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Is Favoritism a Threat to Chinese Aid Effectiveness? A Subnational Analysis of Chinese Development Projects

Axel Dreher
Alfred-Weber-Institute for Economics, Heidelberg University
KOF Swiss Economic Institute
CEPR
Georg-August University Goettingen
CESifo

Andreas Fuchs
Faculty of Economic and Social Sciences, Helmut-Schmidt University Hamburg (HSU/UniBw H)
Research Area "Poverty Reduction, Equity, and Development," Kiel Institute for the World Economy

Roland Hodler
Department of Economics and SIAW-HSG, University of St.Gallen
CEPR
CESifo

Bradley C. Parks
AidData, Global Research Institute, The College of William and Mary
The Center for Global Development

Paul A. Raschky
Department of Economics, Monash University

Michael J. Tierney
Department of Government, The College of William and Mary

Abstract

Chinese aid comes with few strings attached, allowing recipient country leaders to use it for domestic political purposes. The vulnerability of Chinese aid to political capture has prompted speculation that it may be economically ineffective, or even harmful. We test these claims by estimating the effect of Chinese aid on subnational economic development — as measured by per-capita nighttime light emissions — and whether this effect is different in politically favored jurisdictions than in other parts of the country. Contrary to the conventional wisdom, we do not find that the local receipt of Chinese aid undermines economic development outcomes at either the district level or provincial level. Nor does political favoritism in the allocation of Chinese aid towards the home regions of recipient country leaders reduce its effectiveness. Our results from 709 provinces and 5,835 districts within 47 African countries from 2001-2012 demonstrate that Chinese aid improves local development outcomes, regardless of whether such aid is allocated to politically consequential jurisdictions.

Author Information

Axel Dreher
Alfred-Weber-Institute for Economics, Heidelberg University
KOF Swiss Economic Institute
CEPR
Georg-August University Goettingen
CESifo
mail@axel-dreher.de

Andreas Fuchs
Faculty of Economic and Social Sciences, Helmut-Schmidt University Hamburg (HSU/UniBw H)
Research Area "Poverty Reduction, Equity, and Development," Kiel Institute for the World Economy
mail@andreas-fuchs.net

Roland Hodler
Department of Economics and SIAW-HSG, University of St.Gallen
CEPR
CESifo
roland.hodler@unisg.ch

Bradley C. Parks
AidData, Global Research Institute, The College of William and Mary
The Center for Global Development
bparks@aiddata.org

Paul A. Raschky
Department of Economics, Monash University
Paul.Raschky@monash.edu.au

Michael J. Tierney
Department of Government, The College of William and Mary
mjtier@wm.edu

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1 Introduction

Critics of Chinese aid claim that it bankrolls politically motivated and economically inefficient ("white elephant") projects, which would not be funded by Western aid agencies. There is some empirical evidence to support this claim. Dreher et al. (2019) use geocoded Chinese and World Bank project data to test whether donors with widely divergent systems for vetting candidate projects are differentially vulnerable to political capture. They find that Chinese aid disproportionately benefits the home regions of political leaders in host countries, and that this effect is particularly strong in the run-up to executive elections and when executive elections are more competitive. Yet they find no evidence that World Bank projects favor the home regions of political leaders.[1]

The vulnerability of Chinese aid to political capture has prompted speculation that it may be economically ineffective, or even harmful. For example, *The Economist* (2017) has argued that "China seems to be repeating many of the mistakes made by Western donors and investors in the 1970s, when money flowed into big African infrastructure projects that never produced the expected economic gains." U.S. National Security Advisor John Bolton has gone a step further, charging that "[t]he predatory practices pursued by China ... stunt economic growth in Africa" (Bolton 2018).

In political science and economics, the conventional wisdom suggests that aid—and other forms of public expenditure—allocated according to political criteria will be less effective at improving economic development outcomes than public expenditure allocated according to need and efficiency considerations. Political pressures can result in the approval of lower-quality projects that would not otherwise be financed (Dreher et al. 2018). They can also result in higher rates of project non-completion (Williams 2017). There is even evidence that public expenditure can improve short-run economic outcomes in politically consequential jurisdictions (around the time of elections), and yet undermine longer-run economic outcomes in the very same localities (Labonne 2016).

Therefore, if political capture reduces the effectiveness of aid and Chinese aid is more vulnerable to political capture than Western aid, one would not expect Chinese aid projects to substantially improve economic development outcomes in the subnational jurisdictions where they are implemented.[2] There are, however, reasons that politically motivated

[1] Whereas the World Bank has institutionalized the use of ex ante, cost-benefit analysis to screen project proposals and reduce the probability of approving politically-motivated projects, Chinese development finance institutions have not (Dreher et al. 2019).

[2] Recent studies that attempt to get traction on the link between the allocation and effectiveness of aid include Rajan and Subramanian (2008), Clemens et al. (2012), Brückner (2013), and Dreher and Langlotz

aid may be just as effective as other types of aid (Dreher et al. 2013). If many unfunded investment projects exist and they offer similar potential economic returns, choosing among these projects according to political criteria might not reduce the effectiveness of aid. Also, regardless of the motivations of those who influence aid allocation decisions, aid agency staff and their contractors may seek to implement effective programs.

Perhaps most importantly, Chinese aid is different from Western aid on several dimensions other than its vulnerability to political capture. Chinese development projects might still generate more economic growth than Western development projects for two reasons: the high level of priority that China assigns to creating "growth poles" through the geographical co-location of projects, and the speed with which it implements large-scale infrastructure projects. China, unlike Western donors, avoids funding stand-alone projects. It prefers to support a coordinated set of projects that support a host country's broader economic development strategy (Chin and Gallagher 2019).[3] As a result, it often co-locates a complementary set of projects in an effort to develop clusters of interconnected firms, nurturing local markets, crowding-in additional investment, and catalyzing economic agglomeration.[4]

China also has a reputation for implementing large-scale infrastructure projects more efficiently than Western donors. During his tenure as the President of Senegal, Abdoulaye Wade admonished Western donors for their cumbersome bureaucratic procedures, noting 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 the Chinese authorities." Swedlund (2017: 128-129) also reports that "[it] is clearly a dominant perception among many recipient-government officials that the Chinese are much faster than traditional donors at

(2019). See Doucouliagos and Paldam (2011) for a review and meta-analysis of earlier studies on aid effectiveness and Doucouliagos (2019) for a recent survey. At the subnational level, Dreher and Lohmann (2015) do not find any effect of World Bank financing on development.

[3]Coordinated public investment strategies have a rich intellectual history related to "big push" theory (Rosenstein-Rodan 1943, 1961). Chin and Gallagher (2019: 251) note that "[s]ome in the senior ranks of the Chinese state policy banks have drawn inspiration from ["big push" theory], including the former chief economist at the China Development Bank [CDB], Lixing Zou, who saw CDB as having played such a coordinating role within the Chinese growth miracle."

[4]For example, Ethiopia sought to establish itself as a hub for light manufacturing in Africa. The government has adopted an economic development plan—the Growth and Transformation Plan II—that prioritized eight industrial parks (where foreign investors would benefit from high-quality infrastructure, tax breaks, and special regulatory facilitation) by 2020. China agreed to build one of these industrial parks in the city of Hawassa, which is located nearly 900 kilometers from the nearest seaport. However, in an effort to maximize exports from this special economic zone, China also agreed to reduce the cost of transportation by financing the construction of two expressways that link the industrial park in Hawassa to a dry port in Mojo (only 184 kilometers away) and a railway that links the same dry port to a seaport in Djibouti.

getting things done. One donor official recounted ... having it explained to him that, if a traditional donor wants to build a road in 2012, the process needs to start in 2007. If the Chinese are going to build the same road, they start in 2011, and it is finished in 2012."

This paper is the first to quantify the economic effects of Chinese aid at subnational scales across a large number of developing countries. To the best of our knowledge, it is also the first to systematically analyze the untested assumption that political favoritism reduces the effectiveness of Chinese aid.[5] Relying on a new geocoded dataset of Chinese aid projects in Africa over the 2000-2011 period, we test whether Chinese aid undermines subnational economic development outcomes. Using subnational units of observation allows us to explore differences in Chinese aid effectiveness within countries. We thus hold everything constant that affects (i) national-level outcomes (e.g., macroeconomic policies, institutions, interstate conflicts) and (ii) China's bilateral relations with African countries (e.g., diplomatic relations, state visits) in a given year. To the extent that Chinese aid projects are ineffective or harmful because of political favoritism, this will result from factors below the country level. Such analysis requires geocoded data.

We further disentangle the importance of (domestic) political motives for the effectiveness of aid by testing whether a specific type of favoritism that shapes the subnational allocation of aid from China—but not the World Bank—reduces the economic impact of its aid. Dreher et al. (2019) show that Chinese aid disproportionately benefits the birth regions of political leaders in recipient countries in order to improve the leaders' electoral prospects. Making use of this China-specific indicator of favoritism, we test whether projects that are allocated to a subnational jurisdiction at the time a politician who was born in this region is the country's leader are less effective than projects given to the same region at other times.

We construct a new instrumental variable that combines geographical variation in the probability that a subnational region receives Chinese aid with exogenous temporal variation in the supply of Chinese aid that results from China's production of steel.[6] The Chinese government considers steel to be a strategically important commodity and therefore maintains excess production capacity. This strategy results in a time-varying surplus of steel, some of which China then uses for aid projects in Africa. To test whether political favoritism makes Chinese aid less effective, we introduce an interaction term that indicates

[5] For ease of exposition, we use the term "aid" to refer to all official financing flows (Official Development Assistance and Other Official Flows).

[6] Since we have introduced this instrument in the working paper version of this paper, subsequent work has adopted it for different research questions. Examples are Gehring et al. (2018), and Humphrey and Michaelowa (2019).

whether aid has been given to a region at a time when the country's leader was born there. To the extent that such political favoritism reduces the effectiveness of aid, we expect to observe a negative interaction effect, which would imply that the average project allocated to a birth region is less effective than projects in the same region at other times.

Our empirical findings show that Chinese projects accelerate rather than reduce economic growth at subnational scales. We also find no evidence that Chinese projects in birth regions of political leaders are less effective than projects given to the same region at other times. Hence, neither does Chinese aid reduce growth on average, nor does the favoritism towards leaders' birth regions involved in its allocation reduce the effectiveness of its aid. Nevertheless, these results suggest that political favoritism in the allocation of Chinese aid has non-trivial distributional implications. Given that the birth regions of political leaders are wealthier than other regions at baseline, our results imply that Chinese aid has widened economic inequalities between politically-privileged and politically-marginalized jurisdictions in Africa.

2 Data and Method

We analyze the development effects of Chinese aid across subnational units of 47 African countries over the 2001–2012 period.[7] These units are administrative regions at the second (ADM2) and first (ADM1) subnational levels. ADM2 regions typically correspond to counties or districts, while the larger ADM1 regions correspond to provinces or states. We use subnational boundaries from the Database of Global Administrative Areas (GADM) and obtain 5,835 ADM2 regions and 709 ADM1 regions in the 47 African countries covered in our study.[8] Figure 1 shows the allocation of official financing across ADM2 regions.[9]

Our goal is to (i) measure the development effects of Chinese development activities across the African continent and (ii) determine whether political favoritism involved in the allocation of aid reduces its effectiveness. Despite many initiatives to move "beyond GDP," GDP statistics at the provincial and district level would constitute a good starting point to measure development for our purposes. However, most countries in Africa lack (reliable) subnational GDP data. We thus follow a growing stream of research and proxy

[7]We exclude Western Sahara, a disputed territory, Somalia for the absence of a central government, and the five small island states of Cape Verde, Comoros, Mauritius, São Tomé and Príncipe, and Seychelles.

[8]The GADM database includes subnational boundaries only at the ADM1 level for Egypt, Equatorial Guinea, Lesotho, Libya, and Swaziland. We use ADM1 regions for these countries instead in our ADM2-level analysis.

[9]Figure A.2 in the Appendix presents the corresponding map for ADM1 regions.

subnational development with nighttime light emissions (e.g., Chen and Nordhaus 2011; Henderson et al. 2012; Michalopoulos and Papaioannou 2013, 2014; Hodler and Raschky 2014a, 2014b, Dreher and Lohmann 2015; Kuhn and Weidmann 2015; Ahlerup et al. 2017; Briggs 2018). Weather satellites from the U.S. Air Force circle the Earth 14 times a day and measure light intensity. The National Oceanic and Atmospheric Administration (NOAA 2014) uses these satellite measures of light intensity from evenings during the dark half of the lunar cycle in seasons when the sun sets early. It removes observations that are likely to be affected by, e.g., cloud coverage, fires or other ephemeral lights. The resulting annual dataset provides information on nighttime light emissions for pixels that correspond to slightly less than one square kilometer. The measure ranges between 0 to 63, with higher values representing higher levels of nighttime light. Henderson et al. (2012) and Hodler and Raschky (2014a) show that changes in nighttime light intensity are highly correlated with changes in national and subnational GDP, respectively. What is more, nighttime light intensity is also a good proxy for local human development outcomes (Weidmann and Schutte 2017; Bruederle and Hodler 2018).

Our dependent variable is defined as the log of nighttime light per capita and labelled $Lightpc_{ict}$.[10] We use a measure of nighttime light per capita, which is arguably a better predictor of GDP per capita than nighttime light per area (Cogneau and Dupraz 2014).

To track China's development footprint across African regions, Dreher et al. (2019) introduced a new georeferenced Chinese aid dataset. It provides locational details on each project from AidData's Chinese Official Finance to Africa Dataset (Strange et al. 2017).[11] Dreher et al. (2019) applied the geocoding procedure described in Strandow et al. (2011) and used a double-blind system, where two coders employ a defined hierarchy of geographic terms and independently assign uniform latitude and longitude coordinates, information about the precision of the data, and standardized names to each geographic feature of

[10] We follow Michalopoulos and Papaioannou (2013, 2014), and Hodler and Raschky (2014a, 2014b), among others, in adding 0.01 to the average nighttime light intensity before taking its logarithm. Doing so ensures that we do not lose observations with a reported nighttime light intensity of zero.

[11] This dataset was assembled using AidData's Tracking Underreported Financial Flows (TUFF) method, which synthesizes and standardizes a large amount of unstructured information in the public domain. In total, it covers 1,650 projects committed to 49 African countries, amounting to approximately US$ 83.3 billion in official financing over the 2000–2012 period. Given potential concerns about the comprehensiveness of the 2012 data of the 1.1 version of AidData's Chinese Official Finance to Africa dataset, we follow Strange et al. (2017) and Dreher et al. (2019) and exclude 2012. To the extent possible, officially-financed Chinese projects are coded as either "ODA-like" or "OOF-like" based upon the OECD criteria for Official Development Assistance (ODA) and Other Official Flows (OOF). In cases when a project cannot be clearly categorized as ODA or OOF, they are assigned to a residual category called "Vague (Official Finance)." Financial values are available for 65% of the projects. We show in Section 3.2 that the incomplete information on financial values is not driving our results.

interest (see Dreher et al. 2019 for details).[12] The resulting georeferenced dataset contains 1,575 project locations geocoded at the ADM2 level and 1,898 project locations at the ADM1 level.[13] Despite the short time since the dataset's public release, the georeferenced Chinese aid dataset has already been used in a number of subnational studies of Chinese aid (e.g., BenYishay et al. 2016; Brazys et al. 2017; Isaksson and Kotsadam 2018a, 2018b; Gehring et al. 2018).

Our variable of interest, $Aidpc_{ict}$, is the amount of all Chinese official financing flows to region i in country c and year t in constant 2009 US$ divided by the population size of region i at time t. In keeping with the aid effectiveness literature at large, we exclude non-binding pledges and suspended projects. We also use (logged) Chinese funding per capita rather than the (logged) absolute amount of Chinese funding in our main analysis because the overall effects of such funding should differ depending on whether it is given to a more or less populous region.

Our measure of a region's population size is based on high-resolution data on the spatial distribution of the world population from the Center for International Earth Science Information Network (CIESIN).

Table A.1 in the Appendix provides summary statistics at the level of ADM2 regions.

We estimate the following regression equation:

$$Lightpc_{ict} = \alpha_{ct} + \delta_{ic} + \varphi Aidpc_{ict-\tau} + \nu_{ict}, \quad (1)$$

where α_{ct} represents country-year-fixed effects, and δ_{ic} are region-fixed effects. φ is our coefficient of interest that will enable us to evaluate the development effects of Chinese aid. We cluster standard errors by country.

With the data in our sample, identifying a causal effect of Chinese aid on local economic growth is challenging. Compared to most cross-country aid effectiveness studies, our dataset covers a relatively short period of time. Our estimation method might therefore prevent us from identifying significant effects even if such effects exist. Also, given the fragility of aid effectiveness results at the cross-country level (Doucouliagos and Paldam 2011; Roodman 2015), it might be overly ambitious to detect significant treatment effects for Chinese financial flows alone. In comparison to the joint contributions of all Western

[12] For projects with more than one location, they georeferenced all locations. Because we do not observe financial values at the project-location level but only at the project level, we spread project amounts equally across all locations identified in each project.

[13] These numbers are about half the total number of locations the database covers because of imprecise information on the exact locations of many projects.

donors, which is typically the focus of such analyses, Chinese financial flows are small. On the other hand, it might be easier to detect treatment effects if development projects primarily affect local outcomes but fail to measurably increase overall economic growth at the country level (Dreher and Lohmann 2015).

We use the lag of $Aidpc_{ict-\tau}$ (where $\tau \in \{1, \ldots, 5\}$) to account for delays between the time of commitments and the construction of light-emitting assets.[14] The time period covered thus ranges between 2001-2012 for $\tau = 1$ and 2005-2012 for $\tau = 5$.

Although we use up to five lagged values and include region- and country-year-fixed effects in our aid effectiveness regressions, an obvious concern is that Chinese financial commitments and nighttime light are simultaneously determined by other time-variant factors that are unobserved. To address this concern, we apply a two-stage least squares (2SLS) approach inspired by Nunn and Qian (2014). Our instrumental variable is an interaction that exploits exogenous time variation in China's production of steel and cross-sectional variation in the recipient countries' likelihood to receive Chinese aid. Our exogenous source of time variation in Chinese funding is the (logged) annual amount of Chinese steel production (in thousand tons), labeled $Steel_{t-\tau}$ (data from the World Steel Association 2010, 2014). China is the world's leading producer and exporter of steel (Stratfor 2016). The Chinese government considers steel to be a commodity of strategic importance and has facilitated the rapid expansion of its production by, among other things, heavily subsidizing Chinese state-owned enterprises (SOEs). It has a track record of generating an oversupply of steel (Zheng et al. 2009) and looking for overseas markets where it can "dump" its steel products at artificially low prices (Spegele and Miller 2016; Stratfor 2016).[15] Copper (2016: 166) notes that "[i]n 2005, a high official in China spoke of serious overproduction in 11 sectors of the Chinese economy, including cement, steel, textiles, and autos" and "[f]oreign aid and external investing [...] were the means used to increase exports of overproduced goods."[16] For these reasons and because the majority of Chinese development projects in Africa require some form of construction activity, Chinese official financing commitments

[14]There is sometimes a substantial lag between the funding committed by Western donors, when such funding is disbursed, and when it produces results (see Dreher et al. 2018). According to the data from Bartke (1989) used in Dreher and Fuchs (2015), the average Chinese aid project starts about one year after a financial agreement has been signed.

[15]Economic indicators such as steel production also serve as indicators of leader performance at the local level, creating incentives to build excess capacity. In this context, Li and Zhou (2005) speak of an "'obsession' with economic ranking" among local leaders in China.

[16]In this regard, Copper (2016: 2000) argues that China is taking a page out of the U.S. Government's playbook: "in the early post-World War II period when [the U.S.] had too much money and produced too many goods [it] gave extensive foreign aid and made huge foreign investment. China is doing this today."

to Africa should increase with the production of steel in a given year.

Steel production has prima facie credibility as part of our instrument because China's global development finance program is guided by a "going global" strategy explicitly designed to promote national exports and stimulate business for Chinese firms overseas (Davies et al. 2008; Chen and Orr 2009; Giovannetti and Sanfilippo 2009).[17] As such, most Chinese grants and loans are directly tied to the acquisition of Chinese goods, including steel.[18]

To address the endogeneity of aid, we thus estimate the following first-stage regression:

$$Aidpc_{ict-\tau} = \alpha_{ct-\tau} + \delta_{ic} + \lambda(\bar{A}_{ic} \times Steel_{t-\tau}) + u_{ict-\tau}, \tag{2}$$

where $\bar{A}_{ic}$ is the share of years between 2001 and 2011 that region i received Chinese funding.[19] Hence, the instrumental variable $\bar{A}_{ic} \times Steel_t$ is the interaction between the propensity of region i to receive Chinese aid and logged Chinese steel production in year t.

One might be concerned that the interacted instrumental variable violates the exclusion restriction because the probability of receiving aid may directly affect economic growth or because steel production is correlated with other variables. However, our regressions control for the effect of the probability of receiving aid as well as steel production through the inclusion of region- and country-year-fixed effects. Given that we control for these fixed effects, the interaction of the two variables results in an exogenous instrument under mild assumptions (Nizalova and Murtazashvili 2016; Bun and Harrison 2019). 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 regions with a high compared to a low probability of receiving Chinese aid. The identifying assumption is that growth in regions 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 region- and country-year-fixed effects. In other words, as in any difference-in-difference

[17] This strategy was approved in 2000, the year before our period of study begins.

[18] Indeed, China Exim Bank specifies that, for concessional loans, "Chinese enterprises should be selected as contractors/exporters and equipment, materials, technology or services needed for the project should be procured from China ahead of other countries—no less than 50% of the procurement shall come from China" (Davies et al. 2008: 57). More broadly, many Chinese grants and loans are actually trade-finance instruments, such as export seller's credits that help Chinese firms do business in overseas markets and export buyer's credits that help firms from importing countries to buy goods and services from Chinese firms (Dreher et al. 2019).

[19] More formally, $\bar{A}_{ic} = 100[\frac{1}{12}\sum_{t=2000}^{2011} A_{ict}]$, where A_{ict} is a binary indicator variable that switches to one if subnational region i in country c received any Chinese funding in year t.

setting, we rely on an (conditionally) exogenous treatment and the absence of different pre-trends across groups. Controlled for country-year-fixed effects, Chinese steel production cannot be correlated with the error term and is thus clearly exogenous to the aid a region receives in a certain year. In order for different pre-trends to exist, these trends across regions with a high compared to a low probability of receiving aid from China would have to vary in tandem with year-to-year changes in steel production. As we discuss in Figure A.1 in the Appendix, we build on Christian and Barrett (2017) and show that there is little reason to believe that the parallel-trends assumption is violated in our case.

One might be concerned that steel production is correlated with overall export volumes or foreign direct investments. Potentially, regions that frequently receive Chinese aid projects are also frequent host regions of investment projects and those with close trade ties. This could imply that any differential effects of aid on growth that we observe could result from trade and investment rather than aid. To address this concern, we also show regressions that include interactions between a region's probability to receive aid—$\bar{A}_{ic}$—and the total trade flows between China and country c in year t and the total (net) foreign direct investment flows (FDI) from China to country c in year t ($\bar{A}_{ic}\times$ *FDI from China*$_{ct-\tau}$ and $\bar{A}_{ic}\times$ *Trade Flows with China*$_{ct-\tau}$).[20]

We examine the consequences of favoritism more specifically by testing for differential effects of Chinese funding between birth regions and non-birth regions on local economic development. We do this because Dreher et al. (2019) show that Chinese aid—but not World Bank financing—is channeled to the leaders' birth regions. This gives us leverage to test a particular facet of favoritism involved in the allocation of Chinese aid. The average project a region receives at times it is the birth region of the country's leader consists of projects it would receive anyway, and projects it receives in addition. To the extent that the quality of the latter is significantly lower compared to projects received without favoritism involved, average project quality should decline as well. To test differential growth effects of aid in birth regions compared to other regions, we estimate the following

[20]The control variable *Trade flows with China* is the sum of imports and exports between China and country c in year t (in million US$). The raw data are taken from Head et al. (2010). The control variable *FDI from China* is the total flow of FDI from China to country c in year t (in million US$). The data are taken from the World Investment Report (UNCTAD 2015). We do not log FDI given that these net flows can assume negative values. We also do not log trade, as doing so reduces the power of our instrument (but does not change any of the main conclusions).

regression equation:

$$Lightpc_{ict} = \alpha_{ct} + \delta_{ic} + \varphi Aidpc_{ict-\tau} + \theta Aidpc_{ict-\tau} \times Birthregion_{ict-\tau} + \gamma Birthregion_{ict-\tau} + \nu_{ict}, \tag{3}$$

where α_{ct} again represents country-year-fixed effects and δ_{ic} region-fixed effects. We instrument the two endogenous variables—$Aidpc_{ict}$ and its interaction with $Birthregion_{ict}$—with the instrument for $Aidpc_{ict}$ and its interaction with $Birthregion_{ict}$.[21]

3 Results

3.1 Main Results

Table 1 presents our Chinese aid effectiveness results for ADM2 regions. Estimated with OLS, panel A presents correlations between Chinese official financing and per-capita nighttime light. Each column presents results for different lags of the Chinese aid variable, whereby the first row denotes the lag used in the regression. The five estimated coefficients show a positive statistically significant correlation with nighttime light per capita at least at the 5% level of significance.

These estimates do not constitute causal effects, unlike our instrumental-variables regressions to which we turn next. Panel B presents the corresponding reduced-form regressions, and Panel C the first-stage estimates. As expected, we obtain a strong and positive relationship between our instrumental variable and Chinese funding. Frequent recipient regions of Chinese aid obtain significantly larger inflows of Chinese aid at times when Chinese steel production is high. Panel D shows the results from the second stage of the instrumental-variables regressions. The coefficients of the Chinese funding variables are positive and statistically significant at least at the 5% level at all five lags. Comparing the coefficients from the different lags shows that the impact of Chinese financial commitments increases up to the third lag and then decreases again. It is not surprising that it takes

[21] Therefore, the two first-stage regressions are:

$$\begin{aligned} Aidpc_{ict-\tau} &= \alpha^1_{ct-\tau} + \delta^1_{ic} + \lambda^1(\bar{A}_{ic} \times Steel_{t-\tau}) + \mu^1(\bar{A}_{ic} \times Steel_{t-\tau} \times Birthregion_{ict-\tau}) \\ &\quad + \gamma^1 Birthregion_{ict-\tau} + u^1_{ict-\tau} \\ Aidpc_{ict-\tau} \times Birthregion_{ict-\tau} &= \alpha^2_{ct-\tau} + \delta^2_{ic} + \lambda^2(\bar{A}_{ic} \times Steel_{t-\tau}) + \mu^2(\bar{A}_{ic} \times Steel_{t-\tau} \times Birthregion_{ict-\tau}) \\ &\quad + \gamma^2 Birthregion_{ict-\tau} + u^2_{ict-\tau} \end{aligned}$$

time for Chinese aid to show the strongest developmental effects given that it takes on average two years from project start to completion.

In panel D we include interactions between the propensity that a subnational region receives Chinese funding and total trade and FDI activity between China and country *c*. While the overall pattern of the effect of Chinese funding remains similar to the results reported in panel D, the size and significance decreases in the first and second year after the financial commitment. The first-stage F-statistic for the excluded instrument is between 16 and 38 in panels D and E, suggesting that it is unlikely that our estimates suffer from weak-instrument bias.

With respect to the magnitude of the estimated impact of Chinese official financing, the coefficient in panel D (which relies on a three-year lag for aid to register impact) suggests that a 10% increase in Chinese funding leads to a 1.3% increase in per-capita light output within an ADM2 region. This corresponds to an increase in subnational GDP of around 0.39% if one applies the estimated elasticity between nighttime light and GDP of around 0.3 reported in Henderson et al. (2012) and Hodler and Raschky (2014a). This finding stands in contrast to the insignificant growth impacts of World Bank funding, which are documented by Dreher and Lohmann (2015).

Table 2 tests whether aid is less effective when it is committed at times when the national leader comes from the recipient region. As shown above, projects in birth regions are not more or less effective than those in non-birth regions: the interaction between subnational aid distribution and leader birth region is not significantly different from zero in any of the specifications using ADM2 regions. This means that aid given to birth regions has the same development effect as aid given to the same region at other times.

Taken together, our results provide evidence that China is making a positive and non-trivial impact on the local economies of African countries in the short run. The effect exceeds the amount of funding in magnitude, indicating that Chinese official finance has an effect on the local economy that goes beyond the initial investment (e.g., infrastructure installation) phase. This economic development occurs despite the favoritism its critics claim to be inherent in China's aid allocation policies. While the results in Dreher et al. (2019) confirm the importance of favoritism in the subnational allocation of Chinese aid, our findings suggest that such favoritism does not make Chinese aid any less effective.

3.2 Robustness

We now discuss various robustness tests. The corresponding tables are all in the Appendix. Tables A.2 and A.3 use ADM1 regions such as provinces or states rather than ADM2 regions such as counties and districts as units of observations. The general pattern is unchanged. While the effects of aid on nighttime light are slightly smaller and less precisely estimated, they become statistically significant in the third year at the latest. Table A.4 shows that our main findings are also robust when using 3-year averages as units of observation.

We now turn to alternative explanatory variables. Instead of the log of aid per capita, Tables A.5 and A.6 use the log of total aid flows and a binary indicator for the allocation of any aid project to the given ADM2 region in the given year, respectively. The latter is an important robustness test as 35% of the projects in the dataset (mainly scholarships and technical assistance activities) lack information on their financial values. It is reassuring that we find the same pattern as with our main explanatory variable. In Table A.7 we focus on Chinese ODA-like aid (again using the log of per-capita flows). The results are very similar as when using all Chinese development finance. In Table A.8, we restrict our attention to aid projects that would fall into the OECD category "economic infrastructure and services," which includes, among others, transport, energy and communication projects.[22] We again find the same pattern.

Table A.9 presents an alternative instrumental-variables approach. We proxy the regional probability of receiving Chinese funding with historical data on development projects from China during the Cold War era. Bartke (1989) collected data on 520 completed Chinese aid projects in 47 African countries over the 1956–1987 period from Chinese and secondary sources. We have georeferenced all projects and obtained 688 project locations across the African continent. We now proxy for a region's probability to receive aid in the 2000–2011 period with the share of years in which a region received Chinese funding in the 1956–1987 period. While our main conclusions hold, the first-stage F statistics are lower.

Finally, Tables A.10 and A.11 show that our results are robust to many alternative ways of clustering standard errors.

[22]We use the probability to receive such projects rather than those to receive any project to construct our instrument. The same holds in analogy for ODA-like flows above.

4 Conclusions

China's critics claim that, in its zeal to help partner countries efficiently install the "hardware" of economic development (e.g., highways, railroads, dams, bridges), it has prioritized speed over quality.[23] China, they argue, finances poorly-designed and hastily-executed projects that provide few economic benefits, while Western donors and lenders have learned through decades of experience to design and implement development projects in more careful and sustainable ways. Yet others praise China for its ability to efficiently implement large-scale infrastructure projects without placing unreasonable administrative burdens on already overstretched public bureaucracies in recipient countries.[24]

While policymakers bring bluster to this debate and area studies experts bring deep knowledge of individual cases, we bring systematic quantitative data collected using transparent and replicable procedures and we provide the most rigorous econometric analysis to date of Chinese aid on economic growth in recipient countries. The estimated effects in this paper are cleaner and we are more confident in the results than in previous papers using cross-national time-series analysis.

Our results demonstrate that Chinese official finance has a small, immediate, and positive effect on per-capita nighttime light output at the district (or ADM2) level. A similar effect occurs, with some delay, in larger provinces (ADM1 level). This coefficient first increases over time and reaches the largest value in the third year after the aid commitment (both in the ADM1 and ADM2 samples). The effect clearly exceeds the amount of funding in magnitude, indicating that Chinese official finance has an effect on the local economy that goes beyond the initial investment. What is more, Chinese favoritism towards the birth regions of a country's leader does not seem to reduce the effectiveness of its aid. While Chinese aid may suffer from many shortcomings, we recover strong evidence that it has a positive effect on economic development in Africa, in spite of the favoritism involved in the allocation of its aid.

[23] Several recent studies provide evidence that there is a significant "hassle factor" associated with financing development projects through the multilateral development banks—in particular, the World Bank (e.g., Humphrey and Michaelowa 2019; Gallagher and Kilby 2019).

[24] See Dreher and Fuchs (2015) and Strange et al. (2017) for references.

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Figures and Tables

Figure 1: Value of Chinese aid projects per capita in subnational ADM2 units in Africa (total value in 2009 US$, 2000–12)

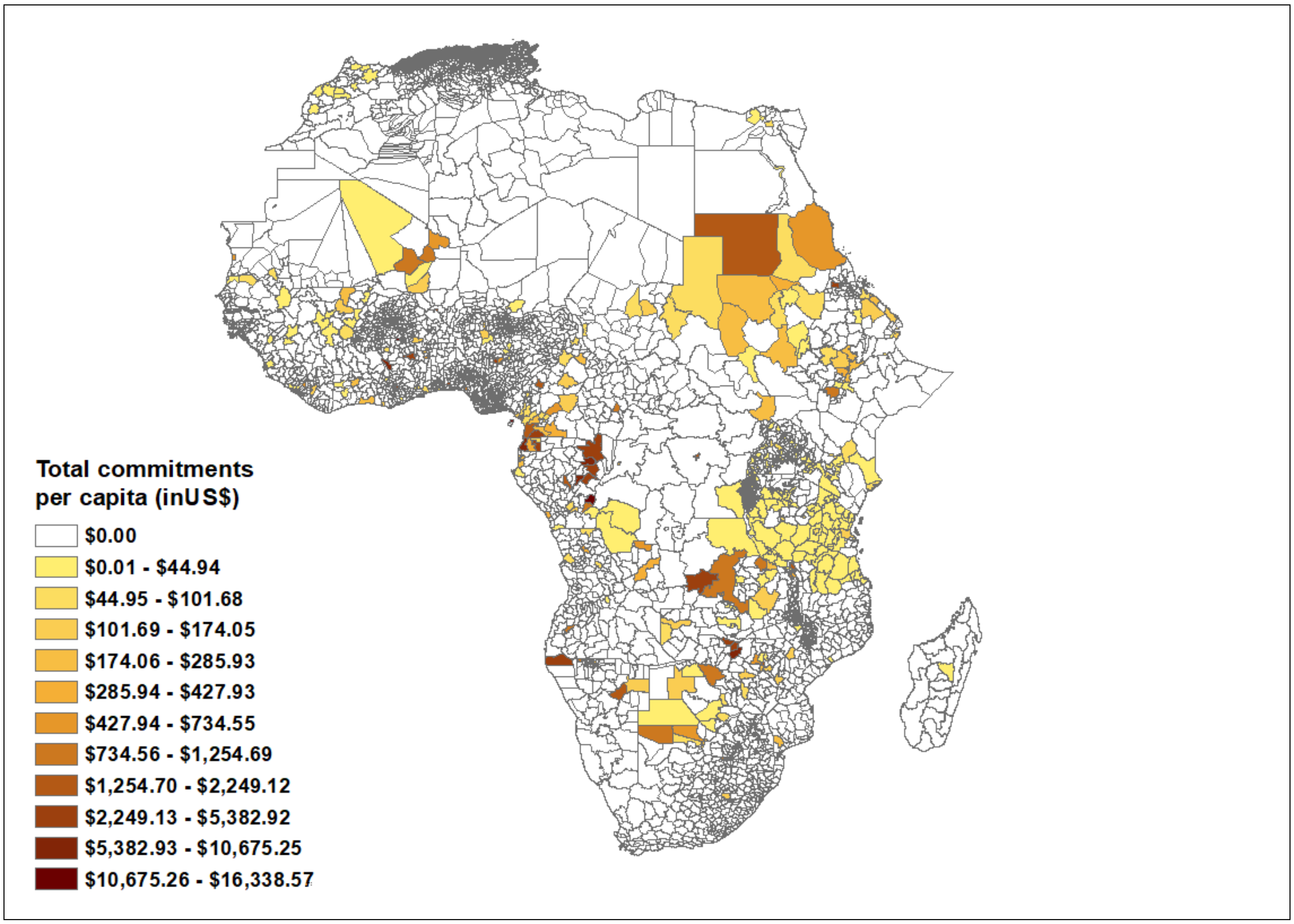


Table 1: Aid effectiveness (OLS and 2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
			Panel A. OLS estimates		
$Aidpc_{ict-\tau}$	0.0045**	0.0075***	0.0128***	0.0146***	0.0077***
	(0.0019)	(0.0029)	(0.0023)	(0.0034)	(0.0023)
Observations	69,252	63,481	57,710	51,939	46,168
			Panel B. Reduced-form estimates		
$\bar{A}_{ic} \times Steel_{t-\tau}$	0.0014**	0.0018***	0.0023***	0.0021***	0.0019***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Observations	69,252	63,481	57,710	51,939	46,168
			Panel C. First-stage estimates		
$\bar{A}_{ic} \times Steel_{t-\tau}$	0.0188***	0.0182***	0.0181***	0.0185***	0.0214***
	(0.0030)	(0.0034)	(0.0033)	(0.0036)	(0.0045)
Observations	69,252	63,481	57,710	51,939	46,168
			Panel D. 2SLS estimates 1		
$Aidpc_{ict-\tau}$	0.0753**	0.1002***	0.1295***	0.1146***	0.0906***
	(0.0293)	(0.0326)	(0.0316)	(0.0269)	(0.0272)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	38.10	28.61	29.31	25.86	22.30
			Panel E. 2SLS estimates 2		
$Aidpc_{ict-\tau}$	0.0588*	0.0915**	0.1434***	0.1215***	0.0986***
	(0.0311)	(0.0370)	(0.0369)	(0.0348)	(0.0316)
$\bar{A}_{ic} \times Trade\ Flows\ with\ China_{ct-\tau}$	0.0444	0.0409	-0.0118	-0.0018	0.0210
	(0.0640)	(0.0747)	(0.0696)	(0.0549)	(0.0789)
$\bar{A}_{ic} \times FDI\ from\ China_{ct-\tau}$	-0.0000	-0.0003*	-0.0002	-0.0003**	-0.0014
	(0.0001)	(0.0002)	(0.0002)	(0.0001)	(0.0014)
Observations	66,948	61,369	55,790	50,211	44,632
F-stat	34.24	23.48	20.54	16.28	17.92

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table 2: Aid effectiveness and birth regions (OLS and 2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
			Panel A. OLS estimates		
$Aidpc_{ict-\tau}$	0.0037**	0.0063**	0.0116***	0.0139***	0.0075***
	(0.0017)	(0.0029)	(0.0023)	(0.0036)	(0.0024)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	0.0114	0.0182	0.0150	0.0115	0.0023
	(0.0097)	(0.0115)	(0.0117)	(0.0138)	(0.0045)
$Birthregion_{ict-\tau}$	0.0495	0.0556*	0.0541**	0.0255	0.0109
	(0.0305)	(0.0290)	(0.0227)	(0.0194)	(0.0151)
Observations	69,252	63,481	57,710	51,939	46,168
			Panel B. First-stage estimates of $Aidpc_{ict-\tau}$		
$\bar{A}_{ic} \times Steel_{t-\tau}$	0.0186***	0.0181***	0.0178***	0.0181***	0.0208***
	(0.0030)	(0.0034)	(0.0033)	(0.0033)	(0.0042)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	0.0005	0.0003	0.0009	0.0016***	0.0020***
	(0.0008)	(0.0008)	(0.0007)	(0.0005)	(0.0004)
$Birthregion_{ict-\tau}$	-0.0168	-0.0170	-0.0482	-0.1237***	-0.1165**
	(0.0546)	(0.0607)	(0.0536)	(0.0460)	(0.0497)
Observations	69,252	63,481	57,710	51,939	46,168
			Panel C. First-stage estimates of $Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$		
$\bar{A}_{ic} \times Steel_{t-\tau}$	0.0016	0.0011	0.0008	0.0009	0.0019
	(0.0011)	(0.0009)	(0.0007)	(0.0008)	(0.0013)
$\bar{A}_{ic} \times Steel_{t-\tau} \times Birthregion_{ict-\tau}$	0.0022***	0.0022***	0.0023***	0.0027***	0.0030***
	(0.0005)	(0.0005)	(0.0003)	(0.0003)	(0.0004)
$Birthregion_{ict-\tau}$	-0.0635	-0.0726*	-0.0779**	-0.1173**	-0.1355***
	(0.0408)	(0.0412)	(0.0395)	(0.0465)	(0.0523)
Observations	69,252	63,481	57,710	51,939	46,168
			Panel D. 2SLS estimates		
$Aidpc_{ict-\tau}$	0.0782***	0.0985***	0.1291***	0.1166***	0.0934***
	(0.0297)	(0.0320)	(0.0318)	(0.0282)	(0.0296)
$\bar{A}_{ic} \times Steel_{t-\tau} \times Birthregion_{ict-\tau}$	-0.0322	0.0063	-0.0095	-0.0283	-0.0212
	(0.0467)	(0.0527)	(0.0473)	(0.0276)	(0.0239)
$Birthregion_{ict-\tau}$	0.0539	0.0534	0.0466*	0.0221	-0.0027
	(0.0370)	(0.0345)	(0.0260)	(0.0207)	(0.0154)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	21.63	14.85	14.22	13.92	10.45

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

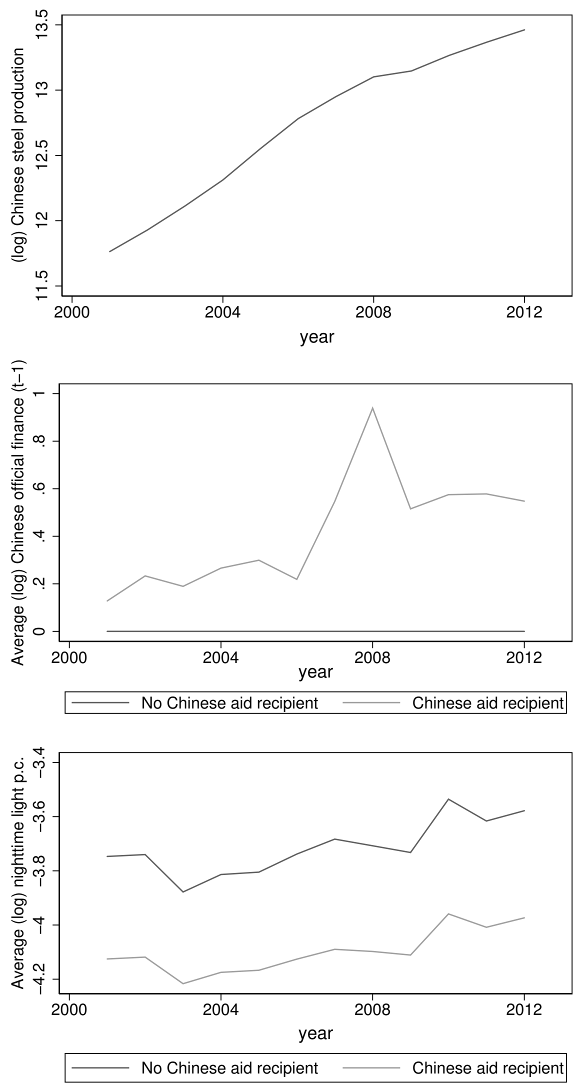
Appendix

Instrumental Variable

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. Figure A.1 plots these graphs. The results give little reason to believe that the parallel trends assumption is violated in our case. More precisely, the probability-specific trends in aid and growth, respectively, seem rather parallel across regions that regularly receive aid (those with a probability of receiving aid that is above the median) and the irregular recipient regions (those with a probability of receiving aid that is below the median, which is zero in our regressions). There is also no obvious non-linear trend in regular compared to irregular recipients that is similar for aid and growth.

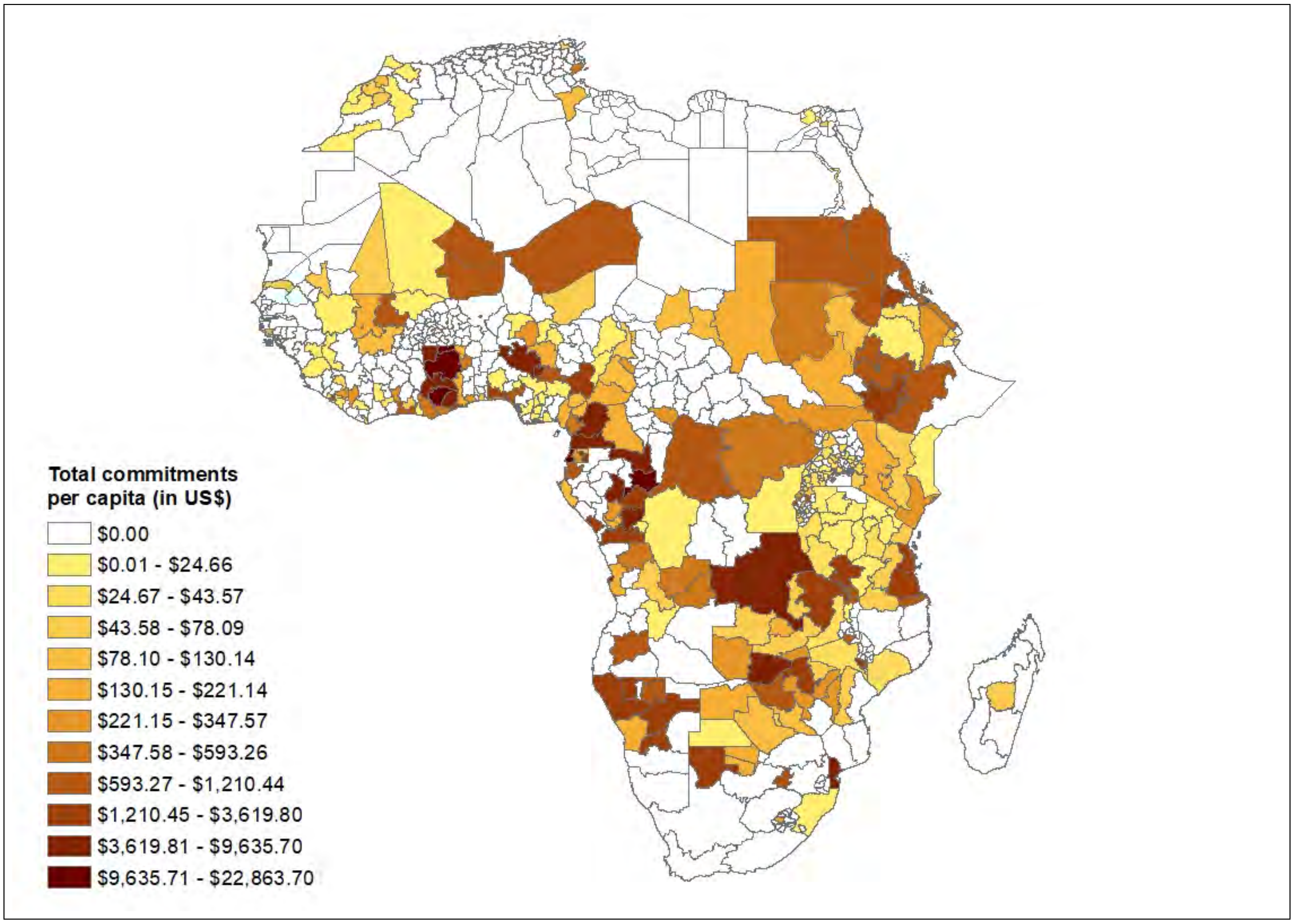
The exogeneity of our interacted instrument would be violated if changes in steel production would affect growth differentially in regions with a high probability to receive aid compared to regions with a low probability to receive aid for reasons unrelated to aid. Steel production is correlated with a large number of other variables. Some of these variables are likely to differentially affect growth in these groups of regions via aid exclusively. Figure A.1 shows that steel production trends upwards over time. It is correlated with China's total yearly production volume and thus with other inputs in aid projects, like cement or timber. Our local average treatment effect thus captures the combined effects of these inputs rather than the input of steel alone, which does not threaten our identification strategy.

Figure A.1: Parallel trends plots for instrument using the interaction of Chinese steel production and the probability of receiving Chinese aid



Notes: 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 of receiving 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.

Figure A.2: Value of Chinese aid projects per capita in subnational ADM1 units in Africa (total value in 2009 US$, 2000–12)



Descriptive Statistics

Table A.1: Descriptive statistics

Variable	(1) N	(2) mean	(3) sd	(4) min	(5) max
Light	69,252	3.983	9.636	0	63
Log light ($Light_{ict}$)	69,252	-1.203	2.680	-4.605	4.143
Light p.c.	69,252	0.0556	0.464	0	32.67
Log light p.c. ($Lightpc_{ict}$)	69,252	-3.721	1.034	-4.605	3.487
Chinese aid	69,054	741,313	2.463e+07	0	3.182e+09
Log Chinese aid (Aid_{ict-1})	69,054	0.150	1.551	0	21.88
Chinese aid p.c.	69,252	3.499	136.9	0	16,050
Log Chinese aid p.c. ($Aidpc_{ict-1}$)	69,252	0.0335	0.399	0	9.684
Chinese aid dummy ($AidDummy_{ict-1}$)	69,252	0.0123	0.110	0	1
$\bar{A}_{ic} \times Steel_{t-1}$	69,252	15.64	70.08	0	1,234
$Bartke_{ic} \times Steel_{t-1}$	69,252	0.457	2.369	0	13.46
$\bar{A}_{ic} \times Trade\ Flows\ with\ China_{ct-1}$	66,948	0.0125	0.122	0	7.013
$\bar{A}_{ic} \times FDI\ from\ China_{ct-1}$	69,252	0.290	7.471	-36.83	1,202

Note: Descriptive statistics based on sample used in Table 1, column 1.

Additional Regression Results

Table A.2: Aid effectiveness (OLS and 2SLS estimates, ADM1)

Time lag τ	1	2	3	4	5
			Panel A. OLS estimates		
$Aidpc_{ict-\tau}$	0.0020	0.0033	0.0065***	0.0053***	0.0046*
	(0.0025)	(0.0023)	(0.0024)	(0.0017)	(0.0028)
Observations	8,508	7,799	7,090	6,381	5,672
			Panel B. Reduced-form estimates		
$\bar{A}_{ic} \times Steel_{t-\tau}$	0.0006	0.0008	0.0010**	0.0009*	0.0008*
	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
Observations	8,508	7,799	7,090	6,381	5,672
			Panel C. First-stage estimates		
$\bar{A}_{ic} \times Steel_{t-\tau}$	0.0118***	0.0105***	0.0122***	0.0128***	0.0162***
	(0.0030)	(0.0031)	(0.0033)	(0.0038)	(0.0047)
Observations	8,508	7,799	7,090	6,381	5,672
			Panel D. 2SLS estimates 1		
$Aidpc_{ict-\tau}$	0.0480	0.0716	0.0839**	0.0687**	0.0486**
	(0.0385)	(0.0445)	(0.0392)	(0.0347)	(0.0247)
Observations	8,508	7,799	7,090	6,381	5,672
F-stat	9.383	14.89	11.22	13.67	11.24
			Panel E. 2SLS estimates 2		
$Aidpc_{ict-\tau}$	0.0476	0.0723*	0.0908**	0.0741**	0.0542**
	(0.0307)	(0.0371)	(0.0362)	(0.0324)	(0.0238)
$\bar{A}_{ic} \times Trade\ Flows\ with\ China_{ct-\tau}$	0.0124	0.0143	0.0061	0.0039	-0.0010
	(0.0135)	(0.0156)	(0.0204)	(0.0127)	(0.0236)
$\bar{A}_{ic} \times FDI\ from\ China_{ct-\tau}$	-0.0001	-0.0002***	-0.0001***	-0.0002***	0.0002
	(0.0001)	(0.0000)	(0.0001)	(0.0000)	(0.0009)
Observations	8,004	7,337	6,670	6,003	5,336
F-stat	22.44	13.69	14.56	12.54	12.46

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.3: Aid effectiveness and birth regions (OLS and 2SLS estimates, ADM1)

Time lag τ	1	2	3	4	5
			Panel A. OLS estimates		
$Aidpc_{ict-\tau}$	0.0015	0.0015	0.0042**	0.0029	0.0047
	(0.0020)	(0.0018)	(0.0018)	(0.0018)	(0.0032)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	0.0018	0.0090	0.0098	0.0114	-0.0011
	(0.0064)	(0.0072)	(0.0075)	(0.0074)	(0.0042)
$Birthregion_{ict-\tau}$	0.0231	0.0353	0.0362*	0.0242*	0.0124
	(0.0321)	(0.0290)	(0.0198)	(0.0139)	(0.0113)
Observations	8,508	7,799	7,090	6,381	5,672
			Panel B. 2SLS estimates		
$Aidpc_{ict-\tau}$	0.0462	0.0669	0.0797**	0.0694*	0.0458
	(0.0385)	(0.0439)	(0.0407)	(0.0402)	(0.0310)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0009	-0.0011	0.0012	-0.0146	0.0130
	(0.0637)	(0.0663)	(0.0504)	(0.0388)	(0.0296)
$Birthregion_{ict-\tau}$	0.0174	0.0325	0.0261	0.0202	-0.0047
	(0.0530)	(0.0482)	(0.0325)	(0.0213)	(0.0142)
Observations	8,508	7,799	7,090	6,381	5,672
F-stat	7.718	5.631	6.485	4.906	4.927

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.4: Robustness tests with 3-year averages (2SLS estimates, ADM2 and ADM1)

Subnational level	ADM2	ADM1	ADM2	ADM1
Time lag τ	1	1	2	2
	Panel A. Aid effectiveness			
$Aidpc_{ict-\tau}$	0.0762***	0.0688*	0.0477***	0.0304
	(0.0234)	(0.0407)	(0.0156)	(0.0209)
Observations	23,084	2,836	17,313	2,127
F-stat	31.56	9.004	19.43	7.226
	Panel B. Aid effectiveness and birth regions			
$Aidpc_{ict-\tau}$	0.0735***	0.0661	0.0483***	0.0356
	(0.0225)	(0.0410)	(0.0160)	(0.0250)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	0.0223	0.0039	-0.0085	-0.0304
	(0.0445)	(0.0506)	(0.0209)	(0.0311)
$Birthregion_{ict-\tau}$	0.0416	0.0191	0.0183	0.0353
	(0.0400)	(0.0525)	(0.0301)	(0.0355)
Observations	23,084	2,836	17,313	2,127
F-stat	17.66	4.722	10.90	3.326

Notes: Data are grouped into the following three-year periods: 2000–02, 2003–05, 2006–08, 2009–2011, and 2012–13 (no data available for 2014). Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.5: Robustness tests with log of total aid flows (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
			Panel A. Aid effectiveness		
$Aid_{ict-\tau}$	0.0175***	0.0218***	0.0266***	0.0247***	0.0211***
	(0.0066)	(0.0067)	(0.0065)	(0.0054)	(0.0057)
Observations	69,054	63,305	57,557	51,810	46,052
F-stat	51.43	44.32	36.95	34.09	36.91
			Panel B. Aid effectiveness and birth regions		
$Aid_{ict-\tau}$	0.0181***	0.0217***	0.0262***	0.0245***	0.0210***
	(0.0068)	(0.0067)	(0.0065)	(0.0055)	(0.0062)
$Aid_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0091	-0.0010	0.0021	0.0022	0.0011
	(0.0113)	(0.0111)	(0.0086)	(0.0067)	(0.0072)
$Birthregion_{ict-\tau}$	0.0544	0.0542	0.0480*	0.0202	-0.0058
	(0.0361)	(0.0341)	(0.0250)	(0.0197)	(0.0151)
Observations	69,054	63,305	57,557	51,810	46,052
F-stat	27.33	22.33	18.76	17.94	17.19

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.6: Robustness test with binary aid indicator (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
	Panel A. Aid effectiveness				
$AidDummy_{ict-\tau}$	0.2628***	0.3100***	0.3720***	0.3358***	0.2581***
	(0.0947)	(0.0921)	(0.0887)	(0.0815)	(0.0756)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	50.30	58.22	47.79	42.02	61.15
	Panel B. Aid effectiveness and birth regions				
$AidDummy_{ict-\tau}$	0.2713***	0.3047***	0.3620***	0.3276***	0.2508***
	(0.0960)	(0.0921)	(0.0888)	(0.0832)	(0.0800)
$AidDummy_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0284	0.0056	0.0237	0.0244	0.0210
	(0.0423)	(0.0406)	(0.0320)	(0.0239)	(0.0215)
$Birthregion_{ict-\tau}$	0.0604	0.0575*	0.0483*	0.0209	-0.0045
	(0.0371)	(0.0347)	(0.0250)	(0.0191)	(0.0142)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	28.34	30.92	25.01	21.77	29.97

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.7: Robustness tests with log of ODA-like aid per capita (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
	Panel A. Aid effectiveness				
$ODApc_{ict-\tau}$	0.0996	0.1744*	0.2331**	0.2126**	0.1423**
	(0.0607)	(0.0957)	(0.0999)	(0.0929)	(0.0613)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	8.246	5.085	6.350	5.765	6.755
	Panel B. Aid effectiveness and birth regions				
$ODApc_{ict-\tau}$	0.1087*	0.1769	0.2318**	0.2269**	0.1587*
	(0.0654)	(0.1080)	(0.1069)	(0.1094)	(0.0838)
$ODApc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0434	-0.0153	-0.0067	-0.0608	-0.0493
	(0.0766)	(0.1028)	(0.0945)	(0.0831)	(0.0798)
$Birthregion_{ict-\tau}$	0.0521	0.0510	0.0435	0.0223	-0.0018
	(0.0375)	(0.0358)	(0.0266)	(0.0218)	(0.0163)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	4.605	2.936	3.110	2.432	2.339

Notes: Dependent variable: $Lightpc_{ict}$. Our instrument for ODA is the interaction of (logged) steel production and the probability to receive ODA-like aid. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.8: Robustness tests with log of economic infrastructure aid per capita (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
	Panel A. Aid effectiveness				
$EconAidpc_{ict-\tau}$	0.1096**	0.1307***	0.1654***	0.1420***	0.1276***
	(0.0433)	(0.0430)	(0.0465)	(0.0328)	(0.0411)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	43.56	52.68	36.70	39.01	29.69
	Panel B. Aid effectiveness and birth regions				
$EconAidpc_{ict-\tau}$	0.1013**	0.1172***	0.1554***	0.1356***	0.1225***
	(0.0409)	(0.0411)	(0.0450)	(0.0322)	(0.0415)
$EconAidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	0.2187	0.3911	0.2567	0.1953	0.1313
	(0.2750)	(0.3985)	(0.3111)	(0.2229)	(0.1768)
$Birthregion_{ict-\tau}$	0.0446	0.0440	0.0424*	0.0154	-0.0043
	(0.0326)	(0.0307)	(0.0243)	(0.0207)	(0.0169)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	1.576	1.314	1.057	0.967	1.081

Notes: Dependent variable: $Lightpc_{ict}$. Our instrument for economic infrastructure aid is the interaction of (logged) steel production and the probability to receive economic infrastructure aid. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.9: Robustness tests with instrument based on China's Cold War aid (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
	Panel A. Aid effectiveness				
$Aidpc_{ict-\tau}$	0.1348*	0.1534**	0.1858**	0.1503**	0.1343*
	(0.0773)	(0.0777)	(0.0829)	(0.0725)	(0.0782)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	8.292	7.116	6.790	8.275	8.757
	Panel B. Aid effectiveness and birth regions				
$Aidpc_{ict-\tau}$	0.1491*	0.1616*	0.1968**	0.1588**	0.1418
	(0.0890)	(0.0872)	(0.0940)	(0.0796)	(0.0867)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.1065	-0.0888	-0.0980	-0.0848	-0.0726
	(0.1099)	(0.1160)	(0.1126)	(0.0929)	(0.1019)
$Birthregion_{ict-\tau}$	0.0653	0.0710	0.0599*	0.0317	0.0029
	(0.0461)	(0.0443)	(0.0336)	(0.0268)	(0.0232)
Observations	69,252	63,481	57,710	51,939	46,168
F-stat	4.193	3.575	3.367	4.543	4.505

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the country level. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.10: Robustness tests with different clustering I (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
	Panel A. Two-way clustered by country and year				
$Aidpc_{ict-\tau}$	0.0753**	0.1002**	0.1295***	0.1146***	0.0906**
	(0.0340)	(0.0394)	(0.0278)	(0.0395)	(0.0389)
	Panel B. Clustered by ADM1 region				
$Aidpc_{ict-\tau}$	0.0753***	0.1002***	0.1295***	0.1146***	0.0906***
	(0.0234)	(0.0255)	(0.0271)	(0.0249)	(0.0230)
	Panel C. Two-way clustered by ADM1 region and year				
$Aidpc_{ict-\tau}$	0.0753**	0.1002***	0.1295***	0.1146***	0.0906**
	(0.0308)	(0.0371)	(0.0273)	(0.0411)	(0.0384)
	Panel D. Two-way clustered by ADM1 region and country-year				
$Aidpc_{ict-\tau}$	0.0883***	0.1000***	0.1272***	0.1151***	0.1027***
	(0.0292)	(0.0296)	(0.0340)	(0.0298)	(0.0284)
	Panel E. Clustered by ADM2 region				
$Aidpc_{ict-\tau}$	0.0753***	0.1002***	0.1295***	0.1146***	0.0906***
	(0.0254)	(0.0298)	(0.0311)	(0.0291)	(0.0265)

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the level indicated in the panel headers. *** (**, *): significant at the 1% (5%, 10%) level.

Table A.11: Robustness tests with different clustering II (2SLS estimates, ADM2)

Time lag τ	1	2	3	4	5
	Panel A. Two-way clustered by country and year				
$Aidpc_{ict-\tau}$	0.0782**	0.0985**	0.1291***	0.1166***	0.0934**
	(0.0343)	(0.0388)	(0.0277)	(0.0421)	(0.0431)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0322	0.0063	-0.0095	-0.0283	-0.0212
	(0.0437)	(0.0411)	(0.0463)	(0.0396)	(0.0348)
$Birthregion_{ict-\tau}$	0.0539	0.0534*	0.0466*	0.0221	-0.0027
	(0.0329)	(0.0293)	(0.0245)	(0.0167)	(0.0140)
	Panel B. Clustered by ADM1 region				
$Aidpc_{ict-\tau}$	0.0782***	0.0985***	0.1291***	0.1166***	0.0934***
	(0.0244)	(0.0257)	(0.0278)	(0.0266)	(0.0255)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0322	0.0063	-0.0095	-0.0283	-0.0212
	(0.0490)	(0.0560)	(0.0503)	(0.0314)	(0.0244)
$Birthregion_{ict-\tau}$	0.0539	0.0534	0.0466	0.0221	-0.0027
	(0.0428)	(0.0422)	(0.0362)	(0.0275)	(0.0148)
	Panel C. Two-way clustered by ADM1 region and year				
$Aidpc_{ict-\tau}$	0.0782**	0.0985***	0.1291***	0.1166***	0.0934**
	(0.0316)	(0.0374)	(0.0275)	(0.0440)	(0.0428)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0322	0.0063	-0.0095	-0.0283	-0.0212
	(0.0467)	(0.0461)	(0.0455)	(0.0402)	(0.0346)
$Birthregion_{ict-\tau}$	0.0539	0.0534	0.0466	0.0221	-0.0027
	(0.0391)	(0.0377)	(0.0334)	(0.0243)	(0.0137)
	Panel D. Two-way clustered by ADM1 region and country-year				
$Aidpc_{ict-\tau}$	0.0782***	0.0985***	0.1291***	0.1166***	0.0934***
	(0.0265)	(0.0302)	(0.0317)	(0.0310)	(0.0291)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0322	0.0063	-0.0095	-0.0283	-0.0212
	(0.0495)	(0.0566)	(0.0466)	(0.0285)	(0.0236)
$Birthregion_{ict-\tau}$	0.0539	0.0534	0.0466	0.0221	-0.0027
	(0.0426)	(0.0418)	(0.0346)	(0.0272)	(0.0152)
	Panel E. Clustered by ADM2 region				
$Aidpc_{ict-\tau}$	0.0782***	0.0985***	0.1291***	0.1166***	0.0934***
	(0.0234)	(0.0254)	(0.0280)	(0.0267)	(0.0249)
$Aidpc_{ict-\tau} \times Birthregion_{ict-\tau}$	-0.0322	0.0063	-0.0095	-0.0283	-0.0212
	(0.0489)	(0.0560)	(0.0499)	(0.0312)	(0.0245)
$Birthregion_{ict-\tau}$	0.0539	0.0534	0.0466	0.0221	-0.0027
	(0.0427)	(0.0420)	(0.0362)	(0.0277)	(0.0148)

Notes: Dependent variable: $Lightpc_{ict}$. All specifications include country-year- and region-fixed effects. Standard errors (in parentheses) clustered at the level indicated in the panel headers. *** (**, *): significant at the 1% (5%, 10%) level.