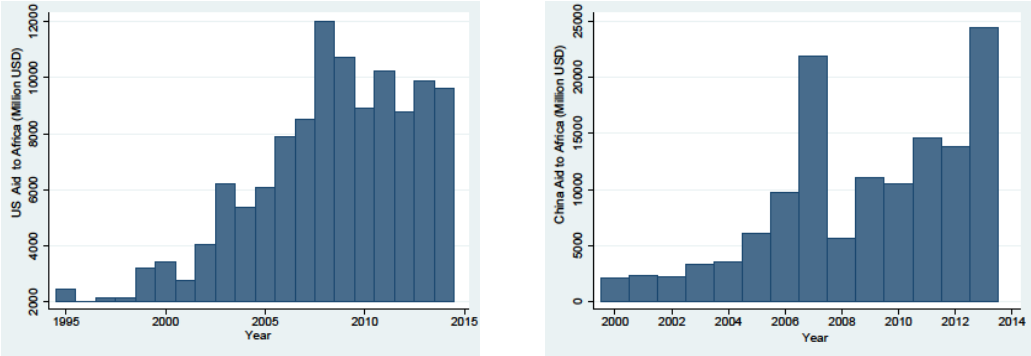
In the existing literature, the gravity model has been a popular paradigm for measuring the impact of foreign aid on trade, since the gravity framework and theoretical foundations of this model can incorporate any time invariant factors that may affect trade, i.e., distance, freedom of trade and governance indicators (Anderson, 1979; Anderson and van Wincoop, 2003; Bergstrand, 1985). This

¹ Conditionality means that aid is only given following conditions which have to be met by the recipient country, i.e. good governance and democracy.

² The cumulative Chinese aid to Africa data is calculated by the author according to the 1.2 version of AidData's Chinese Official Finance to Africa dataset which tracks 2,648 development finance activities in Africa from 2000 to 2013. Chinese Official Finance to Africa dataset is collected from the AidData.

general proposed specification is more adequate as it provides a rationale for any unobserved (time invariant) bilateral effect (Carrere, 2006). Therefore, all factors that affect bilateral trade which are captured by unobserved constant individual effects can be controlled.

Figure 1: US and China Aid to Africa



Source: OECD DAC Creditor Reporting System and AidData's Chinese Official Finance to Africa Dataset

In this paper, following Anderson and van Wincoop (2003) and Baier and Bergstrand (2007) and many others, we apply the gravity model to explore the impact of US and China’s aids to Africa on different bilateral trade flows between donor and recipient countries, including the effects of aid on bilateral total trade, donors’ exports to and imports from recipients. Our sample includes two donors (US and China) and 26/30 recipient countries (26 for the US sample and 30 for China sample) covering the period 2003-2012. With regard to the econometric method, we first adopt a pooled OLS to investigate the aid-trade relationship, then we apply the fixed and random effects model to control for unobserved individual heterogeneity that is constant over time. Concerning the lagged effect of bilateral trade data, we finally use the first-differenced GMM specification to estimate the gravity model.

The main finding of this study is that the Chinese aid shows a positive impact on the China-Africa bilateral trade, but the US aid does not exhibit any influence on the bilateral trade between the US and African countries. When examining the effects of foreign aid on donor’s exports to recipients, both the US and China’s aids present a positive impact on their exports to African economies. This could be explained by the fact that recipient nations import more products from the donor for returning the favor or the donor provides tied aid³ to the recipient. Interestingly, a positive effect on China’s imports from African partners is found resulting from China’s aid, while the US aid does not show any impact on the US imports from Africa. This further implies that only when official aid programs are established on the premise of mutual benefit can a positive impact on the donor-recipient trade relationship be expected.

³ Tied aid means that foreign aid is often tied to the donor country exports or linked to the achievement of specific foreign policy objectives.

The remaining parts of this paper are organized as follows: Section 2 reviews relevant literature on China's foreign aid and the impact of aid on trade. General background of the US and China aid to Africa and the donor-recipient trade relations are given in Section 3. Section 4 discusses the theoretical model and econometric methods. Section 5 describes the data. Empirical results and discussions are detailed in Section 6 and the last section concludes.

2. Relevant Literature

2.1 US and China's Foreign Aids

2.1.1 US Foreign Aid

The US has made efforts to offer foreign aid to the rest world more than a half century, as it is viewed as a key tool of US foreign policy (Tarnoff and Lawson, 2009). Foreign aid comes in the form of either bilateral or multilateral (Gunatilake et al., 2011). Currently, the US aid is mainly bilateral, i.e. the US provides aids to a specific recipient country (Tarnoff and Lawson, 2009). The US aid is primarily conducted by the United States Agency for International Development (USAID), with non-government organizations (NGO) acting as the primary partners alongside. Since the foundation in the 1980s, NGO channel has played a significant role in delivering the Western aid (Opoku-Mensah, 2009). Regarding the sectoral focus, the key focus of the US aid in Africa is the social sector, like the education and health sectors (Wang and Ozanne, 2010; Amusa et al., 2016).

Foreign aid has been acting as a significant role in improving the global economic environment, which eventually promotes the US exports and its global power. The empirical studies of Nowak-Lehmann et al. (2013) and Martínez-Zarzoso et al. (2014) reveal that the US exports to developing countries are positively associated with its bilateral aid. However, the exports of recipient countries are not promoted by the aid (Nowak-Lehmann et al., 2013). With respect to the behavior of different donors, there are some comparative works on the aid allocation of US and other donors (Alesina and Dollar, 2000). Harrigan and Wang (2011) compared the aid allocation of US with the other major donors and found that the US attaches more importance on its national interests than the others do. With a comparative approach, Amusa et al. (2016) empirically studied the aid allocation of US and China to Sub-Saharan Africa (SSA). The findings indicate that, (1) both the recipient needs and donor interests are important factors in determining the US and China's aid allocation; (2) China provides aid to the region for the sake of nature resource, while the US pays more attention to its global power.

2.1.2 China's Foreign Aid

Researchers are increasingly shifting their interests into China's foreign aid with China's ever-increasing presence in Africa. While it comes to the Chinese aid, it is mainly bilateral (Opoku-Mensah, 2009; Lengauer, 2011), and its aid to Africa is no exception either (Lum, et al., 2008). Unlike the US aid, the Chinese aid does not rely on the NGO channel (Opoku-Mensah, 2009), it is primarily provided by the government or relied on the official channel. Considering the sectoral focus, Chinese aid focuses on infrastructure, innovation, exports and health (Amusa et al., 2016). Gharib (2013) found that more than 70% of Chinese aid is geared towards infrastructure construction. Over 30% of the total value of infrastructure projects in Africa is supported by the Chinese aid, which outweighs the Western donors. China's aid to Africa is not used as a political tool in the same way as that of Western donors, but more commercial and win-win cooperation (Sautman, 2005).

Tied aid is one of the characteristics of Chinese aid in Africa (Wang and Ozanne, 2010) and a tool used by China to reach its specific economic and political goals, especially in the African continent (Pehnelt, 2007). To examine the claim that China's aid is characterized by "rogue aid" that guided by selfish interests alone, Dreher and Fuchs (2015) empirically tested to what extent self-interests shape China's aid allocation, based on the data on Chinese project aid, food aid, medical staff and total aid money to developing countries from 1956 to 2006. The evidence suggested that China's aid allocation does not depend on recipients' endowment with natural resources. Therefore, it is unjustified to condemn China's aid as "rogue aid". This is also supported by Brautigam (2009).

Africa, as the main recipient of China's aid, has drawn massive attention from academics probably due to its strategic importance for the balance of global powers. Chinese aid to Africa is the guarantee of mineral resources and potential markets for trade and investment (Brookes and Shin, 2006; Ajakaiye, 2006; Taylor, 2009). However, Ajakaiye (2006) found that the majority of Chinese aid is used to rehabilitate infrastructure and development new ones, such as hospitals, school buildings and sports stadiums. Aid without policy conditionality is considered as a major advantage of China's aid in Africa, while there are still many challenges, for instance, Chinese workers and suppliers implied in the aid, and infrastructures are not genuinely designed to support local production related activities like the African Union Headquarters. Kobayashi (2008) argued that China's aid without conditionality but being tied is to assist Chinese firms to expand their operations overseas. China's aid to Africa, in the form of "barter" with recipients' natural resources, is an efficient instrument that benefits both the donor (China) and the recipients (African countries). Babaci-Wilhite et al. (2013) discussed the attributes of good aid architecture in relation to the peculiarities of Africa's challenges. They suggested that the Beijing Consensus, with the principles of multidimensional, intrinsic and non-economic roles of development aid, is more generous and more attractive for sustainable development in Africa. In terms of the failure of the aid to Africa from traditional donors, Moyo (2009) attributed it

to the conditionality that is incompatible with the local community. In contrast, as the indispensable trade partner of Africa, China's aid benefits the two parties. In spite of this, the "Chinese-style development-assistance model" is still subjected to criticism from the West (Kobayashi, 2008). More recent evidence shows that African economies receiving additional aid flows from China enhance their fiscal response to aid through an increased local economy aid absorption rate (Kilama, 2016).

2.2 Impact of Aid on Bilateral Trade Flows

2.2.1 Transfer Paradox

There has been an extensive literature on the impact of foreign aid on trade flows. Early discussions on the aid-trade relationship can be dated back to the transfer paradox, which states that foreign aid can be donor-enriching and recipient-immiserizing due to terms-of-trade effects associated with aid flows (Martínez-Zarzoso et al., 2014). As an income transfer, foreign aid affects the welfare of both the donor and the recipient countries. Brecher and Bhagwati (1981) conducted the transfer problem analysis in a 3-country model by distinguishing national income from aggregate income. They found that national welfare might deteriorate even when international commodity-market is stable. Brecher and Bhagwati (1982) and Bhagwati et al. (1983) extended the theoretical presumption of the transfer paradox with more general settings. Kemp and Kojima (1985) attributed the donor-enrichment and recipient-impoverishment to the endogenous price distortion. Moreover, Munemo et al. (2007) argued that the effect of foreign aid on the economic activity of a country can be dampened due to potentially adverse effects on exports resulting from real exchange rate appreciation.

Instead, Abe and Takarada (2005) found the condition under which the donor suffered from the tied aid while the recipient benefited from it, i.e. there is no inferior good in the donor country. However, both the donor and the recipient will benefit from the transfers at the expense of the rest world (Gale, 1974; Lahiri and Raimondos, 1995). Kim and Kim (2016) considered foreign aid as a public good and examined the equilibrium aid strategies lying behind foreign aid provision. They showed that tied aid with higher exclusivity will increase the recipient's welfare under an ineffectively worked international aid coordination mechanism, while untied aid with lower exclusivity will improve both donors' and recipients' welfare under a cooperative fashion. Unfortunately, it is difficult to distinguish between tied aid and untied aid. Since the tying percentage is only available as an aggregate figure for each donor, while it is unknown for each recipient (Wagner, 2003).

2.2.2 Impact of Aid on Donors' Trade Flows

Donor self-interested and altruistic objectives are often linked to foreign aid, for instance, the political and economic interests of donors outweigh the developmental needs of the recipients (Hoeffler and

Outram, 2011). The main reason that donors provide aid to developing countries is to facilitate their exports to aid-recipient countries (Nowak-Lehmann et al., 2009). Hence, studies concentrate on the effects of aid on donors' exports.

There are a variety of aid mechanisms promoting the exports from donors to recipients. Arvin and Choudhry (1997) and Arvin and Baum (1997) differentiated tied aid from untied aid and found that untied aid is the catalyst of exports. They attributed it to goodwill for the donor in the recipient country generated by untied aid. Lloyd et al. (2000) argued that aid flows may create donor exports either due to the general economic effects on the recipient, or the direct aid-trade link, or the reinforced bilateral economic and political links, or a combination of all three. Using an intertemporal model of trade, Djajić et al. (2004) investigated the impact of aid on donor-recipient exports. The findings suggest that, in the presence of habit formation or "goodwill" effects, aid may serve to shift preferences of the recipient in favor of the donor's future exporting goods due to the terms-of-trade effect. So when the effect is sufficiently large and the real interest rate is sufficiently low, the donor's intertemporal gain would be positive. Therefore, development aid could lead to an increase in the donor's exports for the following reasons: (1) "tied aid" effect; (2) habit-formation effects; and (3) "goodwill" effects (Martínez-Zarzoso et al., 2009).

To evaluate the effect of aid on trade, the gravity model of trade is a prevailing theoretical framework (Anderson, 1979; Bergstrand, 1985; Anderson and van Wincoop, 2003). Extending the work of Anderson and van Wincoop (2003), Silva and Nelson (2012) modeled the trade flow in an asymmetric structure and derived a positive significant impact of aid on exports from the donor to the recipient. This effect was widely examined in the literature (Nilsson, 1997; Wagner, 2003; Martínez-Zarzoso et al., 2014). Similarly, Martínez-Zarzoso et al. (2009) applied a static and dynamic gravity model of trade to investigate the link between German exports and development aid. The results demonstrated that German aid has a positive effect on German exports.

In addition, there is a large body of literature that deviates from the gravity model framework. Using a dataset covering 137 recipient countries and the 22 donors of DAC of the OECD, Berthélemy (2006) revealed that most donors behave in a rather egoistic way, i.e. they provide aids to the most significant trading partners. Based on more extensive data of 168 recipient countries and 22 DAC donors, Hoeffler and Outram (2011) also found that DAC donors provide more aid to trade partners by controlling for time-invariant donor and recipient effects. However, Lloyd et al. (2000), examining data on 4 European donors and 26 African recipients, found little evidence that aid creates trade even tied aid, which is also proved by Osei et al. (2004), who extended the analysis to more countries.

2.2.3 Impact of Aid on Recipients' Trade Flows

The above mentioned studies mainly focus on the exports of donors. Studying the impact of aid on recipients' trade flows is another analysis perspective. In this field, [Chenery and Strout \(1966\)](#) revealed that foreign assistance can fill the saving gap (the gap between investment and saving) and trade gap, and further raises exports. Under Harrod-Domar context, [Hjertholm et al. \(1998\)](#) found that foreign aid would close the recipient's saving gap and trade gap, but with certain conditions: (1) financial and technical support for mobilization of domestic savings to close the saving gap ; and (2) export growth in excess of import growth to close the trade gap. In terms of the empirical modelling, the gravity model is widely accepted in the existing literature. [Pettersson and Johansson \(2013\)](#) and [Nowak-Lehmann et al. \(2010\)](#) showed that development aid is positively associated with recipient exports. Since aid enhances good bilateral trade relations, mutual trust and familiarity, which reinforce bilateral trade ([Nowak-Lehmann et al., 2010](#)).

Focusing on specific types of aid, [Helble et al. \(2012\)](#) found that aid for trade is positively associated with recipient exports, while other aid flows, are negatively associated with recipient exports. To assure that the change in recipients' trade can be traced back to the change in foreign aid, [Nowak-Lehmann et al. \(2013\)](#) attributed it to the role played by unobservable or unquantifiable characteristics that affect donor-recipient relations, such as reputation, mutual trust and support, goodwill and familiarity as well as customer relations, distribution channels and a better adaptation to the formal and informal market environment. However, they did not find significant effect of aid on exports of recipient countries in an empirical perspective.

In view of recipients' imports, [Kruse and Martínez-Zarzoso \(2016\)](#) considered the foreign aid as a transfer instead of being part of the trade cost in the augmented [Anderson and van Wincoop \(2003\)](#) model, and found that the aid shifts the budget constraint outwards and increases the recipients' purchasing power, hence, causing additional imports. [Lloyd et al. \(2000\)](#) studied the aid and trade flows from UK, France, Netherlands and Germany to 26 African countries over 1969 to 1995, and the results show little evidence of linkage existence between aid and recipients' imports. Furthermore, [Osei et al. \(2004\)](#) found that even tied aid will not increase imports.

In general, the existing literature about the impact of foreign aid on trade predominantly focuses on exports, but attention has been paid to the aid-import relationship, especially from the donors' perspective. In terms of the empirical specification, the gravity model of trade is considered as the prevailing framework, which has been persistently getting theoretical and empirical improvement. Geographically, Africa is widely examined in the literature due to its developing status quo, and related donor countries are usually the European economies for the colonial relatives with African countries. As the two largest economies in the world, both the US and China are offering aid to Africa in line with their strategic plans that may be related to their demands on natural resources from Africa.

Nonetheless, there is little empirical comprehensive research on the comparison of both the US and China's aid to Africa and their aid-trade relationships from a dynamic perspective. Our study is filling the gap in the literature and contributing to better understand the motivation of the aid from US and China to Africa.

3 Donor-Recipient Trade Relations

3.1 US-Africa Trade Relations

The bilateral economic ties between the US and Africa strengthened after the end of the apartheid era in South Africa in the early 1990s (Jones and Williams, 2012). In subsequent years, the Administration and Congress implemented several measures and developed legislation to improve the US-Africa trade relations, such as the African Growth and Opportunity Act (AGOA) approved by the Congress in 2000. Since the initial enactment, AGOA has made a great contribution to the trade between US and Africa. Trade volume between US and beneficiaries doubled during the period 2001-2014.⁴ Nevertheless, the US-Africa trade volume totaled only 53 billion USD in 2015, just more than one third of the peak value in 2008 (146 billion USD).

According to the Economist,⁵ Africa has a population of 1.1 billion and six of the world's ten fastest-growing economies. Africa therefore has been an important strategic area to the US. No matter where it stands politically or economically, the US involvement in Africa has seen an ever increasing pace in recent years, and foreign aid is a crucial instrument to maintain US influence in the African continent. The Development Fund for Africa (DFA), established by the Congress in 1988, is essentially a permanent earmark of economic development funds for Sub-Saharan Africa. The Agency for International Development spent 800 million USD in DFA funds in 1993, which would be used to fund various AID activities, including direct cash assistance to support imports (Sheehy and Foundation, 1993). At the Conference on Financing Development in Monterrey held in March 2002, US announced the "Millennium Challenge Account" with the injection of a 5 billion USD fund that was designated for the poorest developing world. In addition, the Congress was set to provide the administration with 2.4 billion USD for HIV/AIDS programs in 15 countries, primarily in Africa and the Caribbean region. It is well known that most unstable countries are from the African continent.⁶ Hence, strategically assisting only a few African countries is a key feature of the US aid to Africa. In

⁴ Trade volume between US and beneficiaries decreased sharply in 2009, which was possibly due to the spillover effects of the global financial crisis.

⁵ The Economist. "Africa's impressive growth", Jan 6th 2011. http://www.economist.com/blogs/dailychart/2011/01/daily_chart (accessed May 10, 2016).

⁶ According to the Fragile States Index 2017 of the Fund for peace, among the ten most unstable countries, six are African countries. Unstable factors are related to poverty, which is a big threat to the safety of US, even the world.

2014, US provided approximately 9.3 billion USD aid to Africa, more than half of which is to Sub-Saharan Africa.

As the largest economy on the planet, the US consumes more natural resources than any other large economy in the rest world. The US continuously aids Africa in the hope that bilateral trade relations between the two could be enhanced, as the US needs to ensure its development of international trade, especially importing nature resources from African countries. In 2014, among the US top ten largest aid recipients, four of them are the largest trading partners of the US in Africa (see Table 1).⁷

Table 1: US Top Ten Largest Trading Partners and Aid Recipients in Africa (2014) (Million USD)

	Aid Recipient	Value	Trade Partner	Value	Importer	Value	Exporter	Value
1	Kenya	807.37	South Africa	14.83	Egypt	6.47	South Africa	8.47
2	South Sudan	796.07	Nigeria	9.90	South Africa	6.37	Angola	5.84
3	Ethiopia	664.84	Egypt	7.95	Nigeria	5.97	Algeria	4.79
4	South Africa	515.02	Angola	7.88	Algeria	2.62	Nigeria	3.94
5	Tanzania	509.01	Algeria	7.41	Morocco	2.10	Chad	2.38
6	Nigeria	485.59	Morocco	3.16	Angola	2.04	Egypt	1.48
7	Uganda	470.07	Chad	2.45	Ethiopia	1.67	Côte d'Ivoire	1.24
8	Mozambique	395.38	Kenya	2.25	Kenya	1.64	Morocco	1.05
9	Congo, D.R.	385.06	Ethiopia	1.88	Ghana	1.19	Gabon	0.83
10	Zambia	321.06	Côte d'Ivoire	1.47	Togo	1.02	Kenya	0.61

Source: UN Comtrade and OECD.

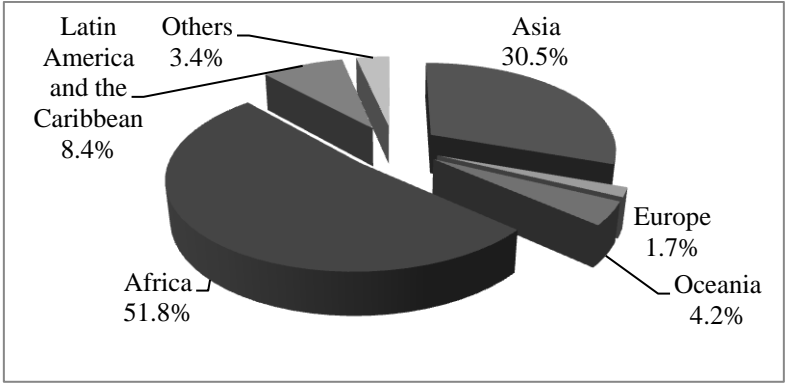
3.2 Sino-Africa Trade Relations

Sino-Africa trade relations can be dated back to the first Han emperors in the Second Century B.C. (Renard, 2011). Since the establishment of the People's Republic of China in 1949, Sino-Africa trade has increased dramatically, especially after China's opening up in 1978. The opening up of the Chinese economy was accompanied by the fast-growing trade with African countries. In the late 1990s, China's remarkable economic performance made policy-makers realize that the future continuous supply of natural resources is needed in order to maintain a stable growth (Busse et al., 2014). Africa, with huge market potential and abundant nature resources, has become a strategically important region for China. Moreover, China's "going-global" strategy, a further shift in the open-door policies, was also a key factor impacting Sino-African economic relations. To encourage foreign trade and outward foreign direct investment, a series of incentive measures including easy access to bank loans, simplified customs procedures, and preferential policies for taxation, importing and exporting were provided to Chinese firms (UNCTAD and UNDP, 2007). In 2000, the First Forum on China-Africa Cooperation (FOCAC) was held in Beijing and passed the Program for China-Africa Cooperation in

⁷ To be coherent with the China-Africa trade data, the US-Africa trade data in 2012 is given in appendix Table A. 1, which also supports the argument above.

Economic and Social Development. Since then, Sino-Africa economic relations have surged. The value of total Sino-Africa trading volume was just 8.9 billion USD in 2000. In 2009, it reached 70.4 billion USD that surpassed the US-Africa trading value (62 billion USD). From then on, China has been the largest trading partner of Africa for the successive eight years. The Sino-Africa trading volume reached 149 billion USD in 2016, more than fourteen times the level in 2000.

Figure 2: 2000-2012 China’s Foreign Aid Allocation



Source: White Paper on China’s Foreign Aid (2014)

China has been focusing on the development of South-South cooperation in pursuit of an equal and mutual development. One way to build the mutual trust is to offer foreign aid to African countries, and in return, the trade relationship between China and African economies has ever prospered. Over the past decade, China’s aid to Africa has increased in line with the surging Sino-Africa trade. According to the White Paper on China’s Foreign Aid 2014, more than 50% of China’s aid was provided to African countries, see Figure 2. The main fields where China is most active in Africa are infrastructure and construction projects (Busse et al., 2014). China normally provides aid in the forms of grants, zero-interest loans and preferential loans. On the sixth Forum on China-Africa Cooperation in 2015, China’s president Xi Jinping committed a total of 60 billion USD investments to Africa, including 5 billion USD for grants and zero-interest loans, 35 billion USD for concessional loans and buyer’s credit, and the remaining for commercial financing. In addition, ten overarching plans for Sino-Africa cooperation were proposed on the summit, one of which is the trade and investment facilitation. China will carry out fifty aid-for-trade programs to improve Africa’s capacity, both “software” and “hardware”, to promote trade and investment between the two sides. On the Belt and Road Forum in May 2017, China promised again to provide assistance worth 60 billion RMB (8.7 billion USD) in the coming three years to developing countries and international organizations participating in the Belt and Road Initiative, which will facilitate connectivity and achieve unimpeded trade.

The foreign aid projects in Africa supported by the Chinese government, are often associated with trade activities (Biggeri and Sanfilippo, 2009). Among China’s top ten largest aid recipients, six of

them are China's largest trading partners in Africa in 2012 (see Table 2). For instance, the Republic of Congo received a total of 3 billion USD aid from China in 2012. At the same time, it is China's major trading partner in Africa in terms of both the volumes of total trade and imports. This is an example of aid-trade relationship that reflects the strategic interaction between China and Africa.

Table 2: China's Top Ten Largest Trading Partners and Aid Recipients in Africa (2012)(Million USD)

	Aid Recipient	Value	Trade Partner	Value	Importer	Value	Exporter	Value
1	Congo	3006	South Africa	6.00	South Africa	15.32	South Africa	44.65
2	Tanzania	1748	Angola	3.76	Nigeria	9.30	Angola	33.56
3	Ethiopia	1565	Nigeria	1.06	Egypt	8.22	Libya	6.38
4	Nigeria	1258	Egypt	0.95	Algeria	5.42	Congo	4.56
5	Egypt	1131	Libya	0.88	Ghana	4.79	Congo, D.R.	3.53
6	Cameroon	6579	Algeria	0.77	Angola	4.04	Zambia	2.69
7	Angola	5158	Ghana	0.54	Liberia	3.45	Algeria	2.31
8	Kenya	3696	Congo	0.51	Togo	3.38	Sudan	2.05
9	Mozambique	3257	Congo, D.R.	0.44	Morocco	3.13	Equatorial Guinea	1.82
10	Sudan	2475	Sudan	0.37	Kenya	2.79	Mauritania	1.47

Source: UN Comtrade and AidData.

4. The Gravity Model and Econometric Methods

4.1 The Augmented Gravity Model

The gravity model is becoming increasingly popular in international trade studies, as it relates bilateral trade flows to gross domestic product (GDP), distance and many other factors that affect trade barriers (Anderson and van Wincoop, 2003). Typically, the log-linear gravity model specifies the trade flow from one country to country, that could be jointly interpreted by economic forces at the original country, economic forces at the destination country, and other economic forces that may either assist or resist the movement of the trade flow from origin to destination (Bergstrand, 1985). Following Anderson and van Wincoop (2003), Carrere (2006) and Baier and Bergstrand (2007), we construct an augmented gravity model to investigate the effects of US and China aid to Africa on the donor-recipient trade relations.

$$\text{Trade}_{ij} = \beta_0 (\text{ODA}_{ij})^{\beta_1} (\text{GDP}_{ij})^{\beta_2} (\text{FDI}_{ij})^{\beta_3} (\text{DIST}_{ij})^{\beta_4} e^{\beta_5 (\text{Tfree}_i)} e^{\sum_{k=1}^k \delta_k z_i^m} \varepsilon_{ij} \quad (1)$$

Where Trade_{ij} is the aggregate merchandise trade flow from donor country j to recipient country i , ODA_{ij} is the value of official development assistance (ODA) from country j to country i , GDP_{ij} is the difference of per capita GDP between countries i and j ,⁸ FDI_{ij} is the stock of foreign direct investment (FDI) of country i from country j , DIST_{ij} is the distance between countries i and j , Tfree_i represents the

⁸ We include the difference of per capita GDP in the model to observe the impact of relative purchasing power on the donor-recipient trade relations.

freedom of trade in country i ,⁹ z_i^m is the six Worldwide Governance Indicators (WGI) for country i , including voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption, e is the natural logarithm base, and ε_{ij} is the error term that is assumed to be log-normally distributed.¹⁰ In this study, country i designates recipient countries and country j represents donor countries (US and China).

Formal theoretical foundations for a gravity model similar to Equation (1) appeared since the 1970s, for instance, [Anderson \(1979\)](#), [Bergstrand \(1985\)](#), [Eaton and Kortum \(2002\)](#) and [Anderson and van Wincoop \(2003\)](#). Theoretically, these papers have a common feature in highlighting the important role of price levels, i.e. bilateral or multilateral price indexes. The omitted variables bias like ignoring prices in the cross-section gravity model is concerned by [Anderson and van Wincoop \(2003\)](#) and [Baier and Bergstrand \(2007\)](#). Based on their framework, the suggested gravity model of the augmented form in Equation (1) can be transformed into the following:

$$\ln \left[\frac{\text{Trade}_{ij}}{\text{GDP}_{ij}} \right] = \beta_0 + \beta_1 \ln \text{ODA}_{ij} + \beta_3 \ln \text{FDI}_{ij} + \beta_4 \ln \text{DIST}_{ij} + \beta_5 \text{Tfree}_i + \sum_{k=1}^k \delta_k z_i^m - \ln p_i^{1-\sigma} - \ln p_j^{1-\sigma} + \varepsilon_{ij} \quad (2)$$

The minimization of Equation (2) is subject to:

$$p_j^{1-\sigma} = \sum_i^N p_i^{\sigma-1} (\text{GDP}_i / \text{GDP}_G) e^{\beta_1 \ln \text{ODA}_{ij} + \beta_3 \ln \text{FDI}_{ij} + \beta_4 \ln \text{DIST}_{ij} + \beta_5 \text{Tfree}_i + \sum_{k=1}^k \delta_k z_i^m} \quad (3)$$

Where $p_j^{1-\sigma}$ refers to multilateral price resistance terms, GDP_G is the global GDP, constant across countries. As suggested by [Anderson and van Wincoop \(2003\)](#), the system can be estimated applying a custom nonlinear least square method assuming all $p_j^{1-\sigma}$ as endogenous variables. But this approach has a complex computational process that is not preferred by many researchers ([Anderson and van Wincoop, 2003](#); [Baier and Bergstrand, 2007](#)). An alternative and computationally easier approach to account for multilateral price levels in cross section data could be a country specific fixed effect that could also generate unbiased estimates ([Anderson and van Wincoop, 2003](#); [Wagner, 2003](#); [Baier and Bergstrand, 2007](#)).

⁹ Existing studies have complex discussions about trade barriers between countries, such as [Anderson and van Wincoop \(2003\)](#) and [Carrere \(2006\)](#). For simplicity, we use the degree of trade freedom of the destination which measures a wide rarity of trade barriers that affect trade flow, instead of the barriers to trade.

¹⁰ The existing literature has different theoretical foundations for the gravity model, e.g., the incorporation of exporter and importer populations or GDPs for each country. Theoretical foundations of this alternative model still need to be refined. This is beyond the scope of this study, but it is an issue discussed by [Anderson \(1979\)](#), [Bergstrand \(1985\)](#) and [Anderson and van Wincoop \(2003\)](#).

4.2 Econometric Modelling

Following [Anderson and van Wincoop \(2003\)](#), [Wagner \(2003\)](#) and [Baier and Bergstrand \(2007\)](#), we use country fixed effects to account for endogeneity bias from bilateral or multilateral price terms. The log-linear version of Equation (1) has the following form:

$$\ln\text{Trade}_{ij,t} = \beta_0 + \beta_1 \ln\text{ODA}_{ij,t} + \beta_2 \ln\text{GDP}_{ij,t} + \beta_3 \ln\text{FDI}_{ij,t} + \beta_4 \ln\text{DIST}_{ij,t} + \beta_5 \text{Tfree}_{i,t} + \sum_{k=1}^k \delta_k z_{i,t}^m + \varepsilon_{ij,t} \quad (4)$$

In Equation (4) we add the time subscript t to express time variations of related terms from the donor country to the recipient country. As the data set contains repeated observations over time for countries, we can control for unobserved individual heterogeneity that is constant over time.¹¹

$$\ln\text{Trade}_{ij,t} = \beta_0 + \beta_1 \ln\text{ODA}_{ij,t} + \beta_2 \ln\text{GDP}_{ij,t} + \beta_3 \ln\text{FDI}_{ij,t} + \beta_4 \ln\text{DIST}_{ij,t} + \beta_5 \text{Tfree}_{i,t} + \sum_{k=1}^k \delta_k z_{i,t}^m + \eta_{ij} + \varepsilon_{ij,t} \quad (5)$$

Rewrite the above equation as:

$$y_{ij,t} = x'_{ij,t} \beta + \eta_{ij} + \varepsilon_{ij,t} \quad (6)$$

Where $y_{ij,t}$ is $\ln\text{Trade}_{ij,t}$, $x'_{ij,t}$ is a group of explanatory variables ($\ln\text{ODA}_{ij,t}$, $\ln\text{GDP}_{ij,t}$, $\ln\text{FDI}_{ij,t}$, $\ln\text{DIST}_{ij,t}$, $\text{Tfree}_{i,t}$ and $z_{i,t}^m$), η_{ij} is the unobserved constant individual effects, $i=1, \dots, N$, $j=1, \dots, M$, $t=1, \dots, T$. We restructure Equation (5) as: $y_{ij,t} = x'_{ij,t} \beta + u_{ij,t}$, and $u_{ij,t} = \eta_{ij} + \varepsilon_{ij,t}$. We assume $E(\varepsilon_{ij,t}) = 0$, $E(\varepsilon_{ij,t} | x_{ij,t}) = 0$. The random effects specification further assumes that $E(\eta_{ij}) = 0$ and $E(\eta_{ij} | x_{ij,t}) = 0$. It means that the individual effect η_{ij} is uncorrelated with regressors $x_{ij,t}$. The Generalized Least Squares (GLS) estimator takes into account the dependence of the error term within individual over time by weighting the observations on the basis of a consistent estimate of variance-covariance matrix.

However, the more likely and interesting case is that the unobserved individual effects are correlated with explanatory variables: $E(\eta_{ij} | x_{ij,t}) \neq 0$. In such a case, the GLS estimator is biased and inconsistent. A possible solution is to estimate the model with a separate intercept for each individual by OLS. Since $\eta_{ij} = \bar{y}_{ij} - \bar{x}'_{ij} \beta - \varepsilon_{ij}$, β parameters can be estimated the transformed, within group model by OLS:

¹¹ The gravity model has two inherent limitations. On the one hand, the selection of control variables is important for the empirical estimates. Our selection of control variables is appropriate for this study. On the other hand, the selection of instrument variables determines the model performance. Each instrument variable in this study has been carefully examined and the results prove the validation of those instrument variables.

$$y_{ij,t} - \bar{y}_{ij} = (x_{ij,t} - \bar{x}_{ij})'\beta + (\varepsilon_{ij,t} - \bar{\varepsilon}_{ij}) \quad (7)$$

For fixed effects (or the within group estimator), therefore, only the effects of variables that change over time can be estimated. The fixed effects estimator is unbiased when the $x_{ij,t}$ in all periods are uncorrelated with the $\varepsilon_{ij,s}$ in all periods: $E(x_{ij,t} \varepsilon_{ij,s}) = 0$, for $s=1, \dots, T$, $t=1, \dots, T$. Usually, the Hausman test is used to examine whether the unobserved heterogeneity is correlated with the regressors. It is given by: $H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' [\widehat{\text{Var}}(\hat{\beta}_{FE}) - \widehat{\text{Var}}(\hat{\beta}_{RE})]^{-1} (\hat{\beta}_{FE} - \hat{\beta}_{RE})$. If H is large, random effects estimator is rejected in favor of the fixed effects estimator.

Considering that bilateral trades are usually dependent on the previous trades, a dynamic model specification with the following form is introduced (Arellano and Bond, 1991):

$$y_{ij,t} = \alpha y_{ij,t-1} + x'_{ij,t} \beta + \eta_{ij} + \varepsilon_{ij,t} \quad (8)$$

Where in this equation, β is the short-run effect and $\frac{\beta}{1-\alpha}$ is the long-run steady state effect. $y_{ij,t}$ is clearly correlated with unobserved heterogeneity. The OLS estimator is biased upwards and the fixed effects estimator is biased downwards. An instrumental variables estimator that uses this information optimally is the Generalized Method of Moments (GMM) estimator. Valid instruments are lagged levels $y_{ij,t-2}, y_{ij,t-3}, \dots, y_{ij,1}$, since $E(y_{ij,t-2}(\varepsilon_{ij,t} - \varepsilon_{ij,t-1})) = 0$. The GMM estimator adopts the moment condition to estimate the parameters consistently and efficiently in two steps. The Sargan and Hansen tests are commonly used to test the validity of the instruments (Arellano and Bond, 1991).¹²

5. Data Description

Bilateral trade data covering the period 2003-2012 between US/China and African countries are used in this study. Specifically, bilateral trade data of 26 African economies for the US and 30 for China were collected.¹³ Data on bilateral exports and imports are obtained from the United Nations Comtrade Statistics Database. Following Pettersson and Johansson (2013), we use reported exports and imports, for instance, Angola's imports from China are China's exports to Angola which are reported by China. Total trade is the sum of exports and imports between donors and recipients. For the US, ODA data are obtained from the OECD Statistics, which provides ODA commitments and disbursements for OECD-DAC members. Since we focus on the impact of ODA on trade, our analysis only considers disbursements rather commitments data. Data on China's ODA can be collected from the AidData. US and China's FDI stock are provided by the United Nations Conference on Trade and Development

¹² The null hypothesis for the test is that the instruments are valid in the sense that they are not correlated with errors in the first-differenced equation.

¹³ There is no problem of data inconsistency as we are running panel data estimations by donor.

(UNCTAD) and the Statistical Bulletin of China's Outward Foreign Direct Investment, respectively.¹⁴ Per capita GDP are taken from the World Development Indicators (WDI) Online database. We are mainly interested in the impact of relative purchasing power on trade, hence, the absolute difference of per capita GDP between countries i and j is used in our analysis. Geographical distance between capital cities¹⁵ is from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) database. Trade freedom data are provided by the Heritage Foundation. Data on voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption are taken from the World Bank's Worldwide Governance Indicators (WGI) online database. Economic development level (Ecolevel) is given the values 1-4 if the country belongs to low-income, lower-middle-income, upper-middle-income and high-income countries, respectively. It is consistent with the classification in the *World Development Report 2014* released by the World Bank.¹⁶ Detailed variable definition and data sources are given in appendix **Error! Reference source not found.** Table 3 presents summary statistics of the variables during 2003-2012 for the US and China, respectively.

Insert Table 3 about here

6. Empirical Analysis

We now turn to the empirical analysis of the effects of aid-to-Africa on the bilateral trade relationship between US/China and Africa. In this section, we are not only interested in the impact of aid on the total trading volume, but also an insight into the exporting and importing behaviors of donors, i.e., whether the donors are dumping products to Africa or importing natural resources from Africa. To observe the short-run and long-run effects of foreign aid on bilateral trade, both static and dynamic specifications are estimated.

¹⁴ Missing values for FDI stock data are replenished via the normalization method:

$$FDI_{new} = (FDI_i - \mu_{FDI}) / \sigma_{FDI}.$$

¹⁵ Following Helpman et al. (2007), we use geographical distance between capital cities. With the development of transportation, the different distance measures seem to make no difference.

¹⁶ The classification is in line with the World Bank's criterion based on the country's GNI per capita in 2012. A country with a GNI per capita of 1035 USD or less is referred as a low-income economy; a country with a GNI per capita of more than 1035 USD but less than 4086 USD is regarded as a lower-middle-income economy; a country with a GNI per capita of more than 4086 USD but less than 12616 USD is considered as a upper-middle-income economy; and a country with a GNI per capita of 12616 USD or more is treated as a high-income economy. The Economic development level (Ecolevel) is only used as an instrument variable in the GMM estimation, therefore it is not list in the summary statistics of Table 3.

6.1 Findings on the US-Recipient Trade Relationship

6.1.1 Impact on Total Trade

Table 4 reports the estimates of the impact of US aid to Africa on the bilateral trade. The linear regression model (4) is estimated firstly using OLS (see column 1). The coefficient associated with the variable of interest, aid (lnODA), is statistically insignificant. This might imply that the aid to Africa does not exhibit significant impact on the US-Africa total trading volume, which could be due to the inefficiency of the pooled linear regression model.¹⁷ The OLS results do little about the problem of unmeasured variables that affect both trade and aid volumes between countries.

To control unobserved individual heterogeneity, model (6) is estimated and the results are shown in columns 2-3. The Hausman test indicates that the fixed effects model is preferred. However, no significant impact can be found on the total trade between US and its recipient countries. It implies that the US aid to Africa is not an indispensable catalysts for the bilateral trade relation, which conforms to the practice. These results seem not to support the assumption that aid increases trade. A possible reason could be that trade benefits of foreign aid are not only limited to the current year.

Dynamic model (8) with lagged terms of dependent variable (trade) and aid and FDI, is estimated using first-differenced GMM to avoid the problems of omitted variable and reverse causality. In Table 4, the model diagnostics show that the first difference GMM model is correctly specified and the instruments we use are valid.¹⁸ The coefficients of lnODA and L.lnODA capturing the effects of foreign aid on bilateral trade between the US and Africa in the short- and medium-run are still statistically insignificant. This could be explained by the priority of the strategic and security interests of the US. Additionally, the lagged terms of trade (L.lnTrade and L2.lnTrade) are insignificant, which further proves that the trade relationship is not the main intention for the US aid to Africa. For remaining regressors, such as the governance indicators and other macroeconomic conditions, some of the control variables show significant impact on trade flows. But in this study, we take them as

¹⁷ Strong serial correlations exist in the regression residuals (not reported). This indicates the inappropriateness of the pooled regression model.

¹⁸ The instrument variables used are the lagged term of dependent variable, the lagged term of independent variables (lnFDI, lnGDP and lnODA), lnDIST, Tfree and Ecolevel. In the panel data analysis, the lagged terms of endogenous independent variables are usually used as instrument variables. On the one hand, they are related to endogenous independent variables. On the other hand, they are predetermined and unrelated to the error term. While Tfree and Ecolevel are also met the two conditions above. Moreover, lagged dependent variable and lnDIST are strictly exogenous. Without special statement, the instrument variables employed in the following sections are like that used here, and the model diagnostics show that the first difference GMM model is correctly specified and the instruments we use are valid.

exogenous when we analyze the impact of foreign aid on the donor-recipient trade relationship. Hereafter, the effects of these control variables are not discussed.

Insert Table 4 about here

6.1.2 Impact on US Exports to Africa

In terms of the impact of US aid on its exports to Africa, the estimated coefficient for aid ($\ln ODA$) is positive and statistically significant at the 1% level in the linear regression test as shown in the first column of Table 5. This implies that the US exports to Africa has benefited from its aid to Africa. However, the serial correction test indicates the misspecification of the linear regression model (not reported for brevity).

Columns 2-3 report results of fixed effects and random effects models, respectively. The Hausman test shows the preference for the random effects model. The estimates from random effects model reveal that the effects of US aid on US exports to Africa is lower, falling to 0.07, but still remains significantly different from zero in this case compared to the OLS estimates regardless of the model misspecification. The result suggests that a 1% increase in the US aid to African countries increases US exports to African partners by about 0.07%.

Dynamic model (8) with lagged terms of the dependent and independent variables, including aid and per capita GDP, is estimated to explore the long-run effects of aid on exports. It is puzzling that the aid coefficient is high but barely significant for the US exports to Africa compared with random effects result. The lagged exports also do not exhibit any impact on US exports to Africa. One might believe that trade benefits from aid would persist because customer/supplier relationships have been established (Wagner, 2003), but the result suggests that the trading relationship establishment is valueless.

Insert Table 5 about here

6.1.3 Impact on US Imports from Africa

Table 6 presents the estimates of the effects of US aid on US imports from Africa. A negative but insignificant coefficient for aid ($\ln ODA$) is found from the OLS estimator, which means that US imports from Africa are not affected by US aid to African countries. The pooled OLS regression does little about the problem of unmeasured variables that affect both imports and aid volumes between countries. When controlling for unobserved individual effects, the estimated coefficient of interest, foreign aid ($\ln ODA$), is still negative and scarcely significant. As indicated by the Hausman test, the

fixed effects model is preferred. However, the dynamic effects should be considered to confirm the insignificant impact of US aid to Africa on its imports from the African recipients.

Taking into account the dynamic effects, foreign aid remains showing its negative but relatively stronger effect on US imports from Africa compared with fixed effects estimator. Nevertheless, the statistical significance of the aid coefficient is unchanged. The insignificant coefficient for foreign aid might be due to the reason that the motivation of promoting foreign trade between the two sides is not as strong as the strategic and security needs for the US, despite the fact that the US is trying to secure oil and energy supplies from Africa. Interestingly, the one-period lagged term of imports is significantly negative, but the two-period lagged term of import becomes insignificant. The results might imply that the preceding US imports from Africa would hamper the current imports.

Insert Table 6 about here

6.2 Findings on the China-Recipient Trade Relationship

In line with the preceding section, both the static and dynamic models are estimated for the total trade flow between China and Africa. As we are interested in investigating if China's aid to Africa promotes more exports to African recipients, or imports more (natural resources) from Africa. Therefore, the same approaches are applied to estimate the impact of China's aid on its exports to and imports from Africa, respectively. Tables 7-9 report the main estimation results for distinguishing the aid-trade relations with different model specifications.

6.2.1 Impact on Total Trade

We start from the linear regression test of the impact of China's aid to Africa on the bilateral total trade. The evidence shows that the impact of China's aid is positive and significant in the pooled OLS, as shown in Table 7, but the linear regression model does not account for individual unobserved heterogeneity and there also exists severe serial correlations. In contrast to the OLS estimator, the fixed effects or random effects model can eliminate the unobserved effects, as discussed in the methodology section. Moreover, the R-squared value of the OLS estimates is lower than that of the fixed effects and random effects model results, indicating that the latter models are more appropriate than the former one. Concerning the choice between fixed effects and random effects models, the Hausman test is rejected. It means that the fixed effects model is favored in this case. We are interested in the coefficient of foreign aid. The estimated within group coefficient indicates that a 1% increase in China's aid to Africa raises bilateral trade by 0.037%, which is much smaller in magnitude than the OLS estimates. Nevertheless, it is still positive and significant at the 5% level.

The estimates of the first differenced GMM model are also presented in Table 7. The results reveal that the current flow of foreign aid impedes total trade between China and African recipient countries. An upturn of China's aid to Africa by 1% decreases bilateral total trade by 0.04%. While the one-period lagged term indicates a significant and positive effect on bilateral trade. The overall effect of foreign aid on bilateral trade is therefore confirmed with the dynamic specification, with an increase of 10% in aid increases bilateral trade by about 0.21% (-0.4% plus 0.61%), which is mainly determined by the one-period lagged term of foreign aid. It implies that the current aid to Africa from China does not promote the bilateral total trade. As time goes by, the preceding foreign aid appears to have a positive impact on bilateral trade. This could be explained by the following three reasons: (1) once a trading relationship has been created by the aid, the relationship may yield additional transactions, e.g., follow-up work, supplies, upgrades, or complementary products; (2) future transactions resulting from reduced costs; and (3) strengthened ability for customers and suppliers to transact with other enterprises in the customer's/supplier's country. Interestingly, the one-period lagged trade shows significant and positive effect on current trade volume between China and African recipients, while the two-period lagged term exhibits significant but negative effect. The former coefficient is larger than the later one in magnitude, which is in line with our expectations.

Insert Table 7 about here

6.2.2 Impact on China's Exports to Africa

Table 8 reports the results of the impact of aid on China's exports to African economies. The aid coefficient is positive and statistically significant at the 1% level in the OLS results, but we tend to reject the analysis since the existence of serial correlation. Both the fixed effects and random effects estimation results present positive effects of aid on China's exports to Africa, which is consistent with the findings of the existing literature. [Swee-Hock \(2007\)](#) saw it as the result of expanding exports of equipments and goods by China's aid program. The Hausman test seems to accept that fixed effects estimator is more preferred. The evidence suggests that a 1% increase in aid leads to an upturn of approximately 0.05% in China's exports to Africa.

The GMM model estimates in Table 8, which take into account the lagged effects of foreign aid and exports, reveal that aid has a positive but insignificant impact on China's exports to Africa. However, the one-period lagged term displays positive and statistically significant coefficient at the 5% level. It means that foreign aid would not exhibit any impact on China's exports to Africa immediately, but affect the exports in the next period. It could be explained by the following reasons. First, the aid-induced growth implies a greater capacity of the recipient country to absorb foreign products, including those originating from donors ([Suwa-Eisenmann and Verdier, 2007](#)). Second, foreign aid

can generate good-will and familiarity effects that promote donor's exports (Martínez-Zarzoso et al., 2014). Nonetheless, these effects may take time. Along this line, aid flows are likely to promote more international trade flows in the recipient country in the medium-run and even long-run. As expected, the overall impact of lagged term of exports is positive and significant, but the coefficient on the two-period lagged exports is negative.

Insert Table 8 about here

6.2.3 Impact on China's Imports from Africa

By looking at the impact of China's aid on its imports from Africa, we can understand if the aid program has enhanced China's imports from the African counterparts, which could be the strategic plan of the Chinese authorities. The OLS estimation results in Table 9 indicate that aid has a positive and significant impact on China's imports from Africa, which implies that China's aid is a catalyst for Chinese imports from Africa.

To control for unobserved individual effects, fixed effects and random effects models are estimated. The Hausman test indicates the preference of the fixed effects model. It is worth noting that the estimated within coefficient of aid is positive but insignificant. Despite that, it does not mean that aid has no effect on China's imports from Africa, as it may play a role in promoting the imports in the following periods.

As discussed previously, a dynamic model based on the specification (8) with the inclusion of lagged terms of aid is estimated to capture the time-varying effects of aid. The results are presented in Table 9, indicating that the present aid does not have any impact on China's imports from Africa, but a positive effect appears to be significant in the following period, which can be explained by the establishment of trading relationship resulting from aid. As expected, the one period lagged imports exhibits positive impact on China's imports from Africa.

Insert Table 9 about here

6.3 Discussions

As for the methodology employed in the previous section, OLS, which is prevailing to estimate the gravity model in the related literature, is firstly used to estimate linear regression model (4). To control unobserved individual heterogeneity, fixed effects and random effects estimators are given then. Furthermore, considering the lagged term of dependent variable in the dynamic model, difference-

GMM is applied. The estimators from both the static and dynamic perspective would ensure the reliability and robustness of the results.

With reference to the impact on total trade, strong and positive effects are shown in the Chinese aid, but not in the US aid. This indicates that trade interests are more crucial to China than the US. Furthermore, lagged effects of Chinese aid on total trade are observed in the empirical results. For the US, we do not observe any significant effects of aid on trade. An explanation for the difference might be due to the economic development stages. China is still a developing country with a low per-capita income and a large poverty-stricken population. For this reason, the need of economic development is much more important. In reality, foreign trade is a key element of Chinese economic activities as it has contributed to approximately 50% of the Chinese GDP since China joined the WTO. Foreign aid policy reflects China's national priority in terms of economic interests.¹⁹ China's aid to Africa is in line with China's Africa Policy, which is also important for China's "package deals" to Africa (Busse et al., 2014). Being the largest donor in the aid market, trade interests in the US aid are not as important as that in China's aid, but aid is indispensable for the US to protect its existing global structure of power and wealth (Johansen, 2014). Despite the trade interest of aid is not as important as the strategic and security interests for the US in the current global climate, it used to play a significant role in enhancing US foreign trade, e.g., the Marshall Plan.²⁰ However, the first US-Africa Leader Summit held in 2014 implies that the core of the US policy in Africa is shifted from security concerns into economic development opportunity.

It is worth noting that donor's exports to recipients are positively correlated with foreign aid, both for the US and China. However, the positive effects are much more significant and long-lasting in the case of China. We tend to attribute it to the following three reasons. First of all, Chinese aid, provided without any political conditions attached, could avoid the foreign aid dilemma from Western countries²¹ and is more effective in generating long run growth (Wang and Ozanne, 2010). Hence, China's aid is more likely to be accepted by African countries. Secondly, government subsidized concessional loans and project joint ventures are the specific initiative of "Grand aid" policies for investment and trade (Shimomura and Ohashi, 2013). Through infrastructure projects and revenue

¹⁹ Sun, Y. China's Aid to Africa: Monster or Messiah? Brookings East Asia Commentary. No. 75 of 88, February 2014. Available at: <http://www.brookings.edu/research/opinions/2014/02/07-china-aid-to-africa-sun> (accessed May 24, 2016).

²⁰ The Marshall Plan was an American initiative to aid Western Europe by offering economic support of 13 billion USD to help rebuild Western European economies after the end of World War II. One goal of the plan was to remove trade barriers. Because of the operation of Marshall Plan, the fastest period of growth in European history was seen during the years 1948 to 1952. In addition, economic prosperity of Western European provided vast market for the American products, which was pivotal for alleviating the destruction of economic crisis in the US.

²¹ Conditional aid provided by the West unduly penalizes countries at the bottom, e.g. most African countries are worse off than they were at independence after decades of ever increasing aid for Western countries.

creation, China's aid contributes to the long-term economic development of African countries. Finally, both the US and China have implemented a policy of tied aid. The members of OECD-DAC agreed to remove tied aid since 1995 due to the increasing cost and low efficiency. But the Chinese experience indicates that tied aid has the advantage of facilitating learning by doing and learning by implementing projects (Lin and Wang, 2015). Hence, most Chinese development assistance is tied. Although the US tied aid had reduced from 72% in 1996 to 54% in 2006 and to 36.8% in 2014, it remains common among the US foreign aid programs. In addition, the reduction of tying percentage does not mean the decline of trade benefits, since a majority of the de facto beneficiary of the aid are domestic firms from donor countries (Kim and Kim, 2016).

Concerning the effects of foreign aid on donors' imports, a positive long-run impact is indicated in China's aid, while it does not appear in the case of US. China currently faces a huge demand-supply gap of resource and energy, so does the US. Even so, more strategic concerns are related in US aid, which is serving the national interests. China's aid is provided within the framework of South-South cooperation. China's development needs Africa, in particular the natural resources while Africa has benefited from the capital and technology input from China as well. China's aid, based on the basic principles of equality and mutual respect, has been keeping the promise of mutual benefits and win-win. However, it has to be admitted that China's foreign aid policy is indeed an internationally controversial issue. Many resource-rich African countries suffer from serious political problems, such as authoritarianism, poor governance and corruption. Chinese aid, without conditionality, is said to hamper good governance in Africa (Wang and Ozanne, 2010). Besides, China's aid is usually accused of plundering the African continent's natural resources. For instance, the "Angola-model" is disputable for China's swapping infrastructure projects for mineral resources. Nevertheless, China's aid indeed contributed to the awakening of fast-growing African "lion economies" (Habiyaemye, 2013).

7. Conclusions

The purpose of this paper is to compare the effects of US and China's foreign aid to Africa on the donor-recipient trade relationships. Specially, it focuses on the effects of foreign aid on different trade flows between the donor and the recipient, including total trade, exports and imports. The key findings are summarized as follows. First, only a positive effect of foreign aid on the US exports to Africa is found in the short-run. The findings are consistent with the notion that foreign aid boosts exports, particularly in the donor countries. Whereas, the total trade between US and Africa and the US imports from Africa are not affected by the US aid due to its strategic concerns. Second, China's aid exhibits a positive effect on the trade flows with African recipients, not only on total trade but also on exports and imports. Third, promoting bilateral trade is the main interest for China to aid the African counterparts. China's foreign aid, provided within the framework of South-South cooperation to

integrate the interests of Chinese people with people of other countries, is a mutual beneficial and win-win activity for both sides, and also serves to balance the interests of China and its African partners. Although China is the second largest economy, it is still a developing country with a low per-capita income and a large poverty-stricken population. China needs to boost its exports and secure natural resources from Africa. China provides unconditional aid to Africa, and in return, African countries import more Chinese products and export their abundant natural resources to China. For the US, its foreign aid used to be a catalyst to boost bilateral trade in history, whereas its trade interests are currently overtaken by the strategic and security interests.

The empirical evidence seems to suggest that a positive relationship between aid and trade would be expected if China insists on its existing foreign aid policy, and the bilateral ties will be strengthened as well. Thus, these results are applicable to other regions of the world. While for the US, the results might be different and can hardly be generalizable to other parts of the world due to its offer of conditional aid to recipient nations. More importantly, the intention behind the tied aid might be different, such as natural resources and political interference tied to the aid to Africa and the Middle East, but political and military influence to the Asia-pacific nations. Therefore, the impact of the US aid to other regions should be explored case by case.

The findings of this paper have important policy implications. The empirical results show that both the US aid and China's aid have a significantly positive impact on their exports to Africa, while there is a lack of evidence for the positive impact of US aid on total trade and its imports from Africa, this may suggest that China can maintain the existing foreign aid policy as a catalyst for its exports within the South-South cooperation framework, which brings win-win collaboration for China and Africa. Nevertheless, China's aid policy should be transformed and upgraded with its economic development. For the US, it might need to adjust its aid policy in Africa. Foreign aid mainly serves for its political and security interests, which might not a wise strategy in the context of an ever-increasing China's presence in the African continent. With regard to the implications for aid recipients, African countries could make full use of the capital and technologies from donors to strengthen and advance their domestic economies, and then they would be less relied on foreign assistance, especially the conditional aid. Only when the future of African economies is largely dependent on their own strengths and resources can a fairer and more equal international economic order be established.

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Table 3: Descriptive Statistics

Variables	Mean	Var.	Std.Dev	Min	Max	Obs.
Panel A: US						
lnTrade	20.517	3.110	1.763	16.864	24.492	259
lnExport	19.307	2.418	1.555	12.326	22.745	260
lnImport	19.646	5.710	2.390	13.450	24.392	259
lnODA	3.486	5.644	2.376	-4.605	6.707	252
lnGDP	10.673	0.013	0.115	10.129	10.843	260
lnDIST	9.207	0.067	0.259	8.724	9.631	260
FDI	-0.054	0.900	0.949	-2.063	2.779	260
Tfree	65.348	127.523	11.293	28.6	90	257
GE	-0.570	0.360	0.600	-1.72	0.93	260
PS	-0.368	0.675	0.822	-2.3	1.19	260
RL	-0.542	0.361	0.601	-1.53	1.06	260
RQ	-0.476	0.320	0.566	-1.66	0.98	260
CC	-0.561	0.350	0.591	-1.71	1.25	260
VA	-0.575	0.507	0.712	-1.94	0.9	260
Panel B: China						
lnTrade	19.875	2.641	1.625	15.451	24.350	300
lnExport	19.320	2.306	1.519	15.052	22.953	300
lnImport	17.738	8.853	2.975	0	24.237	300
lnODA	17.744	5.536	2.353	9.11	23.155	246
lnGDP	7.571	0.911	0.955	0.910	9.899	300
lnDIST	9.274	0.019	0.137	8.929	9.446	300
FDI	-0.020	0.913	0.956	-1.909	2.749	300
Tfree	64.16	127.626	11.297	19	89	294
GE	-0.689	0.307	0.554	-1.72	0.93	300
PS	-0.488	0.684	0.827	-2.51	1.19	300
RL	-0.665	0.379	0.616	-1.84	1.06	300
RQ	-0.595	0.314	0.560	-2.21	0.98	300
CC	-0.628	0.325	0.570	-1.71	1.25	300
VA	-0.603	0.438	0.662	-1.9	0.9	300

Notes:

1. This table reports the summary of datasets used for the investigation of the aid-trade relationship between US/China and African economies over the period 2003-2012.
2. Trade, Export, Import, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

Table 4: Aid and Bilateral Trade Relationship between the US and Africa

	OLS	Fixed Effects	Random Effects	First-differenced GMM
lnODA	-0.014 (0.057)	-0.006 (0.036)	-0.002 (0.036)	-0.099 (0.134)
lnGDP	-3.665*** (1.170)	3.331*** (0.447)	3.186*** (0.458)	4.042** (2.027)
lnDIST	-0.611 (0.454)		-1.969 (1.255)	
FDI	0.139 (0.106)	0.037 (0.028)	0.037 (0.029)	-0.030 (0.121)
Tfree	0.004 (0.011)	0.000 (0.004)	0.001 (0.004)	0.000 (0.011)
CC	-0.910** (0.443)	-0.047 (0.247)	-0.105 (0.251)	2.398 (1.937)
GE	3.116*** (0.536)	-0.600** (0.253)	-0.515** (0.256)	-0.272 (1.548)
PS	-0.435** (0.188)	0.401*** (0.107)	0.377*** (0.108)	-0.041 (0.861)
RL	-1.283*** (0.494)	0.667** (0.320)	0.580* (0.318)	-2.393 (1.636)
RQ	-0.962** (0.474)	0.096 (0.208)	0.058 (0.211)	2.821 (1.828)
VA	-0.309 (0.333)	0.064 (0.211)	-0.026 (0.211)	-1.572 (1.032)
L.lnTrade				-0.230 (0.317)
L2.lnTrade				0.058 (0.204)
L.lnODA				0.022 (0.116)
L.lnGDP				1.756 (1.795)
L.FDI				0.049 (0.113)
L2.FDI				0.246** (0.100)
Constant	64.788*** (13.473)	-14.877*** (4.599)	4.737 (12.490)	
Hausman			115.123	
Hau_p			0.000	
Adj.R2	0.263			
R2	0.296	0.367	0.365	
AR1(p)				0.987
AR2(p)				0.485
Sargan(p)				0.614
Hansen(p)				0.586
Obs.	249	249	249	175

Notes:

1. Trade, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

2. Hau_p means the p-value for the Hausman test. Adj.R2 indicates the adjusted R-square. AR1(p) and AR2(p) indicate p-values for the first and second order of the serial correlation test. The results show that there is no autocorrelation in first – differenced errors. Sargan(p) and Hansen(p) are the p-value for the Sargan test and Hansen test, which are used for testing over-identifying restrictions. Sargan(p) and Hansen(p) indicate that overidentifying restrictions are valid. Obs. is the number of observations.

3. In the first-differenced GMM model, trade (lnTrade), aid (lnODA), FDI, GDP (lnGDP) and their lags (determined by the general-to-specific approach) are endogenous variables. Distance (lnDIST), trade freedom (Tfree) and economic development level (Ecolevel) are treated as instrument variables.

4. ***, ** and * denote 1%, 5% and 10% significance levels. Standard errors are reported in parentheses.

Table 5: Aid and US Exports to Africa

	OLS	Fixed Effects	Random Effects	First-differenced GMM
lnODA	0.173*** (0.045)	0.058 (0.037)	0.070* (0.037)	0.111 (0.080)
lnGDP	-2.047** (0.925)	4.023*** (0.457)	3.858*** (0.467)	2.466* (1.278)
lnDIST	-1.529*** (0.359)		-1.920** (0.951)	
FDI	0.130 (0.084)	0.052* (0.029)	0.052* (0.030)	0.107*** (0.039)
Tfree	0.010 (0.009)	0.007* (0.004)	0.006* (0.004)	-0.001 (0.008)
CC	-1.427*** (0.351)	0.091 (0.252)	-0.047 (0.255)	-0.045 (0.617)
GE	2.696*** (0.424)	-0.541** (0.258)	-0.327 (0.259)	0.388 (0.675)
PS	-0.185 (0.149)	0.317*** (0.110)	0.249** (0.108)	0.004 (0.413)
RL	-0.648* (0.390)	-0.094 (0.327)	-0.025 (0.317)	-0.275 (1.297)
RQ	-0.269 (0.375)	0.189 (0.212)	0.197 (0.213)	2.286 (1.600)
VA	-0.462* (0.263)	0.012 (0.216)	-0.085 (0.211)	-1.021* (0.616)
L.lnExport				0.154 (0.111)
L2.lnExport				-0.147 (0.135)
L.lnODA				0.140 (0.089)
L.lnGDP				2.015* (1.115)
Constant	53.932*** (10.655)	-24.386*** (4.696)	-4.901 (10.022)	
Hausman			0.567	
Hau_p			1.000	
Adj.R2	0.346			
R2	0.375	0.475	0.472	
AR1(p)				0.086
AR2(p)				0.333
Sargan(p)				0.222
Hansen(p)				0.634
Obs.	249	249	249	175

Notes:

1. Export, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

2. Hau_p means the p-value for the Hausman test. Adj.R2 indicates the adjusted R-square. AR1(p) and AR2(p) indicate p-values for the first and second order of the serial correlation test. The results show that there is no autocorrelation in first-differenced errors. Sargan(p) and Hansen(p) are the p-value for the Sargan test and Hansen test, which are used for testing over-identifying restrictions. Sargan(p) and Hansen(p) indicate that overidentifying restrictions are valid. Obs. is the number of observations.

3. Different from the other empirical results, random effects results are preferred here resulting from unobserved heterogeneity is not correlated with the regressors.

4. In the first-differenced GMM model, export (lnExport), aid (lnODA), FDI, GDP (lnGDP) and their lags (determined by the general-to-specific approach) are endogenous variables. Distance (lnDIST), trade freedom (Tfree) and economic development level (Ecollevel) are treated as instrument variables.

5. ***, ** and * denote 1%, 5% and 10% significance level. Standard errors are reported in parentheses.

Table 6: Aid and US Imports from Africa

	OLS	Fixed Effects	Random Effects	First-differenced GMM
lnODA	-0.110 (0.079)	-0.036 (0.057)	-0.035 (0.056)	-0.108 (0.142)
lnGDP	-5.841*** (1.614)	2.661*** (0.705)	2.459*** (0.709)	2.090 (1.929)
lnDIST	1.187* (0.626)		-0.514 (1.773)	
FDI	0.120 (0.146)	0.000 (0.045)	0.001 (0.045)	-0.075 (0.117)
Tfree	0.007 (0.016)	0.001 (0.006)	0.002 (0.006)	0.001 (0.008)
CC	-1.063* (0.612)	-0.709* (0.388)	-0.769** (0.388)	-1.315 (1.065)
GE	4.139*** (0.739)	-0.306 (0.398)	-0.182 (0.396)	-1.205 (2.013)
PS	-0.625** (0.260)	0.455*** (0.169)	0.423** (0.166)	-0.153 (0.583)
RL	-1.788*** (0.681)	0.788 (0.504)	0.669 (0.490)	3.064 (2.178)
RQ	-1.430** (0.654)	0.189 (0.327)	0.123 (0.326)	3.169* (1.915)
VA	-0.420 (0.459)	-0.047 (0.333)	-0.169 (0.326)	-1.678** (0.836)
L.lnImport				-0.250** (0.127)
L2.lnImport				-0.035 (0.139)
L.lnODA				-0.044 (0.165)
L.lnGDP				3.926** (1.945)
L2.lnGDP				-2.704* (1.479)
L.FDI				0.091 (0.085)
Constant	70.613*** (18.594)	-8.706 (7.245)	-1.907 (17.910)	
Hausman			26.880	
Hau_p			0.003	
Adj.R2	0.243			
R2	0.276	0.161	0.159	
AR1(p)				0.170
AR2(p)				0.694
Sargan(p)				0.193
Hansen(p)				0.714
Obs.	249	249	249	175

Notes:

1. Import, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

2. Hau_p means the p-value for the Hausman test. Adj.R2 indicates the adjusted R-square. AR1(p) and AR2(p) indicate p-values for the first and second order of the serial correlation test. The results show that there is no autocorrelation in first – differenced errors. Sargan(p) and Hansen(p) are the p-value for the Sargan test and Hansen test, which are used for testing over-identifying restrictions. Sargan(p) and Hansen(p) indicate that overidentifying restrictions are valid. Obs. is the number of observations.

3. In the first-differenced GMM model, import (lnImport), aid (lnODA), FDI, GDP (lnGDP) and their lags (determined by the general-to-specific approach) are endogenous variables. Distance (lnDIST), trade freedom (Tfree) and economic development level (Ecolevel) are treated as instrument variables.

4. ***, ** and * denote 1%, 5% and 10% significance level. Standard errors are reported in parentheses.

Table 7: Aid and Bilateral Trade Relationship between China and Africa

	OLS	Fixed Effects	Random Effects	First-differenced GMM
lnODA	0.290*** (0.035)	0.037** (0.017)	0.062*** (0.019)	-0.040** (0.019)
lnGDP	-0.557*** (0.088)	0.134*** (0.050)	0.053 (0.057)	0.255*** (0.049)
lnDIST	-0.269 (0.730)		-0.346 (1.155)	
FDI	0.654*** (0.094)	0.477*** (0.041)	0.495*** (0.048)	0.053 (0.053)
Tfree	0.003 (0.009)	0.023*** (0.005)	0.022*** (0.005)	0.000 (0.003)
CC	-1.013** (0.347)	0.628** (0.263)	0.212 (0.282)	0.022 (0.223)
GE	-0.393 (0.393)	-0.488* (0.277)	-0.410 (0.305)	0.437 (0.349)
PS	0.309** (0.142)	0.149 (0.114)	0.170 (0.119)	0.027 (0.243)
RL	0.154 (0.427)	0.055 (0.349)	0.026 (0.360)	-0.760 (0.496)
RQ	1.197*** (0.339)	-0.297 (0.295)	0.027 (0.297)	0.959 (0.811)
VA	-0.621*** (0.232)	-0.762*** (0.260)	-0.731*** (0.235)	-1.974*** (0.665)
L.lnTrade				0.354*** (0.092)
L2.lnTrade				-0.164*** (0.060)
L.lnODA				0.061*** (0.016)
L.FDI				0.244** (0.100)
Constant	21.118*** (6.751)	16.423*** (5.527)	19.796* (10.704)	
Hausman			58.490	
Hau_p			0.000	
Adj.R2	0.463			
R2	0.487	0.732	0.722	
AR1(p)				0.031
AR2(p)				0.661
Sargan(p)				0.245
Hansen(p)				0.993
Obs.	241	241	241	136

Notes:

1. Trade, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

2. Hau_p means the p-value for the Hausman test. Adj.R2 indicates the adjusted R-square. AR1(p) and AR2(p) indicate p-values for the first and second order of the serial correlation test. The results show that there is no autocorrelation in first – differenced errors. Sargan(p) and Hansen(p) are the p-value for the Sargan test and Hansen test, which are used for testing over-identifying restrictions. Sargan(p) and Hansen(p) indicate that overidentifying restrictions are valid. Obs. is the number of observations.

3. In the first-differenced GMM model, trade (lnTrade), aid (lnODA), FDI, GDP (lnGDP) and their lags (determined by the general-to-specific approach) are endogenous variables. Distance (lnDIST), trade freedom (Tfree) and economic development level (Ecollevel) are treated as instrument variables.

4. ***, ** and * denote 1%, 5% and 10% significance level. Standard errors are reported in parentheses.

Table 8: Aid and China's Exports to Africa

	OLS	Fixed Effects	Random Effects	First-differenced GMM
lnODA	0.258*** (0.035)	0.050*** (0.017)	0.063*** (0.019)	0.047 (0.031)
lnGDP	-0.285*** (0.087)	0.194*** (0.052)	0.156*** (0.056)	0.103 (0.084)
lnDIST	-1.357* (0.724)		-1.694 (1.282)	
FDI	0.597*** (0.093)	0.434*** (0.043)	0.447*** (0.047)	0.001 (0.035)
Tfree	-0.003 (0.009)	0.023*** (0.005)	0.022*** (0.005)	0.002 (0.004)
CC	-0.449 (0.344)	0.614** (0.274)	0.310 (0.281)	-0.372 (0.466)
GE	-0.657* (0.390)	-0.637** (0.288)	-0.571* (0.302)	1.236** (0.489)
PS	-0.288** (0.141)	0.279** (0.118)	0.144 (0.119)	0.249 (0.353)
RL	0.154 (0.423)	0.335 (0.363)	0.339 (0.359)	0.112 (0.409)
RQ	1.291*** (0.336)	-0.315 (0.307)	0.075 (0.297)	1.344* (0.792)
VA	0.034 (0.230)	-0.965*** (0.271)	-0.625*** (0.239)	-1.239* (0.741)
L.lnExport				0.485*** (0.112)
L2.lnExport				-0.374*** (0.099)
L3.lnExport				0.230** (0.104)
L.lnODA				0.072** (0.028)
L.FDIS				0.252*** (0.071)
Constant	29.871*** (6.692)	15.155*** (0.549)	31.194*** (11.883)	
Hausman			109.234	
Hau_p			0.000	
Adj.R2	0.395			
R2	0.423	0.729	0.721	
AR1(p)				0.065
AR2(p)				0.263
Sargan(p)				0.209
Hansen(p)				1.000
Obs.	241	241	241	123

Notes:

1. Export, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

2. Hau_p means the p-value for the Hausman test. Adj.R2 indicates the adjusted R-square. AR1(p) and AR2(p) indicate p-values for the first and second order of the serial correlation test. The results show that there is no autocorrelation in first – differenced errors. Sargan(p) and Hansen(p) are the p-value for the Sargan test and Hansen test, which are used for testing over-identifying restrictions. Sargan(p) and Hansen(p) indicate that overidentifying restrictions are valid. Obs. is the number of observations.

3. In the first-differenced GMM model, export (lnExport), aid (lnODA), FDI, GDP (lnGDP) and their lags (determined by the general-to-specific approach) are endogenous variables. Distance (lnDIST), trade freedom (Tfree), World Bank's worldwide Governance Indicators (GE, PS, RL, RQ, CC, VA) and economic development level (Ecollevel) are treated as instrument variables.

4. ***, ** and * denote 1%, 5% and 10% significance level. Standard errors are reported in parentheses.

Table 9: Aid and China's Imports from Africa

	OLS	Fixed Effects	Random Effects	First-differenced GMM
lnODA	0.468*** (0.070)	0.034 (0.050)	0.129** (0.053)	-0.004 (0.020)
lnGDP	-0.910*** (0.177)	0.190 (0.154)	-0.092 (0.159)	0.184*** (0.063)
lnDIST	3.357** (1.464)		4.517** (2.280)	
FDI	0.755*** (0.189)	0.571*** (0.125)	0.627*** (0.135)	-0.053 (0.065)
Tfree	0.050*** (0.018)	0.040*** (0.014)	0.043*** (0.014)	-0.002 (0.008)
CC	-1.099 (0.695)	0.459 (0.802)	-0.211 (0.740)	-0.534 (1.091)
GE	0.869 (0.788)	-0.852 (0.845)	-0.076 (0.813)	-0.286 (0.526)
PS	0.823*** (0.285)	-0.422 (0.347)	0.046 (0.312)	-0.107 (0.210)
RL	0.651 (0.855)	1.593 (1.064)	1.225 (0.944)	-0.310 (1.068)
RQ	-0.357 (0.680)	-0.505 (0.899)	-0.565 (0.772)	-0.366 (0.921)
VA	-1.859*** (0.464)	-1.222 (0.794)	-1.797*** (0.582)	-0.595 (0.844)
L.lnImport				0.184*** (0.068)
L2.lnImport				-0.099 (0.091)
L.lnODA				0.065*** (0.019)
L.lnGDP				0.184** (0.075)
L.FDIS				0.463** (0.182)
Constant	-18.361 (13.533)	12.870*** (1.608)	-29.160 (21.127)	
Hausman			706.629	
Hau_p			0.000	
Adj.R2	0.385			
R2	0.413	0.347	0.322	
AR1(p)				0.150
AR2(p)				0.647
Sargan(p)				0.422
Hansen(p)				0.719
Obs.	241	241	241	136

Notes:

1. Import, aid (ODA), per capita GDP and distance (DIST) are expressed as log terms. Tfree indicates the freedom of trade. The last six variables (GE, PS, RL, RQ, CC, VA) in each panel are the World Bank's worldwide Governance Indicators, see appendix Table A.2 for details.

2. Hau_p means the p-value for the Hausman test. Adj.R2 indicates the adjusted R-square. AR1(p) and AR2(p) indicate p-values for the first and second order of the serial correlation test. The results show that there is no autocorrelation in first – differenced errors. Sargan(p) and Hansen(p) are the p-value for the Sargan test and Hansen test, which are used for testing over-identifying restrictions. Sargan(p) and Hansen(p) indicate that overidentifying restrictions are valid. Obs. is the number of observations.

3. In the first-differenced GMM model, import (lnImport), aid (lnODA), FDI, GDP (lnGDP) and their lags (determined by the general-to-specific approach) are endogenous variables. Distance (lnDIST), trade freedom (Tfree), World Bank's worldwide Governance Indicators (GE, PS, RL, RQ, CC, VA) and economic development level (Ecollevel) are treated as instrument variables.

4. ***, ** and * denote 1%, 5% and 10% significance level. Standard errors are reported in parentheses.

Appendix

Table A. 1: US top 10 Largest Trading Partners and Aid Recipients in Africa (2012) (Million USD)

	Aid Recipient	Value	Total Trade	Value	Importer	Value	Exporter	Value
1	Kenya	818.26	Nigeria	24.44	South Africa	7.55	Nigeria	19.41
2	Ethiopia	693.4	South Africa	16.38	Egypt	5.50	Algeria	10.20
3	Tanzania	561.78	Algeria	11.56	Nigeria	5.03	Angola	10.03
4	South Africa	504.06	Angola	11.52	Morocco	2.17	South Africa	8.83
5	Sudan	454.33	Egypt	8.61	Angola	1.49	Egypt	3.11
6	Nigeria	414.95	Morocco	3.16	Algeria	1.36	Chad	2.71
7	Mozambique	412.56	Libya	3.10	Ghana	1.32	Libya	2.55
8	South Sudan	382.02	Chad	2.75	Ethiopia	1.27	Gabon	1.93
9	Uganda	380.82	Gabon	2.25	Tunisia	0.61	Equatorial Guinea	1.75
10	Mali	342.27	Equatorial Guinea	1.98	Benin	0.57	Congo	1.51

Source: UN Comtrade and OECD.

Table A.2: Variable Definition and Data Sources

Variable	Definition	Data Source and Link
Trade	Total trade between US/China and African countries	United Nations Comtrade Statistics Database https://comtrade.un.org/data/ .
Export	US/China's exports to African countries	United Nations Comtrade Statistics Database https://comtrade.un.org/data/ .
Import	US/China's exports from African countries	United Nations Comtrade Statistics Database https://comtrade.un.org/data/ .
ODA	US/China's aid to African countries	OECD statistics/ AidData http://stats.oecd.org/ and http://china.aiddata.org/
FDI	US/China's FDI stock to African countries	United Nations Conference on Trade and Development/Statistical Bulletin of China's Outward Foreign Direct Investment http://unctad.org/en/Pages/DIAE/FDI%20Statistics/FDI-Statistics-Bilateral.aspx .
GDP	Difference of per capita GDP between US/China and African countries	World Development Indicators Online database http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators
DIST	Geographical distance between capital cities	CEPII database http://www.cepii.fr/CEPII/en/bdd_modele/bdd.asp
Tfree	Trade freedom	Heritage Foundation http://www.heritage.org .
GE	Government effectiveness	World Bank's Worldwide Governance Indicators http://data.worldbank.org/data-catalog/worldwide-governance-indicators (hereafter the same)
PS	Political stability and absence of violence	World Bank's Worldwide Governance Indicators
RL	Rule of law	World Bank's Worldwide Governance Indicators
RQ	Regulatory quality	World Bank's Worldwide Governance Indicators
CC	Control of corruption	World Bank's Worldwide Governance Indicators
VA	Voice and accountability	World Bank's Worldwide Governance Indicators
Ecolevel	Economic development level	World Development Report 2014