

Aid, China, and Growth: Evidence from a New Global Development Finance Dataset

AXEL DREHER, *Heidelberg University, Germany*

ANDREAS FUCHS, *Heidelberg University, Germany*

BRADLEY PARKS, *College of William and Mary, USA*

AUSTIN M. STRANGE, *Harvard University, USA*

MICHAEL J. TIERNEY, *College of William and Mary, USA*

Paper for presentation at the Workshop “Tracking International Aid and Investment from Developing and Emerging Economies,” Heidelberg University, September 22-23, 2017

This version: 15 September 2017

Abstract: This paper introduces a new dataset of official financing – including foreign aid and other forms of concessional and non-concessional state financing – from China to 140 countries between 2000 and 2014. We use these data to investigate whether and to what extent Chinese aid affects the economic growth of recipient countries. To account for the endogeneity of aid, we employ an instrumental-variables strategy that relies on exogenous variation in the supply of Chinese aid over time resulting from changes in Chinese steel production. Variation across recipient countries results from a country’s probability of receiving aid. Controlling for year- and recipient-fixed effects that capture the levels of these variables, their interaction provides a powerful and excludable instrument. Our results show that Chinese official development assistance, i.e., aid in the strict sense, boosts economic growth in recipient countries. For the average recipient country, we estimate that one additional Chinese aid project produces a 0.7-1.1 percentage point increase in economic growth two years after the project is committed. Relying on recent identification strategies proposed in the aid effectiveness literature, we also benchmark the effectiveness of Chinese aid vis-à-vis the World Bank, the United States, and all members of the OECD’s Development Assistance Committee (DAC). Our results indicate that Chinese, US and OECD-DAC aid yield similar economic growth impacts. By contrast, we find no robust evidence that World Bank aid promotes growth. We also find that, irrespective of the funding source, less concessional and more commercially-oriented types of official finance do not boost economic growth. Finally, we test the popular claim that significant financial support from China impairs the effectiveness of grants and loans from Western donors and lenders. Our results do not support this claim.

JEL classification: F35, F43, O19, O47, P33

Keywords: China, foreign aid, Official Development Assistance, aid effectiveness, economic growth

Acknowledgements: The authors are grateful for generous support from the John D. and Catherine T. MacArthur Foundation, the William and Flora Hewlett Foundation, Humanity United, the Academic Research Fund of Singapore’s Ministry of Education, and the German Research Foundation (DFG) for “The Economics of Emerging Donors in Development Cooperation” project at Heidelberg University (DR 640/5-1 and FU 997/1-1). Excellent research assistance was provided by Melanie Aguilar-Rojas, Omar Alkhoja, Katherine Armstrong, Isabelle Baucum, Zach Baxter, Ellie Bentley, Liliana Besosa, Abegail Bilenkin, Allison Bowers, Ariel Cadby-Spicer, Emma Cahoon, Bree Cattellino, Alex Chadwick, Ava Chafin, Anissa Chams-Eddine, Tina Chang, Harrison Chapman, Yining Chen, Yuning Chen, Zihao Chen, Mengfan Cheng, Michelle Cheng, Tiffanie Choi, Miranda Clarke, Kate Connors, Graeme Cranston-Cuebas, Catherine Crowley, Hali Czosnek, Jenna Davis, Alex DeGala, Hannah Dempsey, Harsh Desai, Weiwei Du, Ashton Ebert, Caleb Ebert, Aili Espigh, Claire Etheridge, Ze Fu, Wesley Garner, Melanie Gilbert, Elizabeth Goldemen, Zijie Gong, Grace Grains, Liz Hall, Thompson Hangen, Sarah Harmon, Ethan Harrison, Collin Henson, Jasmine Herndon, Elizabeth Herrity, Gabrielle Hibbert, Carlos Holden-Villars, Keith Holleran, Weijue Huang, Daniel Hughes, Torey Beth Jackson, Jiaorui Jiang, Emmaleah Jones, Amar Kakirde, Naixin Kang, Ciera Killen, Ian Kirkwood, Emily Koerner, Dylan Kolhoff, Lidia Kovacevic, Martyna Kowalczyk, Mirian Kreykes, Dinu Krishnamoorthi, Isabella Kron, Karthik Kumarappan, Daniel Lantz, Caroline Lebegue, Jade Li, Yuwei Li, Yaseen Lofti, Adriane Lopez, Flynn Madden, Sarah Martin, George Moss, Marie Mullins, Qiuyan Ni, Jack Nicol, Brendan O’Connor, Alexandra Pancake, Carol Peng, Grace Perkins, Charles Perla, Sophia Perrotti, Andrea Powers, Han Qiao, Kamran Rahman, Sarah Reso, David Rice, Natalie Santos, Faith Savaiano, Dominic Scerbo, Leigh Seitz, William Shangraw, Kaitlan Shaub, Samuel Siewers, Kyra Solomon, Yifan Su, Elizabeth Sutterlin, Mahathi Tadikonda, Joanna Tan, Rebecca Thorpe, Jessica Usjanauskas, Emily Walker, Yale Waller, Katherine Walsh, Xinyi Wang, Jason (Jiacheng) Xi, Hanyang Xu, Darice Xue, Erya Yang, Gaohang Yao, Antonio Tianze Ye, Lincoln Zaleski, Jack Zhang, Yue Zhang, Echo Zhong, Joana Zhu, and Junrong Zhu.

“Africa is beginning to do well economically. One of the main reasons for such turnaround in the economic fate of Africa is the emergence of the emerging nations in general and China in particular.”—Melas Zenawi, former Prime Minister of Ethiopia, 2012

1. Introduction

Evidence on the effects of aid on economic growth is mixed.¹ Some studies present evidence of positive impacts (Clemens et al. 2012; Galiani et al. 2017). Others detect null effects (Rajan and Subramanian 2008; Doucouliagos and Paldam 2009; Dreher and Langlotz 2017). Still others find that aid accelerates growth only under specific conditions (Burnside and Dollar 2000; Ouattara and Strobl 2008; Minoiu and Reddy 2010; Minasyan et al. 2017). Virtually all of these studies evaluate the overseas development activities of Western bilateral donors or major international financial organizations, such as the World Bank.² These donors and lenders have wide-ranging interests and objectives (e.g., responding to public health challenges, providing relief to internally displaced persons, protecting biodiversity, removing land mines), many of which are orthogonal or only loosely related to the goal of catalyzing or sustaining economic growth.

However, these established donors and lenders no longer dominate the development finance market (Dreher et al. 2011; Walz and Ramachandran 2011; Custer et al. 2015; Fuchs and Müller 2017). Countries like Brazil, China, India, Iran, and Saudi Arabia now spend billions of dollars throughout the developing world to build roads, dams, bridges, railways, airports, seaports, and electricity grids. China, in particular, has positioned itself as a leading global financier of the “hardware” of economic development.³ The scale and scope of its overseas infrastructure activities now rival or exceed that of other major donors and lenders. Its flagship “One Belt, One Road” (OBOR) initiative—a “Belt” of road, rail, port, and pipeline projects that

¹ For recent surveys of the aid effectiveness literature, see Werker (2012), Doucouliagos (2016), and Dreher et al. (2017).

² Throughout this study, we refer to the United States, other donors of the OECD’s Development Assistance Committee (DAC), and the World Bank as “Western” donors. We prefer the terms “Western” and “non-Western” over other frequently used classifications such as “traditional” and “established.”

³ While China is best known for financing the “hardware” of development, it also invests significantly in agriculture, health, education, government capacity building, media, and various social sectors in developing economies. We discuss this point at greater length below.

create an infrastructure corridor from China to Central Asia and Europe and a “Maritime Silk Road” that links China to South and Southeast Asia, the Middle East, and Africa through a series of deepwater ports along the littoral areas of the Indian Ocean—has “little precedent in modern history, promising more than \$1 trillion in infrastructure and spanning more than 60 countries” (Perlez and Huang 2017).⁴ Between 2000 and 2014, China committed more than US\$350 billion in official finance to 140 countries in Africa, Asia and the Pacific, Latin America and the Caribbean, the Middle East, and Central and Eastern Europe.⁵ China’s annual provision of official finance now rivals that of the United States in Africa (Strange et al. 2017), and in some countries, China has now become the single largest source of official finance (Campbell et al. 2012; Greenhill 2013).

Despite the increasingly important role that Chinese aid plays in many developing countries, no studies have rigorously analyzed the effectiveness of Chinese aid with global, cross-country panel data.⁶ The reason for this gap in the literature is the absence of comprehensive data. China’s government considers its international development finance program to be a “state secret” (Bräutigam 2009: 2). It does not disclose comprehensive or detailed information about the overseas development projects that it funds. Nor does it publish a bilateral breakdown of its international development finance activities.⁷

We address this information gap by introducing a new dataset of official financing—including foreign aid and other forms of concessional and non-concessional state financing—from China to five major world regions (Africa, the Middle East, Asia and the Pacific, Latin America and the Caribbean, and Central and Eastern Europe) over the 2000-2014 period. This dataset was constructed with the Tracking Underreported Financial Flows (TUFF) methodology developed by Strange et al. (2017a, 2017b), which triangulates information from

⁴ According to Djankov (2016: 8), “[a]t maturity, investment in [OBOR] is expected to reach \$4 trillion, equivalent to China’s 2015 foreign currency reserves.”

⁵ These estimates are derived from the dataset described in Section 2 of this paper. Official finance consists of Official Development Assistance (ODA), which is the strictest definition of aid used by OECD-DAC members, and Other Official Flows (OOF). Whereas the former must have development intent and a minimum level of concessionality (a 25% or higher grant element), the latter lacks development intent and/or the level of concessionality that is required of ODA.

⁶ Dreher et al. (2016) focus on the localized economic development effects of Chinese aid within African countries only. Busse et al. (2016) analyze the growth effects of Chinese aid in Africa. However, they address endogeneity concerns with a GMM method that relies on internal instruments which are unlikely to be excludable.

⁷ These data likely have not been published by the Chinese government for reasons related to political will and capacity. On these points, see Lancaster (2007) and Strange et al. (2013).

four types of sources—English, Chinese and local-language news reports; official statements from Chinese ministries, embassies, and economic and commercial counselor offices; the aid and debt information management systems of finance and planning ministries in counterpart countries; and case study and field research undertaken by scholars and NGOs—in order to minimize the impact of incomplete or inaccurate information. The dataset includes 4,368 projects financed with Chinese ODA and OOF in 140 countries and territories around the world. We then use this novel dataset to estimate the effect of “Chinese aid” on recipient-country economic growth and on the effectiveness of financial support from more established donors and lenders.⁸

More specifically, we seek to answer four questions. First, does the receipt of Chinese aid promote economic growth? Second, which types of Chinese aid (ODA or OOF) are most effective? Third, how do the growth effects of Chinese aid compare to those of Western donors and lenders? Fourth, does China’s arrival as an alternative source of aid undermine the effectiveness of Western donors and lenders?

To identify causal effects of Chinese aid on growth, we use a variant of an instrumental variable (IV) suggested in Dreher et al. (2016) for aid committed to subnational regions within African countries: the annual production volume of Chinese steel interacted with the recipient province’s probability of receiving aid. The Chinese government considers steel to be a strategically important commodity and therefore maintains excess production capacity. This policy choice by the Chinese government results in a surplus of steel, some of which China uses for aid projects around the world (Dreher et al. 2016). In years when production volumes are high, China’s supply of aid is also higher. We follow Nunn and Qian’s (2014) study on US food aid and conflict to estimate which share of this year-to-year change in supply of aid transmits to a specific recipient country. To this end, we calculate the share of years during our sample period in which a country received positive amounts of Chinese aid. We expect countries with a higher probability of receiving aid from China will be more severely affected by year-to-year fluctuations in the supply of Chinese aid resulting from its production of steel.

⁸ For ease of exposition, we will use the term “aid” in this paper to refer broadly to any types of official finance from a donor (or lender) to a recipient (or borrower). In cases when we wish to reference the narrower (OECD-DAC) definition of aid, we use the term Official Development Assistance (ODA). In cases when we wish to reference concessional and non-concessional official financing that does not qualify as ODA, we use the term Other Official Flows (OOF). Finally, when we wish to reference the sum of ODA and OOF, we use the term Official Finance (OF).

The intuition of our strategy is akin to that of a difference-in-difference approach, since we investigate a differential effect of Chinese steel production on the amount of aid to countries with a high (compared to a low) probability of receiving Chinese aid. The identifying assumption is that growth in countries with differing probabilities of receiving aid will not be affected differently by changes in steel production, other than via the impact of aid, controlling for recipient-country- and year-fixed effects and the other variables in the model. In other words, as in any difference-in-difference setting, we rely on an exogenous treatment and the absence of different pre-trends across groups. Controlling for period-fixed effects, Chinese steel production cannot be correlated with the error term and is thus exogenous to aid. In order for different pre-trends to exist, these trends across countries with a high compared to a low probability to receive aid would have to vary in tandem with period-to-period changes in steel production. We test this possibility below.

To facilitate comparisons between China and other financiers, we also provide estimates of how aid from the World Bank, the United States, and the OECD-DAC as a whole affect economic growth. For each of these donors and lenders, we pursue identification strategies that are analogous to our identification approach for Chinese aid. Variation across recipients results from the recipients' probability of receiving aid. For the United States and the OECD-DAC, exogenous variation over time results from different levels of donor government and legislative fractionalization that are known to shift aid flows (Ahmed 2016; Dreher and Langlotz 2017). For the World Bank (IBRD and IDA), we make use of Galiani et al.'s (2017) idea to exploit variation in aid resulting from a country crossing the IDA's income threshold for receiving highly concessional official financing. We also replicate our comparisons with China in a setting where we use the same type of instrument for all four donors: the respective aid budgets of each donor (interacted with each recipient country's probability of receiving aid). While aid budgets are arguably less exogenous than China's steel production or government and legislative fractionalization in donor countries, this approach has the advantage of producing comparable local average treatment effects (LATE) across donors.

After comparing how aid from these donors impacts recipient economic growth, we turn to the popular but untested claim that Chinese foreign aid might undermine Western aid. We perform several statistical tests that examine whether aid from Western donors registers different

levels of economic growth in countries that are Chinese “aid darlings”—major recipients of aid from Beijing—and other countries that do not receive large amount of Chinese aid.

Our results show that Chinese ODA boosts economic growth in recipient countries. In contrast, we find no robust evidence that the same is true for less concessional forms of Chinese official finance. Comparing Chinese aid with aid flows from the United States, OECD-DAC, and World Bank, we find no evidence that Chinese aid is superior to aid from established donors on economic growth grounds. If anything, there is some evidence that US ODA yields stronger economic growth dividends than Chinese ODA. Our results also provide no robust evidence that Chinese aid undermines the economic growth effects of aid from Western donors.

We proceed in the following manner. In Section 2 we introduce the first global, project-level database of Chinese ODA and OOF and discuss the merits and limitations of the TUFF methodology used to construct the dataset. We also provide a snapshot of China’s official finance activities around the world. In Section 3 we introduce our instrumental-variables approach to estimate causal effects of Chinese aid on growth. We also elaborate the causal identification strategies that we use to compare the growth effects of Chinese and Western aid. In Section 4, we present our main results and discuss their implications. Section 5 investigates the effects of Chinese aid on the effectiveness of Western aid. We conclude the paper in Section 6 with a discussion of avenues for future research.

2. A New Global Chinese Development Finance Dataset

In this paper, we introduce a new dataset that measures foreign aid and other forms of concessional and non-concessional state financing from China to the developing world between 2000 and 2014. More specifically, the dataset captures ODA and OOF from China to 140 countries and territories in five regions of the world: Africa, the Middle East, Asia and the Pacific, Latin America and the Caribbean, and Central and Eastern Europe. It includes 4,368 Chinese development projects (worth approximately US\$362 billion) that were officially committed, in implementation, or completed between 2000 and 2014. The dataset also includes 653 pledges of support worth an estimated US\$135.2 billion. We could not find evidence that these projects reached the official commitment stage, and exclude these records from our

analysis.⁹ Figure 1 illustrates the distribution of project status over time. Unsurprisingly, projects announced in recent years are less likely to have reached the completion stage than those announced in earlier years.

INSERT FIGURE 1 HERE

The dataset was constructed using the TUFF methodology. This methodology was initially developed by several authors of this paper—in collaboration with AidData, a research lab at the College of William & Mary (Strange et al. 2017b). It codifies a set of open-source data collection procedures that make it possible to identify detailed financial, operational, and locational information about officially financed projects that are not voluntarily or systematically recorded by sovereign donors and lenders through international reporting systems, such as the OECD’s Creditor Reporting System (CRS) or the International Aid Transparency Initiative (IATI). This methodology, which is described at greater length in Appendix A, standardizes and synthesizes large volumes of information primarily from four sources: English, Chinese and local-language news reports; documents from Chinese ministries, embassies, and economic and commercial counselor offices; the aid and debt information management systems of finance and planning ministries in counterpart countries; and case study and field research undertaken by scholars and NGOs. It represents a systematic, transparent, and replicable way of tracking the identifiable universe of projects financed by donors and lenders who do not publish official finance data at the project level. The methodology and the datasets that it has produced have been subjected to peer-review, stress-tested, and substantially improved over time (e.g., Muchapondwa et al. 2016; Strange et al. 2017a; Dreher et al. forthcoming,a).¹⁰

TUFF-derived data have now been used in dozens of publications in economics and political science (e.g., Hendrix and Noland 2014; Dreher and Fuchs 2015; Qian 2015; Hsiang and Sekar 2016; Kilama 2016; Hernandez 2017; Strange et al. 2017a). The first empirical application of the TUFF methodology was a dataset that measured 21st-century Chinese official financial

⁹ The dataset also includes 38 projects worth approximately US\$25.8 billion that were suspended or cancelled; and 445 so-called “umbrella” projects that cover a number of specific sub-projects, worth approximately US\$396.6 billion. We also exclude all of these project records from our analysis and from the descriptive statistics presented in this paper.

¹⁰ Muchapondwa et al. (2016) use a “ground-truthing” methodology in Uganda and South Africa to test the reliability of the TUFF methodology and find a generally high level of correspondence between the Chinese development project data collected through the TUFF methodology and the data collected through the systematic application of field-based data collection protocols by local enumerators. However, they find that the TUFF methodology is able to identify significantly more projects than field-based methods.

flows to Africa (see Strange et al. 2013, 2017a). This dataset has been used to study China's motivations for aid giving in Africa and the intended and unintended impacts of these financial flows in one region of the world (BenYishay et al. 2016; Blair and Roessler 2016; Isaksson and Kotsadam 2016; Brazys et al. 2017; Hernandez 2017; Strange et al. 2017a; Dreher et al. forthcoming,a). Since then, researchers have adapted and applied the TUFF methodology to identify grants and loans from Gulf Cooperation Council (GCC) members (Minor et al. 2014), under-reported humanitarian assistance flows from Western and non-Western sources (Ghose 2017), foreign direct investment from Western and non-Western sources (Bunte et al. 2017), and pre-2000 foreign aid flows from China (Morgan and Zheng 2017).

The dataset that we use in this paper builds upon and expands the geographical and temporal scope of the earlier dataset of Chinese official financial flows to Africa that we constructed in collaboration with AidData (see Strange et al. 2017a). We use the same types of methods and sources to build this dataset so that our results are comparable with the previous (Africa-specific) versions of the dataset. The broad patterns described in this section demonstrate some striking similarities between Chinese support for Africa and other parts of the world, but they also capture some important substantive differences across regions and time.

The dataset allows one to distinguish between three different types of Chinese official finance. “ODA-like” projects are comparable to ODA in that they are nominally intended to promote economic or social development and they are provided at levels of concessionality that are consistent with the ODA criteria established by the OECD-DAC. “OOF-like” projects are also financed by the Chinese government, but either have a non-developmental purpose or are insufficiently concessional to qualify as ODA. “Vague Official Finance (OF)” projects represent official financial flows where there is insufficient open-source information to make a clear determination as to whether the flows are more akin to ODA or OOF (Dreher et al. forthcoming,a). Figure 2 presents the distribution of these three categories of Chinese official finance over time. The graph in the left panel demonstrates that the vast majority of Chinese projects each year are ODA-like; however, in financial terms, these projects represents only 21% of total Chinese official finance between 2000 and 2014.

INSERT FIGURE 2 HERE

These patterns make more sense when one analyzes the sectoral distribution of Chinese official finance.¹¹ The conventional wisdom—that China funds the hardware of development—is consistent with the descriptive statistics in Figure 3, which ranks sectors according to the number of dollars committed. China invests significantly more money in the “hardware” areas of transportation, energy generation, industry, mining, and agriculture than it does on the “software” side of development in sectors like health, education, and governance. However, a measure of project counts, rather than dollar amounts, paints a very different picture, as can be seen in the same figure. Because the size of “software” projects are substantially smaller than the large hardware projects that dominate the news, the measure using project counts actually shows health, education, and governance as the most prominent sectors. These smaller, software projects are disproportionately ODA-like, while the large infrastructure projects tend to be funded with OOF-like loans (see Appendix B1).

INSERT FIGURE 3 HERE

A nuanced pattern also emerges when one examines the countries that receive the “most” Chinese official finance. The Chinese State Council’s official White Papers from 2011 and, especially, from 2014, claim that the vast majority of Chinese aid flows to Africa, rather than other regions of the world.¹² This view is reinforced by press accounts (Editors 2016; Poplak 2016) and academic sources (Alden 2006; Carmody 2016: ch. 3) that emphasize a new, Chinese-led “scramble for Africa” in the 21st century. This is also what one observes in our global dataset (see Appendix B2). African countries received a large proportion (54.4 percent) of the total number of projects financed by China between 2000 and 2014. Eight of the top-ten recipient countries are African countries (Appendix B3).

¹¹ We use 3-digit sector classifications based on OECD purpose codes.

¹² China’s 2014 White Paper puts total annual foreign aid from China at about \$4.8 billion (\$14.41 billion over 2010-2012). Kitano (2016) arrives at a slightly higher estimate of \$5.2 billion (in 2012). The dataset used in this paper can be used to generate upper bound and lower bound estimates of global annual Chinese ODA. Our lower bound estimate average annual Chinese ODA (from 2000-2012), which is measured as the sum of all officially financed Chinese projects that were completed or in the implementation phase during this time period, is \$4.96 billion. Our upper bound estimate of average annual Chinese ODA (from 2000-2012), which is measured as the sum of all officially committed projects, projects in implementation, and completed projects during this time period, is \$6.6 billion. Therefore, our global estimates of Chinese aid (ODA) are quite similar to those produced by Kitano (2016) and the Chinese government itself. However, it should be noted that neither Kitano (2016) nor the Chinese Government separately measures other sources of Chinese official financing (i.e. OOF).

However, a very different picture emerges when one counts total dollars, rather than projects, committed. These results reflect the fact that the number of “mega-projects” in East Asia, the former Soviet Union, and Latin America dwarf the number of “mega-projects” in Africa. Of the 25 largest Chinese projects in financial terms, only four are located in Africa and the largest is #10 on that list (see Appendix B4 and B5 for details). More broadly, if one measures the average size of officially-financed Chinese projects in terms of constant dollars, only two African countries are on the list of top 20 recipients (Mali at #18 and Sudan at #20; see also Appendix B6).¹³

In addition to illustrating the broad empirical patterns that emerge from this new dataset, we want to draw attention to several limitations of the dataset that one needs to keep in mind while conducting analysis. First, as described above, because of insufficiently specific information in the underlying data sources, about 20 percent of the project records and almost 50 percent of the project dollars are coded as “Vague Official Finance.” These projects are officially financed, but it is not possible (based upon the underlying source documentation) to make a clear determination of whether they qualify as ODA or OOF. Therefore, one needs to explicitly account for this uncertainty.¹⁴

Second, a substantial and increasing proportion of project records lack information about the financial amounts committed. The percentage of projects that are missing financial amounts ranges from 23 percent in 2001 to 51 percent in 2014 (Appendix B8). Some types of flows are particularly likely to lack financial amounts. For example, over 90 percent of projects that support technical assistance activities and scholarships lack financial amounts. However, projects that involve debt forgiveness and debt rescheduling and most loans excluding debt forgiveness include financial amounts about 90 percent of the time. This missing data problem is not a particularly important challenge for researchers interested in project counts or measuring the Chinese government’s ground game within a country or region, but if one is interested in the

¹³ Appendix B7 shows the top ten recipients of total Chinese official finance from 2000-2014. If no country in a particular region is ranked in the top 10, we list the highest ranked country in each region along with its rank and the total amount of Chinese official finance allocated to that country as it appears in the dataset.

¹⁴ In this paper, we do so by separately analyzing the effects of Chinese ODA and Chinese official finance (the sum of Chinese ODA-like, OOF-like, and Vague OF). We think it is reasonable to assume that most Vague OF is actually OOF since many of the observable attributes of projects coded as Vague OF (e.g., projects in the infrastructure and economic production sectors, projects financed with loans, projects financed by China Development Bank and China Exim Bank) resemble the attributes of OOF projects more so than ODA projects. Therefore, comparisons of the effects of Chinese ODA and Chinese official finance should help reveal differences in the effects of Chinese ODA and OOF.

effects of aid and one believes that the amount of money spent will have an important impact on outcomes, then missingness may be a more significant problem. A third missing data problem is in the coverage of the Chinese government institutions that financed the projects in the dataset. While the dataset identifies dozens of funding agencies within the Chinese government (including various ministries, Chinese embassies, policy banks, state-owned news agencies), 3,234 of the project records in the dataset lack information about the main funding agency responsible for the project. To the extent that the effectiveness of Chinese aid is conditional upon variation in the Chinese government institutions that fund aid projects, this is another a limitation of the data that must be acknowledged.

3. Empirical Strategy

A. Chinese Development Finance and Growth

Leveraging this new dataset, we now analyze the causal effects of Chinese aid on economic growth in all recipient countries that are not classified by the World Bank as high-income countries.¹⁵ Our empirical approach follows Dreher et al.’s (2016) analysis of how Chinese aid affects economic development at the local level within African countries. We estimate the following regression equation:

$$Growth_{i,t} = \beta_1 Aid_{CHN,i,t-2} + \beta_2 pop_{i,t-1} + \beta_3 \eta_i + \beta_4 \mu_t + \varepsilon_{i,t}, \quad (1)$$

where $Growth_{i,t}$ is recipient country i ’s yearly real GDP per capita growth in year t ; $Aid_{CHN,i,t-2}$ is a measure of Chinese aid commitments two years before; $pop_{i,t-1}$ stands for the recipient country’s (logged) population size, η_i and μ_t represent country- and year-fixed effects, respectively, and ε is the error term. Standard errors are clustered at the recipient country level.

We use two measures of $Aid_{CHN,i,t-2}$: the logged financial value of Chinese aid projects and the number of Chinese aid projects.¹⁶ The former comes with the obvious advantage that it accounts for the size of projects. Moreover, given that infrastructure projects make up the bulk of Chinese development finance in terms of financial value, using this measure rather than number

¹⁵ See <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups> (last accessed September 13, 2017).

¹⁶ Note that we added a value of one before taking logs, in order to not lose observations with zero aid.

of projects is especially suitable given our discussion above. However, one important caveat is that 18 percent of the projects lack information on their financial value. While we show results using these data, we test the robustness of our results using the number of projects (and thereby giving projects that differ substantially in size the same weight).

Obviously, Chinese aid is endogenous to economic growth. One likely source of endogeneity is reverse causation in which recipient economic features influence Chinese aid allocation. On the one hand, the Chinese government might provide more aid to poorer countries, which would be in line with its official goal to make “great efforts to ensure its aid benefits as many needy people as possible” (State Council 2011). On the other hand, the Chinese government might prefer to channel more aid to wealthy countries if these recipients provide more attractive commercial opportunities (Dreher et al. forthcoming).¹⁷

To account for endogeneity concerns, we employ an instrumental-variables strategy. Specifically, we estimate the following first-stage regression:

$$Aid_{CHN,i,t-2} = \gamma_1 Steel_{t-3} * p_{CHN,i} + \gamma_2 pop_{i,t-1} + \gamma_3 \eta_i + \gamma_4 \mu_t + u_{i,t-2}. \quad (2)$$

Our instrument for $Aid_{CHN,i,t-2}$ is the interaction of (lagged and logged) Chinese steel production $Steel_{t-3}$, which varies across time, and the probability of receiving Chinese aid $p_{CHN,i}$, which varies across recipient countries. We calculate the probability of receiving Chinese aid as the share of years during our sample period (2000-2014) a country has received positive amounts of Chinese aid, $p_{CHN,i}$.¹⁸ More precisely, we define the probability of receiving aid from China as $p_{CHN,i} = \frac{1}{15} \sum_{y=1}^{15} p_{CHN,i,y}$, where $p_{CHN,i,y}$ is a binary variable that equals one when recipient i received a positive amount of aid from China in year y .

One might be concerned that this instrument violates the exclusion restriction because the probability of receiving aid may directly affect economic growth (for the same reasons described above). However, our growth regressions control for the effect of the probability of receiving aid as well as steel production through the inclusion of recipient-country- and year-fixed effects.

¹⁷ Empirical research on Chinese aid allocation demonstrates a strong, negative correlation between Chinese ODA and the per-capita income of recipient countries (Dreher and Fuchs 2015; Dreher et al. forthcoming). However, Chinese OOF tends to favor creditworthy countries (with higher loan repayment capacity) and countries that have higher levels of trade with China (Dreher et al. forthcoming).

¹⁸ This directly follows the analyses in Nunn and Qian (2014) and Dreher and Langlotz (2017). Also see Werker et al. (2009).

Given that we control for the effects of the probability of receiving aid, a potentially endogenous variable, its interaction with an exogenous one results in an exogenous instrument (Bun and Harrison 2014; Nizalova and Murtazashvili 2016). The intuition of this approach is that of a difference-in-difference regression, where we investigate a differential effect of Chinese steel production on the amount of aid to countries with a high compared to a low probability of receiving Chinese aid. The identifying assumption is that growth in countries with differing probabilities of receiving Chinese aid will not be affected differently by changes in steel production, other than via the impact of aid, controlling for recipient-country- and year-fixed effects. In other words, as in any difference-in-difference setting, we rely on an exogenous treatment and the absence of different pre-trends across groups. Controlled for year-fixed effects, Chinese steel production cannot be correlated with the error term and is thus clearly exogenous to aid. In order for different pre-trends to exist, these trends across countries with a high compared to a low probability to receive aid from China would have to vary in tandem with year-to-year changes in steel production.

Following Christian and Barrett (2017), we plot the variation in Chinese steel production in concert with the variation in per-capita aid and growth for two different groups that are defined according to the median of the probability to receive aid. Appendix C1 plots these graphs. They give no reason to believe that the parallel trend assumption is violated in our case. More precisely, the probability-specific trends in aid and growth, respectively, seem rather parallel across the regular recipients (those with a probability to receive aid that is above the median) and the irregular recipients (with the probability to receive aid being below the median). There is also no obvious non-linear trend in regular compared to irregular recipients that is similar for aid and growth.

Our specification deviates from the extant literature on aid and growth in a number of ways (e.g., Clemens et al. 2012; Dreher and Langlotz 2017; Galiani et al. 2017). First, we rely on commitments rather than disbursements of aid. Given that aid should only affect development after its disbursement, the latter are preferable over the former. However, comprehensive data on disbursements of Chinese aid are not available and are virtually impossible to measure with open-source data collection methods. In our main specification, we lag commitments by two years in order to allow for sufficient time for commitments to affect outcomes. We base our lag duration on a subset of 300 projects in the dataset for which there is information on the actual

project start and end dates.¹⁹ The observed average project duration amounts to 664 days, and thus we apply a two-year lag in our baseline regressions.²⁰ While these data suggest two years may be an appropriate lag period, we also perform analyses using various other lag periods as robustness checks.

Second, most previous studies focus on either aid per capita or aid as a share of GDP. This comes at the disadvantage that it restricts the effect of population or per capita GDP to be the same as those of aid. We instead control for population size and include (logged) aid in levels, following Ahmed (2016), among others.

Third, we primarily employ annual data rather than data averaged over three-, four-, or five-year periods (e.g., Clemens et al. 2012; Dreher and Lohmann 2015; Dreher and Langlotz 2017; Galiani et al. 2017). In order for our tests to show an effect of aid that actually exists with an 80 percent probability, we would however require several thousand observations rather than the sample of roughly 420 observations that we would have if we averaged our data over five-year-periods.²¹ This is a broader empirical challenge within the aid effectiveness literature (Ioannidis et al. 2016).²² However, while much of the literature focusing on Western donors makes use of samples starting in the 1970s, the first year we have comprehensive global data on Chinese aid is 2000.²³ Given that the use of yearly data substantially increases the power of our tests, our main regressions use yearly lags of aid rather than averaging data over longer periods of time, in keeping with Dreher et al. (2016). However, we will also run our analyses using all data over periods of three years in future versions of this paper, in line with Dreher and Lohmann (2015) and Galiani et al. (2017).

¹⁹ In subsetting the data, we exclude projects with a project length of zero days, which is typically the case for monetary grants. However, even in these cases, the *recipient* government will need considerable time to implement these projects, which makes a time lag necessary.

²⁰ Historical Chinese aid data also reveal a median of two years between project start and completion (data from Bartke 1989).

²¹ This high number of required observations is driven by our fixed-effects setting, as both country- and time-fixed effects capture most of the variation in the dependent variable so that the variation caused by aid conditional on these fixed effects is rather small.

²² According to Ioannidis et al. (2016), only about one percent of the 1,779 estimates in the aid and growth literature surveyed have adequate power (see also Doucouliagos 2016; Dreher and Langlotz 2017).

²³ Chinese aid volumes are also available for years prior to 1987 (Dreher and Fuchs 2015) but these values are not necessarily comparable to post-2000 aid as they are gathered based on different data collection procedures.

Fourth, we differ from much of the extant literature in our choice of control variables. In keeping with Dreher et al. (2016), our main regressions are parsimonious. Our main regressions control for fixed effects for years τ and countries η and the population size of recipient countries pop_i . Typical regressions in the aid effectiveness literature include additional control variables such as initial period per-capita GDP, ethnic fractionalization, assassinations, proxies for institutional and economic policies, and proxies for financial development (e.g., Burnside and Dollar 2000). All of these variables are arguably endogenous and introduce bias even if aid is instrumented using a perfectly excludable instrumental variable. Given that our exclusion restriction holds absent the inclusion of these control variables, their omission reduces the efficiency of the estimator, but does not bias our estimates.²⁴

Fifth, “aid” in our main specification refers to all forms of Chinese development finance rather than more narrowly-defined Official Development Assistance (ODA). Existing literature on aid and growth focuses exclusively on the potential growth effects of ODA. During our period of study (2000-2014), most of the official finance provided by China (58-78 percent) and the World Bank was not Official Development Assistance (ODA).²⁵ By contrast, most of official finance provided by the United States and the OECD-DAC was ODA.²⁶ This source of variation could help explain potential differences in aid effectiveness. Cordella and Ulku (2007) find that the provision of more concessional forms of development finance increases growth in poor and highly indebted countries. Similarly, Khomba and Trew (2017) conclude that grants are more effective than loans at generating (localized) growth effects.²⁷ To account for this potential source of variation, we vary our definition of “treatment” and separately investigate the growth

²⁴ We however test robustness by including the variables most commonly used in the aid effectiveness literature.

²⁵ The World Bank has two different funding windows. Its International Development Association (IDA) offers poor countries access to grants and highly concessional loans (ODA), while its International Bank for Reconstruction and Development (IBRD) offers loans on non-concessional terms (OOF). Between 2000 and 2014, 64.3% percent of official finance flows from the World Bank were channeled through the IBRD (OOF) and the remaining 35.6% were channeled through the IDA (ODA). Similarly, only 21.6% of total official finance from China seems to meet the OECD-DAC criteria for ODA. World Bank data were retrieved from <https://data.worldbank.org/> on 12 September 2017. China data were drawn from the dataset that is used in this paper.

²⁶ Between 2000 and 2014, the United States provided US\$424.3 billion of official finance to other countries. 93.3% percent of these official finance flows (US\$396.2 billion) qualified as ODA and 6.6% (US\$28.1 billion) qualified as OOF. Between 2000 and 2014, the OECD-DAC as a whole provided \$1.87 trillion of official finance to other countries; 81.3% percent of these flows (US\$1.52 trillion) qualified as ODA and 18.7% (US\$350 billion) qualified as OOF. Data retrieved from <http://stats.oecd.org/qwids/> on 12 September 2017.

²⁷ On the other hand, Odedokun (2004) provides evidence that the receipt of grants discourages domestic tax collection and undermines fiscal discipline, and Dovern and Nunnenkamp (2007) find that grants do not provide larger growth dividends than loans.

effects of more concessional finance (ODA) in addition to all types of official finance (OF) from China. We apply the same instrumental-variables strategy as described above but now use the interaction of China's steel production with the probability of recipient country i to receive Chinese ODA, which is analogously calculated as the share of years a recipient receives support over the sample period.

B. Growth Effects of Aid from China, the United States, OECD, and World Bank

In order to compare the effectiveness of aid from China and aid from three other major donors—the United States, the OECD-DAC, and the World Bank—we pursue an empirical strategy for each of these donors that is analogous to our approach for China. We require a valid instrument for official finance flows from each of these donors. Our instrumental variables for OECD-DAC and US development aid follow Ahmed (2016) and Dreher and Langlotz (2017), exploiting variation in the composition of the government and legislation. To the extent that government and legislative fractionalization lead to larger government budgets, and larger government budgets lead to an increase in the budget share devoted to foreign aid, fractionalization serves as a powerful instrument.²⁸ Specifically, we use legislative fractionalization in the United States' House of Representatives to instrument U.S. aid, and government fractionalization in donor countries to instrument OECD-DAC aid. We again introduce variation at the recipient-country level by interacting fractionalization with the probability of receiving aid, measured as the share of years in the study period during which a country receives aid from the respective donor. The corresponding first-stage regression equation for US aid reads as follows:

$$Aid_{USA,i,t-2} = \gamma_1 LegFrac_{t-3} * p_{USA,i} + \gamma_2 pop_{i,t-1} + \gamma_3 \eta_i + \gamma_4 \mu_t + u_{i,t-2}. \quad (3)$$

where our instrument for $Aid_{USA,i,t-2}$ is the interaction of US legislative fractionalization $LegFrac_{t-3}$, which varies across time, and the probability of receiving US aid $p_{USA,i}$, which varies across recipient countries. In the case of OECD-DAC, we have to aggregate our instrument over the 28 member countries j , which is why we obtain the following slightly different first-stage regression equation:

²⁸ Among others, Volkerink and de Haan (2001) show that legislature fragmentation increases government expenditures; Brech and Potrafke (2014) demonstrate that overall expenditures as a share of GDP significantly determine aid budgets.

$$Aid_{DAC,i,t-2} = \gamma_1(\sum_j GovFrac_{j,t-3} * \sum_j p_{j,i}) + \gamma_2 pop_{i,t-1} + \gamma_3 \eta_i + \gamma_4 \mu_t + u_{i,t-2}. \quad (4)$$

where our instrument for $Aid_{DAC,i,t-2}$ is the interaction of the sum over each donor country's government fractionalization $GovFrac_{j,t-3}$, which varies across time, and sum over each donor of the respective probability of receiving aid $p_{j,i}$, which varies across recipient countries.²⁹ To the extent that variables correlated with fractionalization do not affect recipients' rates of growth differently in regular and irregular recipients of aid, controlled for recipient-country- and year-fixed effects, the resulting instrument is excludable (see Dreher and Langlotz 2017 for a detailed discussion).

Our instruments for World Bank aid build on Galiani et al. (2017) and use a binary variable for whether a recipient has passed the IDA's threshold for concessional aid eligibility $Crossing_{i,t-5}$.³⁰ After a country surpasses this income, it loses eligibility for IDA grants. Galiani et al. (2017) find that aggregate aid from DAC donors decreases after recipients pass the income threshold. However, the World Bank itself may substitute the reduction in IDA funding with increases in IBRD loans. We thus expect the binary variable to be negatively correlated with the amount of IDA grants. We have no clear expectation regarding the direction of its correlation with the amount of IBRD loans that a country receives. We interact this variable with the probability of receiving IBRD (IDA) aid $p_{WB,i}$, in keeping with Dreher and Lohmann (2015). Arguably, countries that did not receive aid prior to passing the threshold will not experience any downfall, while countries receiving aid in most or all years will be hit 'harder.'³¹ The corresponding first-stage regression equation for World Bank aid reads as follows:

$$Aid_{WB,i,t-2} = \gamma_1 Crossing_{t-5} * p_{WB,i} + \gamma_2 pop_{i,t-1} + \gamma_3 \eta_i + \gamma_4 \mu_t + u_{i,t-2}. \quad (5)$$

²⁹ Note that this approach is identical to estimating a dyadic donor-recipient zero-stage regression, then aggregating across donors for each recipient in a year t , and using the aggregate as instrument for aid in the Two-Stage Least Squares regression (Dreher and Langlotz 2017). Following Dreher and Langlotz (2017) we replace government fractionalization with legislature fractionalization for the United States and Canada (given that government fractionalization is always zero there).

³⁰ As Galiani et al. (2017) explain, the IDA graduation process begins only three years after a country crosses the threshold. We use a five-year lag to allow for sufficient time between graduation and the decrease in new commitments to take effect.

³¹ The interaction with the probability to receive aid also alleviates concerns regarding endogeneity (Dreher and Lohmann 2015), in analogy with our reasoning regarding our interacted instruments above. Note that the power of the instrument is insufficiently low when we use the level of the threshold without interaction, in our setting.

For the United States, OECD and World Bank we introduce ODA and OOF as separate regressors rather than analyzing total development finance.³² In doing so we adjust the instruments for each regressor accordingly, using the probability of recipient country i to either receive ODA or OOF as a function of the variable of interest under investigation.

To increase the comparability of our results across donors, we also re-run our estimations using the same type of instrumental variable for all of them. Broadly following Temple and Van de Sijpe (2017), we use the interaction of a given donor’s total ODA and OF budgets in a given year with the recipient-specific probability of receiving aid from that donor. We calculate the World Bank’s aid “budget” with measures of its aid resources; the IBRD’s equity-to-loans ratio and the IDA’s “funding position.”³³ While this type of instrument is arguably less exogenous than China’s steel production or government and legislative fractionalization within donor countries (Dreher and Langlotz 2017), it has the advantage of producing comparable local average treatment effects (LATEs) across donors.

4. Main Results

Table 1 present our main results on the growth effects of Chinese aid for the 2002-2016 period.³⁴ We show results using OLS in columns 1-4. We start with the number of Chinese aid projects as variable of interest in columns 1 and 2 and then turn to the logged financial amounts in columns 3 and 4.³⁵ As can be seen from column 1, the number of Chinese aid projects is significantly positively correlated with economic growth in recipient countries at the one-percent level of significance. Eight additional Chinese aid projects are associated with an increase in economic growth by more than a percentage point two years after the aid has been committed. When we restrict our analysis to a narrowly defined measure of Chinese aid—i.e., Chinese development projects that meet the OECD-DAC criteria for ODA—the positive correlation is stronger and

³² Note that we do not focus on OOF for China, given the substantial number of projects for which we have insufficient information to include them either in the ODA or OOF categories.

³³ Alternatively, one might think of aggregating country-specific commitments to derive the Bank’s total “aid budget.” For the Bank, however, we expect the liquidity ratios to be more suitable to indicate budgetary leeway, given that, unlike the DAC donors, the Bank has no fixed budget that it will spend independent of the demand for its resources.

³⁴ Note that while we measure Chinese aid annually between 2000 and 2014, we rely on two-year lags.

³⁵ Note that we set monetary amounts to zero for projects we lack information on them. We test robustness to excluding these projects rather than setting them to zero.

remains statistically significant at the five-percent level. The significantly positive correlation for ODA holds up when we look at Chinese aid amounts (column 4) but loses its significance when we look at the entirety of Chinese development finance. According to column 3, the total amount of Chinese aid and economic growth in the recipient country are not significantly correlated. Overall, it appears that it is Chinese ODA which is correlated with the promotion of economic growth, rather than less concessional and more commercially oriented forms of Chinese state finance (Chinese OOF).

INSERT TABLE 1 HERE

The results in columns 1-4 reflect only correlations and likely suffer from endogeneity. This is why we proceed with applying our instrumental-variables strategy to account for reverse causality and other sources of endogeneity. Columns 5-8 replicate the regressions of columns 1-4 with 2SLS where the first-stage regression specification follows Equation 2. As can be seen from the Kleibergen-Paap F test reported at the bottom of the table, our instruments are highly relevant, as the corresponding test statistic clearly surpasses the rule-of-thumb value of 10. Chinese ODA boosts economic growth in recipient countries (columns 6 and 8), while there is no significant effect of overall development finance (columns 5 and 7). The effects are stronger than the correlations obtained with OLS. This is in line with expectations, as China appears to provide more aid at times of low growth (Dreher and Fuchs 2015; Dreher et al. forthcoming,a). One additional Chinese aid project is associated with an increase in economic growth by 0.7 percentage points two years after the aid commitment (column 6). This effect is sizable in light of an average growth rate in the recipient countries of 2.84 percent (in the same sample).

Columns 9-12 replicate the regressions controlling for the most common determinants of growth employed in the aid effectiveness literature: the average number of assassinations in a recipient country (data from Banks and Wilson 2015), its government surplus as a share of GDP, its rate of inflation, money as a share of GDP, and trade openness (all data from the World Bank's World Development Indicators).³⁶ We linearly interpolate the control variables so that the additional regressions use the same sample. The excludability of our instrument does not depend on additional control variables but their inclusion arguably introduces endogeneity. This is why we prefer to omit them in our baseline specifications in columns 5-8. The number of

³⁶ We do not control for good policies or institutions which are obvious transmission channels for aid to affect growth.

observations is lower because of countries with data missing for all years. Nevertheless, as can be seen from columns 9-12, the inclusion of the additional variables does not qualitatively change our conclusions. The coefficients on our Chinese ODA measures remain positive and statistically significant at conventional levels – and of similar magnitude – while there is no such effect for total development finance.

Table 2 reports results for three major Western donors of aid: the OECD-DAC, the United States, and the World Bank. The impact of these donors' aid could well be expected to differ from those of Chinese aid. Chinese aid could be more effective at boosting economic growth due to its focus on infrastructure. Infrastructural investments can ease key constraints to economic growth and induce growth accelerations in recipient countries (Deininger and Okidi 2003; Calderón and Servén 2010a, 2010b; Khandker et al. 2013, 2014). For example, roads make it easier for individuals and firms to get products to markets, improve access to public services, increase the expected returns on private investment, and facilitate economic agglomeration processes (Glewwe et al. 2000; Jalan and Ravallion 2002; Kwon 2005; Agénor and Moreno-Dobson 2006; Fan 2008; Fan and Chan-Kang 2008).³⁷ Electrification programs ease firm productivity and labor productivity constraints, thereby increasing industrial manufacturing output and improving human development outcomes (Rud 2012; Lipscomb et al. 2013).³⁸ Dams increase irrigated land for agricultural production and hydroelectricity production (Duflo and Pande 2007; Strzepek 2008). Calderón and Servén (2010a) estimate that, on average, infrastructural investments increased annual economic growth in developing countries by approximately 1.6% between the mid-1990s and the mid-2000s.

INSERT TABLE 2 HERE

Beyond its role as a financier, China has demonstrated that it can efficiently *implement* infrastructure projects and do so in ways that are responsive to the needs and preferences of host governments (Dreher et al. 2016; Soulé-Kohndou 2016).³⁹ This niche in the international

³⁷ Similarly, Donaldson (forthcoming) provides evidence that investments in rail infrastructure yield major economic development benefits.

³⁸ When households have access to reliable electricity, it reduces the time that households spend collecting firewood for cooking and lighting, thereby increasing school attendance and employment. Electrification also hastens the fertility transition, limits indoor air pollution, and reduces child mortality (Potter et al. 2002; Peters and Vance 2011; Winkelmann 2011; Barron and Torero 2014; Khandker et al. 2014; Grimm et al. 2015).

³⁹ In 2008, the then-President of Senegal, Abdoulaye Wade, published an op-ed in the *Financial Times*, celebrating China for its responsiveness to the local authorities in Africa and admonishing Western donors for their skepticism

development finance market has allowed China to differentiate itself from Western donors and lenders. China's offer of infrastructural assistance and advice also has resonance and credibility with public sector decision-makers in the developing world because China itself sustained high levels of economic growth for more than two decades and successfully lifted 680 million people out of poverty in a generation—and it did so in part by expanding and upgrading public infrastructure (Fan et al. 2002; Fan and Chan-Kang 2008; Ravallion 2009; Chen and Ravallion 2010; Lin and Wang 2014).

China's focus on infrastructure stands in contrast to Western bilateral and multilateral development finance suppliers, which have scaled back their involvement in the infrastructure sector (Dollar 2008; Hicks et al. 2008). It is therefore plausible that Chinese aid may have stronger economic growth impacts than development finance from bilateral and multilateral donors and lenders.

At the same time, there are at least four ways that China could potentially undermine debt sustainability and thus dampen the growth prospects of its borrower countries (Crouigneau and Hiault 2006; Onjala forthcoming).⁴⁰ First, if China finances unproductive, “white elephant” capital investment projects that deliver weak financial and economic returns, host governments may find it difficult to service their debts and cover their recurrent expenditures (Christiansen 2010; Dabla-Norris et al. 2012). They might also find themselves using more public funding than would otherwise be necessary to rehabilitate infrastructure that has fallen into a state of disrepair. Second, if a host government contracts excessive amount of debt through Chinese loans, it could deter foreign investment (Claessens et al. 1996; Pattillo et al. 2003; Ahlquist 2006). Third, a host government that has taken on a high level of Chinese debt might experience foreign exchange shortages, which can lead to import shortages and constrain export growth (Iyoha 1999). Fourth, unsustainable debt levels can lead to expectations of inflation and exchange rate depreciation

and criticism of Beijing: “With direct aid, credit lines and reasonable contracts, China has helped African nations build infrastructure projects in record time. ... I have found that a contract that would take five years to discuss, negotiate and sign with the World Bank takes three months when we have dealt with Chinese authorities” (Wade 2008).

⁴⁰ Tonga provides a case in point. As explained by Brandt (2015), “[c]oncessional loans from China account for 65 percent of the nation's debt stock, and it will be difficult for Tonga to service these debt obligations. Despite high-level overtures to Beijing, former Tongan Prime Minister Lord Tu'ivakano was unsuccessful in having these loans converted to grants. Repayment of one loan set to begin in 2013–14 would have accounted for over 17 percent of government revenue. China recently agreed to defer repayments for five years, but the original 20-year loan term does not change, meaning that annual repayments will be larger when they begin in 2018–19. Pacific Island communities are wondering what will happen if they cannot repay.”

(Fischer 1993). Any or all of these factors could reduce economic growth (Kumar and Woo 2010).⁴¹

To be able comparing the effect of Chinese aid on growth to those of other donors, we rely on the identification strategies described above and summarized in Equations 3-5, which are based on recent innovations in the empirical aid effectiveness literature (Ahmed 2016; Lang 2016; Dreher and Langlotz 2017). The results are consistent across Western donors. We find that neither OECD-DAC nor United States nor World Bank aid promotes economic growth in recipient countries. The corresponding coefficients do not reach statistical significance in any specification. However, the first-stage F statistic is comparably low for US OOF and IBRD and IDA commitments, which likely biases the results. What is more, the estimates are hardly comparable across donors due to the different LATEs resulting from the use of different instruments. To address this problem, Table 3 applies an alternative approach, relying on aid budgets interacted with a recipient’s probability to receive aid to predict year-to-year changes in aid (see Temple and Van de Sijpe 2017 for a similar empirical strategy). The improved comparability across donors comes at a cost, as the instrument is arguably less exogenous than China’s steel production or countries’ government and legislative fractionalization. As Dreher and Langlotz (2017) note, the exclusion restriction could well be violated “given that growth shocks in recipient countries could directly affect donors’ aid budgets [...], while growth shocks in non-recipient countries might not.” They point to a paper by Rodella-Boitreau and Wagner (2011) who find that donors increase their aid budgets in responding to increasing demands for their aid rather than just responding with re-allocations of aid. Nevertheless, we believe that this is a useful exercise for the sake of comparability across donors.

INSERT TABLE 3 HERE

For China, the OECD-DAC and the United States, we use the interaction of the respective donor’s aid budget, computed as the total sum of all ODA (OF) commitments, in a given year with the recipient-specific probability of receiving aid from the respective donor. Our instruments for World Bank aid rely on Lang (2016). Lang suggests the IMF’s liquidity ratio interacted with the probability of a country to be under an IMF program as instrument for IMF loans. We follow this idea by using similar proxies for the World Bank. In order to measure the availability of

⁴¹ Kumar and Woo (2010) estimate that, on average, a ten-percentage point increase in a country’s debt-to-GDP ratio yields a reduction in annual per capita income growth of 0.2 percentage points.

IBRD resources, we rely on the IBRD's equity-to-loans ratio, which has been consistently reported in the IBRD's annual financial statements since 1994.⁴² The equity-to-loans ratio is a measure of the IBRD's "ability to issue loans without calling its callable capital" (Bulow 2002: 245).⁴³ In order to measure the availability of IDA resources, we rely on a measure of IDA's "funding position," which is defined by the World Bank as "the extent to which IDA can commit to new financing of loans, grants and guarantees given its financial position at any point in time and whether there are sufficient resources to meet undisbursed commitments of loans and grants" (IDA 2015: 24). This indicator is publicly disclosed by the World Bank every year in its annual financial statement. However, it only began this practice in 2008, so we reconstruct the 1990-2007 time-series by using the World Bank's description on how it calculates this indicator. More specifically, with the information reported in the IDA's annual financial statements, we first sum the Bank's net investment portfolio and its non-negotiable, non-interest-bearing demand obligations (on account of members' subscriptions and contributions) and then divide this figure by the sum of the Bank's undisbursed commitments of development credits and grants.⁴⁴

We would ideally like to focus on the same periods of time when comparing across donors. However, when we restrict the sample for the Western donors and lenders to the time we also dispose of data for China, our instruments are insufficiently powerful. Our comparison thus relies on comparable LATEs, but different samples in terms of recipients and years.

Using the aid budget instrument, our findings for Chinese ODA are comparable to those obtained with the steel instrument in Table 1. In contrast to Table 1, we obtain a significantly

⁴² "Equity" is defined as the sum of usable paid-in capital, general reserves, special reserves, and cumulative translation adjustments. It does not include the "callable capital" that the IBRD's shareholders are legally obligated to provide if and when it is needed. "Loans" are defined as the sum of loans outstanding and the present value of guarantees.

⁴³ One Executive Director to the World Bank memorably characterized the IBRD's callable capital in this way: "Management and the Board should think about callable capital as a Christian thinks about heaven, that it is a nice idea but no one wants to go there because the price of admission is death" (quoted in Kapur et al. 1997: 991).

⁴⁴ Since 2008, the Bank has summed its net investment portfolio and its "unrestricted" demand obligations. However, prior to 2008, the Bank did not separately report its "restricted" and "unrestricted" demand obligations. Therefore, we rely instead on the total non-negotiable, noninterest-bearing demand obligation figures reported in the Bank's pre-2008 financial reports. The Bank's "restricted" demand obligations from 2008-2014 were almost negligible (less than 1% of total demand obligations), so this difference in the way IDA's funding position is calculated from 1999-2007 and 2008-2014 is small and unlikely to be consequential. Likewise, the Bank reported its "net investment portfolio" as a stand-alone figure from 2008 to 2014 but not in earlier years. Therefore, as an approximation of the Bank's net investment portfolio in each year between 2000 and 2007 we sum "Investments — Notes B and F" and "currencies due from banks" less "net payable from investment securities transactions." As an approximation of the Bank's "net investment portfolio" in each year between 1990 and 1999 we sum cash and investments immediately available and not immediately available for disbursement.

positive coefficient on Chinese development finance when we use logged aid amounts as variable of interest. Again, the growth effects are stronger for Chinese ODA than for total Chinese official finance. The size of the estimated effect for ODA is substantially larger compared to the previous estimate: one additional Chinese aid project is associated with an increase in economic growth by 1.5 percentage points two years after the aid commitment (column 2). An increase in Chinese ODA amounts by one percent increases growth by 1.2 percentage points (column 4). We now find that aid from the Western bilateral donors boosts economic growth in recipient countries as well (columns 6 and 8).⁴⁵ According to the results, an increase in aid from OECD-DAC countries (the United States) increases growth by 2.1 (3.3) percentage points. When we compare these effects to those of Chinese aid, we cannot reject the hypothesis that the effect of Chinese ODA on growth equals those of DAC donors. At the ten percent level, the effect of US ODA however exceeds the effect of Chinese ODA on growth. There is no comparable effect for DAC OOF and US OOF (columns 5 and 7). Nor do we observe any effect of IBRD loans and IDA grants (columns 9 and 10).⁴⁶

Finally, we investigate the timing of the growth effects of aid. In Appendix C2 in the Appendix, we estimate a variant of Table 3 where we change the lag structure of aid. We change the lag structure of the respective instrument in analogy, e.g., when we lag aid by four years, the corresponding instrument is lagged by five years. For the reader's convenience, the second row replicates the results of our baseline specification where we use the second lag. As can be seen, Chinese aid works more in the short run, while DAC and US ODA appear more sustainable in the sense that their growth effects are still visible after six years. DAC OOF and IBRD flows, however, even show negative growth effects after four years.

5. Does Chinese aid harm the effectiveness of Western aid?

This section tests whether and to what extent Western aid is less effective when given to countries that also receive substantial support from China. Scholars, journalists, and

⁴⁵ This is remarkably different from the longer-term results reported in Dreher and Langlotz (2017). Focusing on four-year averages, Dreher and Langlotz find no significant effect of aid on growth.

⁴⁶ These findings deserve a note of caution: the results for the OECD-DAC and the United States are based on a longer panel (1978-2016) as the instrument failed to reach relevance on the shorter 2002-2016 sample. Similarly, the results for the IBRD refer to the 1997-2016 and for the IDA to the 1993-2016 period.

policymakers have argued that China’s disregard for good governance principles diminishes the effectiveness of aid from more “enlightened” donors (Naím 2007; The Economist 2009; Pehnelt 2007; Collier 2007; Crouigneau and Hiault 2006 and Woods 2008).⁴⁷ By way of example, in 2007, the head of the UK’s Department for International Development (DFID), Hilary Benn, asserted that “China’s failure to match the conditions placed on aid by countries such as Britain – including evidence of good governance, respect for human rights and spending directed to alleviate poverty – could set back progress toward democratic administrations” (McGreal 2007). Similarly, in 2009, the Executive Vice President of the Asia Society relayed to the BBC a specific account from Southeast Asia where this dynamic seemed to be at work: “Cambodia was considering a \$600m loan from the World Bank that had conditions about transparency and anti-corruption and accountability. The Cambodians basically told the World Bank to go to hell and the next day they received a \$601m loan from the Chinese with no conditions” (BBC 2009).

Several recent studies suggest that anecdotes like this one may reflect a broader empirical pattern. Hernandez (2017) provides evidence that recipients of Chinese aid receive World Bank loans with fewer conditions. Likewise, Li (2017) finds that Chinese aid has blunted the democratizing effects of DAC aid to Sub-Saharan Africa. Kersting and Kilby (2014) similarly recover evidence that Chinese aid undermines democratic governance. Therefore, to the extent that World Bank conditions and high-quality institutions support economic growth in recipient countries, Chinese aid could have indirectly detrimental effects.⁴⁸

We investigate the popular but empirically untested claim that access to Chinese aid reduces the effectiveness of Western aid. Ideally, we would like to include Chinese and Western development finance in the same regression, and add an interaction between them. However, recall that our instruments lack power for Western aid when we restrict the sample to the recent period where Chinese aid is also available. This is even more so when we also instrument the interaction (with the interaction of the individual instruments). Rather than using interactions, we therefore compare the growth effects of Western aid between countries that have received a major influx of Chinese aid with average recipients of Chinese aid. In order to do so, Table 4 replicates Table 2 but restricts the sample to “Chinese aid darlings.” We define “Chinese aid

⁴⁷ Swedlund (2017) provides a counter-argument.

⁴⁸ On the other hand, Strange et al. (2017a) find that Chinese aid can help prevent civil conflict when recipients are faced with sudden withdrawals of Western aid. Therefore, to the extent that political stability promotes economic growth, Chinese aid could also have indirect positive effects.

darlings” as countries that either received a total of at least ten Chinese officially financed projects over the 2000-2014 period or at least two projects during the 1960-2005 period (using data taken from Dreher and Fuchs 2015).⁴⁹ Only for the IBRD and IDA the F statistics indicate sufficient power when we restrict the sample to the 2002-2016 period for which we also have Chinese aid data available. For them, we therefore also run regressions where we define Chinese “aid darlings” as countries that receive at least one Chinese project in a particular year.

Arguably, the decision of whether a country becomes a “Chinese aid darling” is not exogenous, as China’s aid allocation follows need-based, commercial, and geopolitical motives (Dreher and Fuchs 2015; Dreher et al. forthcoming,a). Our results in Table 4 could thus suffer from sample selection bias. We address this issue by using the predicted number of Chinese projects rather than the actual number to select the sample of Chinese aid darlings (in Table 5). Specifically, we use the first-stage regression results from column 5 of Table 1 to make this decision (and thus exclusively focus on the more recent period). We define “aid darlings” as countries that are predicted to receive at least 10 projects over the sample period. In addition, we again run additional regressions for the IBRD and the IDA where “darlings” are those countries that we predict to receive at least one project in a particular year. Running seemingly unrelated estimations, we compute Wald tests to test statistically significant differences in the effect sizes between the coefficients in Tables 2. The corresponding p-values are reported at the bottom of Tables 4 and 5.

INSERT TABLES 4 AND 5 HERE

Comparing the results in Tables 4 and 5 with those in Table 2, we find no clear pattern. Although the coefficients show statistically significant differences between Table 2 and Tables 4 and 5 in three sets of regressions, the effects of DAC OOF and IDA commitments are more positive when given to “Chinese aid darlings” (columns 1 and 6 of Table 4). Across both tables, only one coefficient points to a lower effectiveness of Western aid in China’s presence. As can be seen from column 5 of Table 4, IBRD commitments are less effective in countries where Chinese aid is given in abundance.⁵⁰ However, when we account for the endogeneity of Chinese aid (in

⁴⁹ These cutoff values reflect the 56th percentile in both distributions. Of course, any cutoff is arbitrary. However, our findings do not hinge on this decision. For example, the results are qualitatively similar if we use 20 projects in the current period (2000-2014) as cutoff and disregard historical aid activities. Results are available on request.

⁵⁰ This latter result should not be interpreted with great caution given the low F statistics of instrument relevance.

Table 5), the difference in effectiveness of IBRD commitments is no longer significant at conventional levels. Taken together, claims that Chinese aid systematically harms the effectiveness of Western aid thus seem to be unjustified.

Although the F statistics are slightly weaker than in Table 4, the results are overall similar. This confirms our earlier conclusion that Chinese aid does not seem to impair the effectiveness of aid from Western donors.

6. Conclusions

China has become a major source of global development finance and chosen to invest heavily on infrastructure projects. Since these types of investments should, in principle, facilitate economic growth more than investments in other sectors, the absence of rigorous evidence on the growth impacts of Chinese development finance represents a major blind spot in the aid effectiveness literature. This paper seeks to address the gap by estimating the average economic growth effects of Chinese development finance and benchmarking China's performance against three other prominent financiers: The World Bank, the United States, and OECD-DAC donors as a whole.

Our results show that Chinese aid boosts economic growth in recipient countries. For the average recipient country, we estimate that one additional Chinese aid project produces a 0.7-1.1 percentage point increase in economic growth 2 years after the project is committed. Relying on recent identification strategies proposed in the aid effectiveness literature, we also benchmark the effectiveness of Chinese aid vis-à-vis the World Bank, the United States, and all members of the OECD's Development Assistance Committee (DAC). Our results indicate that Chinese, US and OECD-DAC aid yield similar economic growth impacts. We also find no evidence to support the idea that Western aid is less effective at accelerating economic growth in countries that also have significant access to Chinese aid. On the whole, we consider this body of evidence to be encouraging and think it should allay some of the longstanding fears that policy makers and policy analysts have expressed about China acting as "rogue donor" (e.g., Naim 2007) or, whatever its intent, that Chinese activity decreases the effectiveness of Western assistance.

Our paper also calls attention to the importance of analyzing donor heterogeneity and financial flow type heterogeneity in studies of aid effectiveness. Whereas we find evidence that Chinese, U.S. and OECD DAC assistance increases economic growth in recipient countries, we

find no such evidence for the World Bank.⁵¹ Also, unlike most studies of aid effectiveness, we decompose growth impacts according to the type of financial flows that host countries received. We find strong evidence that ODA—aid in the strictest sense of the term that is oriented towards development objectives and is offered on highly concessional terms—strongly and consistently registers positive effects on economic growth in recipient countries. However, we do not recover any robust evidence that OOF—less concessional and non-concessional sources of official financing and officially financed activities with non-developmental objectives—improves economic growth outcomes. This pattern, which seems to hold true irrespective of the source of funding, has different implications for China and Western suppliers of official finance. Only about 21% of China’s overseas development program is financed with aid in the strictest sense of the term (ODA). Therefore, if China were to reorient more of its overseas spending towards ODA, low- and middle- income countries would potentially be in a position to reap larger economic growth dividends. Western donors, by comparison, have less scope to achieve large economic growth impacts—within existing budgetary constraints—because they already provide most of their support through highly concessional and developmentally-oriented projects (ODA).

In future research, we plan to evaluate potential mechanisms that may account for these empirical patterns. First, we plan to decompose our donor country-level estimates of aid effectiveness by agency. The effectiveness of U.S. aid might differ according to which agency provides financial support. The Millennium Challenge Corporation (MCC) is only legislatively authorized to provide assistance to low-income and lower-middle income countries that demonstrate a commitment to ruling justly, investing in their people, and promoting economic freedom.⁵² By contrast, USAID is subject to a wide array of geostrategic, diplomatic and commercial pressures that influence its aid allocation patterns (Lebovic 1998; Lai 2003; Lai and Morey 2006); so, to the extent that aid-giving motivations impinge upon aid effectiveness, assistance from USAID might be less effective than MCC assistance at accelerating

⁵¹ These results are consistent with evidence on the growth impacts of Chinese, IDA, and IBRD projects at the subnational level (Dreher and Lohmann 2015; Dreher et al. 2016).

⁵² The U.S. Government has made access to MCC assistance conditional upon a country's performance on third-party measures of good governance. This “aid selectivity” model has been shown to be effective, to some extent, in spurring reforms in countries that are potentially eligible for such assistance (Öhler et al. 2012; Parks and Rice 2013; Parks and Davis 2017). Also, given that the quality of governance is an important determinant of economic growth (e.g., Aidt 2009) and the MCC systematically favors well-governed countries, one might expect MCC funds to be more conducive to growth.

recipient-country growth (Headey 2008; Bearce and Tirone 2010; Minoiu and Reddy 2010; Dreher et al. forthcoming,b). The sectoral composition of aid also varies significantly across U.S. agencies. Whereas the MCC invests heavily in infrastructure and productive sectors, USAID tends to be more engaged in the social, environmental, and governance sectors. These differences might also lead to heterogeneous growth responses in U.S. recipient countries. Ideally, we would disaggregate Chinese development finance by agency (e.g., the Ministry of Commerce, Export-Import Bank of China, China Development Bank); however, our data are not sufficiently fine-grained to allow such comparisons at this time. We therefore plan to compare the effectiveness of Chinese ODA and U.S. ODA from MCC and USAID.

Second, in order to more directly test whether the growth impacts of aid Western and non-Western aid vary by sector, we plan to isolate the sectoral component of aid from specific donors that should in principle have the most direct and immediate effects on economic growth. Clemens et al. (2012) decompose total aid flows into “early-impact” aid flows (e.g., infrastructure and productive sector programs) that plausibly impact near-term growth outcomes and aid flows that could only plausibly generate growth and development benefits over longer periods of time (e.g., health and education programs). They find relatively strong impacts of aid on growth when they limit their analysis to “early-impact” aid flows. However, they do not test whether donors are differentially effective at promoting economic growth when they support the same types of ‘growth’ sector activities (e.g., highways, bridges, railroads, dams, airports, seaports, electricity grids). We will attempt to fill this evidence gap.

Third, the degree to which aid is targeted to address the heterogeneous needs of recipient countries might differ. We therefore plan to follow the analysis in Asmus et al. (2017a), who introduce indicators that measure the alignment between sector-specific needs of recipient countries and the sectoral composition of aid from donor countries as a conditioning factor for the effectiveness of aid. Asmus et al. (2017a) show that well-targeted aid—in the sense that the composition of aid matches the specific needs of recipients at different points in time—enhances the growth effects of aid (or reduces any growth-impairing effects). We plan to follow their approach and calculate targeting indices for the different donor (agencies) in our sample.

A fourth possibility is that our aid effectiveness estimates vary across different types of recipient countries. The growth effects of Chinese aid could vary across countries with and

without debt sustainability problems (Onjala forthcoming).⁵³ Chinese aid effectiveness could also vary across well-governed and poorly-governed countries (Burnside and Dollar 2000; Angeles and Neanidis 2009; Balamoune-Lutz and Mavrotas 2009; Denizer et al. 2013). A related hypothesis suggests that aid from China and Western sources might be differentially effective across countries with high and low levels of public investment efficiency (Dabla-Norris et al. 2012). If the economic growth effects of Chinese aid that we document in this study vanish or diminish in countries with low levels of public investment efficiency, such evidence would help explain why so many pundits and policymakers claim that China has a track record of funding “white elephant” projects.

Finally, given that we measure Chinese development finance over a relatively short span of time (2000-2014), we cannot systematically rule out the possibility that Chinese development finance has longer-run effects on economic growth that we are not able to detect. A relatively long time-series of Chinese aid measurements prior to 2000 would help solve this problem.

⁵³ However, even if we are able to identify differential effects across countries with and without debt sustainability problems, it is unlikely that we will be able to detect long-run growth effects through the debt accumulation channel in the absence of a longer time-series that provides measurements of Chinese aid prior to 2000. As such, we will likely not be able to rule out the possibility that Chinese development finance undermines debt sustainability in recipient (borrower) countries over longer periods of time and eventually slow economic growth (Onjala forthcoming).

References

- Agenor, Pierre-Richard and Blanca Moreno-Dodson. 2006. Public Infrastructure and Growth: New Channels and Policy Implications. Policy Research Working Paper 4064. Washington DC: The World Bank.
- Ahlquist, J.S. 2006. Economic Policy, Institutions, and Capital Flows: Portfolio and Direct Investment Flows in Developing Countries. *International Studies Quarterly* 50(3): 681-704.
- Ahmed, Faisal Z., 2016, Does Foreign Aid Harm Political Rights? Evidence from US Aid, *Quarterly Journal of Political Science* 11, 2: 183-217.
- Aidt, Toke S., 2009. Corruption, institutions, and economic development. *Oxford Review of Economic Policy* 25 (2): 271-291.
- Angeles, L. and K. C. Neanidis. 2009. Aid effectiveness: The role of the local elite. *Journal of Development Economics* 90(1): 120-134.
- Asmus, Gerda, Axel Dreher and Peter Nunnenkamp. 2017a. Is Targeted Aid More Effective? Sector-specific needs, the composition of aid and its effects on growth. Working Paper.
- Baliamoune-Lutz, M. and G. Mavrotas. 2009. Aid Effectiveness: Looking at the Aid-Social Capital-growth Nexus. *Review of Development Economics* 13(3): 510-525.
- Banks, Arthur S. and Kenneth A. Wilson, 2015, Cross-National Time-Series Data Archive, Databanks International, Jerusalem, Israel; <http://www.databanksinternational.com>.
- Barron, M and Torero, M. 2014. Household Electrification: Short-Term Effects with Long-Term Implications. Mimeo. Department of Agricultural and Resource Economics, University of California, Berkeley.
- Bartke, Wolfgang. 1989. *The Economic Aid of the PR China to Developing and Socialist Countries* (2nd ed.). Munich, Germany: K. G. Saur.
- BBC. 2009. China's global reach: lending more than the World Bank. *BBC World Service*. Accessed at <http://www.bbc.co.uk/news/mobile/business-16092634>
- Bearce, David H. and Daniel C. Tirone. 2010. Foreign aid effectiveness and the strategic goals of donor governments. *Journal of Politics* 72 (3): 837-851.
- BenYishay, Ariel, Bradley Parks, Daniel Runfola, Rachel Trichler. 2016. Forest Cover Impacts of Chinese Development Projects in Ecologically Sensitive Areas. AidData Working Paper #32. Williamsburg, VA: AidData.

- Blair, Rob, and Philip Roessler. 2016. China and the African State: Evidence from Surveys, Survey Experiments and Behavioral Games in Liberia. USAID Research and Innovation Grants Working Papers Series. Washington DC: USAID.
- Brant, Philippa. 2015. The Geopolitics of Chinese Aid: Mapping Beijing's Funding in the Pacific. *Foreign Affairs*. 4 March 2015.
- Bräutigam, Deborah. 2011. Testimony on China's Growing Role in Africa before the United States Senate Committee on Foreign Relations Subcommittee on African Affairs. November 1, 2011. Accessed at https://www.foreign.senate.gov/imo/media/doc/Deborah_Brautigam_Testimony.pdf
- Brazys, Samuel, Johan A. Elkink, and Gina Kelly. 2017. Bad neighbors? How co-located Chinese and World Bank development projects impact local corruption in Tanzania. *The Review of International Organizations* 12 (2): 227-253.
- Brech, Viktor and Niklas Potrafke. 2014. Donor Ideology and Types of Foreign Aid, *Journal of Comparative Economics* 42 (1): 61-75.
- Bulow, Jeremy. 2002. First World Governments and Third World Debt. *Brookings Papers on Economic Activity* 1: 229-255.
- Bun, Maurice and Teresa Harrison, 2014, OLS and IV estimation of regression models including endogenous interaction terms. University of Amsterdam discussion paper No. 2014-02.
- Bunte, Jonas B., Harsh Desai, Kanio Gbala, Bradley C. Parks, Daniel Miller Runfola. 2017. Natural Resource Sector FDI and Growth in Post-Conflict Settings: Subnational Evidence from Liberia. AidData Working Paper #34. Williamsburg, VA: AidData.
- Burnside, Craig and David Dollar, 2000, Aid, Policies and Growth, *American Economic Review* 90, 4: 847-868.
- Calderón, C., and L. Servén. 2010a. Infrastructure and economic development in Sub-Saharan Africa. *Journal of African Economies* 19(S1): 13-87.
- Calderón, C., and L. Servén. 2010b. "Infrastructure in Latin America", in J. Ocampo and J. Ros (eds.), *The Oxford Handbook of Latin American Economies*.
- Campbell, Ivan, Thomas Wheeler, Larry Attree, Dell Marie Butler, and Bernardo Mariani. 2012. China and Conflict-affected States: Between Principle and Pragmatism. London, UK: Saferworld.
- Christensen, Benedicte Vibe. 2010. China in Africa A Macroeconomic Perspective. CGD Working Paper 230. Washington D.C.: Center for Global Development.

- Christian, Paul and Christopher B. Barrett. 2017. Revisiting the Effect of Food Aid on Conflict: A Methodological Caution. Policy Research Working Paper;No. 8171. World Bank, Washington, DC. World Bank. <https://openknowledge.worldbank.org/handle/10986/27978> License: CC BY 3.0 IGO.
- Claessens, S., E. Detragiache, R. Kanbur, and P. Wickham. 1996. Analytical Aspects of the Debt Problems of Heavily Indebted Countries. Policy Research Working Paper No. 1618. Washington DC: World Bank.
- Clemens, Michael A., Steven Radelet, Rikhil R. Bhavnani and Samuel Bazzi, 2012, Counting Chickens When They Hatch: Timing and the Effects of Aid on Growth, *Economic Journal* 122, 561: 590-617.
- Collier, Paul. 2007. *The Bottom Billion*. New York, NY: Oxford University Press.
- Cordella, T. and H. Ulku. 2007. Grants vs. Loans. *IMF Staff Papers* 54 (1): 139-162.
- Crouigneau, Francoise and Richard Hault. 2006. Wolfowitz Slams China Banks on Africa Lending. *Financial Times*. October 24, 2006.
- Custer, Samantha, Zachary Rice, Takaaki Masaki, Rebecca Latourell and Bradley Parks. 2015. Listening to Leaders: Which Development Partners Do They Prefer and Why? Williamsburg, VA: AidData.
- Dabla-Norris, Era, Jim Brumby, Annette Kyobe, Zac Mills and Chris Papageorgiou. 2012. Investing in Public Investment: An Index of Public Investment Efficiency. *Journal of Economic Growth* 17 (3): 235-266.
- Deininger, K. and Okidi, J. 2003. Growth and Poverty Reduction in Uganda, 1992–2000: Panel Data Evidence. *Development Policy Review* 21 (4): 481–509.
- Denizer, Cevdet, Daniel Kaufmann and Aart Kraay. 2013. Good Countries or Good Projects? Macro and Micro Correlates of World Bank Project Outcomes. *Journal of Development Economics* 105: 288–302.
- Djankov, Simeon. 2016. “The Rationale Behind China’s Belt and Road Initiative” in *China’s Belt and Road Initiative: Motives, Scope, and Challenges*, edited by Simeon Djankov and Sean Miner. PIIE Briefing 16-2. Washington DC: Peterson Institute for International Economics. Pp. 6-10.
- Dollar, David. 2008. Supply Meets Demand: Chinese Infrastructure Finance in Africa. World Bank blog. 10 July 2008. Accessed at

<http://blogs.worldbank.org/eastasiapacific/supply-meets-demand-chinese-infrastructure-finance-in-africa>

- Donaldson, Dave. forthcoming. Railroads of the Raj: Estimating the impact of transportation infrastructure. *American Economic Review*.
- Doucouliafos, H., and M. Paldam. 2009. The aid effectiveness literature: the sad results of 40 years of research. *Journal of Economic Surveys* 23(3): 433-461.
- Doucouliafos, Hristos, 2016, The Politics of International Aid, in: R. Congleton, B. Grofman, S. Voigt (Eds.), *Oxford Handbook of Public Choice*, forthcoming.
- Dovern, J. and P. Nunnenkamp 2007. Aid and growth accelerations: An alternative approach to assessing the effectiveness of aid. *Kyklos* 60(3): 359-383.
- Dreher, Axel and Sarah Langlotz. 2017. Aid and Growth. New Evidence Using an Excludable Instrument, Heidelberg University Discussion Paper No. 635.
- Dreher, Axel and Steffen Lohmann, 2015. Aid and Growth at the Regional Level. *Oxford Review of Economic Policy* 31: 420-446.
- Dreher, Axel, and Andreas Fuchs. 2015. Rogue Aid? An Empirical Analysis of China's Aid Allocation. *Canadian Journal of Economics* 48, 3: 988-1023.
- Dreher, Axel, Andreas Fuchs, Bradley C. Parks, Austin Strange, Michael J. Tierney. Forthcoming. Apples and Dragon Fruits: The Determinants of Aid and Other Forms of State Finance from China to Africa, *International Studies Quarterly*.
- Dreher, Axel, Andreas Fuchs, Bradley C. Parks, Austin Strange, Michael J. Tierney, forthcoming,a, Apples and Dragon Fruits: The Determinants of Aid and Other Forms of State Finance from China to Africa, *International Studies Quarterly*.
- Dreher, Axel, Andreas Fuchs, Roland Hodler, Bradley C. Parks, Paul A. Raschky, Michael J. Tierney, 2016, Aid on Demand: African Leaders and the Geography of China's Foreign Assistance, AidData Working Paper 3 Revised. Williamsburg, VA: AidData
- Dreher, Axel, Valentin Lang and Sebastian Ziaja. 2017. Foreign Aid in Areas of Limited Statehood, CESifo Working Paper 6340.
- Dreher, Axel, Vera Eichenauer and Kai Gehring. Forthcoming,b. Geopolitics, Aid and Growth, *World Bank Economic Review*.
- Duflo, Esther, and Rohini Pande. 2007. Dams. *Quarterly Journal of Economics* 122 (2): 601-646.

- Fan, S., and C. Chan-Kang. 2008. Regional road development, rural and urban poverty: Evidence from China. *Transport Policy* 15 (5): 305–314.
- Fan, S., ed. 2008. Public expenditures, growth, and poverty: Lessons from developing countries. Baltimore, Md.: Johns Hopkins University Press.
- Fan, S., L. Zhang, and X. Zhang. 2002. Growth, inequality, and poverty in rural China: The role of public investment. Beijing: China Agricultural Publishing House.
- Fischer, Stanley. 1993. The Role of Macroeconomic Factors in Growth. *Journal of Monetary Economics* 32: 485-512.
- Fuchs, Andreas and Angelika Müller. 2017. Aid Donors. Paper presented at the Annual Meeting of the European Public Choice Society, Budapest, Hungary, April 19–22.
- Galiani, Sebastian, Stephen Knack, Lixin C. Xu and Ben Zou, 2017, The Effect of Aid on Growth: Evidence from a quasi-Experiment, *Journal of Economic Growth* 22, 1: 1-33.
- Ghose, Siddhartha. 2017. Tracking Funding for the Ebola Epidemic in Sierra Leone. AidData and the US Global Development Lab.
- Greenhill, Romilly. 2013. The age of choice: Cambodia in the new aid landscape. London, UK: Overseas Development Institute.
- Grimm, Michael, Robert Sparrow, & Luca Tasciotti. 2015. Does Electrification Spur the Fertility Transition? Evidence From Indonesia. *Demography* 52: 1773–1796.
- Headey, Derek, 2008, Geopolitics and the effect of foreign aid on economic growth: 1970-2001. *Journal of International Development* 20: 161-180.
- Hendrix, Cullen, and Marcus Noland. 2014. *Confronting the Curse: The Economics and Geopolitics of Natural Resource Governance*. Washington, DC: Peterson Institute for International Economics.
- Hernandez, Diego. 2017. Are “New” Donors Challenging World Bank Conditionality? *World Development* 96 (C): 529-549.
- Hsiang, Solomon, and Nitin Sekar. 2016. Does Legalization Reduce Black Market Activity? Evidence from a Global Ivory Experiment and Elephant Poaching Data. NBER Working Paper 22314. Cambridge, MA: NBER.
- Ioannidis, John, T.D. Stanley and Hristos Doucouliagos, 2016, The Power of Bias in Economics Research, *Economic Journal*, forthcoming.
- Isaksson, Ann-Sofie, and Andreas Kotsadam. 2016. Chinese Aid and Local Corruption. AidData Working Paper #33. Williamsburg, VA: AidData.

- Iyoha, M. A. 1999. External debt and economic growth in sub-Saharan African countries: An econometric study. African Economic Research Consortium Research Paper.
- Jalan, J., and M. Ravallion. 2002. Geographic poverty traps? A micro model of consumption growth in rural China. *Journal of Applied Econometrics* 17: 329–346.
- Kapur, D., J.P. Lewis and R. Webb. 1997. *The World Bank: Its First Half-Century, Vol. 1*. Washington DC: The Brookings Institution.
- Kersting, Erasmus and Christopher Kilby. 2014. Aid and Democracy Redux. *European Economic Review* 67: 125-143.
- Khandker, Shahidur R., Douglas F. Barnes, and Hussain A. Samad. 2013. Welfare Impacts of Rural Electrification: A Panel Data Analysis from Vietnam. *Economic Development and Cultural Change* 61 (3): 659-692.
- Khandker, Shahidur R., Hussain A. Samad, Rubaba Ali, and Douglas F. Barnes. 2014. Who Benefits Most from Rural Electrification? Evidence in India. Policy Research Working Paper 6095. Washington DC: World Bank.
- Khomba, Daniel Chris and Trew, Alex. 2017. Aid and Growth in Malawi. AidData Working Paper #42. Williamsburg, VA: AidData.
- Kilama, Eric. 2016. Evidences on Donors Competition in Africa: Traditional Donors versus China? *Journal of International Development* 28 (4): 528-551.
- Kitano, Naohiro. 2016. Estimating China's Foreign Aid II: 2014 Update. JICA-RI Working Paper #131.
- Kumar, M. and J. Woo. 2010. Public debt and Growth. IMF Working Paper WP/10/174. Washington DC. IMF.
- Kwon, Eunkyung, 2005. Infrastructure, Growth and Poverty Reduction in Indonesia: A Cross-Sectional Analysis. Paper presented at the ADBI Workshop on Transport Infrastructure and Poverty Reduction, ADB Manila, 18–22 July 2005.
- Lai, Brian and Daniel S. Morey. 2006. Impact of Regime Type on the Influence of U.S. Foreign Aid. *Foreign Policy Analysis* 2(4): 385-404.
- Lai, Brian, 2003. Examining the Goals of US Foreign Assistance in the Post-Cold War Period, 1991-1996. *Journal of Peace Research* 40(1): 103-128.
- Lancaster, Carol. 2007. The Chinese Aid System. Center for Global Development Essay. June 2007. Washington, DC: Center for Global Development

- Lang, Valentin, 2016, The Economics of the Democratic Deficit: The Effect of IMF Programs on Inequality, Heidelberg University Discussion Paper 617.
- Lebovic, James H., 1988. National Interests and US Foreign Aid: The Carter and Reagan Years. *Journal of Peace Research* 25(2): 115-135
- Lin, Justin Yifu and Yan Wang. 2014. China-Africa co-operation in structural transformation: ideas, opportunities, and finances. UNU-WIDER Working Paper 2014/046. Helsinki: United Nations University.
- Lipscomb, Molly, A. Mushfiq Mobarak and Tania Barham. 2013. Development Effects of Electrification: Evidence from the Topographic Placement of Hydropower Plants in Brazil. *American Economic Journal: Applied Economics* 5(2): 200-231.
- McGreal, Chris. 2007. Chinese Aid to Africa May Do More Harm than Good, Warns Benn. *The Guardian*. February 9, 2007
- Minasyan, Anna, Peter Nunnenkamp and Katharina Richert. 2017. Does Aid Effectiveness Depend on the Quality of Donors? *World Development*. Forthcoming.
- Minoiu, C. and S. Reddy. 2010. Development aid and economic growth: A positive long run relation. *The Quarterly Review of Economics and Finance* 50: 27-39.
- Minor, Allison, Pranay Sinha, Brooke Russell, and Charles Perla. 2014. Defining & Measuring Development Assistance from GCC Countries: A Methodological Note. Williamsburg, VA: AidData.
- Moreira, Susana. 2013. Learning from Failure: China's Overseas Oil Investments. *Journal of Current Chinese Affairs* 42, 1: 131-165.
- Morgan, Pippa, and Yu Zheng. 2017. Tracing the Legacy: China's Historical Aid and Contemporary Investment in Africa. Working Paper.
- Naím, Moisés. 2007. Rogue Aid. *Foreign Policy* 159: 95-96.
- Nizalova, Olena and Irina Murtazashvili, 2016, Exogenous Treatment and Endogenous Factors: Vanishing of Omitted Variable Bias on the Interaction Term, *Journal of Econometric Methods* 5 (1): 71-77.
- Nunn, Nathan and Nancy Qian, 2014, U.S. Food Aid and Civil Conflict, *American Economic Review* 104, 6: 1630-1666.
- Odedokun, Matthew. 2004. Multilateral and Bilateral Loans versus Grants: Issues and Evidence. *World Economy* 27 (2): 239-63.

- Öhler, Hannes, Peter Nunnenkamp and Axel Dreher, 2012, Does Conditionality Work? A Test for an Innovative US Aid Scheme, *European Economic Review* 56: 138-153.
- Onjala, Joseph. forthcoming. China's Development Loans and the threat of Debt Crisis in Kenya. *Development Policy Review*.
- Parks, Bradley C. and Caroline Davis. 2017. When Do Governments Trade Domestic Reforms for External Rewards? Explaining Policy Responses to the Millennium Challenge Corporation's Eligibility Standards. Working Paper.
- Parks, Bradley C. and Zachary J. Rice. 2013. Does the 'MCC Effect' Exist? Results from the 2012 MCA Stakeholder Survey. MCA Monitor Report. Washington DC: Center for Global Development.
- Pattillo, C., H. Poirson, and L.A. Ricci. 2003. Through What Channels Does External Debt Affects Growth? Brookings Trade Forum. Washington D.C.: Brookings Institution Press. pp. 229–58.
- Pehnelt, Gernot. 2007. The Political Economy of China's Aid Policy in Africa. Jena Economic Research Papers # 051. Jena, Germany: University of Jena.
- Perlez, Jane and Yufan Huang. 2017. Behind China's \$1 Trillion Plan to Shake Up the Economic Order. *New York Times*. 13 May 2017. Accessed at <https://www.nytimes.com/2017/05/13/business/china-railway-one-belt-one-road-1-trillion-plan.html>
- Peters, J., & Vance, C. 2011. Rural electrification and fertility—Evidence from Côte d'Ivoire. *Journal of Development Studies* 47:753–766.
- Potter, J. E., Schmertmann, C. P., & Cavenaghi, S. M. 2002. Fertility and development: Evidence from Brazil. *Demography* 39:739–761.
- Qian, Nancy. 2015. Making Progress on Foreign Aid. *The Annual Review of Economics* 7(1): 277-308.
- Rajan, R.G. and A. Subramanian. 2008. Aid and growth: What does the cross-country evidence really show? *Review of Economics and Statistics* 90(4): 643-665.
- Ravallion, Martin. 2009. Are there Lessons for Africa from China's Success Against Poverty? *World Development* 37 (2): 303-313.
- Rud, Juan Pablo. 2012. Electricity provision and industrial development: Evidence from India. *Journal of Development Economics* 97: 352–367.

- Soulé-Kohndou, Folashadé. 2016. Passive agents? Bureaucratic agency in Africa-China negotiations: A case study of Benin. LSE Global South Unit Working Paper No. 3/2016. London, UK: London School of Economics and Political Science.
- Strange, Austin M., Bradley C. Parks, Michael J. Tierney, Andreas Fuchs, Axel Dreher and Vijaya Ramachandran. 2013. China's Development Finance to Africa: A Media-Based Approach to Data Collection. CGD Working Paper 323. Washington, DC: Center for Global Development.
- Strange, Austin, Axel Dreher, Andreas Fuchs, Bradley Parks, and Michael Tierney. 2017a. Tracking Underreported Financial Flows: China's Development Finance and the Aid-Conflict Nexus Revisited. *Journal of Conflict Resolution* 61 (5): 935-963.
- Strange, Austin M., Siddhartha Ghose, Brooke Russell, Mengfan Cheng, and Bradley Parks. 2017b. *AidData's Methodology for Tracking Underreported Financial Flows. Version 1.3*. Williamsburg, VA: AidData.
- Strzepek, Kenneth M., Gary W. Yohe, Richard S. J. Tol, and Mark W. Rosegrant. 2008. The Value of the High Aswan Dam to the Egyptian Economy. *Ecological Economics* 66: 117-126.
- The Economist. 2009. An (Iron) Fistful of Help: Development Aid from Authoritarian Regimes. 6 June 2009.
- The Economist. 2015. A brightening continent. January 17th 2015.
- Volkerink, Bjørn and Jakob de Haan. 2001. Fragmented Government Effects on Fiscal Policy: New evidence, *Public Choice* 109 (3-4): 221-242.
- Walz, Julie and Vijaya Ramachandran. 2011. Brave New World: A Literature Review of Emerging Donors and the Changing Nature of Foreign Assistance. CGD Working Paper 273. Washington, DC: Center for Global Development.
- Werker, Eric. 2012. The Political Economy of Bilateral Foreign Aid, In: Gerard Caprio (Ed.): Handbook of Safeguarding Global Financial Stability: Political, Social, Cultural, and Economic Theories and Models, U.K., Academic Press: 47-58.
- Werker, Eric D., Faisal Z. Ahmed and Charles Cohen. 2009. How is Foreign Aid Spent? Evidence from a Natural Experiment, *American Economic Journal: Macroeconomics* 1 (2): 225-244.

- Woods, Ngaire. 2008. Whose aid? Whose influence? China, emerging donors and the silent revolution in development assistance. *International Affairs* 84 (6): 1205–21.
- Yarbrough, Beth and Robert Yarbrough. 2014. *Cooperation and Governance in International Trade*. Princeton, NJ: Princeton University Press.

Table 1: Growth effects of Chinese aid (baseline)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
L2.Chinese OF projects	0.129*** (2.65)				0.268 (0.98)				0.351 (1.18)			
L2.Chinese ODA projects		0.175** (2.37)				0.680* (1.85)				0.807** (2.00)		
L2.(log) Chinese OF amounts			0.032 (1.62)				0.230 (0.93)				0.323 (1.06)	
L2.(log) Chinese ODA amounts				0.047* (1.79)				0.547* (1.69)				0.671* (1.70)
L.(log) Population	5.953** (2.07)	5.753** (2.02)	6.507** (2.26)	6.442** (2.25)	5.338* (1.74)	3.532 (1.09)	6.386** (2.15)	5.542* (1.78)	6.841** (2.19)	4.638 (1.39)	7.652** (2.22)	6.654* (1.82)
L.Assassinations									-0.159 (1.16)	-0.169 (1.10)	-0.080 (0.47)	-0.020 (0.12)
L.Government surplus (% of GDP)									0.031*** (5.96)	0.025*** (4.39)	0.031*** (6.17)	0.032*** (3.42)
L.Inflation									-0.081 (1.56)	-0.085* (1.66)	-0.085 (1.60)	-0.111 (1.56)
L.Money/GDP									0.000 (1.45)	0.000 (0.56)	0.000 (0.26)	-0.000 (0.43)
L.Trade Openness									0.035*** (3.38)	0.033*** (3.10)	0.030*** (2.70)	0.026** (2.47)
First year	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002	2002
Last year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016
Number of observations	2078	2078	2078	2078	2076	2076	2076	2076	1546	1546	1546	1546
Number of countries	153	153	153	153	151	151	151	151	112	112	112	112
Cragg-Donald F					83.89	76.86	21.97	20.12	58.79	49.91	15.17	14.46
Kleibergen-Paap F					80.83	61.88	21.39	18.33	62.18	48.14	14.85	14.38
R squared (within)	0.09	0.09	0.09	0.09	0.09	0.06	0.05	-0.12	0.15	0.07	0.03	-0.25

Table 2: Growth effects of Western aid (baseline)

	(1)	(2)	(3)	(4)	(5)	(6)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
L2.(log) DAC OOF disbursements	1.455 (1.21)					
L2.(log) DAC ODA commitments		0.198 (0.23)				
L2.(log) US OOF disbursements			2.985 (0.76)			
L2.(log) US ODA commitments				0.520 (0.85)		
L2.(log) IBRD commitments					-0.292 (0.96)	
L2.(log) IDA commitments						0.722 (0.61)
L.(log) Population	2.191 (1.04)	0.132 (0.08)	-0.580 (0.45)	-0.685 (0.55)	0.669 (0.48)	0.392 (0.21)
First year	1978	1978	1972	1972	1975	1975
Last year	2016	2016	2016	2016	2016	2016
Number of observations	4990	4995	5465	5464	4700	4699
Number of countries	157	157	155	155	158	158
Cragg-Donald F	67.95	92.98	8.99	117.91	7.75	13.93
Kleibergen-Paap F	14.60	14.45	4.24	14.27	4.01	6.67
R squared (within)	-0.01	0.07	-0.05	0.07	0.02	0.06

Table 3: Growth effects of Chinese and Western aid (budgets instruments)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
L2.Chinese OF projects	0.645*									
	(1.93)									
L2.Chinese ODA projects		1.449***								
		(3.07)								
L2.(log) Chinese OF amounts			0.617*							
			(1.66)							
L2.(log) Chinese ODA amounts				1.233**						
				(2.44)						
L2.(log) DAC OOF disbursements					1.528					
					(1.24)					
L2.(log) DAC ODA commitments						2.050**				
						(2.31)				
L2.(log) US OOF disbursements							-1.458			
							(0.14)			
L2.(log) US ODA commitments								3.276**		
								(2.12)		
L2.(log) IBRD commitments									-0.307	
									(0.95)	
L2.(log) IDA commitments										-0.260
										(0.26)
L.(log) Population	2.495	-0.945	4.852	3.290	2.304	1.816	-0.020	-0.644	-1.312	0.134
	(0.75)	(0.26)	(1.30)	(0.78)	(0.99)	(1.20)	(0.01)	(0.32)	(0.33)	(0.04)
First year	2003	2003	2003	2003	1978	1978	1978	1978	1997	1993
Last year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016
Number of observations	1927	1927	1927	1927	4990	4995	4996	4996	2828	3395
Number of countries	150	150	150	150	157	157	157	157	155	158
Cragg-Donald F	55.44	49.34	12.53	12.33	34.15	183.31	0.62	31.18	21.91	37.51
Kleibergen-Paap F	44.85	35.03	14.26	13.20	14.96	9.18	2.49	7.86	8.07	14.13
R squared (within)	0.03	-0.16	-0.32	-1.08	-0.01	0.04	0.03	-0.13	0.03	0.05
Prob > chi2					0.46	0.35	0.85	0.07	0.07	0.16

Table 4: Growth effects of Western aid for Chinese aid darlings (based on actual number of Chinese projects)

	(1)	(2)	(3)	(4)	(5)	(5')	(6)	(6')
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
L2.(log) DAC OOF disbursements	2.604*							
	(1.90)							
L2.(log) DAC ODA commitments		1.481						
		(1.61)						
L2.(log) US OOF disbursements			-0.936					
			(0.05)					
L2.(log) US ODA commitments				2.401				
				(1.52)				
L2.(log) IBRD commitments					-0.893	-0.627*		
					(1.63)	(1.66)		
L2.(log) IDA commitments							0.750	-0.672
							(0.79)	(0.21)
L.(log) Population	3.432	0.621	-0.923	-1.069	-4.979	1.155	-4.527*	7.915
	(1.14)	(0.40)	(0.56)	(0.61)	(1.06)	(0.21)	(1.65)	(1.04)
First year	1978	1978	1978	1978	1997	2002	1993	2002
Last year	2016	2016	2016	2016	2016	2016	2016	2016
Number of observations	3801	3807	3807	3807	2102	1193	2519	1193
Number of countries	112	112	112	112	111	117	111	117
Cragg-Donald F	33.34	140.69	0.30	21.04	12.03	18.74	30.26	3.99
Kleibergen-Paap F	12.36	6.14	1.62	4.04	6.39	9.66	15.02	4.77
R squared (within)	-0.16	0.06	0.06	-0.03	-0.19	-0.12	0.07	0.05
Prob > chi2	0.18	0.29	0.97	0.40	0.04	0.20	0.13	0.88

Table 5: Growth effects of Western aid for Chinese aid darlings (based on predicted number of Chinese projects)

	(1)	(2)	(3)	(4)	(5)	(5')	(6)	(6')
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
L2.(log) DAC OOF disbursements	4.178*** (2.66)							
L2.(log) DAC ODA commitments		0.694 (0.91)						
L2.(log) US OOF disbursements			-2.737 (0.09)					
L2.(log) US ODA commitments				2.603 (0.90)				
L2.(log) IBRD commitments					-0.629 (1.18)	-0.528 (1.41)		
L2.(log) IDA commitments							1.212 (1.29)	1.857 (0.42)
L.(log) Population	6.234 (1.36)	-2.151 (1.18)	-3.057 (0.90)	-3.061 (1.59)	-2.862 (0.58)	-0.084 (0.02)	-5.627** (2.00)	-2.918 (0.20)
First year	1978	1978	1978	1978	1997	2005	1993	2005
Last year	2016	2016	2016	2016	2016	2016	2016	2016
Number of observations	3363	3369	3369	3369	1891	1201	2260	1201
Number of countries	98	98	98	98	98	112	98	112
Cragg-Donald F	36.55	116.95	0.12	8.08	10.07	11.53	30.83	1.42
Kleibergen-Paap F	11.11	6.26	0.96	1.27	3.91	10.59	15.26	1.90
R squared (within)	-0.61	0.11	-0.05	-0.03	-0.07	-0.05	0.08	-0.00
Prob > chi2	0.01	0.12	0.95	0.66	0.26	0.45	0.03	0.62

Figure 1: Proportion of Chinese official development projects by status (2000-2014)

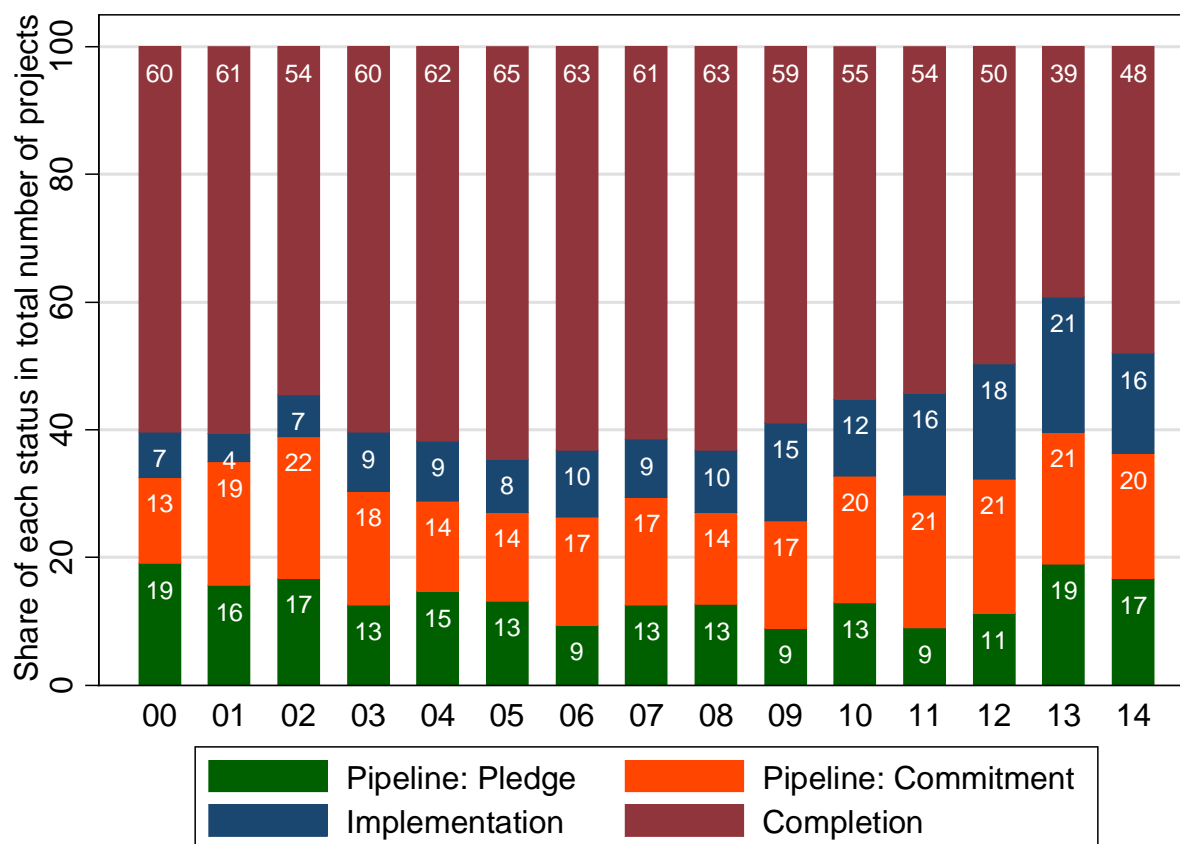


Figure 2: Variation in flow types over time (2000-2014)

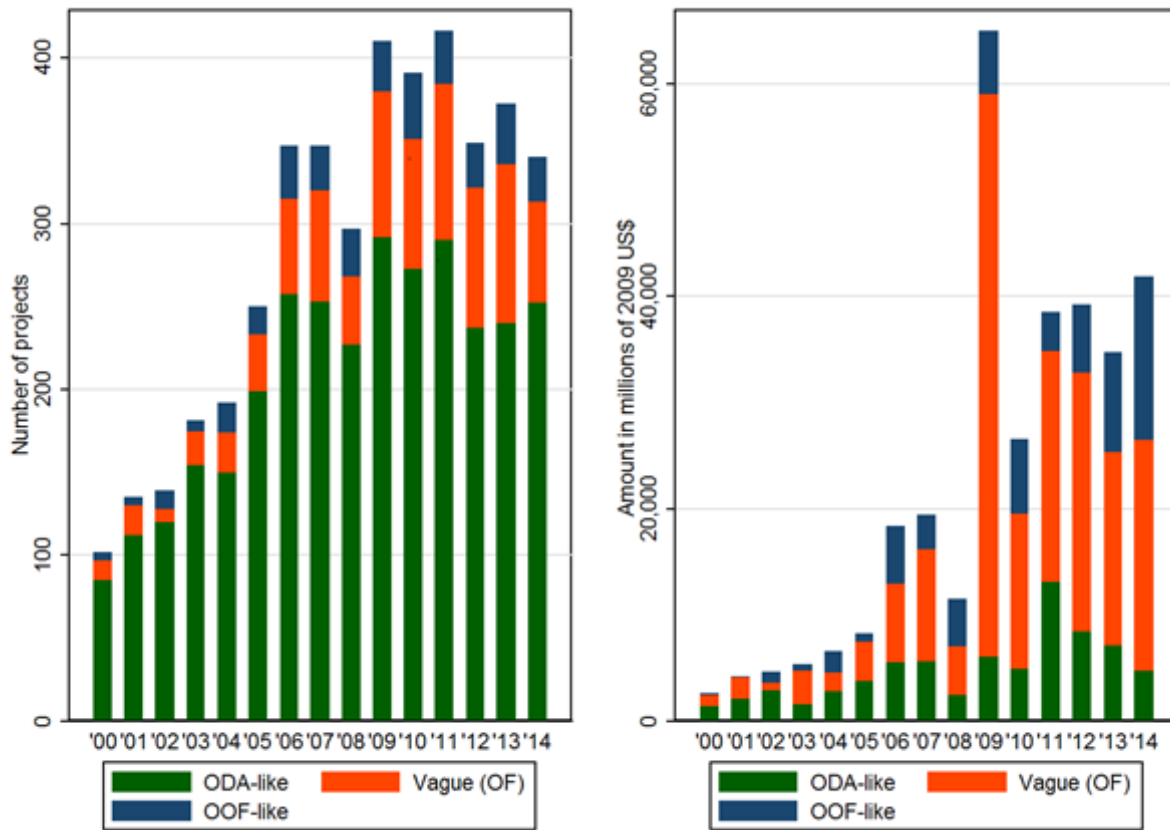
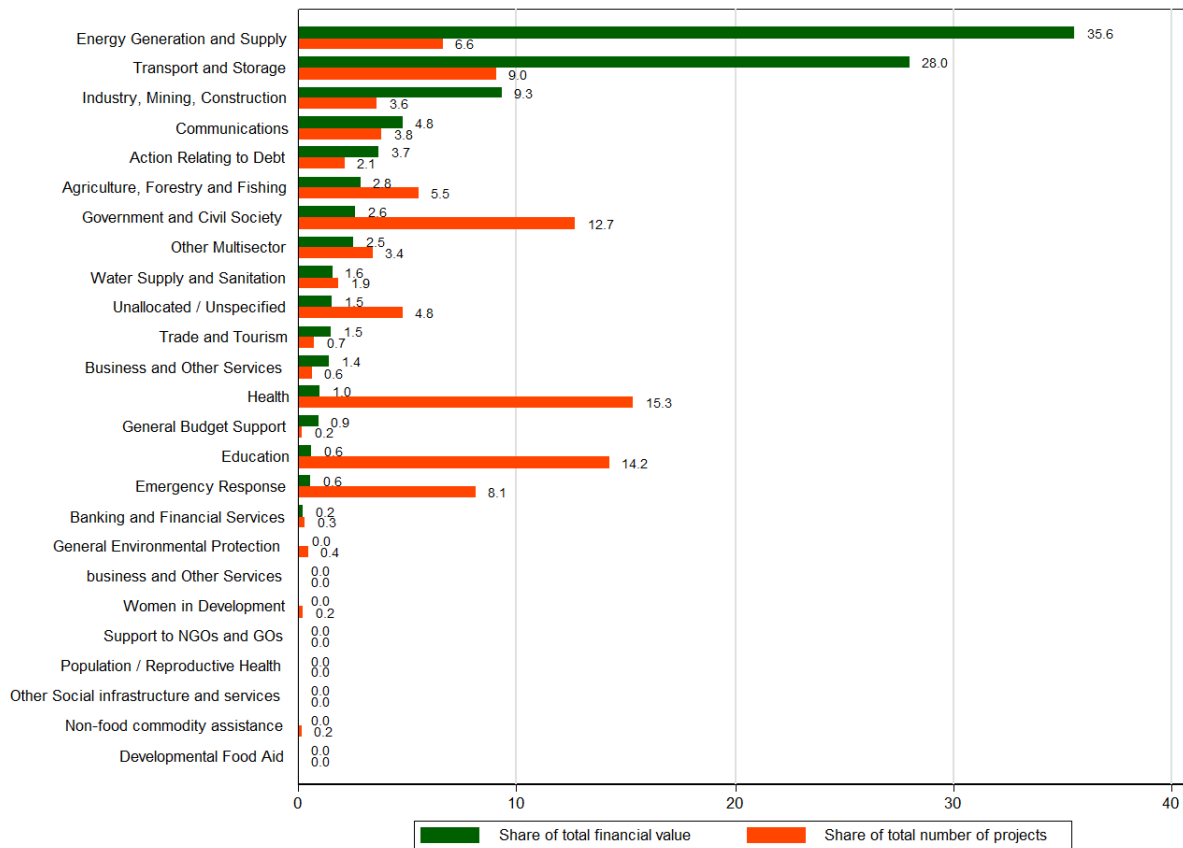


Figure 3: Largest sectors by financial value and project numbers



Appendix A: The Tracking Underreported Financial Flows (TUFF) Methodology

TUFF data collection and quality assurance procedures are documented in their entirety in Strange et al. (2017b). Here we provide a brief summary. The TUFF methodology is divided into two primary stages of data collection. A set of supplementary steps are then employed to review and quality-assure individual project records.

In the first stage of primary data collection, researchers identify potential projects at the donor/lender-recipient/borrower-year unit of analysis through a standardized set of search queries in Factiva, a Dow Jones-owned media database that draws on approximately 33,000 media sources worldwide in 28 languages, including newspapers and radio and television transcripts. A machine learning algorithm is then used to identify the subset of articles retrieved through these Factiva queries that are most likely to contain information about officially-financed projects for the donor/lender of interest.⁵⁴ Researchers then review each of the Factiva records that the machine learning algorithm has classified as “relevant” and make case-by-case determinations about whether those records contain information about an officially financed project by the donor/lender of interest. In parallel, researchers retrieve all individual projects that are financed by the donor/lender of interest and recorded in (a) the aid and debt information management systems of recipient/borrower countries, (b) IMF country reports, and (c) the websites of Chinese embassies and Chinese Economic and Commercial Counselor Offices (ECCOs).

Once a potential project has been identified during the first stage of data collection, it is entered into data management platform with a unique identification number and assigned to a different researcher for a second stage of record review and augmentation. During this second stage, the researcher performs a set of targeted online searches to validate, invalidate, and/or enrich the project-level information that was retrieved in the first stage. These searches are conducted in English, Chinese and recipient/borrower country languages by trained language experts and native speakers in order to improve record accuracy and completeness. The researcher also seeks to collect supplementary information from government sources (e.g., annual

⁵⁴ The machine learning tool that is used relies upon large amounts of training data (i.e. past articles that were identified via Factiva and later classified by researchers as containing or not containing information about projects financed by the official donor/lender of interest) to “teach” the algorithm to accurately classify hundreds of thousands of articles into “relevant” and “irrelevant” categories. Use of this tool significantly reduces the amount of time that researchers would otherwise spend reviewing articles that contain no information about projects financed by the official donor/lender of interest (“false positives”).

reports published by the lender or granting agency), field reports published by NGOs and implementing entities (e.g., private contractors), scholarly research (e.g., case studies of particular projects, doctoral dissertations on the development finance activities of a particular donor/lender in a particular country), and experts with information or knowledge about specific projects that is not in the public domain or is not easily identifiable (e.g., photographic evidence of a project's current status). This process of project-level investigation and triangulation is designed to reduce the risk of over-reliance on individual sources, such as media reports, that might be inaccurate or incomplete.

After completing the first and second stages of data collection, several additional steps are taken to maximize the reliability and completeness of project records. First, given that idiosyncratic coding decisions made by individual researchers can result in inconsistencies across project records, a set of automated data checks are undertaken to limit discretion and eliminate illogical and inconsistent codings.⁵⁵ Second, “health of record” scores are calculated to systematically identify projects that might benefit from additional sourcing or investigation.⁵⁶ Third, feedback provided by prospective and active users through a dynamic, online platform (at china.aiddata.org) is reviewed and, where appropriate, used to update project records.⁵⁷ Finally, the dataset as a whole is subjected to several rounds of careful scrutiny by AidData staff and external peer reviewers. Internal and external reviewers not only seek to identify errors of omission and commission, but also flag inconsistencies that should be addressed and additional sources that should be consulted.

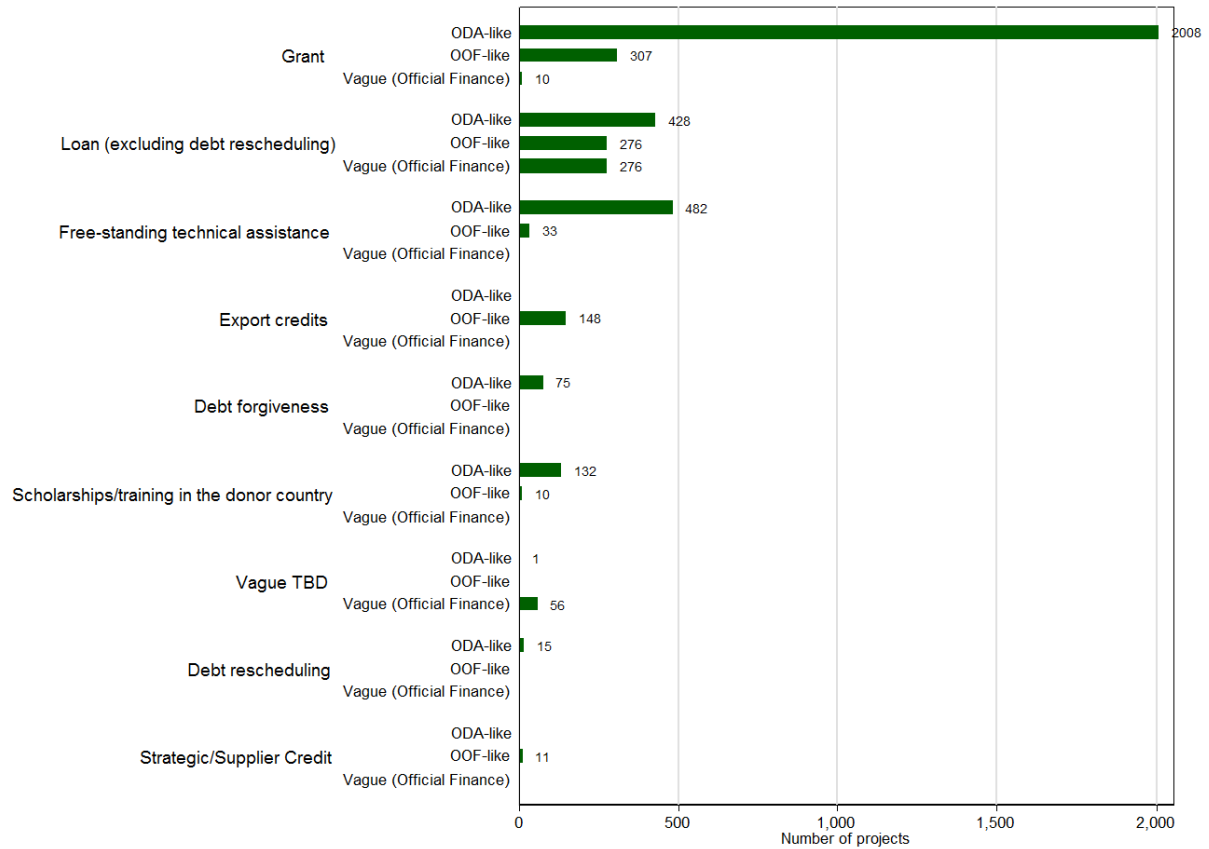
⁵⁵ For example, China Development Bank (CDB) offers finance on commercial, rather than concessional, terms, so an automated decision rule disallows CDB finance from ever being categorized as Official Development Assistance (ODA). Likewise, the China Export-Import Bank offers loans and export credits at commercial and concessional rates, but does not offer grants or interest-free loans, so an automated decision rule disallow any project financed by the China Export-Import Bank to ever be categorized as a grant or interest-free loan.

⁵⁶ For all projects in the dataset, source triangulation and data completeness scores are calculated. Whereas the source triangulation indicator captures the number and diversity of information sources supporting a given project record, the data completeness indicator measures the extent to which fields/variables for a given project record are populated with missing or vague information.

⁵⁷ For example, a PhD student helped AidData to vet and augment project records in the Democratic Republic of the Congo with information she directly gathered through extensive fieldwork in that country. In another instance, Chinese Ministry of Health officials and Chinese university faculty identified missing information about in-kind, medical supply donations made during recurring visits from Chinese medical teams. When a credible source of information about these donations was furnished, new project records were added to the dataset.

Appendix B: Additional tables and figures in Section 2

Appendix B1: Flow type and flow class (number of projects)



Appendix B2: Most important world regions (number of projects)

Rank	World region	#
1	Africa	2320
2	Southeast Asia	496
3	South Asia	417
4	Latin America and the Caribbean	326
5	The Pacific	261
6	Europe	183
7	Central and North Asia	169
8	Middle East	96

Appendix B3: Most important recipient countries (number of projects)

Rank	World region	Recipient country	#
1	Southeast Asia	Cambodia	168
2	Africa	Zimbabwe	126
3	South Asia	Pakistan	123
4	Africa	Angola	114
5	Africa	Tanzania	100
6	Africa	Ghana	98
7	Africa	Kenya	91
8	Africa	Ethiopia	87
9	Africa	Liberia	85
10	Africa	Uganda	82
...			
16	The Pacific	Papua New Guinea	67
...			
36	Europe	Belarus	39
...			
39	Central and North Asia	Uzbekistan	36
...			
43	Latin America and the Caribbean	Bolivia	34
...			
63	Middle East	Yemen	24
...			

Appendix B4: Largest 25 officially-financed Chinese projects by financial amount (in millions of constant 2009 US\$)

	Recipient country	Year	Title	Flow class	Flow type	Amount
1	Russia	2009	Rosneft takes out loan of 10 billion US\$ out of available 15 from China Development Bank	OOF-like	Loan	20356
2	Russia	2009	China Development Bank to offer loans totaling 25 billion USD in to Russian Rosneft	OOF-like	Loan	13571
3	Mali	2014	China and Mali sign \$8 billion railway deal	Vague (OF)	Vague TBD	8000
4	Laos	2012	EXIM Bank loan for construction of Kunming-Vientiane high-speed railway link	OOF-like	Loan	7625
5	Cuba	2011	China forgives US\$ 6 billion worth of Cuban Debt	ODA-like	Debt forgiveness	6660
6	Turkmenistan	2009	China Provides 4 Billion USD for South Yolotanâ Osman Field Development	OOF-like	Loan	5428
7	Turkmenistan	2011	China Provides 4.1 Billion USD for Ioujno-Elotenshoie Field Development	OOF-like	Loan	4551
8	Venezuela	2013	CDB funds \$4 billion PDVSA and CNPC joint venture Sinovensa in Orinoco belt	OOF-like	Loan	4087
9	Pakistan	2014	China's financial package loan includes preferential buyer credit for Karachi Nuclear Power Plant's K-2/K-3	OOF-like	Export credits	4001
10	Kenya	2013	China loans 3.75 bil USD for Kenya's standard gauge railway	Vague (OF)	Loan	3813
11	Ukraine	2012	China EXIM Bank agrees USD3B for Ukraine Agricultural Projects	OOF-like	Loan	3177
12	Belarus	2013	China Exim Bank and CDB loan 3 billion USD in total for China-Belarus Industrial Park	OOF-like	Loan	3050
13	Bahamas	2011	China EXIM Bank loans \$2.6 billion to Bahamas for the Baha Mar Resort	OOF-like	Loan	2886
14	Pakistan	2014	China pledges loan of 233.4177 billion rupees to Pakistan for Karachi-Lahore highway	Vague (OF)	Loan	2309
15	Pakistan	2014	China's financial package loan includes buyer credit for Karachi Nuclear Power Plant's K-2/K-3	OOF-like	Export credits	2250
16	Iran	2014	CMC and SUPOWER signed agreement on the railway electrification program	Vague (OF)	Loan	2143
17	Cote D'Ivoire	2012	Chinese company building railway in Ivory Coast from Man to San Pedro	Vague (OF)	Loan	2118
18	Argentina	2014	China commits 2.1 Billion USD loan for rehabilitation of Belgrano Cargas railway	OOF-like	Loan	2100
19	Angola	2014	CDB provided \$2 billion USD loan to Sonangol	OOF-like	Loan	2000
20	Sudan	2007	Construction of railway from Khartoum to Port Sudan	OOF-like	Export credits	1878
21	Pakistan	2011	Loans from Silk Road Fund, EXIM, and CDB for Korrak hydropower project/ Korat Dam in Pakistan	OOF-like	Loan	1831
22	Kazakhstan	2011	CDB loans Samruk-Kazyna Fund 2 billion USD; allocates \$1.6 million for ENRC iron ore project	OOF-like	Loan	1776
23	India	2010	China Datang loans \$1.4 billion for a thermal power project	OOF-like	Loan	1761
24	Cambodia	2013	China EXIM Bank Agrees \$1.67 billion Cambodia Oil Refinery	OOF-like	Loan	1698
25	Ecuador	2014	China Exim Bank loans Ecuador 1.68 billion USD for CCS hydroelectric facility	OOF-like	Loan	1680

Appendix B5: Largest 25 development projects by country (in millions of constant 2009 US\$)

Sector	Recipient	Year	Title	Flow class	Flow type	Amount
Energy Generation and Supply	Russia	2009	Rosneft takes out loan from China Development Bank	OOF-like	Loan	20356
Transport and Storage	Mali	2014	China and Mali sign \$8 billion railway deal	Vague (OF)	Vague TBD	8000
Action Relating to Debt	Cuba	2011	China forgives US\$ 6 billion worth of Cuban Debt	ODA-like	Debt forgiveness	6660
Industry, Mining, Construction	Turkmenistan	2009	China Provides 4 Billion USD for South Yolotanâ€Osman Field Development	OOF-like	Loan	5428
Agriculture, Forestry and Fishing	Ukraine	2012	China EXIM Bank agrees USD3B for Ukraine Agricultural Projects	OOF-like	Loan	3177
Business and Other Services	Belarus	2013	China Exim Bank and CDB loan for China-Belarus Industrial Park	OOF-like	Loan	3050
Trade and Tourism	Bahamas	2011	China EXIM Bank loan to Bahamas for the Baha Mar Resort	OOF-like	Loan	2886
General Budget Support	Sudan	2012	\$1.5 billion loan from China Development Bank	OOF-like	Loan	1589
Government and Civil Society	Sri Lanka	2009	China to fund mega housing project in Sri Lanka	ODA-like	Loan	1417
Communications	India	2010	Reliance Order \$10B USD in Equipment from Shanghai Electric	OOF-like	Export credits	1383
Other Multisector	Kenya	2013	\$1.1b Loan from Exim Bank to Develop Hydropower Plants in Kenya	ODA-like	Loan	1118
Water Supply and Sanitation	Cameroon	2010	China loans 366 billion CFA to Cameroon for water distribution project	Vague (OF)	Loan	929
Unallocated / Unspecified	Ethiopia	2006	China loans Ethiopia 500 million USD for unspecified development projects	Vague (OF)	Loan	920
Emergency Response	Pakistan	2007	Grant for repatriation of Afghan refugees from Pakistan	ODA-like	Grant	651
Banking and Financial Services	India	2010	CDB signs 400 mln USD deal with ICICI Bank for facility management	OOF-like	Loan	503
Other Social infrastructure and services	Cameroon	2007	China finances 209 million Euro renovation of Provincial Stadiums	Vague (OF)	Loan	466
Health	Zambia	2011	China donates 1.5 billion Kwacha in anti-malarial equipment to Zambia	ODA-like	Grant	343
Education	Angola	2006	Construction of various institutes and admin. centers	ODA-like	Loan	171
General Environmental Protection	Jamaica	2010	China ExIm bank loans to repair and protect the shoreline of Palisadoes	Vague (OF)	Loan	73
business and Other Services	Egypt	2006	Grant for investment headquarters	OOF-like	Grant	18
Developmental Food Aid/Food Security	Somalia	2011	China Grants 16 million USD for Humanitarian Interventions	ODA-like	Grant	18
Support to NGOs and GOs	Zimbabwe	2010	Zimbabwe miners' association received 10 million USD grant	ODA-like	Grant	13
Women in Development	Chad	2012	Grant to Construct Women's Center	ODA-like	Grant	12
Population Policies and Reproductive Health	Zimbabwe	2012	China provides 4.5 million RMB loan for neonatal equipment	Vague (OF)	Loan	1
Non-food commodity assistance	Sri Lanka	2013	China donates ping pong table and equipment to Sri Lanka	OOF-like	Grant	

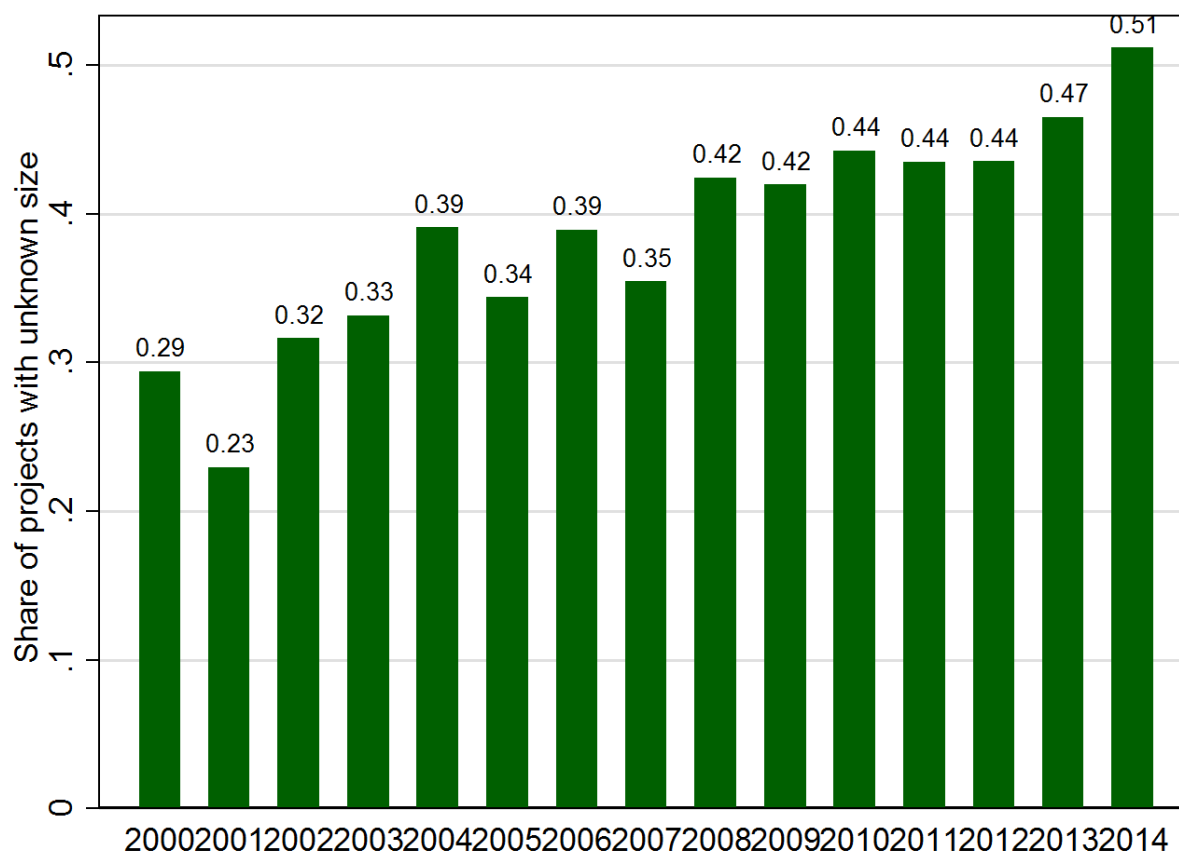
Appendix B6: Average project size by country (in millions of constant 2009 US\$)

Rank	Recipient country	Amount
1	Russia	3268
2	Turkmenistan	1525
3	Cuba	1356
4	India	796
5	Brazil	786
6	Argentina	683
7	Venezuela	623
8	Kazakhstan	606
9	Ecuador	480
11	Bahamas	435
11	Iran	430
12	Montenegro	340
13	Laos	321
14	Belarus	314
15	Ukraine	314
16	Turkey	301
17	Chile	281
18	Mali	251
19	Pakistan	242
20	Sudan	230
...

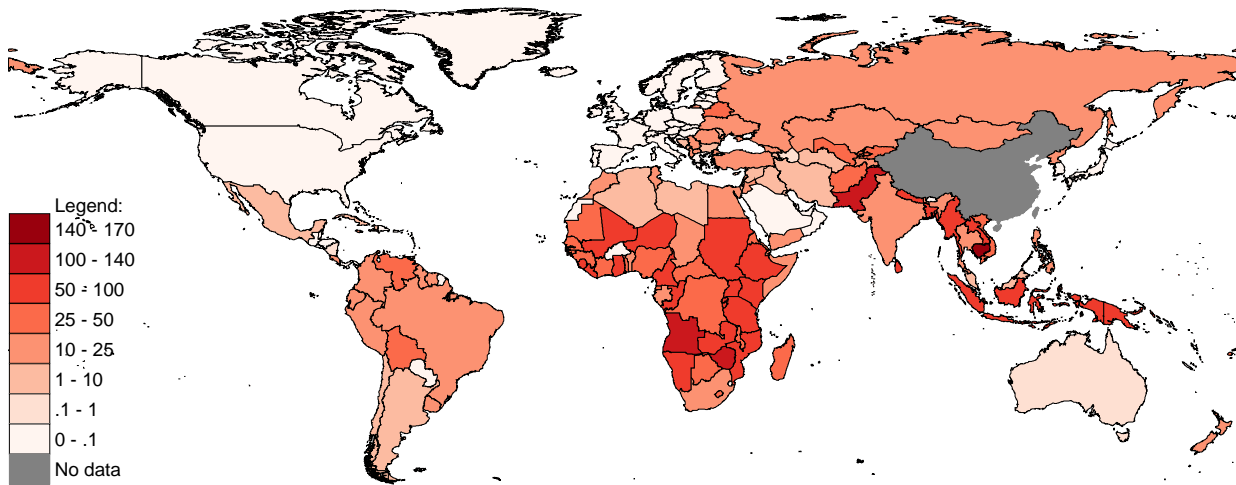
Appendix B7: Most important recipient countries (financial value)

Rank	World region	Recipient country	Amount
1	Europe	Russia	35944.02927
2	South Asia	Pakistan	21788.43031
3	Africa	Angola	14286.0727
4	South Asia	Sri Lanka	11647.16042
5	Southeast Asia	Laos	11540.32632
6	Africa	Mali	10793.45191
7	Central and North Asia	Turkmenistan	10676.42754
8	Africa	Kenya	10444.8498
9	Africa	Ethiopia	9954.626547
10	Africa	Sudan	8524.164085
...			
15	Latin America and the Caribbean	Venezuela	6848.318023
...			
37	Middle East	Iran	2148.073544
...			
57	The Pacific	Fiji	911.5936422
...			

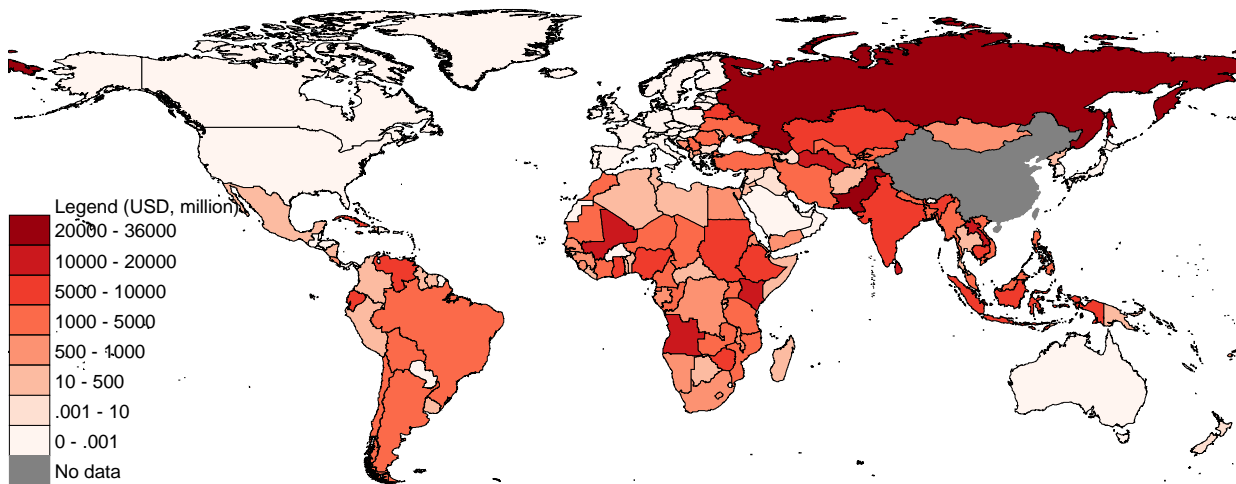
Appendix B8: Share of projects with unknown financial amount by year (2000-2014)



Appendix B9: World maps of China's development assistance (2000-2014, project numbers)

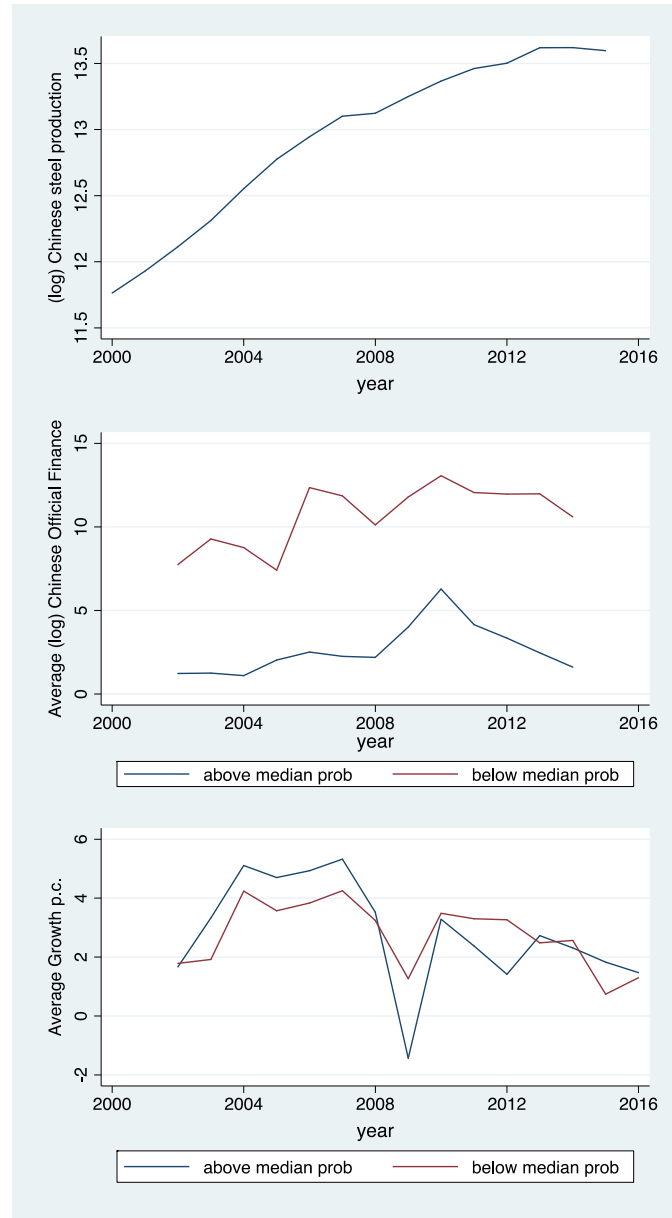


Appendix B10: World maps of China's development assistance (2000-2014, financial amount)



Appendix C: Additional tables and figures in Section 3

Appendix C1: Parallel trends plots for instrument using the interaction of Chinese steel production and the probability of receiving Chinese aid



Note: The upper Panel shows how Chinese steel production varies over time. The middle Panel shows average aid within the group that is below the median of the probability to receive aid and the group that is above the median over time. The lower Panel shows the average real GDP per capita growth rate within these two groups over time. For the construction of the averages we use observations from the sample of column 3 for Table 1.

Appendix C2: Growth effects of Chinese and Western aid (budget instruments)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Chinese OF projects	Chinese ODA projects	(log) Chinese OF amounts	(log) Chinese ODA amounts	(log) DAC OOF disb.	(log) DAC ODA com.	(log) US OOF disb.	(log) US ODA com.	(log) IBRD com.	(log) IDA com.
t-1	0.560* (1.68)	1.105** (2.31)	0.543 (1.49)	0.963** (1.98)	1.273 (1.05)	2.084** (2.32)	-7.405 (0.75)	3.432** (2.06)	0.056 (0.19)	0.326 (0.29)
t-2	0.645* (1.93)	1.449*** (3.07)	0.617* (1.66)	1.233** (2.44)	1.528 (1.24)	2.050** (2.31)	-1.458 (0.14)	3.276** (2.12)	-0.307 (0.95)	-0.260 (0.26)
t-3	0.157 (0.47)	0.831* (1.81)	0.144 (0.46)	0.678 (1.62)	-0.592 (0.57)	1.951** (2.20)	-32.120 (1.54)	3.472** (2.49)	-0.514 (1.52)	0.150 (0.14)
t-4	0.104 (0.32)	0.640 (1.46)	0.090 (0.32)	0.493 (1.37)	-2.357** (2.14)	1.910** (2.10)	-46.410 (1.41)	4.392*** (3.10)	-0.627* (1.78)	0.521 (0.46)
t-5	-0.167 (0.59)	0.333 (0.91)	-0.159 (0.60)	0.273 (0.88)	-2.239** (2.12)	1.815** (2.06)	-39.778 (1.38)	4.470*** (3.51)	-0.577* (1.72)	-0.207 (0.16)
t-6	-0.289 (1.12)	0.052 (0.16)	-0.318 (1.10)	0.050 (0.16)	-2.021** (2.05)	1.740** (2.13)	-17.007 (0.93)	3.434*** (3.07)	-0.464 (1.29)	-0.033 (0.02)