RESEARCH ARTICLE

'The Swarm Principle': A Sub-National Spatial Analysis of Aid Targeting and Donor Coordination in Sub-Saharan Africa

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Do bilateral and multilateral foreign aid donors target poverty? To answer that question, we present a framework for assessing the quality of aid targeting sub-nationally. If donors cluster aid in areas with concentrated poverty, or spread out aid in areas of diffuse poverty, then we conclude that donors are targeting aid well. Furthermore, because co-financing may be a mechanism that improves coordination and information-sharing among donors, we examine whether the frequency of donor co-financing increases the quality of aid targeting. Recently released sub-national georeferenced foreign aid data for all bilateral and multilateral donors are available in five sub-Saharan African countries, making it possible to map the placement of foreign aid along with sub-national poverty levels. Results indicate that foreign donors target poverty in some countries but not others, and higher co-financing is associated with lower quality targeting across all cases.

Introduction

In youth soccer, children inevitably swarm around the ball, regardless of its location on the field. Not yet sufficiently mature or well-coached, the children are unable to distinguish when it is ideal to cluster together and when it is better to space themselves strategically in order to increase their chances of scoring a goal. Kids crowd around the ball, hoping just to kick it — not caring whether the ball advances or moves backward. Many have suggested that foreign aid donors follow a strikingly similar pattern as they have historically failed to coordinate their efforts. Instead, each donor may attempt to capture headlines with high-profile projects in the same areas, while failing to target the aid to areas that may need it the most (Easterly 2007; Knack and Rahman 2007).[1]

This study examines whether bilateral and multilateral aid donors target poverty at the sub-national level in five sub-Saharan African countries, and whether donor coordination, measured here by the level of co-financing of aid, improves the quality of aid targeting. This study is motivated by the observation that the donor community has gone to great lengths to improve aid targeting and the effectiveness of aid efforts more generally by promoting donor coordination, alignment, and harmonization. In February 2003, more than 40 multilateral and bilateral

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donors signed the Rome Declaration on Harmonisation, which was designed to improve coordination between donors and recipients and among donors themselves. From similar high-level forums in Paris (Organisation for Economic Co-operation and Development [OECD] 2008), Accra (OECD 2008), and Busan (OECD 2011), more declarations and statements have followed, all of which underscore the importance of donor-donor coordination and the beneficial results that ostensibly would follow from increased donor coordination.

Many researchers attribute the poor performance of foreign aid to the failure of donors to coordinate their efforts on a cross-national scale to ensure that countries that are the poorest and least capable of generating domestic revenues or foreign investment receive sufficient development assistance (see Easterly 2007; Knack and Rahman 2007; Bigsten 2006; and de Renzio and Mulley 2006). Numerous cross-national studies reveal the less altruistic side of aid allocation, showing that donors tend to direct more development resources to countries that align with national interests or that they have historic alliances with, or to countries that demonstrate higher levels of good governance (Alesina and Dollar 2000; Neumayer 2005; Dollar and Levin 2006; Hoeffler and Outram 2011; Qian 2015). The rise of China as an aid donor has seen an increased emphasis on the mutual benefits of aid provision, perhaps as a response to the traditional aid allocation strategies pursued by donors. As a result, while a consensus in the literature remains elusive, much is nonetheless known about the cross-national allocation of development aid.

Much less is known about the patterns of *sub-national* allocation of development assistance. Yet the patterns of sub-national aid allocation have potentially important implications for development within recipient countries. For example, *The Economist* has reported that even though globally levels of inequality have declined, within-country inequality has actually increased (Beddoes 2012). Kenya, a country classified by the World Bank as a lower middle-income country, has a GNI per capita income of US$ 1,620 (in 2018 dollars) and yet approximately 36.8 per cent of the population of Kenya lives on less than US$ 1.90 per day.[2] If aid in countries like Kenya is distributed sub-nationally only to the relatively well-off areas in the country and not to the most impoverished, then aid may not help alleviate within-country inequality and extreme poverty.

The relative lack of attention to the patterns of sub-national (rather than cross-national) aid allocation in the literature has stemmed from two main sources: most studies use aggregate donor aid flows rather than project-level data and there has been a lack of usable sub-national aid data, which has only recently been addressed in the scholarly literature (Findley et al. 2011; Briggs 2014; Jablonski 2014). Fortunately, developments in geocoding (assignment of geographic coordinates to project locations) in the past several years provide an excellent opportunity to investigate whether aid donors target areas of poverty at the sub-national level.

What is the appropriate way to measure the quality of aid targeting at the sub-national level? If poverty is concentrated within a country, it may be desirable to have multiple donors clustering in the impoverished area. Indeed, such clustering, although ostensibly signalling a lack of coordination, may be the best strategy, a point that appears lost in much of the discussion on spatial coordination of donor activities. However, if aid is concentrated in relatively well-off areas to the neglect of more impoverished areas, it strains credulity to conclude that donors are targeting aid in ways that effectively reduce poverty and within-country inequality.

Conversely, if donors spread out their activities in different geographic areas *within* a country in which poverty is diffuse, donors may indeed be targeting effectively. The strategic spacing of donor activities throughout each country would allow donors to specialise and target their efforts in much the same way that a successful soccer team is composed of different positional players working in concert. If donors spread their efforts widely but

poverty is concentrated, on the other hand, then this may not be a virtue and signals a low-quality aid targeting. Sub-national data on both poverty, albeit estimated for a single year (2005), and development aid allow a closer examination of the extent to which donors successfully target their efforts on the areas that need them the most.

Measuring the effect of poverty on aid targeting is the first goal in the present pilot analysis.[3] As we expect this analysis to offer insights into some of the basic objectives of attempts to increase aid effectiveness, such as the Paris Declaration (OECD 2008), we also examine more closely whether one of the OECD's stated mechanisms for facilitating aid delivery, *co-financing*, has increased the quality of aid targeting. We propose that the frequency of co-financing among donors could facilitate the sharing of information in ways that may improve the overall quality of aid targeting within countries. More co-financing might lead to improved communication and greater cooperation between donor country offices as more than one donor has the ability to influence where and how projects are implemented, which are key concerns for many donors. Therefore, the second goal of this paper is to use donor co-financing as a way to measure whether donor coordination is associated with better targeting of poverty.

This paper uses geocoded aid data for bilateral and multilateral donors in five African countries (Democratic Republic of the Congo (DRC), Malawi, Nigeria, Senegal, and Uganda) to provide greater insight into aid targeting within and across countries as well as into the effects of co-financing. We first examine geographic aid placement patterns by comparing the distribution of multilateral and bilateral development aid at the first administrative division level. Next, we consider whether these donors are clustering their geographic efforts in areas of greatest poverty within a country — by calculating the correlation between aid and poverty and by comparing the aid and poverty concentration levels — within our five case studies. Finally, we compare the quality of aid

targeting to the level of donor co-financing in each country to determine whether donor coordination improves the quality of aid targeting on poverty.

We find evidence that bilateral and multilateral aid donors tend not to target poverty in the countries under examination, although the quality of aid targeting varies widely across countries. Nigeria is rated as having high-quality aid targeting, but also has the lowest level of donor co-financing. Based on the five countries we examine, co-financing is highest in the country with a poor quality of aid targeting, Senegal. While only an initial inquiry, the finding on co-financing offers initial insights into the lack of efficacy of the solutions being proposed by the international community.

Aid Allocation and Targeting Literatures

The current literature on aid allocation is mostly negative in tone. Conventional wisdom suggests that donors do not target countries with the most need, but rather allocate aid on the basis of commercial and strategic interests (Alesina and Dollar 2000). This finding holds up against a variety of ways of measuring need. For example, Thiele, Nunnenkamp, and Dreher (2007: 622) examine how effectively donors target needs as measured by the millennium development goals (MDGs), finding that 'MDG-related indicators of need have hardly shaped the allocation of aid by donors such as Denmark, which are widely perceived to be superior donors because of their strong poverty orientation as measured by per capita income of recipient countries.'

Using poverty alone as the measure of interest does not improve evaluations of donor targeting of aid. Bilateral donors devote only 27.6 per cent of aid dollars to the poorest quartile of aid recipients and 67 per cent to the poorest half, while multilateral donors devote 36.6 per cent to the poorest quartile and 78.7 per cent to the poorest half (Nunnenkamp and Thiele 2006). The authors find little evidence supporting the view that aid is targeted effectively. Collier and Dollar

(2002) similarly derive an efficient allocation of aid — based on poverty — and find that current allocation is substantially different, with the poorest 74 per cent of individuals receiving only 56 per cent of aid. The study posits that a poverty-efficient allocation of aid would increase the number of individuals lifted out of poverty from 30 million to 80 million each year.

A third measure of effective targeting — national policy and governance — provides a mixed picture of the effectiveness of aid allocation. Berthelemy and Tichit (2004: 253) find that 'most donors pay significant attention to political governance when making their aid decision' and that aid tends to flow toward democracies. However, the same study found that aid allocation is substantially influenced by international trade ties and colonial linkages. Canavire et al. (2005) found that policy orientation depended on the measure of effective governance. A separate study, however, found that donors have an overall weak policy orientation, and generally fail to reward governments for sensible improvements in policies (Nunnenkamp and Thiele 2006).

When aid is distinguished between bilateral and multilateral flows, however, there is some evidence that multilateral donors target aid more effectively than bilateral donors. Dollar and Levin (2006) show that multilateral donors between 2000 and 2003 became more selective in targeting aid to countries with more effective rule of law and democracy than they were between 1984 and 2000. Similarly, the World Bank on the whole appears to target more programmatic aid to well-governed countries, although different lending institutions within the World Bank, such as the International Development Association, target these countries less (Winters 2010). Therefore, the literature on the determinants of multilateral aid allocation provides some evidence that, unlike bilateral donors,[4] multilateral donors tend to target aid more effectively at the national level.

More recently, a small number of pathbreaking studies have looked at aid allocation by multilateral and bilateral donors at the sub-national level in single countries. Jablonski (2014) examines World Bank and African Development Bank aid projects in Kenya between 1992 and 2010 and finds that these donors biased aid project locations toward the governing party's political base. Another study using multilateral and bilateral donor information finds that aid was similarly allocated toward the governing party's base in Kenya between 1989 and 1995 (Briggs 2014). Nunnenkamp, Sotirova, and Thiele (2016) examine bilateral and multilateral sub-national aid specialization in Malawi, finding little evidence of donor coordination in district and sectoral aid allocation, which has been confirmed in later studies, including Findley et al. (2017b).

Other research has considered bilateral and multilateral aid allocation to a larger set of recipient countries. Dreher et al. (2019) show that Chinese aid tends to target the region from which the country's leader hails. Öhler and Nunnenkamp (2014) show how World Bank and African Development Bank (AfDB) aid projects in 27 countries also targeted the home region of the political leader of the country. Briggs (2016) considers World Bank and AfDB sub-national allocations to 17 African countries, finding that multilateral aid projects have neglected impoverished areas of countries but targeted richer areas, while a subsequent analysis of World Bank projects suggests greater effectiveness of aid targeting on poverty in some countries but poor quality in others (Öhler et al. 2019).

Donor coordination and aid delivery

Partly as a response to concerns about poor aid allocation, the Paris Declaration of 2005 sought to improve donor coordination in order to 'eliminat[e] duplication of efforts and rationaliz[e] donor activities to make them as cost-effective as possible' (OECD 2008). However, in spite of recent criticism and the efforts of the more than 100 Paris Declaration signatories, it still appears that 'all donors seem to want to give to all sectors in all countries' (Easterly 2007). In fact, the increase in the number of donor

organizations has outstripped the increase in foreign aid levels since 1975 (Bigsten 2006). The opinions in the literature diverge in explaining the causes of poor coordination, as well as the resultant financial and social costs to uncoordinated donor behaviour. The current literature is limited, moreover, in that it examines coordination exclusively at the national or sectoral (e.g., health, education) level, with almost no research occurring at a sub-national level.

One explanation for poor coordination is a lack of information on donor activities. Donors fail to coordinate not because they are unwilling to cooperate with each other, per se, but rather because they are unaware of opportunities for collaboration through projects that are supported by other donors (Halonen-Akatwijuka 2007). Alternatively, donors may fail to coordinate because they are unwilling to relinquish control over aid-funded activities (Findley et al 2017a). This may be particularly true in countries with central and local governments that are perceived to be weak or corrupt (Buse 1999; Platteau 2004; Dietrich 2013). Donors may feel that, if they are not able to directly track funds through the implementation process, elite capture of aid funding may occur (Platteau 2004; Dietrich 2013). A third common explanation for uncoordinated activity is posited by Easterly (2007): donors fail to coordinate their programs because they want the recognition of having a direct presence in every country and sector. Donors have a direct interest in spending their entire budget in order to prevent budget decreases in subsequent years (White and Morrisey 1997). A fourth explanation is that donors refuse to coordinate as their aid flows are largely determined by national diplomatic priorities, rather than altruistic mechanisms (Alesina and Dollar 2000; Woods 2005). Finally, the proliferation of aid donors creates the incentive for some donors to free ride on the efforts of others, leading to a lack of coordination in aid delivery (Rahman and Sawada 2012).

Like the literature on aid allocation, the overall negative findings of the current literature on donor coordination rest on the key assumption that the state is the proper unit of analysis in examining donor behaviour. This assumption may not be appropriate in many cases, however, as the lack of donor coordination at the national level does not preclude the possibility that donors coordinate aid allocations at the sub-national level. In order to definitively assess the effectiveness of donor behaviour, sub-national variations in aid allocation and recipient need must be addressed.

Aid targeting and co-financing
The Rome Declaration on Harmonisation (OECD 2003a) and the declarations and statements that followed in Paris (OECD 2008), Accra (OECD 2008), and Busan (OECD 2011) all emphasise the importance of improving donor-donor and donor-recipient relations and working practices. The Paris Declaration proposes joint financial arrangements as a specific mechanism whereby donors can improve coordination and aid delivery more generally (OECD 2005). If the international emphasis on coordination as a solution to problems with aid delivery is correct, then donor coordination should result in better geographical placement of foreign aid projects, suggesting that donors are working together when they target need more effectively. Therefore, whether coordination enables donors to target need is one of the key outcomes of interest in the development literature and is a key consideration in what follows.

This paper examines the relationship between the level of poverty and aid targeting in two stages. We begin by conceptualizing the quality of aid targeting at a sub-national level and then consider co-financing as a possible explanation for how donors improve the targeting of aid. We argue that the quality of aid targeting depends on the level of geographic clustering and the geographic concentration of poverty — with incidence of donor co-financing potentially explaining and complementing the two key factors.

Prior to developing the model of aid targeting, it is worthwhile to describe our

assumptions about the objectives of these donors. We posit that donors have declared poverty reduction as a goal of international assistance efforts and argue that both donor statements and empirical evidence support this characterization of donor objectives. To begin with, many of these institutions highlight the importance of poverty reduction: the World Bank, for example, states that 'reducing poverty in all its dimensions is at the core of the World Bank's work,'[5] while the AfDB has likewise declared that poverty reduction is its overarching goal (AfDB 2004). The empirical record helps to substantiate that these donors actually pursue this policy goal. Multilateral assistance is generally more effective in promoting development than bilateral aid (Maizels and Nissanke 1984), while more recent studies have shown that at the national level, multilateral development banks target aid on the basis of economic need (Neumayer 2003).[6] Others have found that multilateral development banks are more likely to follow OECD best practices by focusing on recipient needs rather than the goals of donors (Easterly and Pfutze 2008; Martens et al. 2002). So, positing poverty reduction as the objective function of the World Bank and the AfDB is consistent with both the policy statements of these donors and previous research.

Bilateral donors' statements suggest as well that poverty reduction is a key goal. The US Agency for International Development (USAID), for example, put forward the goal of reducing extreme poverty by promoting inclusive economic growth.[7] The UK's Department for International Development (DFID) includes 'tackling extreme poverty and helping the world's most vulnerable' as well as 'promoting global prosperity' in its list of top priorities.[8] The Japan International Cooperation Agency (JICA) lists 'reducing poverty through equitable growth' as its second mission in service of a broader vision of inclusive and dynamic development.[9] The work of the Swedish International Development Cooperation Agency (SIDA) attempts to carry out the government's Policy for Global Development, which aims to 'reduce poverty in the world' and 'enable poor people to improve their lives.'[10] For these donors, all of which are important donors for many African countries, poverty reduction and equitable growth are commonly listed as key mission goals. The extent to which their aid targeting furthers the achievement of those goals is what we attempt to establish in this paper.

Next, we articulate a model of effective aid targeting as a means to evaluate whether multilateral and bilateral donors are in fact acting upon their stated goal to reduce poverty. As a first step, the effectiveness of aid targeting can be illustrated through a contingency table, as depicted in **Table 1**. As the table shows, donors can effectively target their activities whether working in the same areas or different areas, depending on the distribution of poverty within a country. If there is one province of the country that contains the majority of the nation's poor, we should not expect a donor to work in a different province simply because another donor has already initiated activities in the poorest region unless donors engage in a sophisticated division of labour wherein some donors target impoverished regions while other donors target regions with different needs. However, we would still expect to see more aid going to more impoverished regions given the stated goals of donors regarding poverty reduction. Conversely, if

Table 1: Effective Aid Targeting as a Function of Clustering and Poverty.

	Concentrated Poverty	Diffuse Poverty
Low Donor Clustering in Areas of:	Ineffective	*Effective*
High Donor Clustering in Areas of:	*Effective*	Ineffective

poverty is evenly distributed throughout the country, it makes little sense for each donor to focus in the same narrow areas of the country while needs remain unmet elsewhere.

Our approach to conceptualizing aid targeting appears consistent with some other approaches that identify targeting based on poverty concentration. For example, Barrett and Clay (2001) found that targeting errors of inclusion — aid to non-needy individuals — and exclusion — failure to provide aid to those in need — were common in Ethiopia. A study of food aid targeting in Mozambique also found similar targeting errors (Tschirley, Donovan and Webber 1996).

This conceptualization also appears consistent with the strategies outlined in the Accra Agenda for Action, in which the stakeholders outlined strategies to coordinate aid in ways that would target it more effectively. They state:

> The effectiveness of aid is reduced when there are too many duplicating initiatives, especially at country and sector levels. We will reduce the fragmentation of aid by improving the complementarity of donors' efforts and the division of labour among donors, including through improved allocation of resources within sectors, within countries, and across countries. [OECD 2008]

Thus, if donors coordinate their efforts effectively, we should expect that donors will work together in areas of concentrated poverty and spread out to effectively target areas of diffuse poverty.

We have thus far only attempted to conceptualise the quality of aid targeting, which raises the question of what might explain why some aid projects are targeted effectively while others are not. The hypothesis here is that donor coordination may increase the quality of aid targeting. Two potential obstacles to effective targeting that improved coordination can help overcome include a lack of information on the activities of other donors (Halonen-Akatwijuka 2007) and unwillingness to share credit or responsibility for project implementation (Easterly 2007; Platteau 2004). Given the proper institutions and incentives, it is possible that these problems can be overcome.

If targeting problems exist due to information problems or credit-claiming incentives, and if improved coordination may serve to overcome them, we expect that higher levels of co-financing could lead to better overall spatial coordination and targeting of subnational poverty. Co-financing — even on a small sub-set of donor projects — could be a key factor in explaining overall coordination by solving two important problems. First, co-financing may improve coordination by facilitating communication between the donor-country offices, increasing awareness by the donors of each other's activities. Second, co-financing activities may improve coordination by creating a cooperative environment between the two donors, ameliorating concerns about maintaining control over activities, having a broad presence within countries, and remaining committed to organizational or national goals.

The empirical literature on the effectiveness of co-financed aid is limited but suggests mixed findings. Winters (2019) finds that co-financed aid projects are beset by project delays and increased transaction costs due to too many actors exerting influence over the design and implementation of the projects. Kotchen and Negi (2019) suggest that while co-financed aid projects show improved evaluation outcomes, this is not the case if private sector actors are charged with oversight of the project. The pilot analysis here of co-financed aid will help to resolve these conflicting findings in the literature.

While overcoming such challenges may be difficult politically, the international community seems to be banking on co-financed aid as an important component of effective aid delivery. In the OECD's guidelines, *Harmonising Donor Practices for Effective Aid Delivery*, an entire chapter is devoted to

the topic of 'delegated cooperation' (OECD 2003b), in which best practices are recommended for lead and delegating donors. At the heart of these guidelines is an emphasis on communication and mutual benefit. Thus, as donors engage each other more often and work out mutually beneficial arrangements, some of the information and credit-claiming problems should be ameliorated. A reasonable expectation is that positive spillover effects should accrue outside of the specific projects being co-financed, such that donors generally work together more often over time and therefore more effectively coordinate their activities throughout a country.

Given the international community's guidelines for increasing levels of co-financing, a reasonable question is thus: does co-financing improve the effective targeting of foreign aid placement geographically in a country? We now consider this using new sub-national georeferenced foreign aid data.

Data and Research Design
Geocoded aid data
For the first time, geocoded data is now available for 21 bilateral and 22 multilateral donors that were included in the Aid Management Platforms (AMP) for five countries: DRC (AidData 2015a), Malawi (AidData 2012), Nigeria (AidData 2015b), Uganda (AidData 2015d), and Senegal (AidData 2015c). The list of donors is included in the appendix for this article. This paper uses geocoded aid project datasets (Findley et al. 2011) covering the period 1978 to 2014 to examine aid targeting at a sub-national level. Geographic patterns of donor activities are compared in each country to examine whether donors tend to work in the same areas or whether they instead specialise geographically. After establishing the quality of aid targeting, we compare it with levels of co-financing to determine what effect coordination may have.

These countries were selected because they provide coverage for different parts of sub-Saharan Africa. Two countries are located in west Africa (Nigeria and Senegal), one country in central Africa (DRC), one

country in east Africa (Uganda), and one country in southern African (Malawi). For a description of how the data were geocoded, please see the appendix.

Sub-national indicators of poverty
In order to determine whether donors are clustering their activities in areas of greatest poverty, we use sub-national indicator data on poverty from the HarvestChoice Lab's Poverty Maps and Data from 2005, the only year for which the HarvestChoice data is available (HarvestChoice 2010).[11] We chose to use HarvestChoice because it is a consistent measure of poverty across countries based on nationally representative surveys. The measurement in each country is the headcount ratio, which measures the proportion of individuals living on less than 1.25 USD per day. Clearly, there are other potential variables that may be of interest, but poverty data is largely available sub-nationally within the countries of interest and may present an acceptable proxy for some other variables of interest. As the HarvestChoice data are only available at precision code level 4, which refers to the level of the province (i.e., the first administrative level below that of the nation-state), we aggregate our analysis of aid to that level.

Measuring aid targeting
To evaluate the aid targeting of multilateral and bilateral donors, we have used first-order administrative divisions to calculate bilateral and multilateral aid commitments for each administrative unit.[12] Because a given project can affect more than one location, we divide the total aid commitments by the number of locations that it reaches. Given that population size may affect the size of aid commitments, we divide each donor type's aid commitments by local population to create population-weighted aid commitments. Using these population-weighted aid commitments, we can calculate simple correlations between multilateral and bilateral country portfolios. Thus, a strong positive correlation indicates high geographic clustering between both types of donors while a strong negative correlation would indicate

that the donors tend to work in different areas of the country.[13]

As discussed above, simply identifying donor clustering does not indicate that they are poorly targeted. We need to determine whether they are clustering in the most impoverished places. Because our measures of donor clustering and localised poverty can be evaluated at the first-order administrative division (ADM1) level, we calculate the correlation between levels of donor financing — defined as the level of aid commitments per ADM1 — and our measures of poverty. This will allow us to make a better determination about the overall quality of aid targeting, which will be evaluated differently for our spatially clustered and spatially diffuse project locations. We will examine targeting of poverty in three stages.

First, we use a Herfindahl index, which provides a country-level measure of whether poverty is diffuse or concentrated within a country (Rhoades 1993). The Herfindahl index is defined as $H = \sum_{i=1}^{N} s_i^2$ where N is the number of administrative divisions and S is the share of the total poverty levels held by division i. A high Herfindahl index indicates a high geographic concentration of poverty, while a low index indicates a diffuse level of poverty. We use this measure primarily to determine whether there are concentrated areas of poverty; it does not reveal information about which specific areas are most needy.

Second, to understand better whether donors are targeting the right areas, we consider how well donors are targeting concentrated areas of poverty. To do so, we use a simple correlation between the combined (multilateral and bilateral) level of aid commitments in an administrative division and the level of poverty in that region. A positive correlation between the level of aid commitments and poverty suggests that donors are clustering in the most impoverished areas. A negative correlation indicates that the clustering is occurring in the least impoverished areas.

We also offer two alternative specifications to measure whether donors are targeting areas of concentrated poverty. First, we calculate the poverty concentration ratio, defined as the share of the three poorest divisions out of the total poverty in the country, and the aid concentration ratio, defined as the proportion of aid commitments within these same three poorest divisions in the country. If the aid concentration ratio is lower than the poverty concentration ratio, then this suggests that the administrative division is not receiving aid proportional to its poverty needs.

Additionally, because neither of these measures is perfect, we can also compare them informally. If there is a strong positive correlation between aid and poverty *and* the aid concentration ratio is greater than or equal to the poverty concentration ratio, we conclude that donors are targeting the most impoverished parts of the country, perhaps alleviating their failure to specialize geographically.

After assessing overall targeting quality, we consider whether co-financing enhances donor coordination in the targeting of aid in each country. Co-financed projects are those that have multiple donors contributing funds to the project. We examined the project information to determine whether a project had multiple donors contributing to the aid project. If the project information listed multiple donors as contributing funds to the project, we gave it a score of 1. If the project information did not list multiple donors as contributors, we gave it a score of 0. We then averaged the number of projects with multiple donors for each country, giving the final co-financing score. For example, an average of 0 for a country would indicate that no donors were co-financers on any of the aid projects in that country. A country with 20 aid projects, three of which are co-financed by more than one donor, would receive a score of 15 per cent.[14]

To examine the impact of donor co-financing on overall aid targeting, we plotted the co-financing scores for each with our measure of the quality of donor targeting. The plots include icons that indicate how well the donors are targeting the poverty within

the country as measured by both aid-poverty correlation and concentration ratios. A green diamond indicates effective targeting by both measures while yellow squares show good targeting by one measure (either aid-poverty correlation or concentration ratios). Red triangles indicate poor aid targeting by both measures.

Empirical Analysis

We begin with a visual examination and analysis of the spatial placement of aid commitments in the five countries of interest in this paper. **Figures 1–5** contain maps for DRC, Malawi, Nigeria, Uganda, and Senegal.

These maps do not tell a single story. Therefore, we attempt to explain the distribution of aid commitments shown in these maps using the various statistics that we outlined in the previous section.

Do donors cluster?

We first consider the extent to which multilateral and bilateral donors provide aid to the same administrative divisions. Pooling all five countries, multilateral and bilateral aid are positively and significantly correlated (0.569, $p < 0.05$), suggesting that bilateral and multilateral aid target similar areas within countries. Examining the countries individually, two countries, Uganda and Nigeria, have negative but low correlations between multilateral and bilateral donors (−0.197 and −0.021, respectively) and provide limited evidence that bilateral and multilateral donors are targeting different parts of the country. In the other three countries, DRC (0.419), Senegal (0.442), and Malawi (0.465), each show strong correlations, indicating that both sets of donors are working in the same areas within the country. This means that provinces with more multilateral aid commitments are also likely to have more bilateral aid commitments, while areas that may be less served by the multilateral donors will also have fewer bilateral aid commitments. However, these results alone do not tell the entire story, as the donors may or
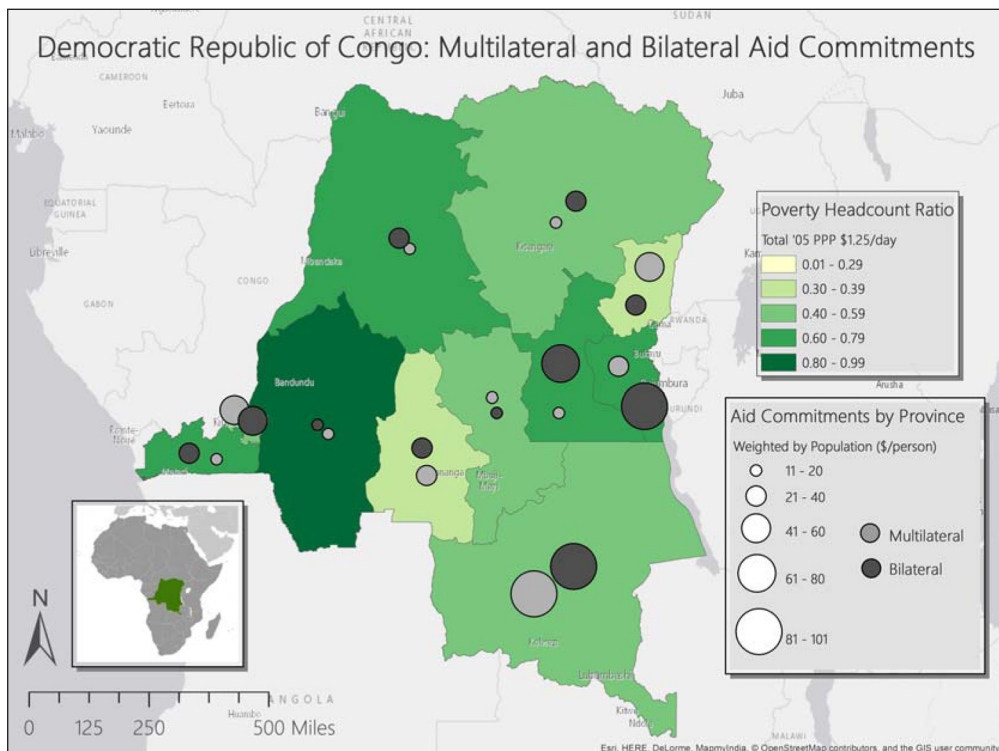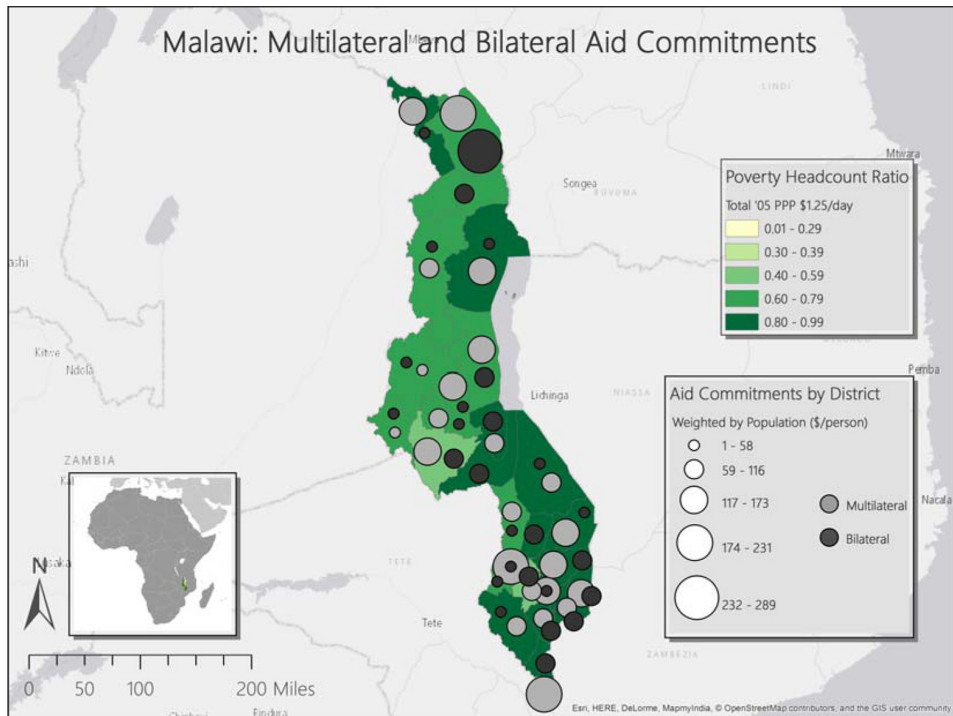

Figure 1: Map of Aid Activity in DRC.

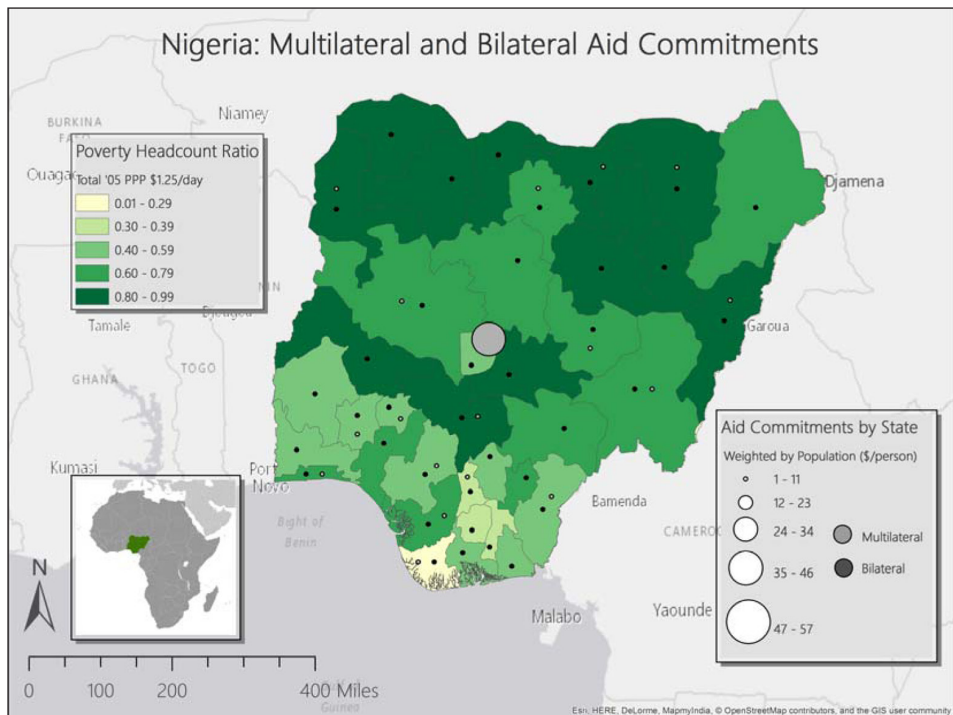**Figure 2:** Map of Aid Activities in Malawi.

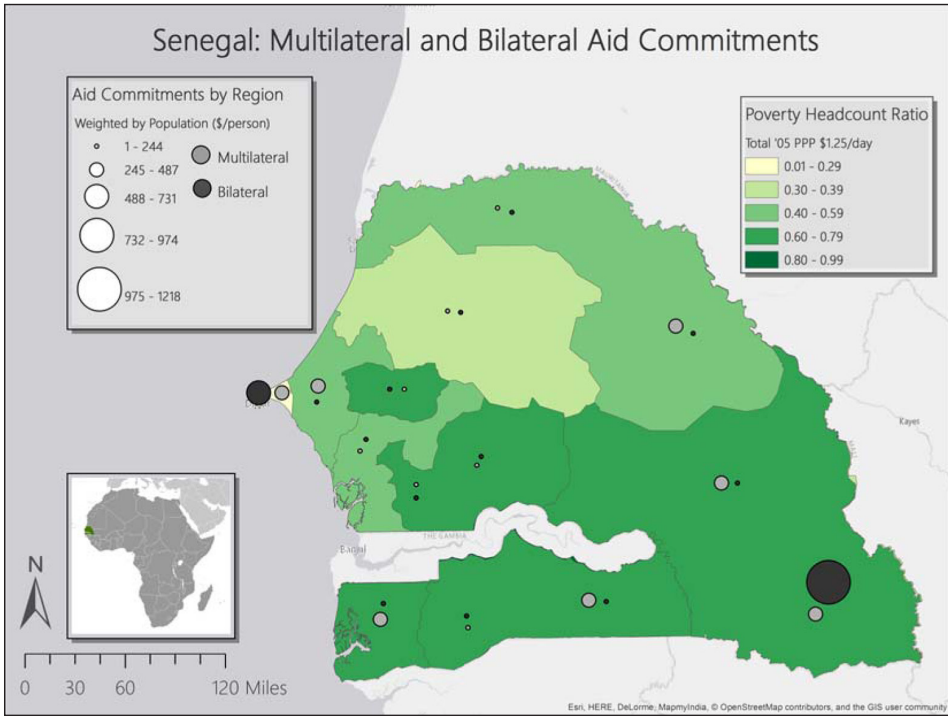**Figure 3:** Map of Aid Activities in Nigeria.

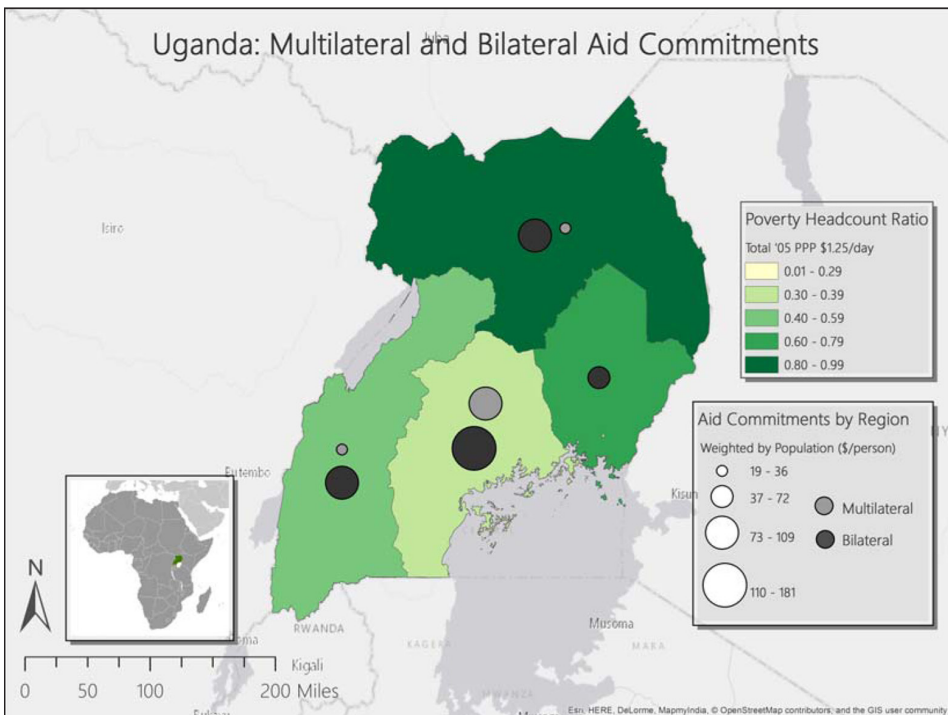**Figure 4:** Map of Aid Activities in Senegal.

Figure 5: Map of Aid Activities in Uganda.

may not be clustering activities in the most impoverished parts of each country.

It is important to note that clustering of aid may have an impact on poverty over time. While the poverty data analyzed here captures a single year, it is possible that aid can change the distribution of poverty within countries by reducing it in some areas more quickly than in others. Furthermore, donor clustering in less impoverished areas may reflect the goal of providing aid to relatively well-off but stable areas that are likely to allow for the successful completion of projects. Less well-off areas within countries may lack the stability and infrastructure that donors need to successfully complete aid projects.

Do recipients have concentrated poverty?

Before considering whether donor clustering occurs in the most impoverished areas, we first identify which countries have localised poverty by examining the Herfindahl index. In examining the concentration of poverty as measured by the Herfindahl index, we find that there is substantial variation across countries. Nigeria (0.029) has the most diffuse poverty, followed closely by Malawi (0.039). The other three countries have increasingly higher concentration of poverty: Senegal (0.097), DRC (0.098), and Uganda (0.273). The poverty concentration ratios are similar to the Herfindahl index, and yield similar variation: Nigeria (0.108), Malawi (0.131), Senegal (0.340), DRC (0.361), and Uganda (0.639). These two measures indicate that the DRC and Uganda have higher concentrations of poverty relative to the other countries, while Nigeria and Malawi seem to have the lowest and thus most diffuse concentration of poverty. We next examine whether aid is associated with areas of poverty at the sub-national level.

What is the quality of aid targeting?

Do multilateral and bilateral donors cluster their activities in the areas of greatest poverty? To answer this question, we first examine the correlation between population-weighted aid commitments and poverty in the various administrative districts, and then compare the aid and poverty concentration ratios. Pooling all five countries, the correlation between aid and poverty is negative (–0.177) but not significant ($p > 0.1$). We now examine this relationship in each country individually.

In the DRC, there is little evidence that donors target their aid to impoverished areas. First, the correlation between levels of aid and poverty is negative (–0.320), suggesting that aid is going to areas with lower poverty. Additionally, the aid concentration ratio (0.149) is lower than the poverty concentration ratio (0.361), suggesting that less aid is going to the three poorest divisions proportional to their share of the country's poverty. So, aid in general is not associated with poverty at the local level, and the poorest areas do not receive a proportion of aid relative to the amount of poverty located there. The quality of aid targeting is rated as poor in the DRC.

The correlation between aid and poverty in Malawi (0.095) is positive and low, and the aid concentration ratio (0.131) is equal with the poverty concentration ratio (0.131) after rounding in Malawi's poorest districts. Contrary to the DRC, this suggests that there is an effort by donors to target the areas of highest poverty within Malawi. Thus, the quality of aid targeting is rated as high.

As stated above, Nigeria has a low correlation of bilateral and multilateral donor aid and very diffuse poverty. The correlation between poverty and aid is positive (0.142), providing some evidence that aid is targeted in general on poverty. The aid concentration ratio (0.131) is also higher than the poverty concentration ratio in the same administrative divisions (0.108). Thus, donors in Nigeria appear to target aid to the areas of greatest poverty. Therefore, the quality of aid targeting is rated as high.

In Senegal, there is a high negative correlation between aid commitments and areas of poverty (–0.562), suggesting that the donors are not effectively targeting poverty. Furthermore, the three poorest regions even

receive a smaller share of the aid (0.160) proportional to their share of the poverty in the country (0.340). Thus, the evidence suggests that the donors are not working to deliver a large portion of their aid to the three poorest regions but are spreading out their activities to areas with lower levels of poverty in the country. The quality of aid targeting is therefore rated as poor.

However, this pilot analysis assumes that the primary goal of donors is to reduce poverty and evaluates the extent to which donors do in fact concentrate aid on impoverished areas within five countries. In reality, donors have a range of potential goals, including stabilization, conflict prevention, democracy promotion, and security (Findley 2018). A future analysis could build on these initial results to analyze the effectiveness of sub-national aid targeting in light of these other goals donors can pursue.

Finally, the correlation between aid and poverty in Uganda is negative (–0.337),

suggesting that the donors tend to target their aid to areas of lower poverty. The aid concentration ratio (0.498) is also lower than the poverty concentration ratio (0.639), however, indicating that the poorest regions are receiving less aid proportional to the rest of the country if donors did in fact target the most impoverished areas.[15] The aid targeting is rated as poor for this country.

To synthesise the results of this discussion with the previous discussion of the donor concentration and recipient poverty concentration results, **Figure 6** displays the clustering of activities relative to poverty concentration. The icons suggest the quality of aid targeting: green circles indicate high quality of targeting, while red triangles indicate poor quality of targeting.

In sum, while the data do not tell a consistent story, some evidence is found for high-quality aid targeting. This echoes in part the finding in Öhler et al. (2019), in which evidence is found of high-quality aid targeting
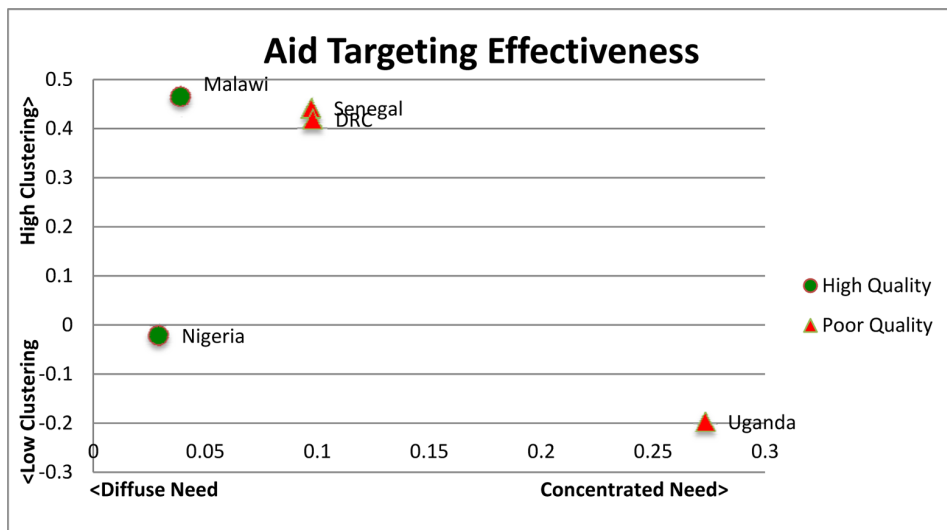

Figure 6: Quality of Aid Targeting by Clustering of Activities and Concentration of Need.
Note: This figure shows the overall effectiveness of donor coordination within the country. As need becomes more concentrated (graph moves farther right), donors should cluster together more (graph moves farther up), provided that they are clustering in the right parts of the country. The icons indicate a rough classification of how well the donors are targeting the need within the country (as measured by aid-poverty correlation and concentration ratios) with a green circle indicating effective targeting by both measures, while red triangles indicate good targeting by one measure.

of World Bank projects in some countries, but lower quality targeting in others. Donors appear to cluster in areas of high poverty in the case of Nigeria and Malawi. But donors do not always cluster together where poverty is concentrated, as found in Senegal, Uganda, and the DRC. These results raise the question of why the quality of aid targeting is higher in some countries than others. We thus examine whether considering levels of multilateral and bilateral *co-financing* helps explain the overall results on aid targeting.

Does co-financing improve aid targeting?

As we have discussed, we might expect co-financing on a higher proportion of projects to improve overall donor coordination regarding the targeting of aid both by improving reciprocal knowledge of donor activities and increasing willingness to cooperate, sharing responsibility and credit for development outcomes. Thus, we hypothesised that countries with higher levels of co-financing would also have a higher quality of aid targeting than countries that do not. Similar to the previous analyses, the overall results offer little support for this expectation about the effects of co-financing.

In the DRC, 15 of its 252 bilateral and multilateral projects are co-financed (5.81 per cent). This low level of communication between the donors in the DRC possibly contributes to its low correlation between aid and poverty. Uganda, with a similar overall average donor co-financing (6.0 per cent), also targets poverty poorly, as described above. The low level of co-financing and poor quality of the aid targeting of both countries could be consistent with the co-financing hypothesis if countries with higher levels of co-financing also have high-quality aid targeting.

However, Senegal and Nigeria paint a picture of the effects of co-financing on aid targeting that does not support the co-financing hypothesis. In Senegal, 83 of its 405 (20.49 per cent) projects are co-financed. Nigeria has the fewest co-financed projects, with only seven of 196 (3.57 per cent) aid projects listed as including co-financing donors. Thus,

donors co-finance in Senegal more, and the country has diffuse poverty, but donors do not target poverty as discussed above. The high level of co-financing in Senegal did not enable donors to work together in targeting areas of poverty. In Nigeria, donors do target poverty as discussed in the previous section. The lack of co-financing in Nigeria did not preclude donors effectively targeting poverty. Instead, the quality of donor targeting is high in this country.

While these represent only initial results from a small sample of countries, there is partial evidence that co-financing has no relationship with improved aid targeting and, if anything, appears to be related to poor quality of aid targeting. These findings are consistent with Nunnenkamp et al. (2016), who find little evidence of donor coordination in Malawi. In fact, the overall correlation between co-financing and the aid-poverty correlation in the present study is negative (-0.710). The correlation between co-financed aid and poverty within countries is also negative (-0.315, $p < 0.05$) across all countries. The results for the individual countries are similar: the correlation between co-financed aid and poverty within countries is negative in the DRC (-0.291), Nigeria (-0.062), Senegal (-0.537), and Uganda (-0.557). As Malawi lacks information on co-financed aid, it is not included in the analysis.

The country-level results are displayed in **Figure 7**, which suggests that the quality of aid targeting declines as co-financing increases. Senegal, with the highest levels of co-financing, has a poor quality of aid targeting. Uganda and the DRC have lower levels of co-financing and also have poor quality of aid targeting. Nigeria has the most effective aid targeting, and the lowest levels of co-financing.

What explains the lack of a positive relationship between co-financing and aid targeting? One reason for the lack of a positive relationship could stem from the types of aid projects that receive co-financing, namely larger infrastructure projects, as suggested by Kotchen and Negi (2019). The types of
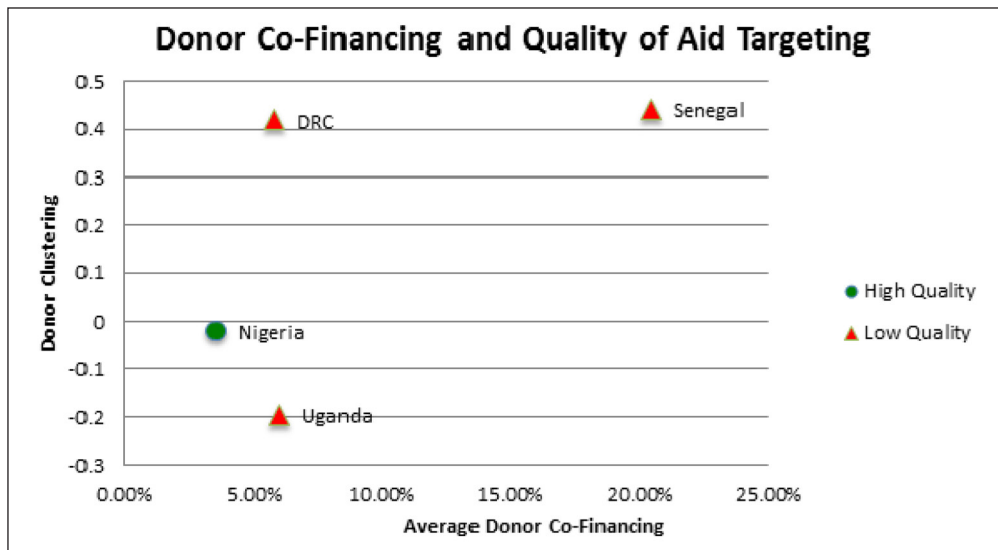
Figure 7: Donor Co-Financing Frequency and Correlation of Donor Activities.
Note: This figure shows the relationship between the incidence of co-financing and the qual-
    ity of coordination between the two donors. The icons indicate a rough classification of
    how well the donors are targeting the need within the country (as measured by aid-poverty
    correlation and concentration ratios), with a green circle indicating effective targeting by
    both measures, and red triangles indicating good targeting by only one measure. Malawi is
    not included due to a lack of information on co-financing of aid projects.

projects that target poverty reduction, such
as social and local development projects,
tend to have lower financial requirements
and thus are less dependent on co-financing.
Another potential reason, drawing from the
analysis of Winters (2019), is that co-financed
aid projects may experience increased trans-
action costs that hinder the sharing of infor-
mation on sub-national aid targeting. A
future analysis could also examine the role
of the recipient government in encouraging
or discouraging the co-financing of projects,
as well as the nature of the relationship
between the central and regional govern-
ments, which may support or undermine the
availability of co-financing and the sectors
that receive aid.

Conclusion
Over the past decade, declarations and
statements from Rome, Paris, Accra, and
Busan have called for, among other things,
greater attention to effective aid delivery.
Until recently, most studies of aid targeting

have been confined to cross-national tests
or treatments of aid targeting within single
countries, which may not adequately capture
the level at which donors spatially target
specific foreign aid or how donor targeting
can vary sub-nationally across countries. The
emergence of new geocoded data on donor
activities for bilateral and multilateral aid
organizations provides us with an opportu-
nity to examine the existence and quality of
aid targeting sub-nationally, and to consider
the effects of donor coordination on it. In
this pilot analysis, we have outlined how the
combination of clustering and concentration
of poverty provides a theoretical framework
for evaluating aid targeting and have found
that the quality of targeting varies substan-
tially from one country to the next.
  In Senegal, we found a high level of aid
clustering in a country with geographically
diffuse poverty, combined with a relatively
high level of donor co-financing. Yet this
country had poor quality of aid targeting.
In Nigeria, we also found high levels of aid

clustering in a country with diffuse poverty. Contrary to what the policy literature on donor coordination would expect, co-financing is lowest in this country despite having high-quality aid targeting. In Uganda, we found that donors do not target their aid to areas with concentrated poverty, and that there is a negative correlation between aid and poverty overall. The DRC has high donor clustering with a low poverty concentration, yet aid is not concentrated in the three poorest regions and aid has an overall negative correlation with poverty. Finally, in Malawi, we showed that poverty is diffuse while aid tends to cluster on areas with the most poverty, and the quality of aid targeting is rated as high. However, more work remains to be done to reach definitive conclusions on the nature of aid targeting on poverty across all aid recipient countries.

While the main goal of this paper is to determine whether donors effectively target their placement of aid activities in areas of poverty, we have also suggested one explanation for why this may or may not be the case: reciprocal co-financing of each other's projects. Co-financing may improve overall portfolio coordination — rather than only that of the cooperative projects — by increasing communication and willingness to cooperate between the donor country offices. While the evidence from Senegal actually undermines the co-financing argument, and we need a wider cross-section of cases to establish this claim more definitively, the lack of a positive result for co-financing does not bolster confidence as to whether co-financing improves aid allocation. The negative results are therefore reflective of the findings by Winters (2019) of co-financed World Bank projects. Nevertheless, much work remains to be done on the effect of donor coordination on the quality of aid targeting.

Of course, there are a host of other country-level variables, including levels of corruption, presence or history of conflict — such as in the Kivu region of eastern DRC — or bureaucratic quality, that undoubtedly also contribute to the quality of aid targeting of the bilateral and multilateral donors, though

to evaluate this properly one would need a much larger set of countries with rich sub-national information. Moreover, we considered poverty as an issue around which these donors target aid, and so future work should consider a larger portfolio of donor goals, such as improved nutrition, child mortality, and disease eradication. In particular, Chambers (2014) suggests a 'tarmac effect' such that development actors target projects overwhelmingly toward areas accessible by roads, widening inequality with areas less accessible by roads. A future project could examine sub-national road networks and the targeting of aid projects. Furthermore, greater temporal coverage of poverty data would allow for a time-series analysis of aid and poverty. Building upon our simple correlational analysis, a future project could conduct a more sophisticated multivariate regression analysis that uses geospatial techniques to examine the sub-national distribution of aid. Finally, future work should also examine the quality of aid targeting by individual donors. While pooling donors as bilateral and multilateral allows for an examination of the broader trends, examining individual multilateral and bilateral donor aid strategies would provide insight into how each donor functions and determines its priorities of where to target aid.

Notes

[1] Jean-Louis Sarbib of Development Gateway and Björn-Sören Gigler of the World Bank have made the soccer analogy frequently. The 'swarm principle' is an incredibly apt description of popular feelings about donor coordination.

[2] World Bank GNI per capita data, https://data.worldbank.org/indicator/ny.gnp.pcap.cd. Poverty data are from 2015, http://povertydata.worldbank.org/poverty/country/KEN.

[3] We examine poverty because it is an important phenomenon in its own right and is also a broader reflection of the overall level of need in an area. USAID (2019), for example, states that 'people who live in extreme poverty lack both

income and assets and typically suffer from interrelated, chronic deprivations, including hunger and malnutrition, poor health, limited education, and marginalization or exclusion.' Thus this study examines all aid to impoverished areas, in addition to short-term, poverty-reducing aid.

[4] However, Claessens, Cassimon and Van Campenhout (2009) find that the selectivity of aid allocations of bilateral donors has improved over time.

[5] See http://www.worldbank.org/en/topic/poverty.

[6] These results have been challenged (Canavire et al. 2005), while some have found evidence that bilateral donors can influence the actions of multilateral banks (Kilby 2006). At the very least, there is a need for more research on the topic of the objective function of multilateral donors.

[7] See https://www.usaid.gov/ending-extreme-poverty.

[8] See https://www.gov.uk/government/organisations/department-for-international-development/about.

[9] See https://www.jica.go.jp/english/about/mission/index.html.

[10] See http://www.sida.se/English/About-us/Our-mission/.

[11] Poverty data is available at the second administrative division level only for select countries. Thus, we use poverty data at the first administrative division level for all countries in our sample. The data for Senegal is lacking for three districts (Kaffrine, Kaodougou, and Saodhiou) and so these districts are not included in the analysis.

[12] Second-order administrative divisions are used in Malawi because of the small number of first-order districts. Uganda has the fewest number of first-order administrative divisions, with four, while Nigeria has the most, with 36.

[13] In Tables 1A and 2A in the appendix, we provide the correlations between sectoral aid commitments and individual donor aid commitments with poverty. A full analysis of sectoral aid and individual donors would go beyond the scope of this paper.

[14] Malawi lacks information on the co-financing of aid projects and so is not included in the analysis.

[15] There are four regions in Uganda, and so the comparison here is the amount of poverty and aid in the two poorest regions compared to the amount of poverty and aid, respectively, in the country as a whole.

Additional File
The additional file for this article can be found as follows:

· **Appendix.** Additional Information on Geo-Coded Aid Data. DOI: https://doi.org/10.5334/sta.669.s1

Competing Interests
The authors have no competing interests to declare.

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