Paving their own Road? Local Chinese and World Bank Aid and Foreign Direct Investment in Africa.

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ABSTRACT

To what extent does foreign aid influence the siting of foreign direct investment? There are strong reasons to think that foreign aid may make a location more attractive to investment by improving the infrastructural, institutional, or human capital environment and/or by serving as a signal of a location's risk. However, while these aid-led improvements may produce public goods increasing the attractiveness of a location to all firms, there is also reason to think that some aid donors might try to privilege investment their own firms when providing aid. To shed further light on these questions this paper uses spatial and temporal variation in localized, geo-referenced, data to evaluate if foreign aid from the World Bank and China attracts FDI in sub-Saharan African. While we expect that foreign aid in a given location should lead to increased investment decisions by firms from all countries, we also evaluate the impact on FDI from China ("1st party effect") compared to FDI from other sources ("3rd party effect"). Given the close linkages between state and firms, we expect that Chinese aid helps "pave the way" for Chinese investment both through state-firm coordination, but also by building longer-term local ties and connections that can facilitate later investment. We compare the Chinese results to the effect of aid from the World Bank on FDI from China and other sources. The paper finds strong overall support that local aid boosts local FDI, supporting cross-country findings with a much more fine-grained analysis. However, we also find that Chinese aid leads to a far greater percent increase from the baseline of Chinese FDI compared to FDI from the third-party countries. Thus, while both Chinese and World Bank appears effective in improving the likelihood of local investment, Chinese aid appears to be used specifically to "pave the way" for later Chinese investment.

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INTRODUCTION

Foreign direct investment (FDI) is an important source of external financing to many countries, in particular, countries in Sub-Saharan Africa (SSA). FDI is crucial to those countries whose levels of income and domestic savings are low. FDI can spur investment and economic growth and development. Despite their efforts, however, it is difficult for Sub-Saharan African countries to attract much FDI (Anyanwu 2012). Due to the irreversible nature of FDI, multinationals are vulnerable to outright expropriation and arbitrary policy changes in host countries. This leads to an important problem for many countries who seek FDI because they can't make credible commitments to their investment-friendly policies and regulations. Especially, due to politically instability and a lack credibility of reform, multinational firms perceive SSA as a risky region for business (Asiedu 2006, Asiedu 2002).

Yet, the source, magnitude, and timing of FDI in Sub-Saharan Africa (SSA) vary greatly. Sub-Saharan Africa is also host to a vast quantity of official development assistance (ODA), which also varies in terms of time and location and is ostensibly purposed to improve the investment environment, among other aims. This variation brings up two important questions: (1) To what extent can the siting of ODA influence firms' decisions to invest in SSA, especially given high levels political risk? and (2) is aid from specific donors used to facilitate their FDI flows from their own firms? To answer these questions, we develop a theory of foreign aid and investment in Africa, emphasizing the role of local aid. Our theoretical framework suggests that foreign aid, especially at the local level, helps to explain patterns of FDI inflows into SSA. We argue that aid provides investors with new information about investment in a given region. Specifically, aid boosts economic infrastructure, increasing the expected productivity and, consequently, the anticipated profits of investments. Also, aid signals political or economic stability for a given region, which lowers investment risk that investors perceive. Thus, foreign aid induces FDI in the same region.

However, we also explore these dynamics with particular reference to Chinese aid and FDI. Since the turn of the century, Chinese investment has increased rapidly and the country is now one of the leading sources of FDI in SSA. Our theoretical framework emphasizes the motives and behavior of Chinese firms relative to firms from other countries. Specifically, we suggest that Chinese firms are more likely to coordinate location decisions, either indirectly or directly with the Chinese government and, consequently, Chinese FDI is more

likely to be directed by strategic state policy planning. As a result, we expect that Chinese aid will have a more pronounced effect on Chinese FDI than FDI from other source countries. As a foil, we compare the China results using aid from the World Bank which we argue, in the absence of a single principal, is less likely to have the source-country specific effect on FDI.

To evaluate these claims, our paper combines several geo-coded foreign aid datasets in Africa from the AidData project with several thousand geo-referenced FDI project locations from the Financial Times fDi Markets database. The geo-spatial revolution in development data has facilitated the rise of new research agendas which consider the political economy of subnational and local aid allocation and impact. Recent studies have used geo-referenced data to consider questions of aid's local impact on topics including growth, welfare, the environment, and governance (Dreher and Lohmann 2015, Bitzer and Goren 2018, Blair and Roessler 2018, Martorano et al. 2018). Other work has considered the political motivations behind sub-national allocation of aid (Briggs 2017). Sub-national investigations allow both for more fine-grained empirical analysis but also for an evaluation of subnational discrepancies or inequalities. In our case, these geo-referenced data allow for estimation strategies that leverage information on project timing and location to evaluate an aid treatment effect. Accordingly, this paper uses a difference-in-difference like identification strategy that compares location-years with *active* aid projects to those locations that do not yet have an active aid project, but subsequently will and the sites local neighbors who never receive aid.

To the best of our knowledge, this is the first subnational analysis of the relationship between aid and FDI in sub-Saharan Africa over time. The results suggest that, in general, aid is substantially effective in attracting local FDI. Location-years with active aid projects are multiple times more likely to receive *any* FDI project compared to location-years without current aid projects, but who will have aid projects in the future, and neighboring locations with no aid projects at any time. When looking at aid and FDI from individual source actors, the results are more nuanced. Chinese aid attracts FDI from all sources, but the increase is substantially larger on Chinese FDI compared to other sources. In contract, while active aid from the World Bank also attracts FDI projects, the differential effects based on FDI source are considerably smaller, although the impact on Chinese aid is still marginally larger than other sources. While some of these effects may derive from the fact that China had a lower base-rate of FDI in SSA, the differential effect of Chinese aid on Chinese FDI is strongly

suggestive of active coordination between Chinese aid and Chinese FDI efforts. This finding contributes to the literature on aid and FDI and also speaks to a broader literature on the heterogeneous behavior of investors.

AID AND FDI

A substantial amount of literature has suggested that aid may facilitate FDI, including in Africa (Harms and Lutz 2006, Anyanwu 2012, Amusa et al. 2016), although others have noted that aid may also simultaneously serve to crowd out FDI (Selaya and Sunesen 2012). At an abstract level, foreign aid can boost economic infrastructure (Donaubauer et al. 2016), serve in a signaling function, especially in post-conflict countries (Garriga and Phillips 2014), or facilitate human capital and social cohesion (Donaubauer et al. 2014, Cleeve et al. 2015, Addison and Baliamoune-Lutz 2016) which in turn attracts FDI.

While most studies have suggested that the relationship between aid and FDI is positive, some have suggested this only applies for some countries (Kimura and Todo 2010, Arazmuradov 2015) while other work has found a negative relationship between the two (Donaubauer 2014). Although a large body of work has examined the relationship between Official Development Assistance (ODA) and FDI at the recipient *country* level, research on the impact of aid on FDI has not considered the subnational impacts of aid.[2] Even in the literature that considers the broader determinants of FDI, there are relatively few papers that considers the politics of subnational siting of FDI.[3]

Theory

We argue that foreign aid will increase investment across Africa, especially at a local level. Generally, we suggest two broad mechanisms by which aid might lead to changes in investors' perceived risks and profits of investment. The two channels through which aid may impact the likelihood of investment are by building public goods (*functional* effect) and by signaling information about the investment environment (*signaling* effect), both of which we expect to be most salient at a local level.

[2] The notable exception is Blaise's (2005) study on Japanese inflows to China.
[3] Samford and Gomez's (2014) study of FDI in Mexico is a notable exception.

We also focus on the source-specific mechanism by which Chinese aid might induce Chinese FDI more than FDI from other countries. Chinese firms are tightly controlled by Beijing. Chinese FDI, especially in developing countries, is heavily influenced by national and/or provincial governments (Morgan and Zheng 2019; Morgan 2021). Due to close coordination between state and business as well as direct control of the state, Chinese aid promotes Chinese FDI; that is, China paves their own path. In contrast, we expect World Bank aid increases FDI inflows in Africa, regardless of the source.

Infrastructure and productivity

The *functional* argument asserts that aid may serve a specific economic purpose by increasing the expected productivity of new FDI. This may occur particularly with aid that is classified as "Aid for Trade" (AfT). AfT is a broad conceptualization and includes categories of productive infrastructure – including transportation, energy, communications and utilities infrastructure – but also can include, often industry-specific, technical training or research and development (Brazys 2013). This type of aid may help improve the regulatory and infrastructural business environments, increasing attractiveness to FDI (Lee and Ries 2016). Donaubauer et al. (2016) show that this functional effect can also be indirect in that infrastructure aid may increase a recipient countries' infrastructure endowment. This functional argument becomes even more plausible when considering a local proximity. For most physical infrastructure, it is reasonable to assume that firms need to be sufficiently near to take advantage of the amenities in a manner which will increase productivity. New roads, electric transmission lines or water supplies will only be attractive for firms if they can directly access that infrastructure. Even infrastructure such as airports or seaports, or international road or rail links, will likely only serve those firms within a defined geographic catchment area.

The literature has also argued that functional aid may consist of that which improves the *human* capital in a given area. Most notably, Donaubauer et al. (2014) argue and evidence that education aid attracts FDI in Latin America. However, the causal link in this argument again is stronger when considering local effects. While there may be some human factor mobility, one can assume that improved education is most likely to upskill the *local* labor pool. Health aid may work in a similar fashion, as it has been shown that healthier workers

are more productive (Graff and Neidell 2013, Baldwin and Weisbrod 1974). Again, health projects are likely only to disproportionately impact those in geographic proximity to the project. Projects that promote health and education may then increase the productivity of the local labor pool, making that locality more attractive to foreign investors.

Risk and signaling

Because all FDI is irreversible to some degree, multinationals face the "obsolescing bargain" problem (Vernon 1971), which arises when firms lose the initial bargaining advantage after investment as the balance of bargaining power shifts to host governments. Firms are vulnerable to outright expropriation and arbitrary policy changes in host countries. As a result, it is difficult for countries to make credible commitments to their business-friendly policies and attract FDI. This is an important problem for many developing countries who depend on FDI as a major source of external financing. However, aid can mitigate the adverse effect of expropriation risk on FDI (Asiedu et al. 2009**).** Aid provides new information to potential investors about the investment climate. Local aid signal investors that the area is politically and economically safe and stable, and further business-friendly and -efficient. Investors revise their assessment of the investment environment in the host country and/or region and reconsider investing.

Once again, locality heightens the *signaling* argument of aid attracting foreign investors. Garriga and Phillips (2014) examine aid as a signal in post-conflict situations, suggesting that aid can serve a role in low information environments, signaling to investors that a country has sufficient political or economic stability for investment. As many conflicts are subnational, aid may signal to investors that a region previously affected by conflict or instability is now safe for investment. But this signaling need not be constrained to post-conflict states. Aid from a particular host country can also signal a country's broader engagement with a partner country, perhaps reducing institutional risk for investors. New aid might also suggest that future economic relations between the countries may intensify, say through a closer trading relationship, which could positively impact the return on the investment.

Donaubauer et al. (2016) also explain how FDI may serve as a signal to investors to anticipate an increase in (domestic) (economic) infrastructure. Thus, the aid itself may not (only) be doing the heavy lifting in increasing productivity but may also send a signal on the

infrastructure priorities and focus of a host government. Again, this signal is likely to be local. If, for instance, an aid project supports the construction of a bridge then it may be a reasonable assumption that the host government will also invest in upgrading the local thoroughfares and access roads that utilize that bridge. States often invest heavily in promoting infrastructure in specific areas, most notably by fostering special economic or export zones (SEZs) (Cieslik and Ryan 2005). Aid may be a leading indicator of further state investment in these areas.[4] Importantly, however, some authors note that some types of aid, such as IMF programs, may instead act as a *critical* signal, sending information about ongoing or impending crisis (Breen and Egan 2019). However, with this latter caveat in mind, the discussion above generally suggests a positive relationship between aid and FDI. Accordingly, our first hypothesis is:

Hypothesis 1: Local aid will increase local foreign direct investment

Chinese Aid and FDI

While the cross-country literature is broadly supportive of this positive link between aid and FDI, the existing literature is relatively agnostic regarding source country heterogeneity in the aid-FDI relationship.[5] However, there is substantial reason to suspect country heterogeneity in the political economy of aid allocation. Considerations of foreign economic policy motivation date to at least McKinlay and Little (1977) and McKinlay (1979) and have sustained a prolonged debate if foreign aid is given to suit "donors' interests", "recipients' needs" or both (Alesina and Dollar 2000, Berthelemy and Tichit 2004, Brazys 2013). More recently, Bermeo (2017) has argued that aid may be "targeted" for development purposes in countries most likely to engender spillovers to the donor. Extending the logic of this literature, it is eminently plausible to think that aid from some donors may be used to facilitate FDI from that country in a self-interested, strategic, fashion. Indeed, the use of aid to "pave the way" for subsequent FDI from the same originating country would be highly suggestive of an imperialist critique that has undermined discourses such as the "new scramble for Africa" (Ayers 2013).

[4] Empirically, however, China's development efforts in Africa appear to be the only ones that have been explicitly focused around these types of special economic areas (Brautigam and Xiaoyang 2011, Page and Shimeles 2015).
[5] Kimura and Todo (2010) who find that Japanese aid only attracts Japanese FDI being an important exception.

China has recently emerged as a major actor in the development space, particularly in sub-Saharan Africa. Globally, China has also substantially increased its net outflows of FDI from $4.6 billion in 2000 to zenith of $216.4 billion in 2016.[6] In Africa, China has become one of the leading sources of FDI since China's Going Global Strategy along with the Forum on China-Africa Cooperation (FOCAC) in 2000, with an FDI stock of nearly $50 billion by 2019. In the past years, China has overtaken the US as the largest foreign direct investor in Africa.[7] Overall, the empirical evidence on this engagement is nuanced. While some work suggests that Chinese aid is effective in boosting growth (Dreher et al. 2017), other work suggests Chinese development efforts may undermine local governance (Brazys et al. 2017; Isaksson and Kotsadam 2018) or traditional donors' conditionality efforts (Hernandez 2017). Indeed, work examining Chinese outward FDI suggests that it is more likely to be directed to weak governance states than FDI from other sources (Chen et al. 2018).

As China has been rapidly becoming an important source of external financing, there are a growing number of studies on the motivations and behavior of Chinese FDI, especially in Africa. Much literature on Chinese FDI explores why Chinese firms choose to invest Africa despite its high political risk. Scholars have suggested the imperfect property and capital market (Buckley et al. 2016, Chen et al. 2018, Jean et al. 2011), coordination between state and business (Buckley et al. 2007), or provincial features of China (Morgan 2021, Chen 2015) as a key determinant of Chinese FDI inflows into such a risky market. Morgan and Zheng's (2019) historical study of Chinese aid and contemporary investment, in particular, notes how Chinese aid built "social capital", or familiarity and knowledge of an area, which was then used to inform commercial investment in the same area.

Several studies have suggested that a strong interest in securing access to the natural resources is a key determinant of Chinese aid to developing countries (Mohan and Power 2008, Berthélemy 2011, Foster et al. 2008), though the results have been mixed (Hendrix and Noland 2014, Dreher and Fuchs 2015). In a similar vein, there is a popular perception that Chinese development efforts are primarily intended to help China, and indeed there is some

[6] Current USD. Source: https://data.worldbank.org/indicator/BM.KLT.DINV.CD.WD?locations=CN Accessed 09/29/2201

[7] http://www.sais-cari.org/chinese-investment-in-africa; https://blogs.lse.ac.uk/africaatlse/2021/04/02/why-substantial-chinese-fdi-is-flowing-into-africa-foreign-direct-investment/ accessed 29/09/2021

evidence that Chinese aid flows increase Chinese FDI flows to the same country which is perhaps unsurprising given the state's heavy hand in both aid and FDI (Su et al. 2017). In addition to that, Chinese FDI is influenced by the state and often considered as state-owned as Chinese firms are directly and indirectly controlled by the state (Buckley et al. 2007, Buckley et al. 2006). In the state-led business system of China, private firms would like to avoid conflicts and friction with Beijing.

Thus, while aid facilitates the provision of public goods which are not completely excludable, we think that Chinese aid may provide a disproportionate boost to Chinese FDI via private informational advantages that Chinese aid can provide to Chinese FDI on the institutional quality, market opportunities, and risk in a locality. This information is both private and costly, and non-Chinese firms will find it more difficult to obtain. Moreover, Chinese aid may directly coordinate with firms, and thus give Chinese firms a "first mover" advantage in locating FDI to an area. Chinese firms can begin planning investment decisions alongside aid planning decisions which may not be immediately known to non-Chinese firms. In contrast, World Bank aid should provide no such informational or coordination advantage to FDI from any particular source country. World Bank project planning is transparent and likely to be accessible to all parties equally, while any World Bank knowledge on location-specific institutional quality, market opportunities or risk is also unlikely to be private to FDI from any particular source. Accordingly, while we expect local aid to boost local FDI generally, we expect that Chinese aid will disproportionally boost Chinese FDI. As such, our second hypothesis:

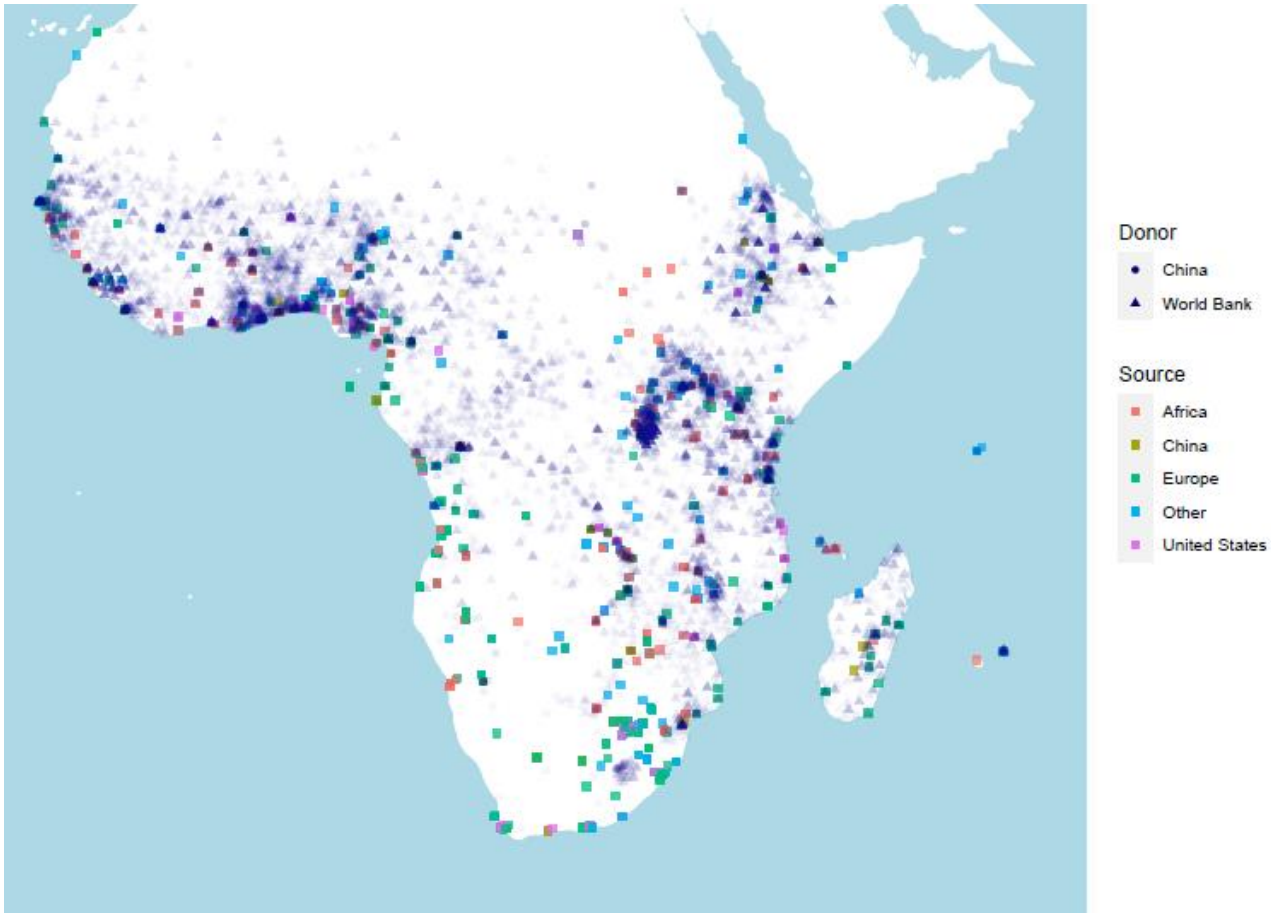
Hypothesis 2: Chinese Aid will disproportionally increase Chinese FDI compared to FDI from other sources.

DATA AND METHODS

We limit our analysis to Sub-Saharan African host countries to examine the unique relationship between the aid and FDI in the poorest global region which is recognized as a risky continent to conduct business but has also seen a recent uptick in Chinese investment in the region. The outcome phenomena of interest are greenfield and expansion FDI projects drawn from the Financial Times fDI markets database, which has been used in a small but growing number of recent studies in economic and political science (Gil-Pareja et al. 2013,

Owen 2018, Saltnes et al. 2020, Brazys and Kotsadam 2020). These data include timing information, source country and geographic data for 9,864 project locations in fifty-six African countries from 2003 to 2017. Of these, 6,133 project records contain geographic destination information at the city-level and 3,986 are in the sub-Saharan region, and accordingly the analysis uses these projects. While the data does include information on project size, both in terms of investment amount and job creation, the bulk of this is estimated, and potentially biased. Accordingly, this paper relies on project events as this data is verified and cross-referenced in the original fDi Markets methodology.[8] The main explanatory variables come from AidData's geo-coded datasets: the World Bank geo-coded research release 1.4.2 (AidData 2017) which covers World Bank projects across the globe and similar project-level, geo-coded, and data on Chinese development efforts

Map 1: FDI and World Bank and Chinese Aid in sub-Saharan Africa



[8] The fDi markets data is gathered from media sources, industry organizations, investment promotion agencies, market research companies and from the Financial Times' own newswires and sources. The dataset is cross-referenced to multiple sources with preference for direct company sources. The World Bank, UNCTAD and over 100 national governments use the information as primary source data for investment trends.

(Strange et al. 2017) which also has pan-African coverage.[9] Across sub-Saharan Africa we identify 17,217 unique aid locations (15,315 World Bank; 1,902 China) from 1995 to 2014. Descriptive statistics can be found in the supplementary appendix. Map 1 displays the spatial locations, in navy, of the World Bank (triangle) and Chinese (circle) ODA projects, while the FDI projects are displayed as squares, colored by source country (China=Tan , US=Magenta , Europe=Green , Africa=Red , and "Other"=Blue)[10]

The paper employs a spatial-temporal identification strategy to evaluate the hypotheses. Starting with a panel of 5-minute grid cells across sub-Saharan Africa, we geo-locate both aid and FDI within a capture radius of the centroid of these cells. This gives a panel of spatial units from 2003 to 2017 that contain aid, FDI, both or neither. With this data construction, we employ a difference-in-difference like approach similar to that used in Knutsen et al.'s (2017) study of mining and local corruption. To set up the analysis, the paper takes advantage of the fact that both the aid and FDI project records indicate the timing of projects. The outcome measure is a new FDI project in the capture radius in a site-year. To evaluate our hypotheses, we both evaluate FDI from all sources combined, but then also identify FDI by country/region source including FDI from China, the United States, Europe (EEA and UK), Africa, and all other countries. The primary analysis relies on a linear probability model. For these models, the outcome variable is a binary indicator that equals "1" if the site had any new FDI project (from a given source) in a given year and "0" otherwise.

In terms of the treatment, three groups of sites are considered. First, there are site-years that are within the capture radius of *active* aid project, i.e. one that has begun in or prior to that year. Second, there are site-years that capture an *inactive* aid project, i.e. a project that has not yet begun in the panel year but subsequently will. Finally, there are sites which are outside the capture radius of any aid project (active or inactive). However, as discussed in a similar approach in Christensen (2019), rather than comparing the active and inactive sites to all other sites, it may be more appropriate to compare these sites only to their geographic neighbors. This comparison is based on the fact that location-specific unobservable factors are likely to be more similar at neighboring sites rather than sites far afield. Additionally,

[9] Where we only use projects that are coded as "ODA-like."
[10] Where "Europe" FDI projects include those from the EU-27, the EEA, Switzerland and the UK.

many grid cells are likely to be in locations that are theoretically unlikely to ever attract aid or FDI (deserts, mountain peaks, lakes, etc.). Accordingly, keeping those sites as comparators might both bias the treatment effect but also artificially reduce standard errors. As such, we match sites that receive aid at any time to their eight closest neighbors (their contiguous grid-cell neighbors) and only keep these units as comparators.

Paraphrasing Knutsen et al.'s (2017, pp. 327-8) explanation, interpreting the *active* coefficient alone in the setup above would assume that aid siting is uncorrelated with FDI placement before the aid project becomes active. However, this is a strong assumption since unobserved characteristics may make a particular site attractive to both aid and FDI. Accordingly, including *inactive* allows for comparing sites *before* an aid project become active with sites *after* an aid project becomes active, and not only areas near and far from aid projects. As such, test results are provided for the *difference* between *active* and *inactive* ($\beta_1 - \beta_2$) which gives a difference-in-difference like measure that accounts for any latent, time-invariant, features that influence both aid and FDI siting. In setting *active* site-years we assume that once a site becomes active it stays active for the duration of our sample period. This assumption is driven by two arguments. First, aid projects may take some (variable) amount of time to be implemented and completed. Second, we expect that once aid has "improved" a location (either through the provision of new infrastructure or the improvement in the quality of human capital or institutional environment), that improvement is durable, at least for the duration of our sample period which is no more than 15 years. Accordingly, our expectation is that "active" aid increases the attractiveness of a site to FDI an any time after the aid has been implemented.

The spatial identification assumes that aid will attract FDI within a given some cutoff distance. As discussed in Knutsen et al. (2017), one has to make an assumption about the geographic reach of the capture radius for the treatment. This is ultimately an empirical question that includes a trade-off between the precision of the geo-location in the data, noise, and the size of the treated unit. The analysis employs precision code "2" or better in the AidData, which is equivalent to " 'near', in the 'area' of, or up to 25 km away from an exact location".[11] Accordingly, we use a 25km capture radius in our primarily analyses. However,

[11] See the AidData geocoding methodology at http://docs.aiddata.org/ad4/files/geocoding-methodology-updated-2017-06.pdf accessed 13-02-2019

we are also cognizant of the Modifiable Area Unit Problem (MAUP) (Fotheringham and Wong, 1991). The MAUP can introduce biases into spatial analysis as arbitrary borders may introduce bias. In essence, the concern is exemplified by a situation where an outcome of interest and its explanatory factor may lie very close but on either side of an (arbitrary) border. While the phenomenon might be spatially contiguous, they would not be coded as being in the same areal unit. Accordingly, to try and mitigate this problem, in the robustness checks we run our primary models across a range of capture radii for the treatment. That said, larger capture radii will introduce attenuation bias (wherein units that are not actually "treated" are coded as "treated"), and thus we would expect the magnitude of the treatment effect to diminish at expanded radii.

We use country-year fixed effects with standard errors clustered by site. The country-year fixed effects capture any unobserved country-level, temporal, phenomena which might otherwise influence FDI location such as the establishment of a new trade agreement (Osnago et al. 2017), changes in institutional or infrastructural environment (Jensen 2012), participation in an IMF program (Breen and Egan 2019), regime change / stability / expropriation risk / institutional quality / electoral rules (Li 2009; Morrissey and Udomkerdmongkol 2012), or the presence / absence of conflict (Driffield et al. 2013). Clustering standard errors at the site level accounts for any site-level autocorrelation over time.

The baseline reduced form specification is:

$$Y_{it} = \beta_1 * active + \beta_2 * inactive + \alpha_{ct} + \varepsilon_{it}$$

where the FDI project outcome measure at site *i* in time *t,* is regressed on *active* and *inactive.* As discussed, (α_{ct}) are the country-year fixed effects, and ε_{it} are the clustered standard errors. However, it is also important to note that the data is temporally truncated, as the fDi Markets data coverage only begins in 2003 and, as such, the existing stock of FDI prior to 2003 is unknown. Thus, as robustness check below, we consider a model where countries who were "active" in the first three years (2003-2005) are omitted to ensure that every site was "untreated" for at least the preceding three years prior to the arrival of aid. We do not include any other exogenous controls in the models as almost any site-level, observable, control that we might imagine - poverty, population, nighttime light, governance quality, etc. - is likely to

also be influenced by aid and incorporating these controls would introduce post treatment bias (Montgomery et al. 2018) even if we could find data at this level of granularity.

RESULTS

The results for the active-inactive approach presented in Tables 1 to 3. Before turning to the source country of the aid, we make a few general observations. First, in each table, the general hypothesis (1) that aid attracts FDI is strongly supported. This result holds both when considering all FDI (models 1 in each table), and FDI from specific subgroups of actors (models 2 to 6 in each table). Second, and likewise holding for all FDI and FDI from specific subgroups, there is strong evidence that there are indeed selection effects, as the positive and significant finding *inactive* coefficient indicates that site-years where there was not yet received aid, but would be in later years, were also more likely to have FDI compared to neighboring sites that would never receive aid. This finding stresses the importance of accounting for these selection effects in the "active-inactive" approach. However, the magnitude of the difference between "active" and "inactive" is large and strongly significant in all models.

Table 1: Combined World Bank and China Aid by FDI Source

VARIABLES	(1) All	(2) China	(3) US FDI	(4) Europe	(5) Africa	(6) Other
Active	2.337***	0.214***	0.457***	1.097***	1.000***	0.930***
	(0.055)	(0.010)	(0.021)	(0.034)	(0.030)	(0.024)
Inactive	0.304***	0.036***	0.084***	0.167***	0.153***	0.009
	(0.048)	(0.005)	(0.020)	(0.033)	(0.021)	(0.025)
Observations	1,209,225	1,209,225	1,209,225	1,209,225	1,209,225	1,209,225
Country-Year FE	YES	YES	YES	YES	YES	YES
Clustered SEs	YES	YES	YES	YES	YES	YES
Difference in difference	2.034	0.178	0.374	0.930	0.848	0.922
F test: active-inactive=0	880.253	349.724	196.630	476.962	649.104	647.132
p value	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Turning to the substantive effects, as these are linear probability models, the difference-in-difference measure is interpreted as the absolute increase in probability that a site-year

receives a FDI project. As receiving FDI is a relatively low-probability event, the magnitude of the coefficients is quite small. The probably that any site-year in the combined sample receives an FDI project is just less than 2%. Also, as the baseline probability differs depending on the source of the FDI, these coefficients and differences are not directly comparable across models. Indeed, the baseline probability in the combined sample ranges

Table 2: China Aid Only by FDI Source

VARIABLES	(1) All	(2) China	(3) US	(4) EU	(5) Africa	(6) Other
Active	11.274***	1.327***	2.634***	5.696***	5.961***	4.121***
	(0.303)	(0.064)	(0.132)	(0.200)	(0.190)	(0.121)
Inactive	2.497***	0.089***	0.570***	1.233***	0.935***	0.964***
	(0.186)	(0.033)	(0.070)	(0.119)	(0.093)	(0.091)
Observations	231,240	231,240	231,240	231,240	231,240	231,240
Country-Year FE	YES	YES	YES	YES	YES	YES
Clustered SEs	YES	YES	YES	YES	YES	YES
Difference in difference	8.777	1.238	2.064	4.463	5.026	3.157
F test: active-inactive=0	731.407	324.767	225.773	453.009	640.686	473.954
p value	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: World Bank Aid Only by FDI Source

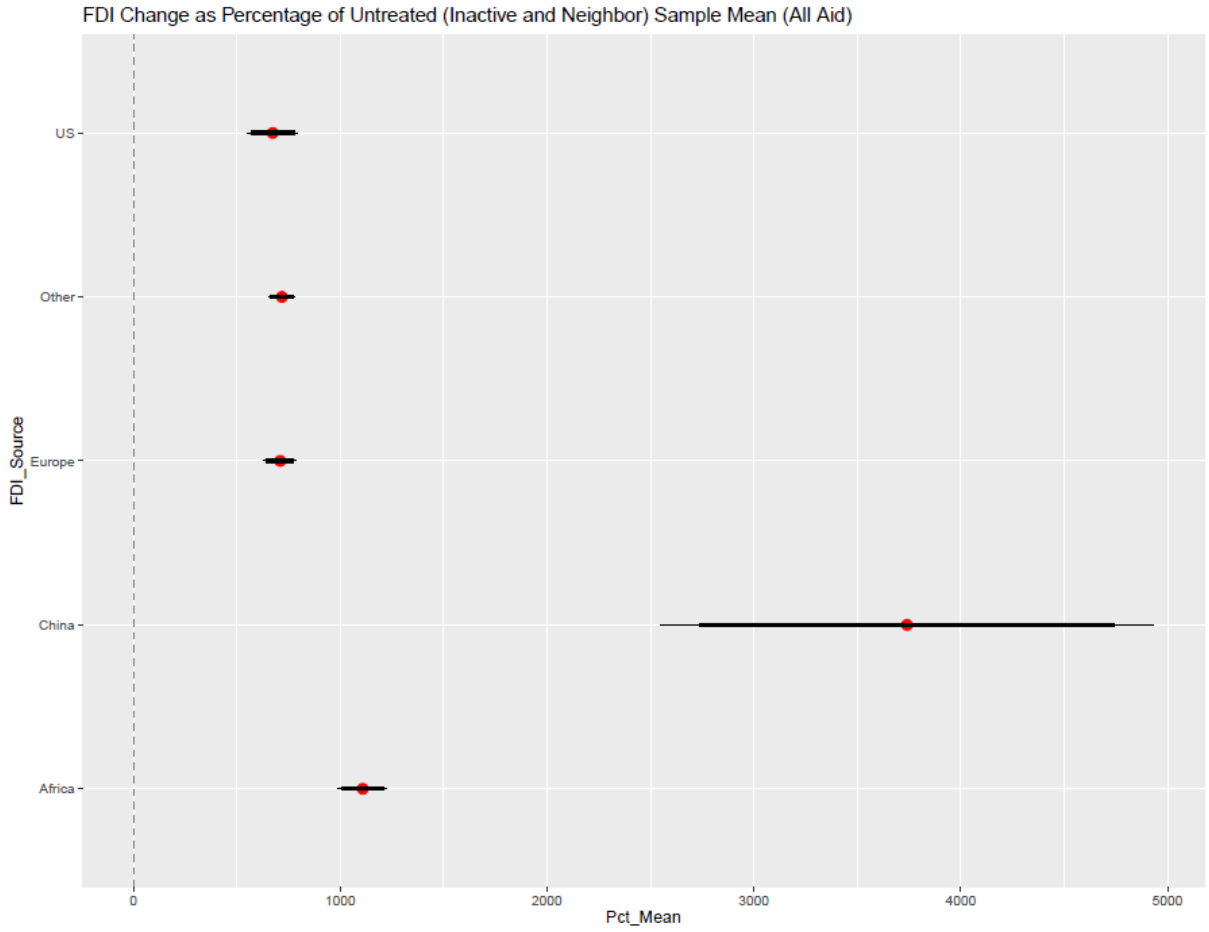
VARIABLES	(1) All FDI	(2) China	(3) US	(4) EU	(5) Africa	(6) Other
Active	2.183***	0.204***	0.436***	1.037***	0.930***	0.842***
	(0.051)	(0.010)	(0.019)	(0.031)	(0.028)	(0.021)
Inactive	0.620***	0.074***	0.173***	0.379***	0.262***	0.109***
	(0.055)	(0.007)	(0.025)	(0.041)	(0.024)	(0.025)
Observations	1,100,925	1,100,925	1,100,925	1,100,925	1,100,925	1,100,925
Country-Year FE	YES	YES	YES	YES	YES	YES
Clustered SEs	YES	YES	YES	YES	YES	YES
Difference in difference	1.563	0.130	0.263	0.658	0.669	0.733
F test: active-inactive=0	557.149	181.921	81.760	232.589	567.201	536.105
p value	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

from 0.158% that a site-year receives Chinese FDI to 0.876% that a site-year receives European FDI. Accordingly, a better comparison is the difference measure as a percentage

increase on the mean sample probability.[12] We present these results graphically in figures 1 through 3. When viewed this way, the substantive impacts are substantial. Overall, the increase of the difference between active and inactive sites on probability of a site-year receiving FDI, compared to the sample mean probability of the inactive and neighbor sites, is between roughly 450% and roughly 3750%, depending on the source of the aid and FDI. These findings are again very strong evidence in support of our general hypothesis (1) that active aid sites attract future FDI, consistent with the cross-national evidence.

Figure 1: Difference in receiving FDI as Percentage of Sample Mean (All Aid)

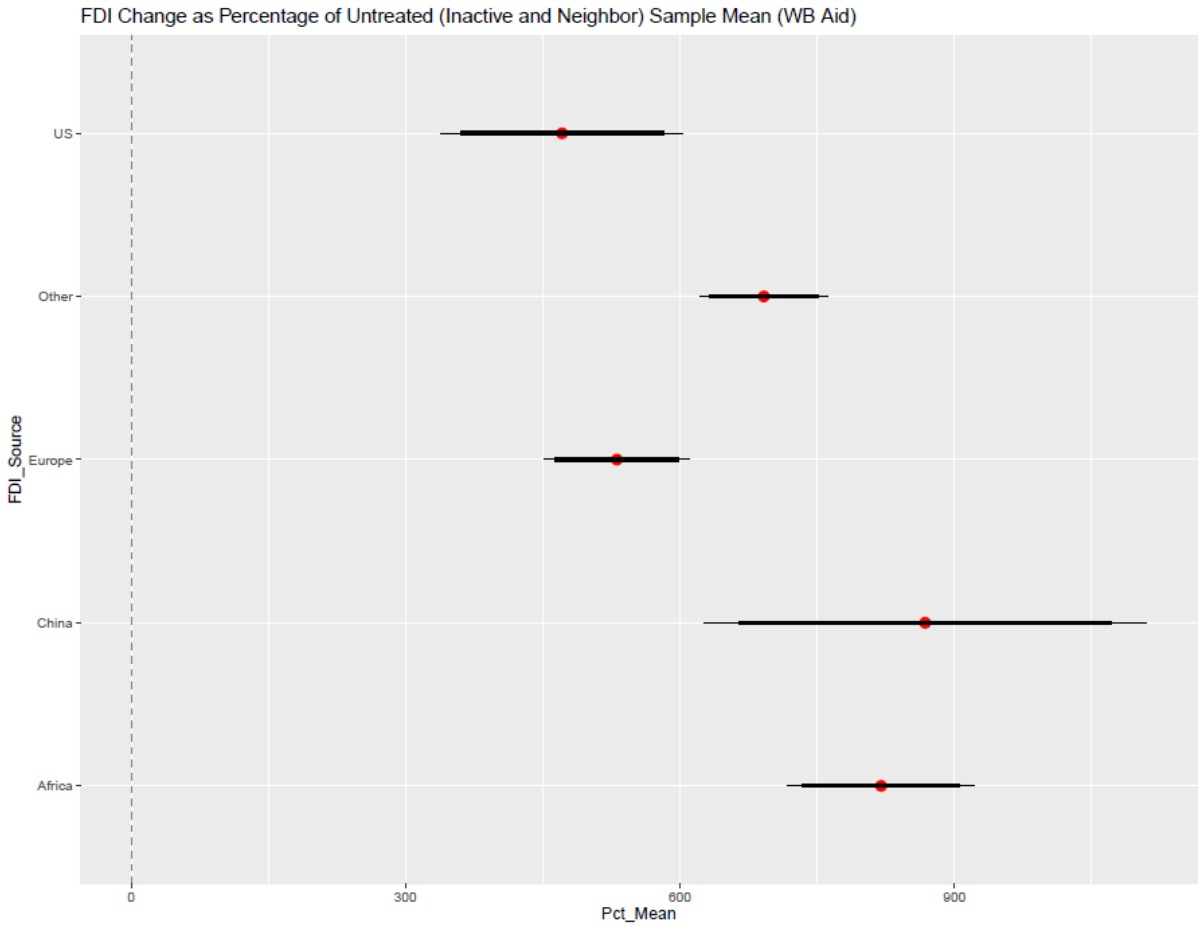


To evaluate our expectations on heterogenous effects based on the source of aid and FDI, we again turn to the comparisons in figures 1 to 3. As shown there, the range of impact on FDI

[12] In order to calculate the standard errors for this measure we first simulate a number of active and inactive draws for each model equal to the number of observations from the model. From these simulations we derive a distribution of the difference measure. We then simulate the same number of draws of the non-active sample mean (inactive and neighbor sites). We then take the ratio of the difference measure and this sample mean measure to get the point estimate of the difference as a percentage of the non-treated sample mean. We then use a Taylor expansion using the moments from the difference and sample mean distributions to derive the variance of the ratio measure.

varies somewhat depending on the source. When considering aid from both China and the World Bank (figure 1) we see that the impact on Chinese aid is quite substantial. The increase of the difference between active and inactive sites equals 3750% of the FDI probability in the sample of inactive and neighbor sites, while the increase of this difference is between roughly 675% and 720% for Europe, US and "Other" FDI sources. Notably, the increase from the difference between active and inactive sites for FDI from other African countries, at roughly 1110% of the inactive and neighbor sample mean, is also significantly higher than US, European and "other" sourced FDI, although this impact is still significantly less than the impact for Chinese-sourced FDI.

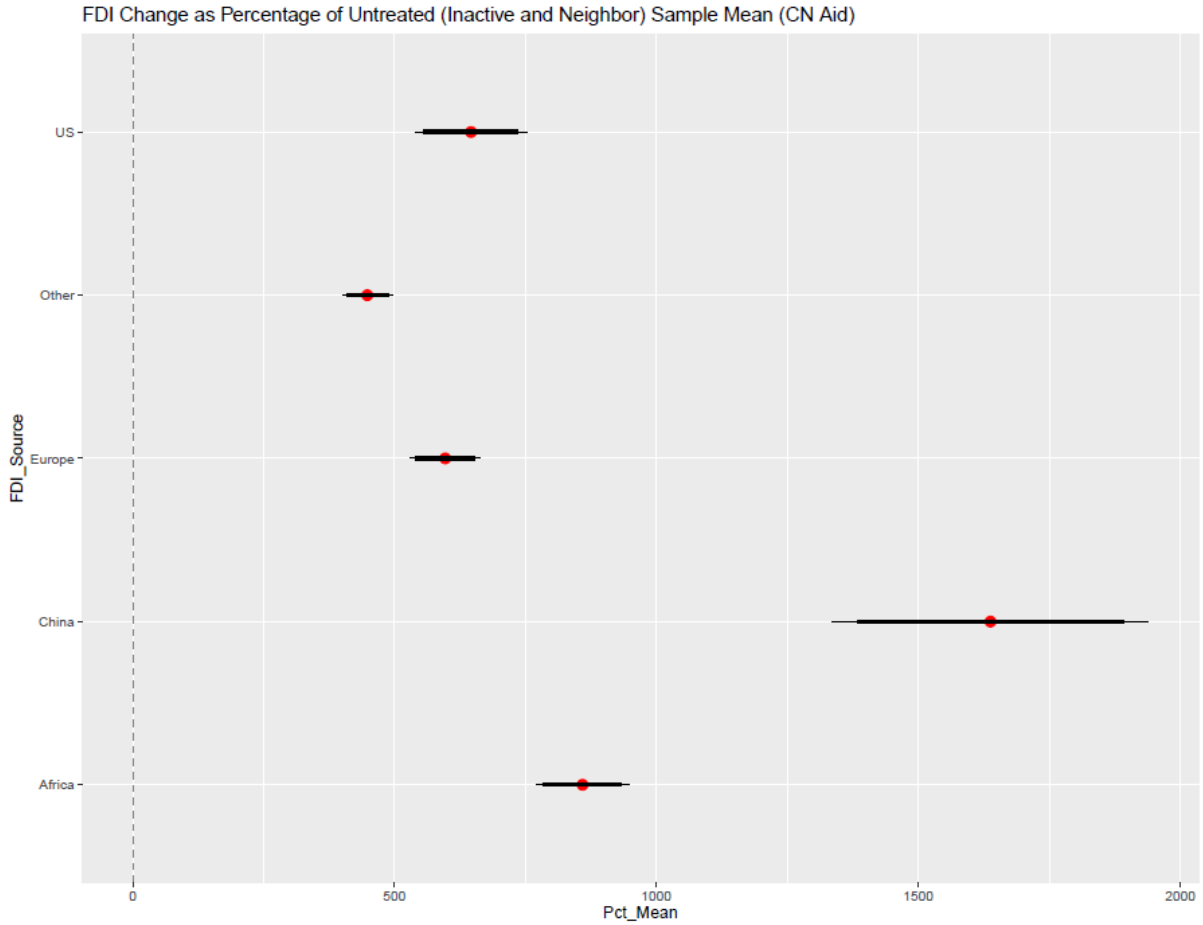
Figure 2: Difference in receiving FDI as Percentage of Sample Mean (WB Aid)



Turning to the results of World Bank and Chinese aid, individually, in figures 2 and 3 we see that most of the differences in the combined model appear driven by the differential impact of Chinese aid. As shown in figure 3, while World Bank aid appears to have a slightly elevated impact on Chinese and African-sourced FDI, the magnitude is much smaller than in figure 2 which shows in the impact of Chinese aid. This is consistent with our expectation that WB

aid is more likely to have a "universal" effect that is not prejudiced towards FDI from a particular source. However, the large differential and significant effect of Chinese aid and Chinese FDI in figure 2 provides strong evidence in support of our hypothesis (2) that Chinese aid is used to facilitate Chinese FDI. While some of this difference is driven by the base effects of a lower initial probability of Chinese Aid, the magnitude of the difference between Chinese FDI and other sources in figures 2 and 3 is strongly suggestive that it is Chinese aid prompted Chinese investment. Thus, while aid appears to improve the environment for investment from any source, these benefits are clearly felt to a much greater degree for FDI from China, especially when the aid is from China.

Figure 3: Difference in receiving FDI as Percentage of Sample Mean (CN Aid)

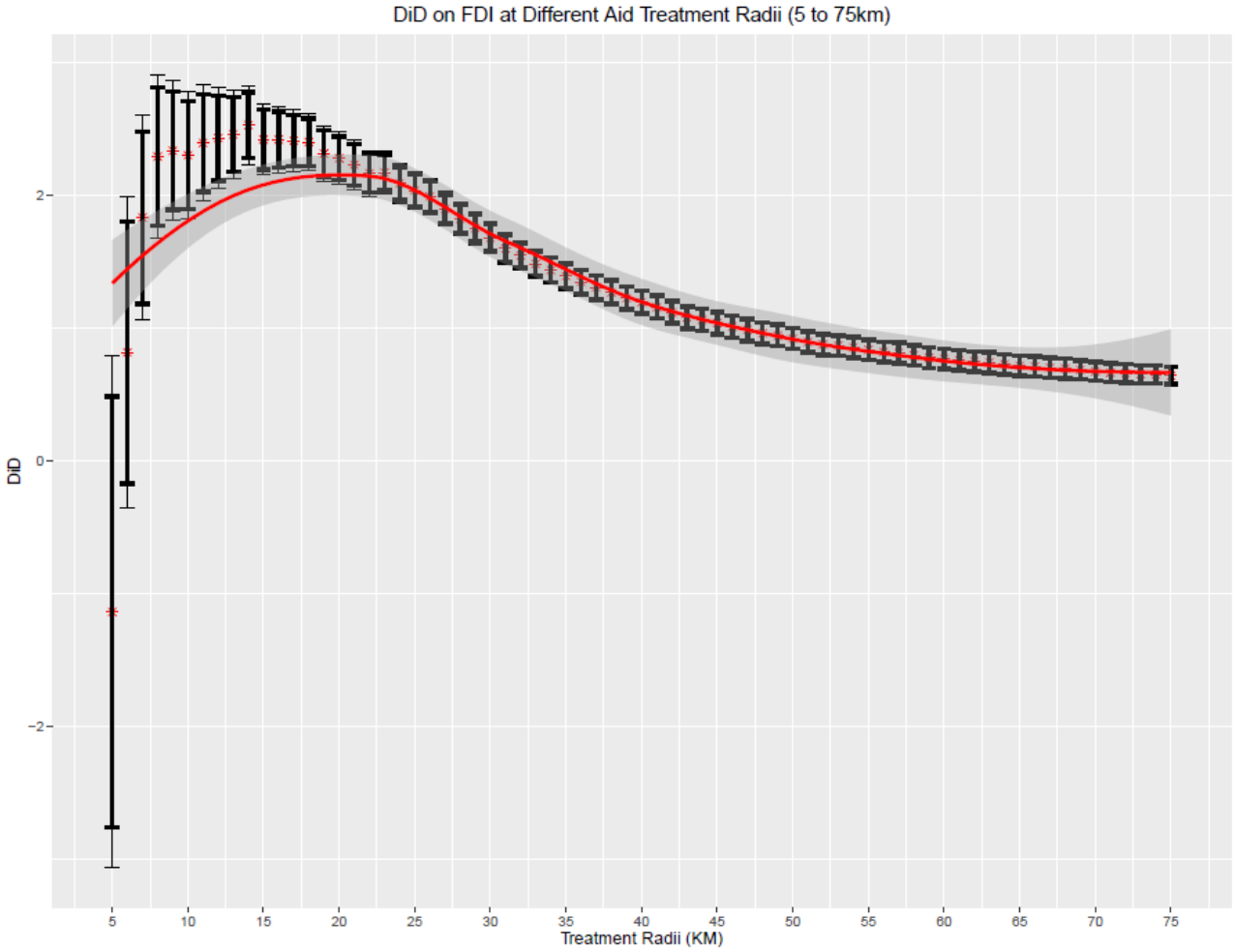


EXTENSIONS AND ROBUSTNESS CHECKS

In this section additional (features of the) data are utilized the extend the analysis and check on the robustness of the baseline results in table 1, model 1. In the first robustness check we

address the modifiable areal unit problem (MAUP) by running model 1 from table 1 at all treatment capture radii from 5 to 75 kilometers. We would expect that the results will be noisier at smaller capture radii, given the paucity of treated units, while increasing in precision but decreasing in effect size at larger capture radii as a result of attenuation bias wherein areas that are actually too far away to be "treated" are coded as such. The results are presented graphically below in figure 4. As seen there, the results perform in the manner we would expect. The DiD changes smoothly with differently sized treatment capture areas, reaching a maximum value of 2.52 at a capture radius of 14km, and then decaying towards 0 as the capture distance increases. This suggests that our main results above are not unduly biased by, or a random artifact of, the MAUP and our choice of a 25km capture distance.

Figure 4: Difference-in-Difference from Table 1, Model 1 at Different Treatment Radii



The full tables of our further robustness checks are available in table A.2 in the Appendix. First, we investigate if our results are robust to using a less precise precision code from

AidData. Here we use all projects at precision code "3" or better, which is equivalent to an "Administrative 2" Unit (i.e. a county or district). We also check if our results are robust to the exclusion of any sites who were "active" in the first 3 years as we do not have FDI data prior to 2003 and, as such, we do not know the FDI behavior at "inactive" sites prior to that year. Using a 3-year "burn in" ensures that at each site was without aid for at least 3 years before being deemed "active". Next, whereas in our main specifications we assume that once a site become "active" it remains "active", we test models where sites only stay "active" for 5 years following the arrival of aid. While our primary assumption is that aid improvements are "durable", restricting the active period is a more conservative approach that also better tests the causal temporal logic of our argument. In a further robustness check, we conduct a placebo test using the neighboring cells where we randomly assign active (and inactive) status by site. These difference between active and inactive in these results is insignificant. As our data is spatial-temporal, we also include a model that adjusts the standard errors for spatial-temporal auto-correlation following the Conley (1999) approach. Finally, we evaluate a model that includes country and year fixed effects, despite recent critiques of this approach (Imai and Kim, 2021), and an even more conservative approach where we only comparing sites that received aid, using the temporal aspect of the data to compare times before and after the site received aid. These finding are presented in the appendix, but our main conclusions remain robust to each of these checks.

CONCLUSIONS

This paper sought to clarify both the extent to which aid project influences where firms decide to locate their foreign direct investment and the extent to which aid donors, China in particular, might use aid as a precursor for commercial interests from their own country. We believe that China presents a most-likely case for this kind of evaluation due to the close and documented ties between the Chinese government and its firms which are often directly state-owned or indirectly influenced by the state. While aid should mostly provide public goods, which should make a location more attractive to investment from any environment, we think it is highly likely that the Chinese state is likely to coordinate its aid efforts with their commercial interests, which may enable Chinese firms either to access private information about a location and/or give them a temporal "first mover" advantage. We compared Chinese aid with aid from the major multilateral development donor, the World Bank, whose aid

should not confer any country-specific FDI benefits but, instead, build public goods which may locations more attractive to investment from all sources.

Using spatial-temporal data on both aid and FDI we find strong evidence in support of our contention. Local aid has a large and significant impact on a location receiving FDI in the future. This finding is robust to a number of different approaches to the data and estimation. However, while the World Bank aid is roughly similar on FDI from diverse sources, Chinese aid has a massively disproportionate impact on Chinese FDI. While some of this impact is attributable to base effects of lower overall levels of Chinese investment, the discrepancy between the World Bank and Chinese results is suggestive that Chinese aid is "paving the way" for Chinese investment.

While many papers have evaluated the aid-FDI relationship at the cross-national level, there are few that test the relationship at a local level. Thus, we believe our findings represent an important step forward. First, as elaborated above, the theoretical mechanisms about aid serving a signaling or functional role to attract FDI by reducing informational or production costs, respectively, are largely dependent on proximity between the flows. Evaluating aggregated, cross-country, flows of aid and FDI mean that aid and FDI project sites in the data could be hundreds of miles from each other, undermining the theoretical linkage and this the analysis improves our understanding of the *efficacy* of aid. Second, evaluating local aid and FDI provides a better chance to observe the *politics* of aid allocation. Scholars have long debated about the extent to which aid is provided to meet the needs of recipient countries compared to serving the self-interest of the donor actors. China, in particular, has been accused of using its development assistance to further its own commercial interests in sub-Saharan Africa. By evaluating the proximity of Chines aid projects from to FDI projects from that same actor, the paper evaluated the extent to which strategic economics aims may be influencing donor development behavior.

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ae6169e5627ae1/The-effects-of-Aid-on-Foreign-Direct-Investment-in-Africa-and-other-regions.pdf

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Data Replication Statement

Replication data and accompanying .do file can be found with the supplemental online material associated with this article.

SUPPLEMENTAL APPENDIX

Table A1: Summary Statistics and Data Sources (Table 1, Model 1)

Variable	Source	Mean	SD	N Obs
Active	https://www.aiddata.org/	0.0057	0.0049	1,252,410
Inactive	https://www.aiddata.org/	0.0007	0.0025	1,252,410
FDI (All)	https://www.fdiintelligence.com/fdi-markets	0.0179	0.1325	1,252,410
FDI (US)	https://www.fdiintelligence.com/fdi-markets	0.0036	0.0597	1,252,410
FDI (China)	https://www.fdiintelligence.com/fdi-markets	0.0015	0.0381	1,252,410
FDI (Europe)	https://www.fdiintelligence.com/fdi-markets	0.0085	0.0917	1,252,410
FDI (Africa)	https://www.fdiintelligence.com/fdi-markets	0.0077	0.0875	1,252,410
FDI (Other)	https://www.fdiintelligence.com/fdi-markets	0.0071	0.0840	1,252,410

Table A.2 Robustness Checks

VARIABLES	(1) Precision 3	(2) Ex 03-05	(3) Active off	(4) Placebo	(5) TWFE	(6) Aid Only	(7) Conley SEs
Active	2.544***	0.667***	1.395***	-0.000	2.319***	2.250***	2.337***
	(0.060)	(0.058)	(0.045)	(0.000)	(0.055)	(0.088)	(0.267)
Inactive	0.277***	0.346***	0.074	0.000	0.443***		0.304*
	(0.039)	(0.040)	(0.047)	(0.000)	(0.047)		(0.167)
Observations	1,209,225	544,473	771,661	433,020	1,209,225	776,190	1,209,225
Diff-in-Diff	2.267***	0.331***	1.321***	0.000	1.886***		2.034***
Country-Year FE	YES	YES	YES	YES	YES	YES	YES
Clustered SEs	YES	YES	YES	YES	YES	YES	CONLEY

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1