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The rise of China:
Competing or complementary to DAC aid flows in Africa?

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Abstract: This study investigates if the relationship between bilateral DAC aid and Chinese aid allocation is better described as competing aid flows, or if Chinese aid has been mainly a complement to DAC aid in Africa between the years 2000 and 2012. The relationship is analysed in a two-level framework, both cross-country and within countries at the sector level, where China is assumed to be responsive to established DAC aid allocation priorities. This study makes use of the most recent update of AidData's unique dataset on Chinese Official Finance to Africa and the DAC aid data is extracted from the OECD Creditor Reporting System database. The results suggest a positive and statistically significant effect of DAC aid allocation with respect to Chinese aid allocation in the following year at the country level. The result is interpreted as a competition between China and DAC to serve the same recipient countries with aid. A similar, or any, relationship between DAC and Chinese aid allocation at the sector level within recipient countries is however not confirmed.

Key Words: Foreign aid, China, donor coordination, bilateral DAC, Africa

JEL Classification: F35; O55

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1. Introduction

Since the beginning of the 21st century the foreign development assistance provided by emerging donors has increased sharply in both absolute and relative terms (Manning, 2006; Woods, 2008; Dreher et al., 2011; Walz & Ramachandran, 2011; Tierney, 2014). China is suggestively the most important non-member of the Organization for Economic Cooperation and Development, Development Assistance Committee (OECD DAC), and in the forefront of this group of emerging donors. In particular, China's engagement as a donor in Africa is growing, but the knowledge about China's motives and the aims of its aid commitments as well as the actual aid allocation is still limited (Strange et al., 2013). Recent findings confirm that Chinese aid in Africa is channeled to most African countries and most sectors where also DAC aid is represented, this has induced a discussion about whether China will compete with or complement aid flows from the existing DAC donor community (Strange et al., 2013; Hernandez, 2015).

It is only recently, owing to Strange and co-authors' collection and publication of the first project-level database on Chinese aid to African countries between year 2000 and 2013, that academic scholars are now able to run the first cross-country econometric allocation regressions on Chinese aid commitments. Since the first publication of the data in 2013, the database has been widely used by academic scholars, but so far, the relationship between Chinese aid and the traditional DAC donors' spatial and sectoral aid allocation has received little attention in the literature. Knowledge about China's allocation strategy and in particular China's interest or disinterest to cooperate with the DAC community may have important policy implications for the ongoing debate about donor coordination and aid effectiveness. Aid fragmentation and lack of donor coordination are two confirmed sources of increasing transaction costs, unnecessary administrative burdens in recipient countries and in the end reduced aid effectiveness (Acharya et al., 2006; Anderson, 2011; Bigsten & Tengstam, 2015). The traditional DAC donor community is already struggling to improve on these issues and the emergence of an increasing number of "new"[1] donors with China in the forefront may further complicate the coordination attempts if the motives and interests of China are contradictory to those of the DAC donors.

In an attempt to address the coordination concerns about China's increasing engagement in international aid activities, the aim of this study is to investigate whether the presence of bilateral DAC aid is taken into account in the Chinese aid allocation process, and hence

[1] China's foreign aid programs in Africa started already in the 1950s. The term "new" donors is commonly used to separate the increasingly active non-DAC donors from members of the traditional OECD DAC community (Woods, 2008).

investigate if the Chinese aid flows mainly compete with or complement established DAC aid allocation priorities. This study will try to identify the relationship between actual DAC aid allocation and Chinese aid allocation in Africa employing a two-level, cross-country and within-country sectoral framework and investigate whether the two aid sources are better described as either competing with each other over the same countries and sectors or if the aid flows have been mainly complementary to each other under the time period 2000-2012.

By employing the database on Chinese aid by Strange et al. (2015a), this study contributes not only to the growing body of empirical literature on the determinants of Chinese aid allocation (see for example Dreher et al., 2015a; Dreher et al., 2015b; Li, 2015), but also with an examination of the relationship between bilateral DAC aid and Chinese aid in Africa. This study may be the first attempt to analyze the relationship in a framework proposing that a potentially systematic relationship between Chinese aid and DAC aid is driven by Chinese direct or indirect responsiveness to DAC aid allocation. Additionally, this study is probably the first to examine this relationship in a two-level analysis, both across and within aid recipient countries. In spite of the ongoing debate on the implications of the increasing Chinese aid flows to Africa, there are exceptionally few econometric studies on this topic. Hence, this study can hopefully contribute with new and interesting knowledge. Furthermore, the results can serve as informative input into the future discussion about what implications the increasing Chinese engagement as a donor in Africa might have for the traditional DAC donors' coordination attempts, imposed conditionality requirements and fulfillment of the Paris Declaration and the Accra Agenda for Action.

One of the few papers that has examined the relationship between Chinese and DAC aid cross-country allocation directly is a study by Giovannetti and Sanfilippo (2011). The authors empirically test whether Chinese financial flows are directed towards countries that receive less aid from bilateral DAC donors and find a country-level negative and significant relationship between DAC aid and Chinese financial flows. Another paper Hernandez (2015), shows that the World Bank imposes significantly fewer conditions on aid recipient countries if Chinese ODA loans are present. The author's interpretation is that the World Bank lessens its conditionality to cope with the excess supply of development resources and cross-country competition from China.

In Hernandez (2015) the analysis is limited to a setting where the World Bank is reacting to the presence of Chinese ODA loan options. This current study does instead consider a model where China is assumed to be the responsive donor and respond to DAC's aid allocation.

In the cross-country analysis of this study, three different measures of Chinese aid are employed as the dependent variable, and this study runs a binary choice model as well as Ordinary Least Square (OLS) models in the baseline empirical strategy. In the within-country sector analysis the baseline empirical strategy is again a binary choice model. The key explanatory variable of interest is bilateral DAC aid and numerous robustness checks are performed where the econometric model is altered, the country sample is restricted and alternative lags of the key explanatory variable are used. Additionally, a test for differences between countries concerning natural resource endowments, democracy, corruption prevalence, income and a division of observations into an early and late time period is performed at the country-level. Within countries, differences between sector categories are investigated.

There are a number of reasons why the current study suggests that China is likely to be the more responsive donor of the two. First, China's aid is frequently described as demand driven (see for example Dreher et al., 2015a), and China imposes no conditionality[2] on aid recipients, which may suggest that China indirectly allocate aid to countries and sectors not eligible for DAC aid, or where DAC aid is not sufficient. Second, the literature suggest that China may not be motivated to integrate and coordinate aid efforts with the traditional donor community (Lancaster, 2007; Tierney, 2014; Dreher et al., 2015b). Third, information and data on DAC aid have been transparent and officially published since the beginning of the 21st century, while there are still today no disaggregated official figures on Chinese aid commitments. Chinese aid is typically negotiated by high level politicians and the process generally lacks transparency. Hence, it seems reasonable to expect that China is better informed about DAC aid strategies and allocation decisions, and in a better position to react on DAC aid allocation rather than the other way around.

Still, the simultaneity issue is an aggravating factor for the empirical analysis and there are obvious reasons to suspect that reverse causality may be a source of endogeneity. It is, for example, not unlikely that the DAC donors are better informed about Chinese aid commitments and more flexible and responsive in their allocation decisions than assumed in the current study. To be able to credibly address the endogeneity concerns, this study would have to use an Instrumental Variable (IV)-strategy and instrument for DAC aid, but due to difficulties to find a valid instrument this study has instead introduce a lag to the DAC aid flows in a modest attempt to address the endogeneity concerns.

[2] One exception is the recognition of the "One-China"-policy, i.e. recognition of the government in Beijing and not in Taipei, Taiwan, as the representative of China (Dreher et al., 2015b; Dreher & Fuchs 2016).

The main empirical finding is a positive and statistically significant relationship between DAC aid allocation and Chinese aid allocation at the country level. China does not seem to coordinate with the DAC donors when allocating its aid in Africa, and respond to increasing DAC aid in a competitive way with additional aid to the same countries. However, the empirical investigation for the within-country sectoral analysis cannot confirm any systematic relationship between DAC aid allocation and Chinese aid allocation.

The rest of this study is structured as follows; section 2 provides a short background to Chinese aid management and the official statements (White Papers) on Chinese foreign aid programs. In section 3, the related qualitative and quantitative literature is reviewed. Section 4 develops the theoretical framework and presents the research questions. Next, section 5 describes the data sources, variables and presents some descriptive statistics. Section 6 presents the econometric specification and discusses the empirical strategy, robustness checks and heterogeneity tests. The main results and findings are presented in section 7, while section 8 contains the analysis and discussion of the findings. Finally, section 9 concludes.

2. Background to Chinese Foreign Aid

This section provides a short introduction to China's foreign aid management and presents some basic insights about differences between traditional DAC aid and Chinese aid characteristics.

2.1 China's Foreign Aid Management

According to the State Council (2011), there are several different departments and ministries involved in the Chinese aid management system; two examples are the Ministry of Commerce and the Ministry of Foreign Affairs. Involved ministries are responsible for their own foreign aid projects and budgets, and the foreign aid plans are submitted on an annual basis to the Chinese State Council for approval. Chinese embassies and consulates play an important role in the Chinese aid management system; it is often the host government themselves that approaches the Chinese embassies in order to initiate aid programs and propose specific projects. In short, the host government's proposal is submitted to the ministries in Beijing and thereafter a team of experts visits the host country for project feasibility assessment and budget negotiations. If the project is found to be feasible and attractive to fund, a final aid project proposal is prepared and submitted to the Chinese State Council for approval. Moreover, the Chinese embassies are also in charge of the coordination and management of approved foreign aid projects in recipient countries (State Council, 2011). Hence, the aid management and negotiation process involve mainly high level political officials and the process seems to lack transparency.

The most substantial part of China's aid is provided through bilateral channels and Africa has been the continent receiving the largest share of Chinese aid. Forum on China-Africa Cooperation (FOCAC), which was initiated in 2000, might be China's most important multilateral platform for dialogue and cooperation with its diplomatic allies in Africa. However, since 2005, China has been participating also in cooperative projects with other donor countries and international organizations according to the State Council (2011).

2.2 White Papers on Chinese Foreign Aid

China has a tradition of issuing official White Papers declaring China's stance to complex issues and to inform the public about China's strategies. The only official figures on China's foreign aid are presented in two government White Papers on *China's Foreign Aid*, the first paper was published in 2011 followed by a second paper in 2014. These two documents elaborate on the Chinese stance on foreign aid and disclose some aggregated figures of the total volume of China's foreign development assistance. The White Papers clearly state that China, unlike the western DAC donors, is not imposing any particular conditionality on their aid flows and affirm China's well-known policy of "no strings attached", i.e. that China does not make any attempts to intervene in internal political affairs in aid recipient countries. Furthermore, China acknowledges the aid recipient countries' right to independently choose their own path of development and promises that Chinese aid is tailored to meet the actual needs in recipient countries (State Council, 2011; 2014). Table 1 present a short overview of some basic differences between traditional DAC aid and Chinese aid characteristics.

Table 1. Overview of some basic differences between traditional DAC aid and Chinese aid

Donor	Receiving country eligibility	Initiation and screening for aid projects	Tying of aid	Transparency of aid programs
China	"No- Strings attached" -policy	Often host country initiated aid programs – demand driven aid	Usually tied aid to Chinese delivery - or imports of resources	Low transparency and aid, i.e. ODA, often mixed together with other types of financing
DAC-members	Often require some conditionality	Aim to deliver well-coordinated and harmonized aid	Today about 90 percent of DAC aid is untied	Transparent and clearly defined what flows are counted as ODA

Sources: See for example, Tan-Mullins et al. 2010; Walz & Ramachandran 2011; Berthélemy 2011; Bräutigam 2011; State Council 2011; 2014; Lin & Wang 2014; Dreher et al 2015a.

3. Related Empirical Literature

The rise of China as a global aid donor has fostered both interest and skepticism about China's motives. This resulted in an early body of qualitative literature that generally describes China as an aid donor driven by selfish motives such as securing natural resources rather than by development concerns, and a supporter of undemocratic and corrupt regimes (see for example

Tull, 2006; Mohan & Power, 2008; Woods, 2008; Vines et al., 2009; Tan-Mullins et al., 2010)[3]. Some scholars have even suggested that the unconditional nature of Chinese aid undermines the traditional donors' effort to promote democracy and human rights (Woods, 2008;Tan-Mullins et al., 2010). This early qualitative literature is important to review, since it is the origin of today's conventional "wisdom" about Chinese aid. However, the results presented in this literature are typically anecdotal evidence from qualitative case-studies on an individual country basis and the findings may therefore be hard to generalize.

Only very recently, the first econometric studies of the determinants of Chinese aid allocation have been published. Dreher and Fuchs (2016), make one of the first attempts to empirically examine the Chinese development financing activities and the determinants of Chinese aid allocation. The authors treat their data as cross-sectional and employ a fractional logit model for the empirical investigation. Dreher and Fuchs (2016) find that China acts in consistency with its principle of non-inference as the allocation is not influenced by democratic status or recipient governance characteristics and the authors find no evidence of a surge for natural resources. The findings by Dreher and Fuchs (2016) suggest that there is little difference between the determinants of Chinese aid allocation and the determinants of DAC donors' aid allocation.

Two recent studies by Dreher et al. (2015b) and Li (2015) run cross-country regressions on Chinese aid allocation in Africa, both studies use AidData's database as the source of Chinese aid. Li (2015) treats the data as cross-sectional, while Dreher et al. (2015b) run both pooled OLS regressions and then make use of the data's panel structure in a fixed effects estimation. Both studies make the important distinction between ODA flows and Other Official Flows (OOF) to examine what determines the allocation of the respective resource flows. Their results are in line with Bräutigam (2009), who claims that the early qualitative literature mixed different financial development flows like apples with oranges and therefore misinterpreted Chinese aid determinants. Dreher et al (2015b) and Li (2015) find that Chinese ODA is mainly driven by recipient needs, proxied by GDP per capita, and by foreign policy considerations[4]. OOF allocation is better explained by China's commercial interests. Inconsistence with the Chinese policy of non-inference, the authors find no evidence that ODA flows are determined by institutional quality considerations like control of corruption or democracy.

[3] Also Strange et al., (2013) provides an excellent overview.
[4] Measured as the recipients stand on the "One-China" policy, UN voting behavior and number of visits by high level Chinese politicians.

Closely related literature to this current study is Giovannetti and Sanfilippo (2011), who empirically test whether Chinese financial flows are directed towards countries that receive less aid from bilateral DAC donors, and Hernandez (2015), who empirically investigates whether World Bank conditionality in Africa is affected by aid inflow from China. Giovannetti and Sanfilippo (2011) use data that originates from publications of the annual *China Statistical Yearbook*. One big drawback of this data, compared to the data available today, is that it includes all kinds of Chinese external assistance from ODA to overseas contracts won by Chinese firms. Hence, the authors are not clear on what they actually measure, and even if their data may be correlated with actual Chinese ODA flows, the figures are most likely biased. The authors use a fixed effects estimator and find a negative and statistically significant correlation between DAC aid and their employed measure of Chinese aid. The authors' interpretation of this finding is that China substitute for DAC aid withdrawals in recipient countries. However, from an aid effectiveness point of view, a negative and statistically significant relationship could instead be interpreted as good coordination as geographic clustering is avoided (Klasen & Davies, 2011), and the interpretation would instead be a complementing Chinese aid allocation to that of the DAC. The validity of the data employed by Giovannetti and Sanfilippo (2011) is a concern that needs to be considered in a serious manner and unfortunately the data caveat questions the overall validity of their results. When Berthélemy (2011) employs data from the same source, a significant correlation between the DAC donors' and Chinese cross-country allocation of aid cannot be confirmed. The author's interpretation is that Chinese aid does not increase aid fragmentation in recipient countries.

Hernandez (2015) uses the same data source of Chinese aid as this current study, and there are also similarities in the theoretical frameworks employed. The author's main hypothesis is that increasing aid, exclusively in the form of ODA loans (not grants), from emerging donors like China, may explain the changes in rigidity of the World Bank loan conditionality in recent years. This is considered to be the case if these new sources of aid are perceived by recipient governments as attractive and uncoordinated outside options to DAC aid that impose no conditionality. Hernandez (2015) assumes that emerging donors impose no or few conditions, and argues that the World Bank will adjust conditionality downwards if aid from emerging donors causes an excess supply of aid in aid recipient countries. The main finding of the study, and in line with the author's hypothesis, is that a larger inflow of Chinese aid is associated with significantly less World Bank conditions. One plausible explanation discussed in the study is that the World Bank adjusts the number of conditions in an attempt to stay competitive and maintain its level of aid activities in recipient countries.

Hernandez's result suggests that Chinese aid may be additional to World Bank aid and perceived as a competitive aid source by the World Bank, but a more proper analysis examining the general relationship between Chinese aid and DAC aid allocation also needs to take the bilateral DAC aid and grants into account. This analysis may also be better performed in a model running in the reverse direction, where China is responsive to already established DAC aid allocation priorities. Therefore, this current study aims to perform such an exercise and analysis in a framework where China is the more responsive donor and allocation is determined by DAC aid allocation, rather than the other way around. Furthermore, there are no attempts in the existing literature to examine the relationship between Chinese and DAC aid allocation within countries at the sector level, hence this study seems to be the first.

4. Theoretical Framework, Mechanisms and Research Questions

There is no existing theoretical framework that tries to explain the potential relationship between the allocation of DAC and Chinese aid flows in terms of donor coordination, and whether Chinese aid and DAC aid could be described as competing or complementing each other. Therefore, this study reviews the related literature concerning DAC donor coordination and aid conditionality as well as Chinese non-inference policy and demand-driven aid, in an attempt to build a theoretical basis. The literature is used in order to identify theoretical mechanisms that may explain why Chinese aid allocation responds more to DAC aid allocation, than the other way around, and hence present empirical indices and suggestions about the likely direction of this response in a two-level framework.

The definitions of competition and complementarity aid efforts in the two-level framework, that the following part of the study will refer to, are presented in Table 2. One of the five principles to make aid more effective, outlined in the *Paris Declaration on Aid Effectiveness*, is donor harmonization. The idea is that when donors coordinate their efforts, reduce aid fragmentation and project duplication in recipient countries, a complementary allocation of resources on both cross-country and within-country sectoral and geographical levels would increase the overall aid effectiveness (OECD, 2005/2008). Following this logic, a complementary relationship between Chinese aid and DAC aid allocation would imply a negative correlation between the respective donors' country level allocations (Klasen & Davies, 2011). However, even if the aid flows on average target the same recipient countries, Chinese aid and DAC aid could still be complementary to each other within countries if the aid flows target different sectors. As defined in Table 2, this study considers Chinese aid an uncoordinated and competing aid flow to DAC aid if the Chinese aid target the same countries and the same

sectors within countries as the DAC aid. However, if the aid flows target different sectors within countries, the coordination problem is alleviated and the Chinese aid should be considered a within-country complement. If Chinese aid and DAC aid on average target different countries but the same sectors within countries, this implies a complementary cross-country coordination but less coordination within countries as Chinese aid and DAC aid compete to serve the same sectors. If Chinese aid on average targets both different countries and different sectors within countries this would imply a well-coordinated and effective outcome of aid allocation from the perspective presented in the Paris Declaration. Such a result would suggest that the increasing Chinese aid engagement in Africa is mainly complementary to the traditional DAC donors' aid engagements both across and within countries.

Table 2. Definition matrix of donor competition and complementary aid efforts in a two-level analysis

		Within-country analysis	
		Within a recipient country Chinese and DAC aid is allocated to the same sectors	**Within a recipient country Chinese and DAC aid is allocated to different sectors**
Cross-country analysis	**Chinese aid and DAC aid do on average target the same recipient countries**	Chinese aid is allocated additional to DAC aid across and within countries. Implies low coordination and competition between donors.	At country level, Chinese aid compete with DAC aid. Within countries, Chinese aid is a complement to DAC aid.
	Chinese aid and DAC aid do on average target different recipient countries	At country level, Chinese aid is a complement DAC aid. Within countries, Chinese aid compete with DAC aid.	Chinese aid is allocated as a complement to DAC aid both across and within countries. Implies well-coordinated and potentially effective allocation of aid.

Source: Author's own definitions

4.1 Theoretical Mechanisms

The fact that China is not involved in coordination activities, that their aid appear to be more demand driven and require little or no conditionality may have implications for how the Chinese aid is allocated directly or indirectly in response to DAC aid allocation.

In alignment with *The Paris Declaration on Aid Effectiveness* of 2005 and the subsequent *Accra Agenda for Action* of 2008, the traditional DAC donors have committed to improve the coordination of aid activities in an attempt to avoid aid fragmentation, duplication of project initiatives and ultimately increase aid effectiveness (OECD, 2005/2008). China, on the other hand, is not actively participating in the DAC donor community and has only signed the declaration as an aid recipient and not as a donor. Instead, China has established FOCAC as a main forum for dialogue with the African countries and China is labeling its engagement in Africa a South-South development cooperation model that is built on mutual understanding and mutual benefits (Ministry of Foreign Affairs, 2004). Furthermore, the prevailing literature has

suggested that China may not have an interest in integrating into the current donor system constructed by the traditional aid donors[5] (Lancaster, 2007; Tierney, 2014). Even if China is not aiming to overturn the existing OECD DAC community, there are several examples of situations where an outside aid option offered by China disrupted ongoing project negotiations between DAC donors and recipient governments in Africa (Woods, 2008;Tan-Mullins et al., 2010). Hence, this block of literature may suggest that China prefers a global presence as a donor and that China is mainly competing with DAC over the same countries.

To what extent China's aid allocation is essentially motivated and initiated from within China is still an open question. Chinese aid is suggested to be more demand driven than aid from traditional DAC donors, which implies that aid projects are initiated and requested from the government in a recipient country. Demand driven aid implies that a certain aid project starts with a request from the recipient country government to the Chinese embassy office in the host country. Thereafter, the Chinese aid programs and projects are typically negotiated in high-level political meetings with little or no transparency (Tan-Mullins et al., 2010; Dreher et al., 2015a). If demand for Chinese aid is the main driving mechanism in Chinese aid allocation, this would imply that the Chinese aid is indirectly responsive to DAC aid through recipient demand. This mechanism suggests that the demand for Chinese aid increases in countries and in sectors within countries where DAC aid is not sufficient or not available, and that China will indirectly allocate its aid accordingly. This may suggest that Chinese aid is allocated as a cross-country and a within-country sector level complement to DAC aid. This would be a result of the demand driven nature and non-conditionality of Chinese aid, which gives the domestic leaders in the recipient countries the opportunity to allocate funds in accordance with the most urgent needs in sectors that have been unable to attract large DAC aid and private flows, for example infrastructure and productive sectors (Bräutigam, 2011; Strange et al., 2013). However, a downside of the demand driven nature and fungibility of Chinese aid that needs to be mentioned is that it may also enable recipient governments to allocate the aid according to their own self-interest rather than development concerns. For example, Dreher et al. (2015a) find that Chinese aid is disproportionally allocated to the recipient leader's birth region and Bräutigam (2011) argue that Chinese aid is more prone to be captured for prestige-projects, like presidential palaces and stadiums.

China's no strings-attached policy has been heavily debated and criticized. Some scholars argue that China's unconditional aid undermines DAC aid conditionality aimed to encourage

[5] China may on the other hand have an interest in coordinating future activities with the other BRICS countries, Brazil, Russia, India and South Africa.

democracy and human rights (Woods, 2008; Tan-Mullins et al., 2010). There is a consensus in the existing literature that, at least some traditional donors, allocate according to democratic principles (Alesina & Dollar, 2000; Alesina & Weder, 2002; Gates & Hoeffler, 2004; Brück & Xu, 2012), while Chinese aid allocation is not influenced by democracy in recipient countries (Dreher et al., 2015b; Li, 2015; Dreher & Fuchs, 2016). Furthermore, it is rather intuitive that China has no incentives to condition its aid on western democratic values. Hence, this block of literature may suggest that Chinese aid could be more competitive in the category of less democratic recipient countries where the governments find the Chinese aid particularly attractive.

The findings in the reviewed literature on cross-country determinants of Chinese aid, presented in section 3, suggest that Chinese allocation principles are similar to those of the traditional donors (Dreher et al., 2015b; Li, 2015; Dreher & Fuchs, 2016). Additionally, Hernandez (2015) finds that the World Bank adjusts the number of conditions if Chinese aid is available in the same country. At the country level, this literature suggest that there are small differences between the motivations behind China's and DAC's aid allocation. Political interest and recipient "need" proxied by GDP per capita are the two forceful determinants, and this suggests that Chinese aid and DAC aid is likely to be additional to each other and compete for aid allocation to the same countries.

4.2 Research Questions

The theoretical framework presented in this section is built on the identification of theoretical mechanisms in the empirical literature that can be employed to make predictions about the relationship between DAC aid and Chinese aid allocation. Even though this theoretical framework and the discussions on potential mechanisms are far from conclusive, this study aims to utilize this framework in the following empirical investigation due to the lack of other available theoretical frameworks in the existing literature. Based on the discussions in the previous section, there is no absolute prediction about the relationship between DAC aid and Chinese aid allocation. The different blocks of the literature point to different plausible mechanisms involved and different corresponding outcomes. Some literature suggests that China is not interested in active collaboration and coordination with the DAC community and hence allocates its aid additional to DAC aid, which in this framework implies that China and DAC are competing to serve the same recipients with aid. A significant and positive correlation between DAC aid and Chinese aid would be in favor of such a relationship. The demand driven aid literature may instead suggest a complementary relationship, which would be identified through a significant and negative correlation between DAC aid and Chinese aid allocation.

Considering the conflicting predictions in the theoretical framework, the following two research questions are used as guidance in the following empirical investigation:

Research Question 1: Is Chinese aid allocated in competition with or as a complement to cross-country DAC aid allocation?

If Chinese aid is found to be additional and competing with DAC aid allocation, this would be in line with the suggestions that China is not interested in coordination with the DAC countries. It would also be in line with the findings in the recent literature on Chinese aid allocation, suggesting that there is little difference between the motivations behind Chinese and DAC aid allocation. If Chinese aid is found to complement DAC aid, this would be in line with the argument that the demand driven nature of Chinese aid may induce Chinese aid to target countries where DAC donors are not swarming.

Research Question 2: Is Chinese aid allocated in competition with or as a complement to DAC aid sector allocation within recipient countries?

If Chinese aid is found to be a complement to DAC aid, i.e. Chinese aid and DAC aid target different sector priorities, this would be in favor of the idea that China serves sectors where DAC aid is not as influential. This would also be in line with the theoretical argument that Chinese demand driven aid is allocated to sectors where traditional aid is more scarce or, if Chinese aid is more exposed to political capture, it may be targeted to prestige projects as well as to sectors or projects that do not qualify for DAC aid. If the Chinese aid is found to be allocated to the same sectors as DAC aid within countries, this would suggest a low coordination within countries as China and the bilateral DAC countries are competing to serve the same sectors with aid.

5. Data, Variables and Descriptive Statistics

5.1 Data Sources

This study relies on two key data sources. First, the most recently published version of the unique data set on Chinese aid introduced by Strange et al. (2015a), AidData's *Chinese Official Finance to Africa Dataset, 2000-2013, version 1.2*. Second, the officially published data on bilateral and multilateral DAC aid flows from OECD DAC's *Creditor Reporting System (CRS)*. As China does not publish information about their annual foreign aid activities officially or report their aid activities to OECD DAC, the data set collected by Strange and co-authors is the only available source of disaggregated data on Chinese foreign aid. The methodology used for gathering the data is an open-source data collection methodology called Tracking

Underreported Financial Flows (TUFF). In the data collection process a wide range of worldwide data sources are screened and additional to traditional media sources as newspapers, radio and television transcripts, also academic articles, non-governmental organization (NGO) reports and government websites etc. are utilized in the collection process (Strange et al, 2015a; Strange et al, 2015b). One strength of the *Chinese Official Finance to Africa* data is that it is compiled in a way that makes the structure similar and comparable to OECD DACs *CRS* data. The 1.2 version of AidData's *Chinese Official Finance to Africa* data provides disaggregated project-level information about 2 647 Chinese development finance activities in 51 African countries, all of them committed to the recipient countries between the year 2000 and 2013.

Strange et al. (2015a) have raised and discussed a number of concerns about the data completeness and potential pitfalls. First, there is risk of human errors in the data coding process. The risk of data errors do, however, apply to most available datasets and in an attempt to mitigate this risk, each project in the database has been reviewed by multiple researchers. A second concern is incompleteness of information and conflicting information about a certain project in different public media sources. In order to overcome this problem, researchers have used complementing sources such as government documents, NGO reports and journal article to be able to decide on conflicting media information. As the data sources rely mainly on public media, a third concern about the data is the risk of "detection bias". It seems reasonable to assume that there is a general media bias towards larger projects as well as projects attracting public interest. Smaller aid projects and projects located in rural areas far away from the capital or other large cities may on the other hand be less likely to receive public media attention. A related problem is also the issue that media coverage of aid projects in countries with low levels of press freedom is likely to be deficient (Strange et al., 2015a).

All in all, it seems reasonable to assume that the number of projects and financial amounts reported in the Chinese aid database are the lower boundary of total Chinese aid to Africa. AidData's *Chinese Official Finance to Africa* dataset is of course an incomplete substitute for official data, but it is still the most comprehensive and reliable data on Chinese aid available today. Therefore, this study makes the assumption that the largest and most significant Chinese aid projects are very likely to be covered in the data.

5.2 Sample Selection

In the following empirical analyses, this study will use the most conservative definition of aid, ODA. For an aid project to qualify as ODA, the aid flow must be provided by official agencies to developing countries on the DAC list of ODA recipients. Furthermore, the main target of the flow must be economic development and welfare and the flow needs to be concessional in its

nature and have a grant element of at least 25 percent (OECD, 2008). Due to some uncertainty about the development intent and degree of concessionality of the Chinese aid projects, this study needs to rely on the coders' second-best definition, labelled ODA-like projects in the Chinese aid data. Projects coded as anything else but ODA-like in the Chinese aid data or ODA in the *CRS* data are excluded from the following analyses. To make the data in the two databases more comparable to each other, projects coded as administrative costs and costs covering refugees in donor countries in the DAC *CRS* data are excluded. The argument is that the two aid budget posts inflate the DAC aid compared to the Chinese aid as these two aid costs are hard to track through media reports and hence comparable budget posts are not reported in Chinese aid data. Furthermore, the final sample is restricted to bilateral flows with only one recipient country. This implies that any project in the data sources without a breakdown to specified country level is excluded.

Following Dreher et al. (2015b), this study excludes data from 2013 with the argument that the Chinese aid data for 2013 may be restricted in comparison to previous years due to limited accumulated media information. When searching in the database, missing values of the actual aid amounts committed to aid projects in year 2013 is confirmed as a big concern. Aid flows to South Sudan and Somalia are also excluded from the final sample. South Sudan is excluded as it became an independent state in 2011 and Somalia is excluded due to data limitations in the explanatory variables employed for this study. Libya was not a country on the DAC recipient list between the years 2000 and 2004 and will therefore be excluded from the analysis before year 2006[6].

The final sample used in the cross-country empirical analysis includes 52 African recipient countries and cover the years from 2000 to 2012. It is an unbalanced panel[7] with a total of 670 individual country-year observations.

For the within-country sector analysis, the country level aid flows are aggregated into nine broad sectors, following the sector categorization used by Bigsten et al. (2016). However, three of these sectors are excluded from the within-country analysis, these are *Actions related to debt*, *Humanitarian aid* and the sector category *Other*. *Actions relating to debt* is excluded because the aid reported in this channel, like debt forgiveness, is only received in the recipient countries in an abstract rather than practical sense. *Humanitarian aid* is excluded because it is inherently unpredictable and *Other* is excluded because it is inflated by aid spent in donor countries. In

[6] DAC aid enter the econometric regression with a one year lag and Libya will therefore not be included in the sample until 2006, i.e. 2005 + 1 year.
[7] Unbalanced only due to the exclusion of Libya before year 2006.

the panel used for the within-country sector analysis, the unit of observation is a specific country-sector-year, i.e. a specific sector within a recipient country in a given year. It covers 6 sectors within 48 countries during 2000-2012 and it is an unbalanced panel with 3708 individual sector-country-year observations. Compared to the country sample included in the cross-country analysis, Gambia, Swaziland, Sao Tome & Principe and Burkina Faso are excluded because none of these countries received Chinese aid during the time period under consideration. This means that the countries, if included, would be useless for within-country predictions. Appendix A1 and A2 provide exhaustive lists of the countries and sectors covered in this study.

5.3 Dependent Variable

This study employs different dependent variables in the spatial cross-country analysis and in the within-country sector analysis. The cross-country regressions use three different measures of the dependent variable, $Chinese\ aid$. The main measure is a binary indicator variable that is equal to 1 if a country *c* receives Chinese aid in year *t*. This is a rough measure of aid and comes with the caveat of providing limited variation and information about the Chinese aid. Due to the limitations of the binary indicator variable, this study follows the existing literature on the determinants of Chinese aid allocation and complement the cross-country analysis with two continuous measures of Chinese aid. $Chinese\ aid$ will be measured as the log amount of Chinese aid per capita[8] committed to a country *c* in year *t* and as the total number of Chinese aid projects committed to a country *c* in year *t*. There are pros and cons with both these measures. The actual aid amounts that China has committed themselves to deliver would probably be the most intuitive way of measuring Chinese aid, but unfortunately a large fraction, approximately 42 percent, of the individual project data on committed amounts is missing in the Chinese data sample[9]. Even if the bias introduced by the missing amounts might be negligible, conditional on an assumption that most of this missing values correspond to small projects that did not attract public attention, this measure of Chinese aid might still be misleading. Therefore, the number of Chinese aid projects will be employed as a third measure of Chinese aid even if it holds no information about the size of aid projects. This study argues that the two latter measures are imperfect, but still informative as complements to the main measure of the dependent variable, i.e. the binary indicator variable of Chinese aid.

[8] This study uses logged amounts in an attempt to reduce problems with heteroscedasticity and outliers as well as to make interpretation of the results more convenient and the large deviations in aid volumes easy to compare.
[9] Committed amounts are missing for 659 of the 1567 Chinese aid projects covered in the sample selection. The share of missing amounts per year ranges between approximately 20 percent in 2001 and 52 percent in 2008.

In the within-country sector analysis, the dependent variable, $Chinese\ Sector\ aid,$ is defined as a binary indicator variable that is equal to 1 if sector *i* in a country *c* receives Chinese aid in year *t*. No additional measure of the dependent variable will be employed as the mean and median number of aid projects received by a country in a specific year is only equal to 2, while the within-country sector analysis considers 6 different sectors, and hence the dependent variable will therefore contain a lot of country-sector-year observations that do not receive any Chinese aid. See the summary statistics for the dependent variables in Table 4, section 5.6.

5.4 Key Explanatory Variables

The key explanatory variable in the cross-country analysis, $DAC\ aid$, is defined as the logged amount of total bilateral DAC aid per capita committed to country *c* in year *t-1*. This variable is used to examine the relationship between cross-country DAC aid and Chinese aid allocation. The sign, magnitude and significance level of this variable is assumed to capture the extent to which China takes notice of the aid allocation of DAC donors and how China responds to that given allocation. The main argument for excluding all multilateral donors' aid from the analysis, is that it would be difficult to make an informative decision about which multilateral donors that should be included and not. China has at least to some extend been cooperating with some multilateral agencies since 2005 and without any further knowledge about these cooperations the decision about which multilateral donors that should be included or not would be arbitrary. A list of the 29 bilateral DAC donors is provided in appendix A3.

The key explanatory variable in the within-country sector analysis, $DAC\ Sector\ aid$, is measured as the logged amount of total bilateral DAC aid committed to the specific sector *i* in country *c* in year *t-1*.

A notable difference between the key explanatory variable in the spatial cross-country analysis and the within-country sector analysis is that $DAC\ aid$ is measured in per capita terms while $DAC\ Sector\ aid$ is not. In the cross-country analysis, DAC aid per capita is employed as this study considers it a better measure for how "crowded" an aid recipient country is. However, in the within-country sector analysis, this study argues that it makes little sense to employ DAC aid per capita rather than the total amount of DAC aid committed to a certain sector.

5.5 Additional Control Variables

The reviewed literature on Chinese cross-country aid determinants provides an extensive list of suitable control variables that will be used also in this study. The control variables can be categorized into four broad clusters; variables controlling for recipient "need", variables controlling for commercial interest and the recipient countries' natural resource endowments, a

set of controls for China's political ties with recipient countries and controls for the quality of institutions.

AidData uses a wide range of sources in different languages, but still most of the sources are in English and Chinese. Therefore, a binary variable that indicates if English is official language in the recipient country is added to control for the likely underestimation of aid in countries where English is not an official language, as proposed by Dreher et al.(2015b). Year dummies are included to control for year fixed effects and following the United Nations geographical geoscheme, the African continent is divided into five subregions[10] to be able to include region dummies and hence control for region fixed effects (United Nations Statistical Division, 2014).

To proxy for recipient countries' level of need, logged GDP per capita, logged population size and logged number of people affected by natural disasters are employed. The logged value of China's total trade with a recipient country is employed as a proxy for China's commercial interest, and the logged value of mineral depletion together with a control for the logged value of energy depletion are employed as controls for natural resource endowments in recipient countries.

The recipient countries' stance towards the One-China policy and their voting behavior in the United Nations General Assembly (UNGA)[11] are employed as proxies for recipient countries' political ties with China. The control employed for stance towards the One-China policy is Timothy Rich's binary indicator variable that is equal to 1 if a recipient country recognize the government in Taiwan, Taipei, rather than the government in Beijing[12]. The indicator of UNGA voting behavior is measured as the voting alignment on all votes in the United Nations General Assembly and it ranges between 0 and 1.

The Political Rights index from Freedom House and the Control of Corruption index from the Worldwide Governance Indicators project are used as proxies for recipient countries' institutional quality. There are numerous indexes available that can be used to proxy for institutional quality. The Political Rights index is chosen for this study because of the extensive data coverage, even though it has not been widely used in the aid literature. The Political Rights index is a point scale ranging from 1 to 7 where the value of 1 representing most free countries and 7 representing least free countries in the original index. However, in order to make the interpretations in the following econometric analysis more intuitive the index is transformed

[10] Northern Africa, Western Africa, Central Africa, Eastern Africa and Southern Africa.
[11] The author is extremely grateful to Axel Dreher and Andreas Fuchs for sharing this unpublished data.
[12] The author updated this indicator for year 2008 to 2012 using news articles and government website as sources.

into the reverse direction in this current study. This implies that a point of 1 representing the least free countries and a point of 7 representing the most free countries in the data sample. The Control of Corruption index[13] ranging from -2.5 to 2.5, higher values correspond to better governance. Table 3 presents the predictive capacity of the explanatory variables (or similar variants of the explanatory variables from the earliest literature) that has been found in the existing literature. The dependent variables, key explanatory variables and all additional control variables are presented with variable definitions and the variable sources in appendix A4.

Table 3. Predictive capacity of the control variables

Name of control variable	Predictive capacity	Source
GDP per capita (log)	+ and statistically significant	Dreher et al., 2015b; Li 2015; Dreher and Fuchs 2016
	ambiguous	Giovannetti and Sanfilippo 2011; Berthélemy 2011
Population size (log)	- and statistically significant	Dreher et al. 2015b; Li 2015; Dreher and Fuchs 2016
	- and statistically significant	Berthélemy 2011
People affected by disasters (log)	ambiguous	Dreher et al., 2015b; Dreher and Fuchs 2016
Total trade with China (log)	not informative	Dreher et al., 2015b
	+ and statistically significant	Giovannetti and Sanfilippo 2011
Mineral depletion (log)	not informative	Dreher et al., 2015b; Dreher and Fuchs 2016
Energy depletion (log)	not informative	Dreher et al., 2015b; Dreher and Fuchs 2016
Taiwan recognition	- and statistically significant	Dreher et al., 2015b; Dreher and Fuchs 2016
UNGA voting with China	+ and statistically significant	Dreher et al., 2015b; Dreher and Fuchs 2016
Control of Corruption	not informative	Dreher et al., 2015b; Li 2015
Political Rights	not used in reviewed literature	
English language	+ and statistically significant	Dreher et al., 2015b

5.6 Descriptive Statistics

Table 4 presents summary statistics for the three measures of $Chinese\ aid$, the key explanatory variable and all additional controls employed in the cross-country regressions. The Chinese aid dummy has a mean of 0.716, hence the distribution is skewed towards 1 and approximately 72% of the independent country-year observations in the sample receive Chinese aid. The continuous measure of the dependent variable, amounts of Chinese aid committed per capita, is presented both before and after taking the log in order to get a better intuition of the amounts. The mean of Chinese aid that a country in the sample receives in a year is approximately 5.57 US dollars per capita, the maximum amount of Chinese aid that a country has received over the years is 699.2 US dollars per capita and the minimum amount is zero. Concerning the third measure of $Chinese\ aid$, number of Chinese aid projects, both the mean and median number

[13] To solve the problem with missing values for year 1999 and 2001 when data for Control of Corruption was not collected, the variable is interpolated. Appendix A5 provides summary statistics before and after the interpolation.

of projects received in a country over the years is 2 Chinese aid projects. The number of projects ranges from a minimum of zero to a maximum of 18 projects.

Also the key explanatory variable, $DAC\ aid$, is presented in Table 4 both before and after taking the log of DAC aid per capita. As can be seen in the table, all African countries receive DAC aid in all years represented in the sample. The mean amount of DAC aid that a country receives in a year is equal to 52.51 US dollars per capita and the median is equal to 35.38 US dollars per capita. The maximum amount of DAC aid that a country has received over the years is approximately 624 US dollars per capita which is less than the maximum Chinese amount of US dollar per capita. Amounts of US dollars are not deflated to a common base year, and the main argument for that is the short panel employed with low inflation rate over the time period covered. Furthermore, year dummies and the use of log amounts should be able to partly mitigate the potential problem with inflated values.

Concerning the descriptive statistics for the control variables it is worth noting that only 12 percent of the country-year observations recognize Taiwan and that some of the additional controls suffer from missing values, which will unfortunately reduce the number of observations that can be utilized in the empirical investigation.

Table 4. Summary Statistics, variables in cross-country analysis[14]

Dependent variable	**Obs**	**Mean**	**Median**	**Std.dev**	**Min**	**Max**
China aid dummy	670	0.716	1	0.451	0	1
Chinese aid per capita (log)	670	-7.235	-3.347	8.249	-16.12	6.550
Chinese aid per capita (current USD)	670	5.573	0.0352	33.23	0	699.2
Number of Chinese projects	670	2.339	2	2.476	0	18
Key explanatory variable (t-1)	**Obs**	**Mean**	**Median**	**Std.dev**	**Min**	**Max**
DAC aid per capita (log)	670	3.532	3.566	0.914	0.010	6.437
DAC aid per capita (current USD)	670	52.51	35.38	64.18	1.010	624.4
Additional controls (t-1)[15]	**Obs**	**Mean**	**Median**	**Std.dev**	**Min**	**Max**
English language	670	0.427	0	0.495	0	1
People affected by disasters (log)	670	6.875	8.185	5.219	0	16.52
UNGA voting with China	670	0.834	0.877	0.116	0.500	0.957
Taiwan recognition	670	0.119	0	0.325	0	1
Control of Corruption	670	-0.574	-0.649	0.564	-1.733	1.250
Mineral depletion (log) (current USD)	670	10.51	13.86	8.089	0	23.11
Energy depletion (log) (current USD)	661	8.807	0	9.893	0	24.68
GDP per capita (log) (current USD)	669	6.701	6.421	1.149	4.612	10.02
Population size (log)	670	15.74	16.10	1.599	11.29	18.91
Total trade with China (log) (current USD)	665	18.80	19.02	2.337	11.00	24.54
Political Rights	670	3.530	3	1.819	1	7

[14] The value of 10^{-7} was added to the dependent variable, $Chinese\ aid$, before taking the logarithm when measured as the amount of Chinese aid per capita. The value 1 was added to the key explanatory controls, $DAC\ aid$ and $DAC\ Sector\ aid$, as well as to the additional controls for Mineral depletion, Energy depletion and People affected by natural disasters before taking the logarithms.

[15] Except for People affected by disasters

Table 5 presents summary statistics for the dependent variable, *Chinese Sector aid*, defined as a binary indicator variable that is equal to 1 if a sector within a country receives Chinese aid in a particular year *t*. Presented is also the key explanatory variable, *DAC Sector aid*, defined as the log amount of DAC aid committed to a certain sector within a country in year *t-1*. The Chinese aid dummy has a mean of 0.189, which implies a skewed distribution towards zero; approximately 19% of the independent sector-country-year observations in the sample receives Chinese aid over the time period. The minimum amount of DAC aid committed to a sector within a country during a specific year is zero, while the maximum amount is close to astonishing 1.3 billion US dollars. The mean amount of DAC aid is approximately 62 million, while the median is only 15 million US dollars.

Table 5. Summary Statistics, variables in within-country sector analysis

Variables	Obs	Mean	Median	Std.dev	Min	Max
China aid dummy	3,708	0.189	0	0.392	0	1
Total DAC aid (log) t-1	3,708	14.80	16.55	5.471	0	20.98
Total DAC aid t-1 (current USD)	3,708	62.29 million	15.45 million	134.6 million	0	1 294 million

Figure 1 displays the time trend for Chinese aid to Africa, measured as both the number of aid projects and the amount in millions of current US dollars. Both measures of Chinese aid indicate an overall increase in Chinese aid to Africa over the time period. The figure reveals a large increase in Chinese aid projects and amounts in 2006 as compared to previous years. A speculative explanation for this peak might be that China, during the 2006 FOCAC meeting in Beijing, made promises to increase its financial assistance to Africa. Another peak in Chinese aid amounts is revealed for 2012, this time without a corresponding increase in Chinese aid projects. This time a speculative explanation could be a larger number of Chinese megadeals in 2012 than in previous years, four large aid recipient countries[16] did for example receive more aid from China in 2012 than from total bilateral DAC donor countries. However, this is only guesswork due to the lack of proof for any other explanation.

Figure 2 shows the time trend of the Chinese aid amounts as a share of the total bilateral DAC aid over the years. During most years Chinese aid amounts has fluctuated around 5 percent of the total DAC aid and the trend follows closely the trend in Chinese aid amounts displayed in Figure 1. The Chinese aid as a percent of the total bilateral DAC aid peaks in 2012 when Chinese aid was equivalent to approximately 23 percent of bilateral DAC aid in Africa.

[16] Tanzania, Nigeria, Zimbabwe and Republic of the Congo.

Figure 1. Chinese aid to Africa, 2000-2012

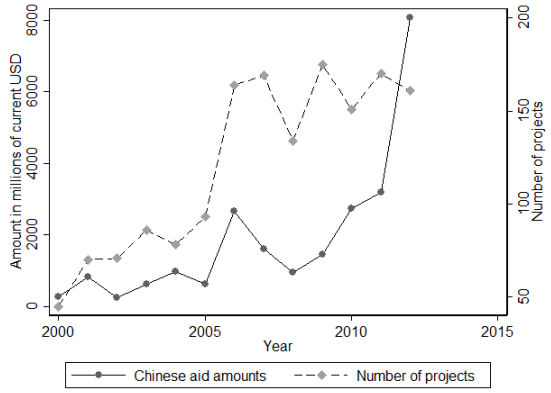
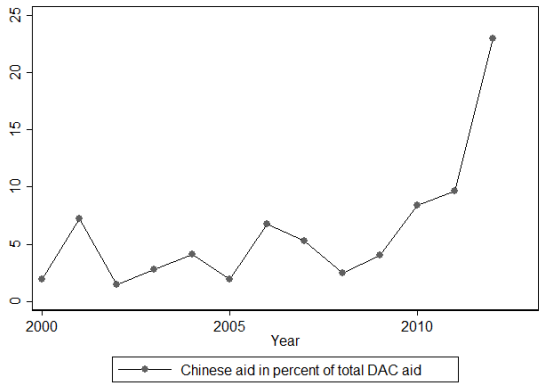


Figure 2. Chinese aid to Africa in percent of total DAC aid



Appendix A6 presents the evolution of log amounts of Chinese aid and DAC aid per capita by recipient country and year. Compared to the DAC aid, the Chinese aid is highly volatile from year to year. There are also four countries in the sample that do not receive any aid from China over the time period, it is Sao Tome and Principe, Gambia, Swaziland and Burkina Faso. Interestingly, these countries have in common that they all recognized the government in Taipei and not the government in Beijing during the full time period, 2000-2012.

6. Econometric Specifications and Empirical Strategy

6.1 Baseline Econometric Specifications and Empirical Strategy

The following econometric specifications are employed for the investigation of research question 1 and 2:

Spatial Cross-Country Analysis

$$\Pr(Chinese\ aid_{crt} = 1) = \Phi(\beta DAC\ aid_{crt-1} + \gamma \boldsymbol{X'}_{crt-1} + \alpha_t + \tau_r + \epsilon_{crt}) \quad (1)$$

$$Chinese\ aid_{crt} = \beta DAC\ aid_{crt-1} + \gamma \boldsymbol{X'}_{crt-1} + \alpha_t + \tau_r + \epsilon_{crt} \quad (2)$$

Within-Country Sector Analysis

$$\Pr(Chinese\ Sector\ aid_{ict} = 1) = \Phi(\partial DAC\ Sector\ aid_{ict-1} + \varphi_{ic} + \alpha_t + u_{ict}) \quad (3)$$

The baseline specifications in equation (1) and (2) are used for the spatial cross-country analysis. In equation (1) a pooled probit model is used as the dependent variable is a binary indicator variable that is equal to 1 if Chinese aid is committed to country *c* in subregion *r* in year *t*. $DAC\ aid_{crt-1}$ is the key explanatory variable, it is the total amount of DAC aid per capita committed to country *c* in subregion *r* in year *t-1*. α_t is a vector of year dummies controlling for year fixed effects and τ_r is a vector of the five subregion dummy variables. $\boldsymbol{X}$ is a vector including the additional control variables presented in section 5.4, except for the

variable People effected by disasters, all controls enter the equations with a one year time lag. The pooled probit model predicts whether the likelihood for a country to receive Chinese aid in year *t* is determined by the amount of DAC aid per capita that the same country received in the previous year.

Equation (2) is a pooled ordinary least square (OLS) model, in which the two continuous measures of the dependent variable are employed. The dependent variable is measured as the log amount of Chinese aid per capita committed to country *c* in subregion *r* in year *t* and as the total number of Chinese aid projects committed to country *c* in subregion *r* in year *t*. The pooled OLS models examine if the amounts of Chinese aid per capita and number of Chinese aid projects committed to a country in year *t* is determined by the amount of DAC aid per capita that the same country received in the previous year. The key explanatory variable and the additional control variables in equation (1) and (2) are identical. A negative and significant estimate of β is in favor of a complementary relationship between DAC aid and Chinese aid at the country level. While a positive and significant estimate of β suggests that Chinese aid is mainly additional and allocated in competition with DAC aid.

The specification in equation (3) is used for the within-country sector analysis. Again, a pooled probit model is employed as the dependent variable is a binary indicator variable that is equal to 1 if Chinese aid is committed to sector *i* in country *c* in year *t*. $DAC\ Sector\ aid_{ict-1}$ is the key explanatory variable, it is the log total amount of bilateral DAC aid committed to sector *i* in country *c* in year *t-1*. Following Öhler (2013), φ_{ic} is added to control for country-sector fixed effects that accounts for sector-specific needs that vary across countries and α_t is a vector of year dummies controlling for year fixed effects. The pooled probit model predicts whether the likelihood of receiving Chinese aid allocated to a certain sector *i* within country *c* in year *t*, is determined by the committed amount of DAC aid to the same country and sector in the previous year. A negative and significant estimate of ∂ is in favor of a complementary sector level relationship between DAC aid and Chinese aid allocation within countries. A positive and statistically significant estimate of ∂ implies that Chinese aid is allocated additionally and in competition with DAC aid sector priorities.

In the following regression analyses, and if nothing else is specified, robust standard errors are clustered at the level of individual recipient countries in equation (1) and (2), and clustered by country-sector pairs in equation (3) to allow for within cluster correlation.

6.2 Endogeneity Concerns and Robustness Checks

A discussion about the key assumption in this study and endogeneity problems are important. According to the theoretical framework, China seems more likely to respond to the traditional DAC donors' aid allocation than the other way around. Hence, the key assumption is that China is the more responsive donor. The proposed mechanisms are that Chinese aid might be guided by direct motivation of not coordinating aid with other DAC donors and instead behave in a competitive manner. Another idea is that the DAC aid allocation is constrained by a consensus of certain conditionality and coordination efforts in their allocation which does not apply to Chinese aid and hence makes Chinese aid management more flexible. Chinese aid is also purported to be demand driven and hence predicted to be demanded by countries and targeting sectors where governments perceive that DAC aid is not sufficient. Furthermore, this study suggests that China is likely to be in a better position to react to DAC aid allocation than vice versa due to the lack of transparency in the Chinese aid management process.

This empirical approach do however suffer from endogeneity, and the potential simultaneity issue is the most aggravating factor in the following empirical analysis. There are obvious reasons to believe that reverse causality may be a source of endogeneity. The DAC donors may be better informed about Chinese aid commitments and more flexible and responsive in their allocation decisions than what is assumed in this study. Hence, it is possible that China and the DAC donors are simultaneously reacting on each other's aid allocation which makes identification of a causal relationship impossible. An instrumental variable (IV) strategy could have been employed to establish causality, but in the absence of a valid IV for DAC aid, this study makes a modest attempt to mitigate the endogeneity concerns by the introduction of a time lag, as proposed by Hernandez (2015). It also important to note that even without a strong case of causality, the identification of a simple correlation between Chinese aid and DAC aid allocation is still interesting for the discussion on donor coordination and aid effectiveness, hence the importance of causality may be of second order.

Following Dreher et al. (2015b), this study does not attempt to employ the fixed effects approach or add country dummies to control for country fixed effects in the spatial cross-country baseline specifications, equation (1) and equation (2), as it would only allow this study to exploit country-specific variation over time. That approach would imply a loss of important between-recipient country variation and hence make it more difficult to identify the relationship between Chinese aid and DAC aid allocation. Therefore, this study aggregates the fixed effects one level and employs subregion fixed effects rather than country fixed effects in the baseline specifications. A caveat of this approach is unfortunately that a statistically significant effect of

DAC aid allocation on Chinese aid allocation may be spurious and come from country specific unobserved heterogeneity that is correlated with both Chinese aid and DAC aid. Therefore, this study utilizes the data's panel structure and introduces country fixed effects in a fixed effects estimation as a robustness check. As already presented in the previous section, a pooled probit model is employed for the baseline regression, equation (1), with the binary indicator of Chinese aid as dependent variable. As a robustness check, equation (1) is also estimated with a pooled linear probability model (LPM) using the OLS estimator and a LPM country fixed effects estimation. Next, the dependent variable is altered to the two continuous measures of Chinese aid in equation (2). For the baseline regressions pooled OLS estimations are employed and the fixed effects estimator is employed as robustness checks.

The descriptive statistics in appendix A6 reveal that four countries, all of which recognize Taiwan, received no Chinese aid during the 2000-2012 period. It seems unlikely that this is a random coincidence and could therefore introduce bias in the regression results. To make sure that this is not the case, an additional robustness check is performed where equation (1) and (2) are re-estimated with a restricted country sample excluding these four countries. One additional concern related to the econometric specification is the uncertainty about how fast China can respond to changes in DAC aid allocation and whether a one year lag is the most appropriate choice. To test the robustness of this choice of a one year time lag, equation (1) and (2) are re-estimated both with a two year time lag and without lagging DAC aid at all, in order to test for an instant reaction.

Finally, it is important to mention that both equation (1) and (2) may suffer from multicollinearity, it is for example likely that the key explanatory variable, *DAC aid*, is highly correlated with some of the other control variables. Appendix A7 presents a table of the pairwise correlations of all variables, the correlation matrix gives no reason to expect that high correlation between DAC aid and any of the other control variables should be a major concern[17].

The within-country baseline regression specified in equation (3) is a pooled probit model where the introduction of country-sector and year fixed effects is used to isolate the sector allocation within countries. Thereafter, equation (3) is estimated with a logit model and with a fixed effects logit model to check the robustness of the result. The fixed effects logit model has an important advantage over the simple probit and logit models, as it can be employed to control

[17] The baseline equations were estimated also without the control for DAC aid. This exercise suggested that a potential correlation problem may be of small scale as the introduction of DAC aid in the regressions did not, to a large extent, affect the significance, sign or magnitude of the other explanatory variables. The results are available upon request.

for the time invariant unobserved country-sector fixed effects. On the other hand, a big drawback of the fixed effects logit model is that marginal effects cannot be computed as the elimination procedure of the unobserved heterogeneity provides no estimates of the unobserved heterogeneity for the individual country-sector pairs. In an additional robustness check, the sample is restricted to the three largest key sectors, including Social infrastructure & Services, Economic infrastructure & Services and Productive Sectors. As for heterogeneity tests, separate regressions will be performed with the three key sectors as subsamples.

6.3 Cross-Country Heterogeneity Analysis

This study performs numerous heterogeneity tests to investigate if the effect of DAC aid allocation on Chinese aid allocation is heterogeneous for different subsamples. The full country sample is divided into two subsamples after income status, democracy status, prevalence of corruption, oil endowments and after time period, 2000-2005 and 2006-2012. Table 6 presents the descriptive statistics for the variables that define the different subsample. All the country and year observations with the lowest 25% point score of the Control of corruption index are defined here as having high corruption prevalence. The sample threshold is equivalent to approximately -0.985 on a scale ranging from -2.5 to 2.5. The Low income dummy is equal to 1 if the population in a country during a specific year, lives on less than 1.25 US dollars a day. The Oil dummy is equal to 1 if a country has proven oil reserves in a particular year according to BP (2015) and lastly the Democracy dummy equals 1 if the country is identified as an electoral democracy in a certain year by Freedom House (2015).

Table 6. Summary statistics, variables defining subsamples in the heterogeneity analysis

Variable	Obs	Mean	Median	Std.dev	Min	Max
Democracy dummy	670	0.404	0	0.491	0	1
Oil dummy	670	0.203	0	0.403	0	1
Low income dummy	669	0.387	0	0.487	0	1
High corruption dummy	670	0.251	0	0.434	0	1

7. Results and Findings

The aim of this study is to investigate whether Chinese aid allocation takes into account the presence of bilateral DAC aid in the cross country and within country aid allocation, as well investigate if the two aid sources are better described as competing with each other over the same recipient countries and sectors or if the aid flows are mainly complementing each other. The two research questions intended to be answered through the analysis of the regression results, robustness checks and heterogeneity tests presented in this section is whether the Chinese aid is allocated in competition with or as a complement to cross-country DAC aid allocation as well as to DAC aid sector allocation within countries.

7.1 Cross-Country Regression Results

Starting with the first research question at the country level, Table 7 column 1 presents the regression results when the binary indicator variable of Chinese aid is employed in equation (1). The log amount of lagged DAC aid per capita that a country receives is highly statistically significant at a 1% significance level with a positive magnitude of 0.0767. Given the inclusion of all conventional controls from the Chinese aid allocation literature, this result implies that there is a positive relationship between DAC aid allocation and Chinese aid allocation. A one standard deviation (0.914) increase in log of DAC aid per capita, is associated with an average increase in a country's probability of receiving Chinese aid with approximately 7.0 percentage points the following year.

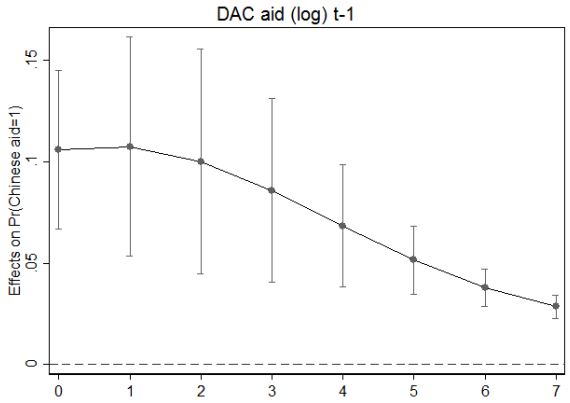
Table 7. Binary indicator of Chinese aid- Average Marginal effects and Coefficients

Variable	**Marginal effects**	**Coefficients**	
	(1)	(2)	(3)
Binary indicator Chinese aid	Pooled Probit	Pooled LPM	LPM FE (within)
DAC aid per capita (log) t-1	0.0767***	0.0833***	0.0437*
	(0.0192)	(0.0214)	(0.0236)
UNGA Voting t-1	-0.00603	0.0711	0.0538
	(0.126)	(0.142)	(0.156)
Taiwan recognition t-1	-0.592***	-0.742***	-0.401***
	(0.0605)	(0.0589)	(0.0718)
Trade with China (log) t-1	0.0284*	0.0214	0.0346
	(0.0159)	(0.0151)	(0.0257)
Energy depletion (log) t-1	0.000680	-0.000583	0.00325
	(0.00287)	(0.00282)	(0.00530)
Mineral depletion (log) t-1	0.00216	0.00132	-0.00331
	(0.00258)	(0.00320)	(0.00493)
Political Rights t-1	-0.000149	-0.00609	-0.0345
	(0.0142)	(0.0155)	(0.0213)
Control of corruption t-1	-0.0479	-0.0340	-0.0352
	(0.0507)	(0.0543)	(0.118)
GDP per capita (log) t-1	-0.0995***	-0.0940***	-0.167*
	(0.0322)	(0.0324)	(0.0947)
Population (log) t-1	-0.0428*	-0.0285	0.300
	(0.0255)	(0.0237)	(0.597)
People affected by disasters (log)	0.00312	0.00281	0.00218
	(0.00336)	(0.00357)	(0.00314)
English language	0.124**	0.0999**	omitted
	(0.0482)	(0.0443)	
Number of observations	*655*	*655*	*655*
Pseudo R2 / R2	*0.366*	*0.400*	*0.141*
Clustered standard errors	*Yes*	*Yes*	*Yes*
Year dummies	*Yes*	*Yes*	*Yes*
Subregion dummies	*Yes*	*Yes*	*No*
Country fixed effects	*No*	*No*	*Yes*
Number of recipient codes	*52*	*52*	*52*

Year dummies, region dummies and the constant terms are suppressed to save space.
Significance levels: *:10% **:5% ***:1%

However, it is reasonable to expect that the marginal effect of DAC aid per capita on the probability of receiving Chinese aid may be different for changes at different initial levels of DAC aid per capita that a country receives. Figure 3 displays the average marginal effects of DAC aid on the probability of receiving Chinese aid at different log amounts of lagged DAC aid per capita together with the corresponding 95% confidence intervals. The marginal effect of DAC aid on the probability of receiving Chinese aid is confirmed non-linear and the estimated effect is larger for increases at low levels of DAC aid per capita. Furthermore, the confidence intervals indicate that the calculated marginal effects are statistically significant at conventional levels for all different log amounts of DAC aid per capita in the country-year sample. As the Chinese aid to a recipient country is generally lower than the DAC aid, the result might indicate that it is more strategic and easier for China to respond in a competitive way in countries and years where the DAC increases its aid from relatively low initial levels.

Figure 3. Probability of Chinese aid allocation- Marginal effects of log amount of DAC aid per capita



The positive and statistically significant relationship between log amount of lagged DAC aid per capita and Chinese aid shown in Table 7, column 1, is robust to different choices of econometric models. The coefficient estimates for the pooled LPM presented in column 2 and the fixed effects estimation in column 3 can be compared with the average marginal effects presented for the probit estimation in column 1. One caveat of the LPM and fixed effects estimator is that the predictions are linear. Hence, the effects of lagged DAC aid on the probability that Chinese aid is allocated to the same country in the following year is predicted to be exactly the same for DAC aid changes at all initial amounts of DAC aid per capita, which Figure 3 has shown is not the case. The magnitude of the DAC aid per capita coefficient is slightly larger in the pooled LPM than in the pooled probit model, a one standard deviation increase in DAC aid per capita is associated with an increase in the probability of receiving Chinese aid by approximately 7.6 percentage points. As discussed in section 6.2, the inclusion

of country fixed effects is expected to significantly reduce the chances to identify a relationship between DAC aid and Chinese aid allocation. However, also with the inclusion of country fixed effects in the estimation presented in column 3, DAC aid per capita is a weak, but still statistically significant determinant of the probability of receiving Chinese aid, at the 10% significance level. This is a reassuring finding as it indicates that the positive and statistically significant relationship between DAC aid allocation and Chinese aid allocation is not driven by country specific and time invariant unobserved heterogeneity. A one standard deviation increase in logged DAC aid per capita in the fixed effects estimation is translated into a 4.0 percentage point increase in a country's probability of receiving Chinese aid the following year.

Presented in Table 8 are the coefficient estimates where the two continuous measures of Chinese aid in equation (2) are employed. Column 1 shows the result for the baseline specification with the log amount of Chinese aid per capita as dependent variable. The main variable of interest, log amount of lagged DAC aid per capita is again positive and statistically significant at the 1% significance level. The positive correlation implies that a 1 percent increase in DAC aid per capita is associated with an increase in Chinese aid by approximately 1.73 percent in the following year. In the fixed effects estimation in column 2, it is again reassuring to find that the coefficient estimate for DAC aid per capita is positive and that the effect is still statistically significant at conventional levels, now at the 10% significance level.

Column 3 and 4 present the coefficient estimates when Chinese aid is measured as the number of Chinese aid projects. The results confirm the previous findings. The regression results for the baseline specification in column 3, indicate that the log amount of lagged DAC aid per capita is a highly significant determinant of the number of Chinese aid projects committed to a country in the following year. The estimated coefficient has a value of 0.574 which implies that a one standard deviation increase in DAC aid per capita is associated with an increase in the number of Chinese aid projects by approximately 0.52 projects, which could be considered high as the mean and median recipient receives approximately two Chinese aid projects per year. Hence, a one standard deviation increase in DAC aid per capita can be translated to a 25 percent increase in the number of aid projects for the average aid recipient. The result is robust to the inclusion of country fixed effects in column 4. The magnitude of the coefficient in the fixed effects estimation is 0.368, which implies an increase of approximately 0.34 aid projects. The estimate is statistically significant at the 5% significance level.

Table 8. Continuous measures of Chinese aid- Coefficients Estimates

Variables	**Coefficients**		**Variable**	**Coefficients**	
Chinese aid per capita (log)	(1) Pooled OLS	(2) FE (within)	**#aid projects**	(3) Pooled OLS	(4) FE (within)
DAC aid per capita (log) t-1	1.727***	1.232*		0.574***	0.368**
	(0.598)	(0.629)		(0.147)	(0.165)
UNGA Voting t-1	4.186	3.491		1.362	1.187
	(3.334)	(3.660)		(1.100)	(1.063)
Taiwan recognition t-1	-7.964***	-3.495*		-1.812***	-1.134*
	(1.255)	(1.764)		(0.355)	(0.664)
Trade with China (log) t-1	0.665*	0.134		0.169	-0.0791
	(0.381)	(0.460)		(0.108)	(0.158)
Energy depletion (log) t-1	0.0417	0.0454		0.0167	0.0420**
	(0.0655)	(0.0648)		(0.0185)	(0.0200)
Mineral depletion (log) t-1	0.0340	-0.149		0.0503**	-0.00425
	(0.0659)	(0.0976)		(0.0195)	(0.0265)
Political Rights t-1	0.225	0.174		0.120	0.158
	(0.319)	(0.507)		(0.0909)	(0.131)
Control of corruption t-1	-1.438	-0.715		-0.892**	-0.182
	(0.952)	(2.117)		(0.363)	(0.405)
GDP per capita (log) t-1	-1.804**	-1.517		-0.607***	-0.426
	(0.678)	(1.443)		(0.214)	(0.529)
Population (log) t-1	-0.663	13.86		-0.245	1.871
	(0.533)	(11.61)		(0.180)	(3.192)
People affected by disasters (log)	-0.00996	-0.0444		0.00537	-0.00129
	(0.0700)	(0.0679)		(0.0180)	(0.0194)
English language	3.044**	omitted		1.550***	omitted
	(1.162)			(0.381)	
Number of observations	*655*	*655*		*655*	*655*
R2	*0.274*	*0.091*		*0.407*	*0.233*
Clustered standard errors	*Yes*	*Yes*		*Yes*	*Yes*
Year dummies	*Yes*	*Yes*		*Yes*	*Yes*
Subregion dummies	*Yes*	*No*		*Yes*	*No*
Country fixed effects	*No*	*Yes*		*No*	*Yes*
Number of recipient codes	*52*	*52*		*52*	*52*

Year dummies, region dummies and the constant terms are suppressed to save space.
Significance levels: *:10% **:5% ***:1%

In addition, one can note that the marginal effect and coefficient estimates for political ties with Taiwan is also able to maintain a negative and statistically significant relationship with Chinese aid when the fixed effects estimator is employed. It is however important to note that this effect is driven by a limited number of countries that have switched recognition from Taiwan to China in recent years. In line with previous findings by Dreher et al. (2015b), Li (2015) and Dreher and Fuchs (2016), the log of GDP per capita is found to be statistically significant and negatively correlated with all three measures of Chinese aid in the baseline regressions. The control for trade with China is positive and weakly significant in the baseline probit regression, Table 7, and in the pooled OLS models in Table 8. These results imply that countries trading more with China receive more Chinese aid, all else equal. In previous studies, Dreher et al. (2015b) have found trade with China to be a determinant of less concessional

Chinese aid flows, but not of traditional ODA aid flows. However, the statistically significant relationships do not survive in the fixed effects models.

7.2 Cross-Country Additional Robustness Checks

As additional robustness checks, equations (1) and (2) are re-estimated with the restricted country sample excluding Gambia, Sao Tome and Principe, Swaziland and Burkina Faso. These four countries have in common that they are the only African countries in the sample that did not receive any Chinese aid between the year 2000 and 2012 and they are the only countries that upheld diplomatic ties with Taiwan during the full time period. This study consider it unlikely that this is a random coincidence. A table of the regression results is presented in appendix A8. The estimated magnitude of the calculated marginal effect and coefficient estimates for the lagged log amount of DAC aid per capita are very similar to the estimates in the baseline regressions. Hence, the baseline results are robust to the exclusion of the four countries.

In the last robustness checks the uncertainty about how fast China can respond to changes in DAC aid per capita allocation and whether a one year lag is appropriate is tested. The baseline regressions in equations (1) and (2) are now re-estimated without lagging DAC aid, in an attempt to test for an instant reaction, as well as with a two year time lag. The regression results are presented in appendices A9 and A10. Appendix A9 presents the marginal effect and estimated coefficients for an instant Chinese reaction to the log amount of DAC aid per capita. The estimated magnitude is in general larger than in the baseline regressions with the one year lag and the calculated marginal effect and coefficients are significant at 1% significance level across all econometric models and specifications. Figure 4 displays the average marginal effects of DAC aid on the probability of receiving Chinese aid at different log amounts of lagged DAC aid per capita and the corresponding 95% confidence interval. Compared to Figure 3, the pattern is similar but the magnitude of the marginal effect is larger, hence changes in DAC aid has a larger effect on the probability of receiving Chinese aid at low initial amounts of log DAC aid per capita. Appendix A10 presents the marginal effects and estimated coefficients when the log amount of DAC aid per capita enters the regressions with a two years lag. This time the estimated magnitude is in general much lower than in the baseline regressions and the regressions for instant reaction. Additionally, the coefficient estimates are not statistically significant at conventional levels in the fixed effects estimations. Figure 5 displays the average marginal effects of DAC aid on the probability of receiving Chinese aid at different amounts of log DAC aid per capita and the corresponding 95% confidence interval.

The results from this exercise implies that Chinese aid is flexible and responds quickly to changes in DAC aid allocation. However, when DAC aid does not enter the regressions with a time lag, the simultaneity problem is more alarming than in the baseline regressions. Therefore, it is reasonable to introduce the lag, and the employment of a one year lag of DAC aid seems to be the most appropriate choice.

Figure 4. Probability of Chinese aid allocation- Marginal effects of log amount of DAC aid per capita, instant reaction

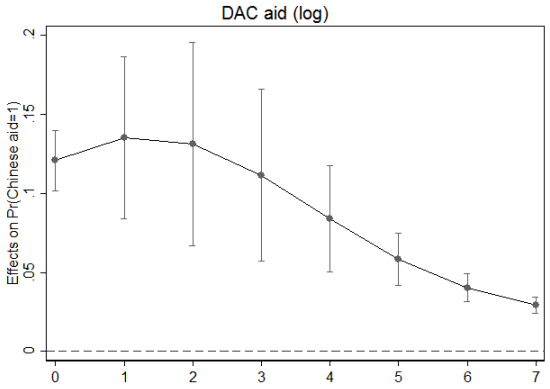
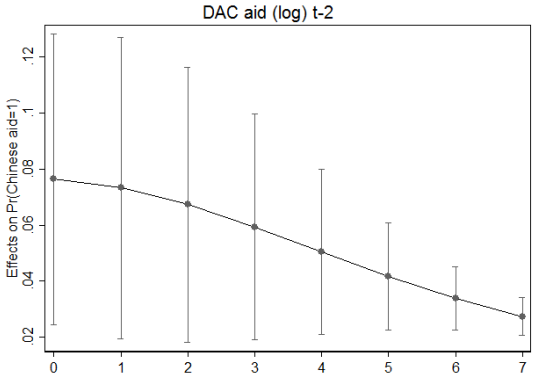


Figure 5. Probability of Chinese aid allocation- Marginal effects of log amount of DAC aid per capita, 2 years lag



7.3 Cross-Country Heterogeneity Tests

Table 9 presents the average marginal effects and coefficient estimates of the explanatory variable lagged log amount of DAC aid per capita in the five different heterogeneity tests outlined in section 6.3. In columns 1 and 2 the country-year sample is divided into one group of countries with confirmed oil endowments and another group with no oil endowments. Some of the early qualitative literature, presented in section 3, suggests that Chinese aid allocation is driven mainly by natural resource endowments. Therefore, the first heterogeneity test examines whether the Chinese aid allocation responds differently to DAC aid allocation if a country has oil endowments. The Chinese could potentially be less likely to coordinate when countries have oil endowments. The regression results gives no clear indication of whether China's response

to DAC aid differ for the two samples. When testing for a significant difference between the two groups, the effect is not found to be statistically different from each another for any of the three measures of Chinese aid[18].

Based on the discussion about China's no strings-attached policy and its likely implications for coordination outcomes, countries are divided into democratic and non-democratic countries over the years in the second heterogeneity test. The results in columns 3 and 4 indicate that the Chinese aid allocation may follow DAC aid allocation more closely and hence be more competitive in non-democracies, while a similar pattern is not found in more democratic countries in column 3. However, the difference between democracies and non-democracies is only statistically significant when Chinese aid is measured as the number of Chinese aid projects.

The third heterogeneity test divides the country-year sample into groups after corruption prevalence. The results in column 5 and 6 suggest little difference between the two groups and the difference is not statistically different from each other when employing any of the Chinese aid measures.

Columns 7 and 8 show the results from the fourth heterogeneity test. Here, the sample is divided into two different time periods, before and after the year 2005. The reason why year 2005 is employed as the threshold is because it is the year when the Paris Declaration was endorsed by the OECD DAC donors as well as the year when China, according to the White paper in 2011, started to cooperate with other bilateral and multilateral donors. This could suggest that China may have had stronger incentives to coordinate with other bilateral donors after the year 2005. However, the results shown in column 7 and 8 suggest that, from an aid effectiveness perspective, China has responded more competitively to DAC aid allocation in the period after 2005 and coordinated the aid effort worse. The difference is confirmed to be statistically different from each other at the 1% significance level in the regressions employing the continuous measures of Chinese aid, and it is a border case at the 10% significance level when the Chinese aid dummy is employed.

The last heterogeneity test divides the country-year observations into two groups after a threshold where a country's population lives on less than 1.25 US dollars per day in a year. This subsample is defined as low income in this test. According to Powell and Findley (2012), donor coordination should still be considered effective if the donor clustering is high in geographical areas where the need of aid is high. The division of the observations into a subsample of low

[18] When testing for statistically different effects interaction terms between DAC aid and the variables defining the subgroups are employed in a regression of the full sample. The regression results are available upon request.

income country-years could therefore be used to test whether the positive correlation between DAC aid and Chinese aid is mainly driven by donor clustering in countries and years with high need.

According to the results shown in columns 9 and 10, China does however seem to allocate its aid as additional to DAC aid per capita mainly in wealthier countries, rather than the other way around. The effect is confirmed to be statistically different from each other at the 5% significance level when employing both the binary indicator of Chinese aid and Chinese aid projects as the measures of the dependent variable. All else equal, low income countries receive more Chinese aid. However, if DAC aid per capita is increasing in low income countries, China is confirmed to respond with smaller increase in aid the following year than in wealthier countries. Hence, the results suggest an ineffective coordination between Chinese aid and DAC aid also using the definition of Powell and Findley (2012).

Table 9. Heterogeneity analyses- Marginal effect and estimated coefficients of DAC aid per capita for different subsamples

Variables	**Marginal effects**									
	(1) Oil=1	(2) Oil=0	(3) Democracy=1	(4) Democracy=0	(5) Corruption=1	(6) Corruption=0	(7) year 2000-2005	(8) year 2006-2012	(9) Low income=1	(10) Low income=0
Chinese aid dummy										
Pooled Probit										
DAC aid per capita (log) t-1	0.192***	0.0320	0.0135	0.101***	0.0425*	0.0745***	0.0686**	0.0743***	0.0436[19]	0.135***
	(0.0623)	(0.0224)	(0.0346)	(0.0265)	(0.0249)	(0.0236)	(0.0336)	(0.0227)	(0.0392)	(0.0266)
Chinese aid per capita (log)	**Coefficients**									
Pooled OLS										
DAC aid per capita (log) t-1	3.023***	1.332**	0.118	2.335***	1.832**	1.633***	0.318	2.629***	2.111***	2.177***
	(0.955)	(0.566)	(0.870)	(0.490)	(0.836)	(0.538)	(0.655)	(0.568)	(0.782)	(0.552)
# Chinese projects	**Coefficients**									
Pooled OLS										
DAC aid per capita (log) t-1	0.802***	0.437***	0.289	0.615***	0.497**	0.505***	0.261*	0.765***	0.353	0.906***
	(0.257)	(0.152)	(0.206)	(0.147)	(0.242)	(0.133)	(0.139)	(0.174)	(0.249)	(0.149)
Observations	*136*	*528*	*267*	*388*	*159*	*496*	*294*	*361*	*258*	*397*
Number of recipients	*11*	*42*	*30*	*40*	*23*	*49*	*50*	*52*	*31*	*45*

Year dummies, region dummies, additional controls and the constant terms are suppressed to save space. Robust standard errors (not clustered) in parenthesis.
Significance levels: *:10% **:5% ***: 1%

[19] The number of observations is reduced to 205 due to a number of years and regions that predict Chinese aid perfectly.

7.4 Within-Country Sector level Regression Results

Let us now turn to the second research question, at the within-country sector level. Table 10 presents the coefficient estimates for the lagged log amount of DAC aid in the within-country sector analysis, see equation (3) in section 6.1. The magnitude of the coefficient estimates cannot be interpreted directly, but the sign and statistical significance of the coefficients can be interpreted. The coefficient estimates are positive in both the probit model, column 1, and in the logit model, column 2, but the estimates are far from being statistically significant at conventional levels. Column 3 presents the coefficient estimate for the conditional fixed effects logit model, the estimate for log amount of DAC aid per capita is again positive and statistically insignificant. This may suggest that the simple probit and logit estimations do not suffer from severe bias, but the regression results presented in Table 10 are in any case not informative regarding the relationship between the allocation of DAC aid and Chinese aid at the within-country sector level. Compared to the indications of Chinese competition and duplication behavior at the country level, a similar behavior cannot be confirmed within countries.

Table 10. Coefficient estimates, Within-country sector analysis

Variables	**Coefficients**		
	(1) Probit	(2) Logit	(3) fe Logit
Chinese aid dummy			
Amount of DAC aid (log) t-1	0.0264 (0.0222)	0.0423 (0.0407)	0.0384 (0.0426)
Number of Observations[20]	*2,171*	*2,171*	*2,171*
Number of country-sector pairs	*167*	*167*	*167*
Year dummies	*Yes*	*Yes*	*Yes*
Clustered Standard Errors	*Yes*	*Yes*	*No*
Pseudo R2	*0.303*	*0.301*	

Year dummies, country-sector dummies and the constant terms are suppressed to save space.
Robust standard errors clustered on recipient country-sector pairs in parenthesis for probit and logit.
Significance levels: *:10% **:5% ***:1%

In a robustness check, the sample is restricted to include only the three largest sectors; Social infrastructure & Services, Economic infrastructure & Services and Productive Sectors. The regression results, presented in appendix A11, give again no indications of a statistically significant relationship between within-country DAC aid allocation and the Chinese aid allocation.

In an additional test the DAC aid variable enters equation (3) without the time lag in an attempt to test for an instant Chinese reaction. The regression results from this exercise again

[20] The sample size is reduced to 2171 country-sector-year observations due to the fact that 121 of the country-sector pairs predict the dependent variable perfectly.

confirm the statistically insignificant within-country relationship between DAC aid and Chinese aid[21].

One drawback of the econometric specification in equation (3) is that it cannot distinguish between the included sectors. Hence, if there is a relationship between DAC aid allocation and Chinese aid allocation only within a certain sector, equation (3) cannot make such separate predictions. Therefore, separate regressions for the Social infrastructure & Services, Economic infrastructure & Services and Productive Sectors are performed in a heterogeneity test of potentially different responses of Chinese aid on DAC aid allocation in different sectors. The probit and logit specifications control for year fixed effects and country fixed effects through the inclusion of dummy variables. The results are presented in appendix A12, and once again, the regression results fail to identify a relationship between DAC aid and Chinese aid sector priorities as all coefficient estimates are insignificant across all econometric models. Hence, the results presented in this section do not suggest a systematic relationship between DAC and Chinese aid allocation at the sector level within countries. One obvious reason for this could be that in reality, there is no relationship to identify at the within-country sector level. Other potential reasons will be discussed in the following section.

8. Analysis and Discussion

Aid fragmentation and lack of donor coordination are two confirmed sources of increased transaction costs and increased administrative burden in aid recipient countries with reduced aid effectiveness as an unpleasant outcome (Acharya et al., 2006; Anderson, 2011; Bigsten & Tengstam, 2015). The traditional DAC donor community has struggled to improve on these issues since the endorsement of the Paris Declaration in 2005, but China, purportedly the most important bilateral donor outside the DAC, has not signed on the Paris Declaration as an aid donor which has induced uncertainty about China's interest to either compete or cooperate with the existing DAC donor community.

The empirical results from the cross-country regressions provide support for a positive and statistically significant relationship between DAC aid allocation and Chinese aid allocation, where China responds to DAC aid allocation with addition aid flows. When putting this finding for research question 1 into the perspective outlined in the theoretical framework, the results give clear indications of a cross-country competition between DAC aid allocation and Chinese aid allocation over the same recipient countries. This competition has made Chinese aid mainly

[21] Regression results are available upon request

additional to DAC aid in recipient countries, i.e. if the traditional DAC donors increases its aid engagement in a country China will most likely do the same. The idea that the demand driven nature of Chinese aid would indirectly induce aid to be allocated in response to a higher demand for Chinese aid in recipient countries where DAC aid is not sufficient or not available can therefore be rejected. Chinese aid is instead allocated in addition to and in competition with DAC aid at the country level, which suggests unfavorable donor coordination from the perspective of aid effectiveness. According to Powell and Findley (2012), donor coordination should, however, still be considered effective if the donor clustering is high in geographical areas where the need of aid is high. Unfortunately, the idea that Chinese aid flows could be additional to DAC aid flows due to the recognition of particularly high recipient need is rejected in the heterogeneity test, which shows that the positive correlation between DAC aid allocation and Chinese aid allocation is mainly driven by allocation to wealthier countries rather than the other way around.

The empirical results suggest that, when the conventional explanatory variables in the Chinese aid allocation literature are controlled for, there is room for China to also take the DAC aid allocation into account and this study confirms the competitive allocation outcome found and discussed in Hernandez (2015). It is however important to acknowledge that the empirical strategies employed for this study cannot rule out that the competitive allocation outcome could be driven by omitted variables bias or country specific shocks that attracted both Chinese aid and DAC aid at the same time. The results in this study can also confirm previous findings in the Chinese aid allocation literature, which suggest that the determinants of DAC aid and Chinese aid allocation are similar, mainly driven by political interest and need in recipient countries (Dreher et al., 2015b; Li, 2015; Dreher & Fuchs, 2016). If Chinese aid and DAC aid allocation are mainly driven by the same determinants, the competitive allocation outcome across countries is not unexpected.

In this discussion, it is important to note that the DAC donors have not been able to coordinate themselves in a desirable way. Bigsten and Tengstam (2015) suggest that political motivations behind donors aid allocation prevent desirable aid allocation outcomes. Donors seem to favor a global presence and they want to allocate to a broader range of countries according to political and economic interests. Especially larger donors are expected to be particularly keen on giving aid to all countries at the same time. Hence, it seems reasonable to believe that this motivation is also applicable to Chinese aid allocation. When the bilateral DAC donors are increasing their engagement in recipient countries, China may respond in a competitive manner to prevent a loss of influence and goodwill in the same countries. China

has established FOCAC, which may be the most important multilateral platform for dialogue and cooperation with its allies in Africa. The results in this study suggest that decisions about China's aid allocation favor a good relation with their African allies over a closer relationship with the DAC donor community. All African countries that maintain diplomatic ties with China have received Chinese aid during the period 2000-2012, while Burkina Faso, Sao Tome and Principe, Swaziland and Gambia, who all recognized Taiwan during the time period, have not received any Chinese aid. Excluding these countries from the empirical analysis does not alter the regression results but it gives a clear indication of the importance of international recognition in the Chinese aid allocation process..

The heterogeneity tests performed in this study do not indicate that the Chinese response to DAC aid allocation is different in natural resource rich countries or in countries with high corruption prevalence. Furthermore, the Chinese response to DAC aid in democracies versus non-democracies is ambiguous and hence there is little reason to believe that Chinese aid, due to its demand driven nature and the no strings-attached policy, is indirectly allocated in a more competitive way to less democratic countries where the governments might find the Chinese aid particularly attractive. The anecdotal evidence of Chinese "rogue aid" and search for natural resources in the early qualitative literature seem to be only anecdotal evidence, rather than the general outcome. On the other hand, the heterogeneity tests revealed that the Chinese aid allocation has been more competitive in response to DAC aid allocation in the period 2006-2012 than in the earlier period, 2000-2005. This suggests that the initiation of Chinese cooperation with other multilateral and bilateral donors in 2005 has not encouraged a better coordination between China and the traditional DAC donor community.

If the empirical investigation of the relationship between DAC aid and Chinese aid allocation at the country level provides robust support of a competitive allocation to the same recipient countries, the results from the within-country sector investigation are less informative. The regression results do not show any systematic relationship between Chinese within-country sector allocation and DAC aid sector allocation. The empirical investigation fails to find statistically significant results irrespective of the choice of empirical strategy. In the theoretical framework, the demand driven nature of Chinese aid suggests that Chinese aid might be indirectly targeted to sectors neglected by the DAC donors or where DAC aid is insufficient, for example in infrastructure and productive sectors. However, the results in this study cannot confirm or reject such a relationship. What is found, however, is that China's motivation to cover a wide range of countries and compete with the DAC aid allocation at the country level is not as apparent when investigating allocation at the sector level within recipient countries.

There are a number of possible reasons why a relationship between DAC aid allocation and Chinese aid allocation cannot be found within countries at the sector level. One obvious reason is that in reality, there is no existing relationship to identify at the within-country sector level, maybe because sector aid is simply more ad hoc than the more politically motivated country level allocation.

A second reason may be due to an inappropriate choice of empirical strategy in this study. There are very few previous studies investigating the relationship between different donors' within-country sector allocation that could be used as empirical guidance.

A third reason why this study fails to identify a relationship may be due to the choice of sector aggregation. This study considered sectors at the aggregate level, as a consequence, sector categories include a number of subsectors which may differ in their effect. The aggregation of the sector Economic infrastructure & Services, for example, includes energy generation, banking and transport & storage. The aggregation of the sector Productive Sectors includes agriculture, mining and construction, but also trade policy & tourism. This choice of aggregation may have been unsuitable and further research about the relationship between Chinese and DAC aid sector allocation should definitely consider different sector categorizations to test whether a relationship between within-country sector allocation of DAC aid and Chinese aid exist or not.

Under the assumption that China is more likely to be the most responsive donor, the results from the cross-country and within-country empirical investigation in this study find no evidence in favor of a Chinese interest to coordinate with the traditional DAC donors. The findings suggest that China does not respond to the presence of bilateral DAC aid in a well-coordinated way. However, if the assumption that China is the most responsive donor is not valid, the bad donor coordination may be the unfavorable outcome of a simultaneous aid betting game between China and the traditional DAC donors.

To summarize the main findings of this study, China respond to increasing DAC aid with additional aid in a competitive way at the country level. Chinese aid and DAC aid are competing with each other over the same recipient countries and the competition has been more apparent after the year 2005 as well as in wealthier countries. Returning back to the definition matrix in section 3, Table 2, the results are in favor of the relationship definitions in the upper panel where Chinese aid and DAC aid allocation is better described as competing with each other. Due to the fact that the within-country sector results do not provide a clear answer to research question 2, it is therefore impossible to decide whether the upper right or upper left box in the

definition matrix provide the most appropriate definition of the relationship between DAC aid and Chinese aid allocation.

Even if the results of this study cannot fully confirm whether Chinese aid is allocated in competition with or as a complement to DAC sector allocation, the knowledge about the significant cross-country competition still provides important insights for policy. As the DAC donors themselves are struggling to coordinate their aid more effectively, China is now an additional player to the DAC donors swarming in some countries. According to the analysis and the discussion in this section, it seems unlikely that China would cut aid to their African allies and risk their influence and goodwill. On the other hand it seems equally unlikely that any of the big bilateral DAC donors would cut their aid to leave room for China. Even if the aid flows on average target the same recipient countries, the coordination problem is less problematic if China's aid and DAC aid target different sectors within countries. From the perspective of aid effectiveness, it is therefore important that the DAC donor community and China collaborate on the "ground" within recipient countries in an attempt to reduce the risk of project duplications. With the knowledge that the Chinese embassies in aid recipient countries play an important role in the Chinese aid management system, a close dialogue between the DAC community and the Chinese embassy personnel could be a way forward if the bilateral DAC donors themselves are not willing to adjust to Chinese allocation priorities.

9. Conclusion

The recent rise of China as a global aid donor has induced a discussion about whether China will compete with or complement aid flows from the existing DAC donor community. Therefore, the aim of this study was to investigate whether Chinese aid allocation takes the presence of bilateral DAC aid into account in its aid allocation process, and identify the relationship between actual aid allocation of Chinese aid and DAC aid in a two-level cross-country and within-country sectoral framework.

After accounting for a number of controls effecting Chinese aid allocation, this study is able to confirm a robust, positive and statistically significant relationship between Chinese aid allocation and DAC aid allocation across recipient countries in the African continent between the year 2000 and 2012. China does not respond to the presence of bilateral DAC aid in a well-coordinated way. Instead the response to increasing DAC aid is competition and additional Chinese aid flows to the same countries.

The result is robust to the choice of different econometric models and specifications and surprisingly also when the fixed effects estimator is employed, which assures that the result is

not driven by any country specific time invariant unobserved heterogeneity. The most aggravating factor for the result of this study is the simultaneity issue. There are obvious reasons to suspect that reverse causality may be a source of endogeneity if the DAC donors are better informed about Chinese aid commitments and more flexible and responsive in their allocation decisions than what is assumed in this study. However, even without a strong case of causality, the simple positive correlation between Chinese aid allocation and DAC aid allocation is still interesting in the lights of donor coordination and aid effectiveness, and hence the importance of causality may be of second order. In the discussion about the possible mechanisms explaining why Chinese aid is allocated in competition with DAC aid, this study considers it likely that China is more interested in an aid allocation which favors a good relationship with its African allies rather than a closer relationship with the DAC donor community. Hence, when the bilateral DAC donors are increasing their engagement in recipient countries China respond in a competitive manner to prevent a loss of influence and goodwill in the same countries.

While this study can confirm that the two aid sources appear to be in competition with each other over the same countries, the relationship at the sector level within countries is less straight forward. The results of this study cannot confirm any relationship between the two aid flows within countries. As this is one of the first studies that investigates the relationship between aid flows to sectors within countries, more research regarding this topic needs to be performed. In future research it might be possible to find better strategies to investigate if there is a relationship between DAC aid and Chinese aid allocation at sector level within countries. Furthermore, it would be interesting to exploit the georeferenced aid data available to investigate if there is a geographic relationship between DAC aid allocation and Chinese allocation also within countries at the regional level. Even if Chinese aid flows and DAC aid flows on average target the same recipient countries as suggested by the findings of this study, the coordination problem is less problematic if Chinese aid and DAC aid target different sectors and regions within countries. Therefore, one of the most important insight from this study might be the need for collaboration efforts between DAC and China in aid recipient countries to mitigate the worst coordination problems.

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Appendix

A1. List of recipient countries covered in this study

Recipient name	UN Region	Years covered	Recipient name	UN Region	Years covered
Algeria	Northern Africa	2000-2012	Liberia	Western Africa	2000-2012
Angola	Middle Africa	2000-2012	Libya	Northern Africa	2004-2012
Benin	Western Africa	2000-2012	Madagascar	Eastern Africa	2000-2012
Botswana	Southern Africa	2000-2012	Malawi	Eastern Africa	2000-2012
Burkina Faso	Western Africa	2000-2012	Mali	Western Africa	2000-2012
Burundi	Eastern Africa	2000-2012	Mauritania	Western Africa	2000-2012
Cameroon	Middle Africa	2000-2012	Mauritius	Eastern Africa	2000-2012
Cape Verde	Western Africa	2000-2012	Morocco	Northern Africa	2000-2012
Central African Republic	Middle Africa	2000-2012	Mozambique	Eastern Africa	2000-2012
Chad	Middle Africa	2000-2012	Namibia	Southern Africa	2000-2012
Comoros	Eastern Africa	2000-2012	Niger	Western Africa	2000-2012
Democratic Republic of the Congo	Middle Africa	2000-2012	Nigeria	Western Africa	2000-2012
Republic of the Congo	Middle Africa	2000-2012	Rwanda	Eastern Africa	2000-2012
Cote D'Ivoire	Western Africa	2000-2012	Sao Tome & Principe	Middle Africa	2000-2012
Djibouti	Eastern Africa	2000-2012	Senegal	Western Africa	2000-2012
Egypt	Northern Africa	2000-2012	Seychelles	Eastern Africa	2000-2012
Equatorial Guinea	Middle Africa	2000-2012	Sierra Leone	Western Africa	2000-2012
Eritrea	Eastern Africa	2000-2012	South Africa	Southern Africa	2000-2012
Ethiopia	Eastern Africa	2000-2012	Sudan	Northern Africa	2000-2012
Gabon	Middle Africa	2000-2012	Swaziland	Southern Africa	2000-2012
Gambia	Western Africa	2000-2012	Tanzania	Eastern Africa	2000-2012
Ghana	Western Africa	2000-2012	Togo	Western Africa	2000-2012
Guinea	Western Africa	2000-2012	Tunisia	Northern Africa	2000-2012
Guinea-Bissau	Western Africa	2000-2012	Uganda	Eastern Africa	2000-2012
Kenya	Eastern Africa	2000-2012	Zambia	Eastern Africa	2000-2012
Lesotho	Southern Africa	2000-2012	Zimbabwe	Eastern Africa	2000-2012

A2. List of sectors countries covered in this study

Sector name	Including aid to
Social infrastructure & Services	Education, Health, Population policies, Water & Sanitation, Government & Civil Society
Economic infrastructure & Services	Transport & Storage, Communication, Energy generation & supply, Banking, Business & Financial services,
Productive Sectors	Agriculture, Forestry, Fishing, Industry, Mineral resources & Mining, Construction, Trade policy & Tourism
Multisector/Cross-cutting	General environmental protection, other multisector (Urban and Rural development e.g.)
Other Commodity aid	Development food aid/Food security assistance, Other commodity assistance
General Budget Support	General budget support

A3. List of Bilateral DAC members

Australia	Korea
Austria	Luxembourg
Belgium	The Netherlands
Canada	New Zeeland
Czech Republic	Norway
Denmark	Poland
European Union	Portugal
Finland	Slovak Republic
France	Slovenia
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom
Italy	United States
Japan	

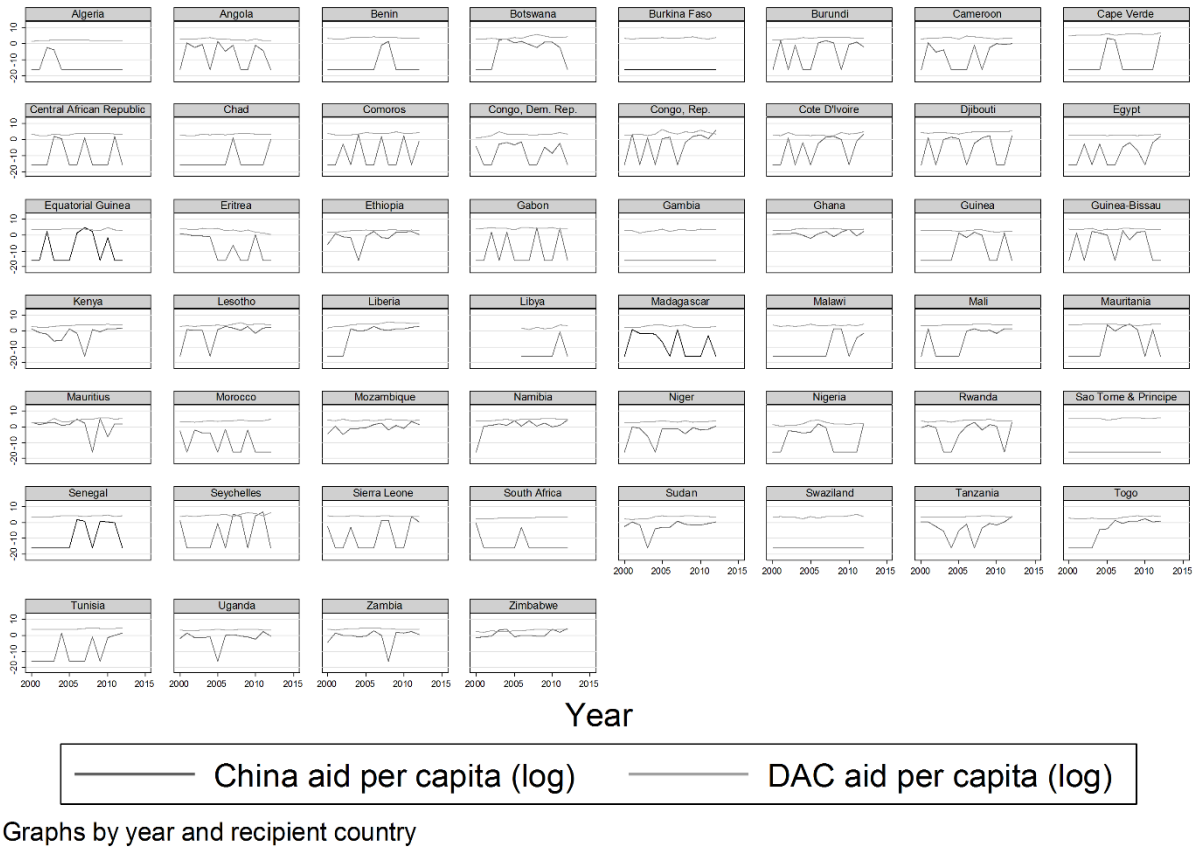
A4. Variables, definitions and sources

Variables	**Description**	**Data source**
Chinese aid (binary)	Binary variable=1 if receiving Chinese aid and =0 otherwise	AidData (Strange et al. 2015a)
Chinese aid (log)	Amount of ODA per capita, in US$	AidData (Strange et al. 2015a)
Chinese aid (level)	Number of ODA projects	AidData (Strange et al. 2015a)
Chinese Sector aid (binary)	Binary variable=1 if receiving Chinese aid and =0 otherwise	AidData (Strange et al. 2015a)
DAC aid (log)	Amount of ODA per capita, in US$, lagged	OECD (2016)
DAC Sector aid (log)	Amount of ODA, in US$, lagged	OECD (2016)
GDP per capita (log)	GDP per capita, lagged	World Bank (2015)
Population (log)	Total population size, lagged	World Bank (2015)
Total affected from disasters (log)	Total number of people affected from natural disasters	EM-DAT (2015)
Trade with China (log)	Bilateral trade (exports plus imports) with China in US$, lagged	UN Comtrade via WITS (2016)
Energy depletion ((log)	Adjusted savings: energy depletion, lagged	World Bank (2015)
Mineral depletion ((log)	Adjusted savings: mineral depletion, lagged	World Bank (2015)
Proved oil reserves (log)	Proved oil reserves on barrels, lagged	BP (2015)
UN voting with China	Voting alignment in the UN General Assembly all votes, lagged	Access from Axel Dreher and Andreas Fuchs
Taiwan recognition	Binary variable=1 if country have diplomatic relations with Taiwan and =0 otherwise, lagged	Rich (2011)
Democracy dummy	Binary variable=1 if electoral democracy and =0 otherwise, lagged	Freedom House (2015)
Control of corruption	Control of Corruption index ranging from -2.5 to 2.5 with higher values corresponding to better governance, lagged	Worldwide Governance Indicators (2015)
Political rights	Political rights index ranging from 1 to 7 with 1 representing the least free and 7 the most free political rights, lagged	Freedom House (2015)

A5. Descriptive Statistics for corruption variable before and after interpolation

Variables	Obs	Mean	Median	Std.dev	Min	Max
Control of Corruption- original	568	-0.579	-0.650	0.563	-1.706	1.250
Control of Corruption-interpolated	670	-0.574	-0.649	0.564	-1.733	1.250

A6. Log of Chinese aid and DAC aid over time by recipient country, 2000-2012



A7. Pairwise correlation of all explanatory variables

	DAC aid per capita	Political Rights	Trade with China	Population	GDP per capita	Energy depletion	Mineral depletion	Control of corruption	Taiwan recognition	UNGA voting	People affected by disasters	English dummy
DAC aid per capita	1.0000											
Political Rights	0.3681	1.0000										
Trade with China	-0.1819	-0.1721	1.0000									
Population	-0.4956	-0.2144	0.5539	1.0000								
GDP per capita	0.2251	0.0853	0.3760	-0.3287	1.0000							
Energy depletion	-0.2168	-0.3019	0.6229	0.4564	0.3899	1.0000						
Mineral depletion	-0.0523	-0.0775	0.5327	0.5567	0.0550	0.3508	1.0000					
Control of corruption	0.3330	0.5645	-0.1602	-0.2751	0.3521	-0.2131	-0.0357	1.0000				
Taiwan recognition	0.0410	-0.0010	-0.3206	-0.2220	-0.1304	-0.1631	-0.2872	0.0565	1.0000			
UNGA voting	-0.0259	0.0997	0.3656	0.3015	0.1130	0.1815	0.2803	0.2057	-0.2227	1.0000		
People affected by disasters	-0.1841	-0.0056	0.2061	0.4615	-0.2920	0.0586	0.2614	-0.1757	-0.0656	0.0782	1.0000	
English dummy	-0.0107	0.1984	-0.0144	0.0406	-0.0062	-0.1772	-0.0381	0.2811	0.0451	-0.0278	0.0476	1.0000

A8. Robustness check- Marginal effect and coefficient estimates excluding Gambia, Sao Tome and Principe, Swaziland and Burkina Faso

Variable	**Marginal effect**	**Coefficients**		**Variable**	**Coefficients**		**Variable**	**Coefficients**	
Binary indicator	(2)	(4)	(5)	**Chinese aid**	(2)	(3)	**#aid**	(5)	(6)
Chinese aid	Pooled Probit	Pooled LPM	LPM FE (within)	**per capita (log)**	Pooled OLS	FE (within)	**projects**	Pooled LPM	FE (within)
DAC aid per capita (log) t-1	0.0776***	0.0806***	0.0448*		1.730**	1.304*		0.551***	0.396**
	(0.0209)	(0.0232)	(0.0247)		(0.654)	(0.681)		(0.160)	(0.176)
UNGA Voting t-1	0.0647	0.111	0.0401		5.070	4.048		1.431	1.307
	(0.131)	(0.139)	(0.172)		(3.723)	(4.170)		(1.238)	(1.169)
Taiwan recognition t-1	-0.482***	-0.617***	-0.383***		-5.864***	-3.153*		-1.459**	-0.980
	(0.0745)	(0.0855)	(0.0732)		(2.058)	(1.719)		(0.661)	(0.663)
Trade with China (log) t-1	0.0298*	0.0236	0.0388		0.719*	-0.0201		0.198*	-0.169
	(0.0166)	(0.0168)	(0.0287)		(0.399)	(0.535)		(0.108)	(0.174)
Energy depletion (log) t-1	-0.0000528	-0.000667	0.00286		0.0477	0.0464		0.0174	0.0470**
	(0.00318)	(0.00316)	(0.00562)		(0.0702)	(0.0721)		(0.0194)	(0.0184)
Mineral depletion (log) t-1	0.00217	0.00139	-0.00500		0.0160	-0.182*		0.0475**	-0.0183
	(0.00276)	(0.00334)	(0.00486)		(0.0636)	(0.0969)		(0.0196)	(0.0251)
Political Rights t-1	-0.00160	-0.00365	-0.0412*		0.0905	0.147		0.117	0.134
	(0.0166)	(0.0182)	(0.0226)		(0.386)	(0.555)		(0.113)	(0.140)
Control of corruption t-1	-0.0471	-0.0371	-0.0428		-1.504	-0.815		-0.884**	-0.215
	(0.0568)	(0.0592)	(0.123)		(1.016)	(2.227)		(0.391)	(0.406)
GDP per capita (log) t-1	-0.108***	-0.106***	-0.206**		-1.920**	-2.169		-0.678***	-0.661
	(0.0343)	(0.0366)	(0.0976)		(0.760)	(1.493)		(0.227)	(0.525)
Population (log) t-1	-0.0525*	-0.0445	0.498		-0.885	18.56		-0.328	3.651
	(0.0269)	(0.0279)	(0.612)		(0.629)	(12.13)		(0.196)	(2.960)
People affected by disasters (log)	0.00339	0.00288	0.00252		-0.00281	-0.0478		0.00797	-0.00115
	(0.00363)	(0.00381)	(0.00340)		(0.0746)	(0.0744)		(0.0190)	(0.0207)
English language	0.141***	0.116**	omitted		3.425**	omitted		1.677***	omitted
	(0.0530)	(0.0501)			(1.291)			(0.404)	
Number of Observations	*605*	*605*	*605*		*605*	*605*		*605*	*605*
Pseudo R2/ R2	*0.247*	*0.254*	*0.151*		*0.206*	*0.098*		*0.372*	*0.251*
Clustered standard errors	*Yes*	*Yes*	*Yes*		*Yes*	*Yes*		*Yes*	*Yes*
Year dummies	*Yes*	*Yes*	*Yes*		*Yes*	*Yes*		*Yes*	*Yes*
Subregion dummies	*Yes*	*Yes*	*No*		*Yes*	*No*		*Yes*	*No*
Country fixed effects	*No*	*No*	*Yes*		*No*	*Yes*		*No*	*Yes*
Number of recipient codes	*48*	*48*	*48*		*48*	*48*		*48*	*48*

Year dummies, region dummies and the constant terms are suppressed to save space.
Significance levels: *:10% **:5% ***:1%

A9. Robustness check- Marginal effect and coefficient estimates without lagging DAC aid per capita, test for instant reaction

Variable	**Marginal effect**	**Coefficients**		**Variable**	**Coefficients**		**Variable**	**Coefficients**	
Binary indicator	(2)	(4)	(5)	**Chinese aid**	(2)	(3)	**#aid**	(5)	(6)
Chinese aid	Pooled Probit	Pooled LPM	LPM FE (within)	**per capita (log)**	Pooled OLS	FE (within)	**projects**	Pooled LPM	FE (within)
DAC aid per capita (log)	0.0959***	0.102***	0.0769***		2.105***	1.738***		0.602***	0.364***
	(0.0220)	(0.0250)	(0.0255)		(0.615)	(0.622)		(0.154)	(0.124)
UNGA Voting t-1	0.0168	0.0708	0.0564		4.185	3.542		1.395	1.194
	(0.123)	(0.136)	(0.151)		(3.199)	(3.555)		(1.110)	(1.075)
Taiwan recognition t-1	-0.586***	-0.738***	-0.394***		-7.873***	-3.415*		-1.790***	-1.160*
	(0.0588)	(0.0577)	(0.0669)		(1.238)	(1.825)		(0.348)	(0.692)
Trade with China (log) t-1	0.0283*	0.0215	0.0334		0.668*	0.111		0.171	-0.0823
	(0.0156)	(0.0150)	(0.0255)		(0.373)	(0.455)		(0.106)	(0.161)
Energy depletion (log) t-1	-0.000143	-0.00120	0.00253		0.0291	0.0290		0.0141	0.0386*
	(0.00288)	(0.00289)	(0.00542)		(0.0663)	(0.0653)		(0.0187)	(0.0202)
Mineral depletion (log) t-1	0.00207	0.00136	-0.00338		0.0352	-0.145		0.0526**	-0.000569
	(0.00260)	(0.00320)	(0.00487)		(0.0646)	(0.0941)		(0.0199)	(0.0273)
Political Rights t-1	-0.00425	-0.00985	-0.0399*		0.149	0.0723		0.108	0.145
	(0.0143)	(0.0157)	(0.0212)		(0.329)	(0.530)		(0.0876)	(0.133)
Control of corruption t-1	-0.0594	-0.0408	-0.0515		-1.575	-0.980		-0.897**	-0.191
	(0.0527)	(0.0556)	(0.114)		(0.972)	(1.980)		(0.361)	(0.387)
GDP per capita (log) t-1	-0.0935***	-0.0886***	-0.146		-1.694**	-1.069		-0.595***	-0.348
	(0.0313)	(0.0328)	(0.0934)		(0.692)	(1.484)		(0.214)	(0.539)
Population (log) t-1	-0.0334	-0.0205	0.460		-0.503	16.68		-0.233	2.100
	(0.0251)	(0.0236)	(0.588)		(0.523)	(11.56)		(0.182)	(3.395)
People affected by disasters (log)	0.00262	0.00255	0.00183		-0.0154	-0.0528		0.00404	-0.00325
	(0.00315)	(0.00347)	(0.00308)		(0.0707)	(0.0697)		(0.0181)	(0.0197)
English language	0.125**	0.0969**	omitted		2.984**	omitted		1.536***	omitted
	(0.0486)	(0.0454)			(1.159)			(0.379)	
Number of Observations	*655*	*655*	*655*		*655*	*655*		*655*	*655*
Pseudo R2/ R2	*0.378*	*0.408*	*0.149*		*0.283*	*0.099*		*0.409*	*0.233*
Clustered standard errors	*Yes*	*Yes*	*Yes*		*Yes*	*Yes*		*Yes*	*Yes*
Year dummies	*Yes*	*Yes*	*Yes*		*Yes*	*Yes*		*Yes*	*Yes*
Subregion dummies	*Yes*	*Yes*	*No*		*Yes*	*No*		*Yes*	*No*
Country fixed effects	*No*	*No*	*Yes*		*No*	*Yes*		*No*	*Yes*
Number of recipient codes	*52*	*52*	*52*		*52*	*52*		*52*	*52*

Year dummies, region dummies and the constant terms are suppressed to save space.
Significance levels: *:10% **:5% ***:1%

A10. Robustness check- Marginal effect and coefficient estimates when using a 2 years lag of DAC aid per capita

Variable	**Marginal effect**	**Coefficients**		**Variable**	**Coefficients**		**Variable**	**Coefficients**	
Binary indicator	(2)	(4)	(5)	**Chinese aid**	(2)	(3)	**#aid**	(5)	(6)
Chinese aid	Pooled Probit	Pooled LPM	LPM FE (within)	**per capita (log)**	Pooled OLS	FE (within)	**projects**	Pooled LPM	FE (within)
DAC aid per capita (log) t-2	0.0549***	0.0454***	0.00850		0.702**	0.226		0.258**	0.120
	(0.0180)	(0.0106)	(0.00770)		(0.324)	(0.195)		(0.123)	(0.0853)
UNGA Voting t-1	0.00135	0.0882	0.0521		4.636	3.444		1.502	1.172
	(0.127)	(0.144)	(0.157)		(3.482)	(3.705)		(1.137)	(1.084)
Taiwan recognition t-1	-0.602***	-0.746***	-0.415***		-8.037***	-3.897**		-1.836***	-1.238*
	(0.0620)	(0.0598)	(0.0684)		(1.244)	(1.689)		(0.364)	(0.668)
Trade with China (log) t-1	0.0276*	0.0211	0.0344		0.666*	0.130		0.169	-0.0854
	(0.0160)	(0.0152)	(0.0257)		(0.385)	(0.456)		(0.112)	(0.159)
Energy depletion (log) t-1	0.00114	2.29e-05	0.00337		0.0565	0.0485		0.0214	0.0436**
	(0.00286)	(0.00280)	(0.00529)		(0.0666)	(0.0656)		(0.0183)	(0.0201)
Mineral depletion (log) t-1	0.00224	0.00177	-0.00238		0.0520	-0.123		0.0554***	0.00263
	(0.00262)	(0.00329)	(0.00497)		(0.0650)	(0.0920)		(0.0204)	(0.0268)
Political Rights t-1	0.00256	-0.00157	-0.0316		0.350	0.257		0.158	0.178
	(0.0141)	(0.0151)	(0.0213)		(0.314)	(0.519)		(0.0958)	(0.134)
Control of corruption t-1	-0.0411	-0.0239	-0.0189		-1.094	-0.250		-0.791**	-0.0565
	(0.0492)	(0.0531)	(0.118)		(0.941)	(2.259)		(0.359)	(0.427)
GDP per capita (log) t-1	-0.107***	-0.100***	-0.173*		-2.007***	-1.692		-0.667***	-0.478
	(0.0327)	(0.0339)	(0.0977)		(0.725)	(1.516)		(0.236)	(0.550)
Population (log) t-1	-0.0521*	-0.0436*	0.176		-1.080*	10.33		-0.373*	0.943
	(0.0266)	(0.0254)	(0.586)		(0.556)	(11.22)		(0.203)	(3.257)
People affected by disasters (log)	0.00336	0.00323	0.00224		-0.00233	-0.0429		0.00800	0.0000485
	(0.00339)	(0.00367)	(0.00311)		(0.0731)	(0.0683)		(0.0192)	(0.0195)
English language	0.125***	0.103**	omitted		3.111**	omitted		1.571***	omitted
	(0.0484)	(0.0447)			(1.188)			(0.383)	
Number of Observations	*655*	*655*	*655*		*655*	*655*		*655*	*655*
Pseudo R2/ R2	*0.361*	*0.396*	*0.137*		*0.263*	*0.083*		*0.395*	*0.227*
Clustered standard errors	*Yes*	*Yes*	*Yes*		*Yes*	*Yes*		*Yes*	*Yes*
Year dummies	*Yes*	*Yes*	*Yes*		*Yes*	*Yes*		*Yes*	*Yes*
Subregion dummies	*Yes*	*Yes*	*No*		*Yes*	*No*		*Yes*	*No*
Country fixed effects	*No*	*No*	*Yes*		*No*	*Yes*		*No*	*Yes*
Number of recipient codes	*52*	*52*	*52*		*52*	*52*		*52*	*52*

Year dummies, region dummies and the constant terms are suppressed to save space.
Significance levels: *:10% **:5% ***:1%

A11. Coefficient Estimates for restricted sample including only Social infrastructure & Services, Economic infrastructure & Services and Productive Sectors , Within-country sector analysis

Variables	**Coefficient estimates**		
	(1) Probit	(2) Logit	(3) fe Logit
Chinese aid dummy			
DAC aid (log) t-1	0.0207	0.0329	0.0296
	(0.0295)	(0.0531)	(0.0504)
Number of Observations	*1,651*	*1,651*	*1,651*
Number of country-sector pairs	*127*	*127*	*127*
Year dummies	*Yes*	*Yes*	*Yes*
Clustered Standard Errors	*Yes*	*Yes*	*No*
Pseudo R2	*0.289*	*0.288*	

Year dummies, country-sector dummies and the constant terms are suppressed to save space.
Robust standard errors clustered on recipient country-sector pairs in parenthesis for probit and logit.
Significance levels: *:10% **:5% ***:1%

A12. Coefficient Estimates, Sector analysis

Probit	**Coefficient estimates**		
	Social infrastructure & Services	Economic infrastructure & Services	Productive Sectors
Amount of DAC aid (log) t-1 in Social Sectors	**0.205** **(0.179)**	0.167 (0.192)	0.0913 (0.183)
Amount of DAC aid (log) t-1 in Economic Sectors	-0.00591 (0.0295)	**0.0174** **(0.0322)**	-0.0196 (0.0332)
Amount of DAC aid (log) t-1 in Productive Sectors	-0.0161 (0.0799)	0.0438 (0.0827)	**-0.118** **(0.0981)**
Observations	*585*	*546*	*520*
Logit	**Coefficient estimates**		
Amount of DAC aid (log) t-1 in Social Sectors	**0.364** **(0.315)**	0.346 (0.336)	0.189 (0.316)
Amount of DAC aid (log) t-1 in Economic Sectors	-0.00476 (0.0472)	**0.0199** **(0.0599)**	-0.0348 (0.0584)
Amount of DAC aid (log) t-1 in Productive Sectors	-0.0302 (0.139)	0.0737 (0.151)	**-0.217** **(0.178)**
Observations	*585*	*546*	*520*
fe Logit	**Coefficient estimates**		
Amount of DAC aid (log) t-1 in Social Sectors	**0.330** **(0.244)**	0.318 (0.282)	0.171 (0.297)
Amount of DAC aid (log) t-1 in Economic Sectors	-0.00495 (0.0484)	**0.0180** **(0.0592)**	-0.0316 (0.0599)
Amount of DAC aid (log) t-1 in Productive Sectors	-0.0273 (0.116)	0.0676 (0.125)	**-0.199** **(0.139)**
Number of Observations	*585*	*546*	*520*

Year dummies, country dummies and the constant terms are suppressed to save space.
Robust standard errors clustered on recipient country in parenthesis for probit and logit.
Significance levels: *:10% **:5% ***:1%