Why do former colonies receive more foreign aid? Decomposing the colonial bias

Daina Chiba[*]   Tobias Heinrich[†]

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Abstract

One of the strongest findings in foreign aid is that donors provide much more foreign aid to their former colonies than to other states. Unfortunately, we know relatively little about why this is the case. In fact, scholars seldom offer a theoretical justification for the inclusion of colonial history in statistical models. This paper provides an analysis of the only explicitly made rationale, which unfortunately suffers an identification problem: a colonial history may matter for how salient policy concessions are, but it may also be the case that former colonies make for favorable targets of aid regardless of their saliency. Thus, the usual coefficient estimate conflates these two sources. We solve this inferential quandary using a decomposition approach from labor econometrics. Our results show that about 75–100% of the colony effect on foreign aid stems from the greater saliency that donors give to policy concessions from former colonies.

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[*]Department of Government, University of Essex, dchiba@essex.ac.uk.

[†]Department of Political Science, University of South Carolina, heinrict@mailbox.sc.edu. Corresponding author.

1 Introduction

For development aid to live up to its titular goal, donors should direct their funds to the poorest countries (Rosenstein-Rodan 1961, McGillivray 1989). This perspective is a cornerstone of many efforts to assess how much donors value development priorities in aid allocation (Knack, Rogers & Eubank 2011, Dollar & Levin 2006, Easterly & Williamson 2011, Clist 2011, Easterly & Pfütze 2008). *Prima facie* evidence that (some) donors are only weakly development-oriented emanates from the well-known empirical result that donors disproportionately bankroll former colonies with foreign aid (see among many Alesina & Dollar 2000). In our data set, colonizer–colony aid flows make up 17% of the total aid while such dyads constitute only 3% of the observations.

Donors' pro-colony bias in foreign aid research has been found by researchers regressing the amount of aid that flows between a donor and a recipient on a variable that indicates whether the two countries shared a colonial history. As scholars almost always obtain a positive, sizable, and robustly significant coefficient, the finding is among the most prominent in the foreign aid allocation literature (see Neumayer (2005) for a comprehensive summary). Despite its robustness, however, we know relatively little about the theoretical underpinnings of this empirical relationship. Part of the reason is that scholars seldom offer a theoretical justification for the use of the colony indicator other than by saying that other studies have used it to remedy concerns about omitted variable bias[1] or to capture the "links" between the donor and the recipient. This is unfortunate because we could potentially learn more about the politics of foreign aid by theorizing what lies behind this powerful association. Simply treating the colony history as a proxy for "link" is unsatisfactory as a strong "link" could increase or decrease foreign aid flows depending on the theoretical model in which it occurs.[2] In short, not having a good explanation for one of the strongest results

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[1]   Including a colony dummy to reduce omitted variable bias for other covariates means that we cannot interpret the coefficient for the colony variable causally, for other covariates generate post-treatment bias (King & Zeng 2006).

[2]   Do donors use aid to bribe states with a weak shared "link" or subsidize with aid those with a strong "link"? As we argue in greater depth below, any strength of "link" can be consistent with high levels of aid for a different reason.

should generate unease.

We are aware of only one article that embeds colonization within a fully specified theoretical model of political decision-making and formally derives a hypothesis about the effect of colonial history on foreign aid (Bueno de Mesquita & Smith 2009).[3] These authors argue that the flow of foreign aid is a donor government's payment for a policy concession from the recipient country that the domestic constituency of the donor government enjoys. The colony indicator is one operationalization of how much saliency this constituency attaches to the bought policy change from former colonies relative to those from other states. For example, French citizens care about the legacy of French colonialism and thus strongly support providing aid for educational programs in former colonies (Schraeder, Hook & Taylor 1998). However, these scholars provide no evidence beyond anecdotes that the donor constituency appreciates aid projects in former colonies more. We report results from a novel survey experiment conducted in the United Kingdom that affirms the rationale.

This saliency explanation of the colony effect —embedded within a formal model of aid-for-policy deal— is a significant improvement over the "link" argument as the model gives us an unambiguous prediction as to how a colonial history affects aid flows. However, the empirical association between a colonial history and aid flows is consistent with yet another interpretation that can also be derived from the same theoretical model, generating an identification problem.[4] Specifically, the aid-for-policy model also points to the recipient countries' governmental resources and political institutions that shape the price for a given policy concession from a recipient country (Bueno de Mesquita & Smith 2009): bribing becomes more costly as the recipient's institutions grow more inclusive and the government's budget increases. These features of recipient countries are exactly those that recent research on economic development unequivocally emphasizes as having been drastically affected by colo-

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[3]   Another is by Heinrich (2013) who explicitly builds on the arguments by Bueno de Mesquita & Smith (2009). For parsimony, we keep the emphasis on the original article. Steinwand (2015, pg. 7) provides a similar rationale for his theoretical considerations.

[4]   As we explain this in details below, this occurs as two more variables in the theoretical model can be operationalized via a history of colonization.

nization (Sokoloff & Engerman 2000, Nunn 2009, Spolaore & Wacziarg 2013, Pepinsky 2015).[5]

As policy concessions are more valuable from a former colony *and* as colonization shapes (other) determinants of the optimal foreign aid flow, then there is an identification issue at the heart of the only theoretically grounded explanation for the pro-colony bias in aid. Depending on how colonization affects other determinants of aid, the usually obtained positive coefficient on the colony indicator can understate, overstate, or be about right with respect to the saliency interpretation forwarded by Bueno de Mesquita & Smith (2009). For example, if former colonies' governmental resources and institutions are different from those of the states that were not colonized such that donors choose greater aid flows regardless of the saliency of the policy concession, then the estimated coefficient for the colony indicator will *overstate* the extent to which donors care about the policies in former colonies. That is, the widely obtained positive coefficient is also due to the observable heterogeneity of the sample and not only because donors treat former colonies differently. In contrast, if the political institutions and wealth are conducive to generally less aid, then the coefficient estimates would *understate* donors' saliency for colonies' policies. Lastly, it may also be that these differences are negligible or cancel out across variables so that the estimated coefficient may thus correctly capture the hypothesized saliency effect on aid flows.

Which of these three cases is at play? We will provide a data-based estimate of the extent to which the saliency-based explanation drives the well-known pro-colony bias. To this end, we reanalyze the data by Bueno de Mesquita & Smith (2009) by turning to a variant of the Blinder-Oaxaca decomposition (Blinder 1973, Oaxaca 1973). The approach was developed to understand why male workers receive higher wages than female counterparts: is this because male workers are observably more qualified (i.e., have higher education and/or more work experience) or is it because female workers are treated differently (i.e., discriminated against)? This approach allows us to make a precise data-based claim about the relative power that *observable* differences between colonies and non-colonies (wealth, institutions)

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[5]   Technically, most research captures the effects of colonization on gross-domestic product per capita. This multiplied by the population and the share of GDP that the government commands provides the measure of "government resources" in Bueno de Mesquita & Smith (2009) and subsequent work.

have compared to differences in donors' saliency over policy concessions.

Our decomposition analysis shows that the colony-as-saliency explanation—the *behavioral* effect—strongly dominates. In the model specification that is closest to the theoretical argument, about 95% of the colony bias is explained by differences in saliency, leaving only the remainder to *observable* differences due to a legacy of colonization on today's economy and political institutions. To us, this is a remarkable finding. A huge body of research shows how profound the latter effects of colonization have been (see for example Nunn 2009). However, when we consider foreign aid, these consequences are minuscule compared to the lingering effects on the preferences of present-day citizens in the former colonizer.

Our findings have a range of implications. We preview the three most crucial ones here and develop all fully at the end of the paper. First, our results highlight the importance of the contents of the preferences of donor government's constituents. While our research is not intended to directly extract preferences, we provide some initial evidence that usually prominent interests in the donor country (military, trade, and normative concerns) may only reduce the *behavioral* component in the colony-bias from 95% to about 75%. Much about the content of these aid-for-policy deals remains ill-captured in existing data, and thus future research should focus on a better understanding of what actors in the donor country seek.

Second, a growing literature in economics and to a smaller extent in political science is interested in "deep" behavioral causes of today's world. Slavery in the U.S. South, medieval anti-Semitism in Germany, and experiencing the well-functioning bureaucracy of the Habsburg Empire have been shown to affect people's behaviors and attitudes many decades, even centuries later (Acharya, Blackwell & Sen 2015, Acharya, Blackwell & Sen 2016, Voigtländer & Voth 2012, Becker, Boeckh, Hainz & Woessmann 2016). To our knowledge, such lingering behavioral effects have not been shown for foreign policies.

Third, the just-mentioned channel also raises another exciting possibility. The development literature has discussed numerous paths through which a colonial history affects the economic and political outcomes today, including institutional changes and transmission of social and human capital (Alesina, Devleeschauwer, Easterly, Kurlat & Wacziarg 2003, Spo-

laore & Wacziarg 2013). However, the channel via aid has received little attention in this context. The newly reached consensus is that aid can have positive development effects when the donor and the recipient are democracies (Bearce & Tirone 2010, Bermeo 2011, Dutta, Leeson & Williamson 2013, Wright & Winters 2010). It turns out that this latter circumstance is itself a consequence of colonization (see for example Nunn 2009). If (some) colonization spurs democracy in the long run thus making aid effect and today's donors fund former colonies more because of deep behavioral roots, then aid to former colonies may have been responsible for part of the greater wealth in former colonies nowadays. This positive, optimistic view about aid is in stark contrast to the common thought that aid is ineffective (Easterly 2009).

In the next section we review how scholars have been using the colony indicator in research on foreign aid allocation and present the results from a novel survey experiment that affirms for the first time this basis for the colony-as-saliency explanation. In the following section we introduce the identification problem that plagues the interpretation of the procolony bias and illustrate the point via a synthetic data exercise. After outlining the decomposition procedure that allows us to disentangle the sources of this bias, we carry out the analysis and discuss the wider implications.

2   Colonial history and foreign aid allocation

The literature on foreign aid allocation sprung from economists' quest to understand why aid inflows barely or inconsistently generated economic growth. Scholars realized that donors were using aid as a political tool for influence and therefore would not direct it to where it would be needed the most or could spur economic growth (Morgenthau 1962). These biases, driven by "donor interests," were said to explain the absence of a robust aid-and-growth relationship (McKinlay & Little 1977, Maizels & Nissanke 1984).

Within this "donor interest" strain emerged the focus on a history of colonial relations.[6]

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[6]   Other perennials in this strain include the donor's exports, geographic distance, regional effects, and West-

In a review of aid allocation research, Neumayer (2005) reports that of thirteen major studies, nine feature an indicator for a colonial history between the donor and the recipient.[7] Of the eighteen articles on bilateral aid allocations featured in the recent edited volume by Milner & Tingley (2013*b*), eleven use colonial history as an explanatory variable. In short, if one reads an article on foreign aid allocations, the odds are good that a colony indicator will be among the regressors, and its coefficient is positive and statistically significant.

Unfortunately, the authors of the bulk of these studies seldom offer an explanation as to what exactly is being operationalized by the colony variable, or how they arrive at the expected direction of the effect on aid outcomes. For instance, Dudley & Montmarquette (1976, p. 138) use the variable as it "proxies for political links between donor and recipient." Alesina & Dollar (2000) justify the use by saying that others have used it. Neumayer (2003, p. 653) argues that it "is a well-established result that many donors favor their former colonies in part at least because of a political interest in maintaining their influence on those countries." Berthélemy & Tichit (2004) write that "another indicator of the donors' self-interest may be found in the privileged relations with their former colonies, usually their political and commercial allies." Carey (2007) writes that to "account for the impact of donor interests on aid commitments, I include a binary variable for former colonies for British and French aid" in her analysis of European states' aid flows. As a last example, Bermeo & Leblang (2015) use the indicator as they "are interested in controlling for 'connections' between the donor and recipient."

While some scholars include the colony indicator because others have used it or to guard against omitting an important variable, the desire to proxy political "links" and "connections" between the donor and recipient seems to drive the other uses. The latter approach is unsatisfactory, however, as one cannot derive a hypothesis without specifying the role of "links" within a decision-making context with respect to aid. For example, let the strength of a "link" correspond to the degree of alignment of interests between the donor and the re-

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ern troop deployments. See the charts in Neumayer (2005).

[7] The count only relies on research that (also) studies countries that were major colonizers, such as Great Britain and France. Studies on U.S. aid only are omitted from this count.

cipient governments. In the case of a strong alignment of interests, a donor might give more aid because it wishes to subsidize the already aligned policies of the recipient. The recipient would use aid to pursue more of the existing policy that the donor already likes. In the case of a weak alignment, a donor could bribe the recipient so that its policies become more to the donor's liking. The scholars cited above are not clear whether "maintaining [...] influence" (Neumayer 2003) and "privileged relations" (Carey 2007) suggest aid flows as a subsidy or bribe.

An illustration for the basic rationale should show its inadequacy. Let's contrast U.S. aid to Pakistan and the Philippines after 9/11. Prior to 9/11, the government of the Philippines was putting "constant military pressure on Abu Sayyaf" (Niksch 2007, p. 7), an organization that has been intermittently associated with Al Qaeda. Niksch (2007) emphasizes that the Philippine government's means were strained as it faced material limitations in countering Abu Sayyaf. After 9/11, the United States subsidized Philippine efforts with aid to help overcome these shortages. In contrast, Pakistan had more amicable prior relations with Al Qaeda so that then-U.S. President "Bush made enormous U.S. grants-in-aid *in exchange* for Pakistani cooperation in fighting terrorism" (Ambrose & Brinkley 2011, p. 504) (emphasis added). After 9/11, the alignment of interests between the United States and the Philippines over battling Abu Sayyaf just as the non-alignment with Pakistan over Al Qaeda lead to increases in U.S. aid.

In short, it is not obvious which implications for aid flows follow when "links" grow stronger. Without a theoretical model, we cannot understand the role that "links" and "connections"—the widely invoked justifications for the use of the colonial history in prior research— play in the decision to provide foreign aid. Consequently, we do not have a theoretical expectation about the direction of the coefficient.

3 Colonial history as donor-side saliency

To our knowledge, there exists only one set of uses of the colonial variable in the context of a theoretical model. Bueno de Mesquita & Smith (2009) present a formal model that treats foreign aid as a payment in aid-for-policy deals between the donor and the recipient governments. The model stipulates that donors vary in the saliency they attach to policy concessions from a recipient country. One of the empirical operationalizations of donors' saliencies is that "former colonies hold higher salience for donors than do states with which they had no special prior relationship" (p. 325). Because the donors' leaders act to provide their supporters[8] with what they seek and since policy concessions from former colonies are assumed to be valued more, donor leaders are willing to buy more policy concessions and thus pay more in foreign aid to a former colony. Working from a modified version of the model, Heinrich (2013, p. 429) justifies similarly the colony-as-saliency interpretation by writing "policies in former colonies play a significant role in donors' domestic politics. For example, France cares that its culture and language are carried on in former colonies, which it ensures by extending aid to recipient governments." For these authors, the colony variable proxies saliency, a concept for which their political economy models produce clear predictions.

The central assumption is that the public in the donor country appreciates differently policies and results bought by foreign aid depending on whether they occur in former colonies. While Bueno de Mesquita & Smith (2009) and Heinrich (2013) argue this to justify their operationalization, they provide no evidence that this is warranted. A search by us for existing public opinion surveys that could corroborate this crucial assumption turned up empty.[9] Therefore, we conducted our own short survey experiment in the United Kingdom, a significant former colonizer.

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[8]   For legibility reasons, we use the terms "supporters" and "winning coalition" interchangeably just as we do with "size of the winning coalition" and "inclusiveness."

[9]   The dissatisfaction with the theoretical "saliency" variable is common at conference panels involving aid and in referee reports. Unfortunately, none of these have appeared in writing (yet).

Saliency of aid projects in former colonies

In November 2016, we recruited 547 British participants via a service called Prolific, an online survey company out of University of Oxford that caters to academics. We asked British respondents to rate their support for specific policies that British aid generates in countries abroad. If the assumptions of the colony-as-saliency interpretation are correct, then survey-takers should rate aid projects in former colonies more highly. Out of space constraints, we provide only the most crucial details here and relegate much detail to Section A in the appendix.

In order to achieve a high level of external validity, we culled summary descriptions of currently active projects from Britain's main aid agency, the Department for International Development (DfID), and retained 20 that could have occured in any country in which DfID operates. Such projects include health, education, governance, and general poverty interventions. Each survey-taker is shown four minimally edited project descriptions. For each, we randomly draw a Sub-Saharan African country in which the project is taking place. For the first and third description that a participant sees, the country is not a former colony; for the other two, the project is taking place in a former colony. We ask the person to provide his or her support for DfID's pursuit of the project on a 1–5 point scale.

We find that about 50% of respondents express a high level of support[10] for the aid project when it goes to country that was not a former colony. The proportion of people who support the aid project increases by about 20 (plus or minus 3) percentage points when the name of a former colony is used in the project description. For a thorough explanation of the design and analyses of the survey experiment, see Section A in the appendix.

This suggests that British people are considerably more appreciative of policies that were brought about by aid in former colonies as opposed in countries that were not former colonies, *ceteris paribus*. This substantiates the foundational assumption behind using the colony indicator as a measure of saliency, a *behavioral effect*, in statistical models of aid allocation.

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[10]   For brevity, we dichotomize the levels of support; the two highest levels of support on a 1–5 point scale correspond to "high" level of support.

4 Identification issue

What neither Bueno de Mesquita & Smith (2009) nor Heinrich (2013) consider is that colonization has affected two other major variables in their theoretical models, namely the size of the recipient country's governmental budget and the political institutions (Nunn 2009, Pepinsky 2015). To understand the inferential issue that arises here, we return to the model to develop how these two features affect aid allocations.

We developed above how a donor leader can pay for policy concessions to cater to his supporters in the model of Bueno de Mesquita & Smith (2009). Equivalently, the recipient leader has to please his supporters in light of the policy change. When the donor pays for a change in policy, it follows that the recipient's winning coalition will be upset about the donor-demanded change and is thus more likely to oust the leader. Therefore, aid has to allow the recipient leader to provide more bribes and expanded policies that mollify his own supporters. The model predicts that the sizes of the recipient governmental budget and of the winning coalition affect how costly the bribe is. Considering this, the donor leader decides for how much policy change to ask and how much foreign aid to offer conditional on the recipient's budgetary resources, its size of the winning coalition, and his own winning coalition's saliency for policies in the recipient country.[11]

We have already reviewed how Bueno de Mesquita & Smith (2009) and Heinrich (2013) argue that the saliency over policies of the recipient is affected by a history of colonization. It turns out that political institutions and wealth of the recipient country were also profoundly shaped through colonization. Scholars in the field of the political economy of development argue that colonization led to transfers of knowledge, destruction of old institutions, erection of new institutions, and migration of settlers. Each of these consequences relates to political

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[11]   Bueno de Mesquita & Smith (2009) derive precisely and show in the data how the recipient's governmental budget and the size of the winning coalition affects the observed aid flow; it turns out that the relationship follows an inverse-u shape (Bueno de Mesquita & Smith 2009, p. 318–321). However, the inflection point of the inverse-u shape cannot be mapped into the observational data. Therefore, we use the vaguer statement that the donor leader makes aid choices "conditional on" the size of the winning coalition and that of the recipient's governmental budget.

institutions and wealth nowadays in some ways or others.[12]

Whereas many studies report uniform effects, more recent studies show some heterogenous consequences of colonization due to different policies pursued by colonizers (Feyrer & Sacerdote 2009, Bruhn & Gallego 2012, Lee & Schultz 2012). For example, Acemoglu, Johnson & Robinson (2002) demonstrate how colonizers implemented extractive institutions where they found many people that could be exploited, but investment-conducive institutions where there were fewer people. Today, the former group of countries have lower wealth than states that were not colonized, whereas the latter group of countries have higher wealth. Others argue that the effect of colonization on development of institutions depends on the pre-colonial institutions as colonization itself was not a random process (Hariri 2012, Gartzke & Rohner 2011).[13] Whereas the mechanisms and magnitudes of the effects are still studied extensively, it is undoubtedly the case that colonization has "played a central role in determining the long run evolution of national political economies," as Pepinsky (2015) puts it without any qualification.[14,15]

This lays bare the inferential issue. In the context of the model by Bueno de Mesquita & Smith (2009), colonial history affects aid through two channels, via the degree of appreciation of a given policy concession — the saliency interpretation — and via the price to be paid

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[12]   Again, wealth relates to a country's budget when it is multiplied by the number of people in the country and by the government's share of the economy. In the data we are using below, these variables are only very weakly correlated.

[13]   It is also possible that being a colonizer has left a mark on donors' institutions and wealth which work analogously in constraining the donor's leader to provide aid. However, to our knowledge, this literature is not sizable. Therefore, we focus on the effects of colonization on the colonies.

[14]   We are focusing on wealth and political institutions in the recipient countries, as these are the variables that are explicitly incorporated in the theoretical model of aid allocation. However, several other mainstays in aid allocation regressions are also known to have been affected by colonization, exacerbating the inferential issue we discuss. Most prominently, donors' trade with recipients is often used to proxy another manifestation of economic "donor interests," although these are themselves outcomes of colonization as countless studies show. Most recently, Bermeo & Leblang (2015) demonstrate how bilateral migration drive aid which itself is known to be influenced by a colonial history (Kim & Cohen 2010). For both migration and trade, colonial history is interpreted as generating familiarity with each other which in turn lowers transaction costs so that more exchange in goods and people may occur. In short, the effects of colonization on widely used monadic and dyadic determinants of aid are profound and wide spread. However, as neither migration nor trade are well tied in via the theoretical framework by Bueno de Mesquita & Smith (2009), we retain the focus on recipients' wealth and institution.

[15]   It is worth nothing that while we illustrate the identification issue using monadic covariates of the recipient, the implications for aid from the two are not monadic. For example, the donor-side resources interact with recipient-side resources in the model by Bueno de Mesquita & Smith (2009).

per one unit of policy change — the observable heterogeneity interpretation. While we have developed the theoretical basis of the inferential issue, we illustrate in the next section via a synthetic data demonstration that the common statistical approaches connecting the presence of a colonial history to aid are ill-equipped to distinguish profoundly different causal arguments. Therefore, the interpretation of the pro-colony bias by Bueno de Mesquita & Smith (2009) and Heinrich (2013) may be off in *a priori* unknowable directions.

Illustration of the identification issue

We conduct a synthetic data exercise to illustrate the inferential issue developed on theoretical grounds in the previous section. We generate five synthetic data sets, each of which has two groups — colonial dyads and non-colonial dyads. The two groups of observations differ not only in their covariate distributions (i.e., wealth), but also in how this covariate affects aid.

Figure 1 shows the scatterplots of the five data sets. Each data set has three variables: *Aid* represents aid flow between the donor and the recipient, shown on the y-axis; *Resources*, shown on the x-axis, is the recipient government's resources, which is one of the features in the model by Bueno de Mesquita & Smith (2009) that influences aid; finally, *Colony* is a colony dummy indicating whether there is a colonial history between the donor and recipient.[16] Each of the five data sets has 200 colonial observations (shown with black crosses) and 200 non-colonial observations (shown with grey circles). We add marginal rugs to each scatterplot. The bottom one in grey shows the marginal distribution of *Resources* for non-colonial observations, and the top one in black shows that for colonial observations. Similarly, the left-hand rug shows the marginal distribution of *Aid* when *Colony* $= 1$, and the right-hand side when *Colony* $= 0$. The relationship between *Aid* and *Resources* is assumed to be a concave-down parabolic relationship in all five cases.[17]

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[16]   The illustrations are analogous if we used the winning coalition size instead of resources.
[17]   This is motivated by the empirical results by Alesina & Dollar (2000) and Bueno de Mesquita & Smith (2009) which show that there is an inverse-*u* relation between resources (as well as GDP per capita) and aid. The theoretical results of the latter article also predict this relationship (see also Footnote 11).

Figure 1: Simulated data
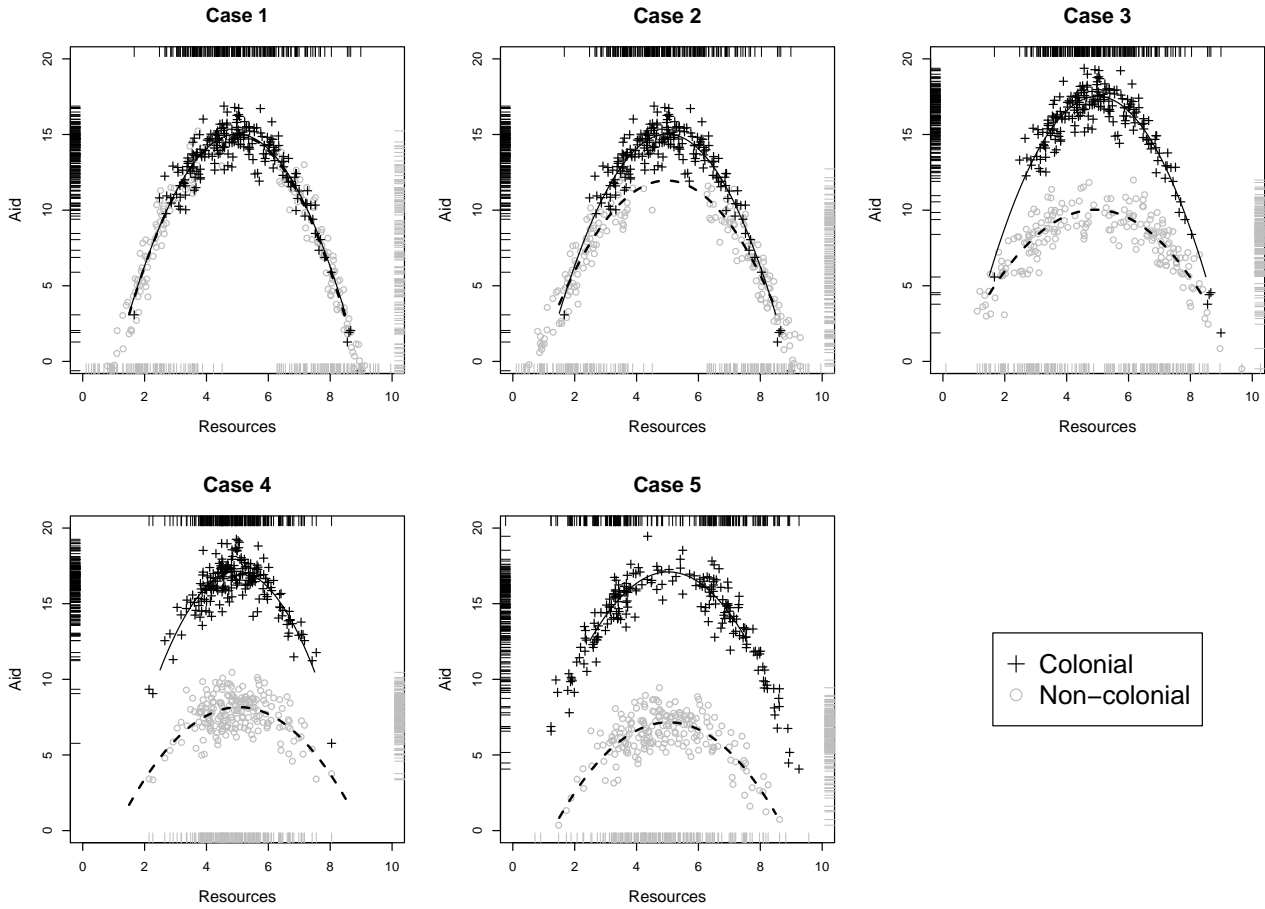
Notes. This figure shows bivariate scatterplots for five hypothetical data sets. Each data set contains 400 observations and three variables, *Aid* (y-axis), *Resources* (x-axis), and *Colony* dummy that splits the observations. Colonial observations are denoted with black crosses and non-colonial observations are shown with gray dots. Marginal distributions of *Aid* and *Resources* are shown with rugs in corresponding colors on the axes. Solid and dashed curves show the relationship between *Resources* and *Aid* for colonial and non-colonial observations, respectively.

What is common across these five synthetic data sets is that the mean value of *Aid* is higher for colonial observations than for non-colonial observations, consistent with the findings documented in previous studies of foreign aid. Moreover, if we regress *Aid* on *Resources* and the *Colony* indicator, as is typically done in research, the estimated coefficient for the colony dummy is positive and statistically significant across all five cases.[18] As shown in Table 1, the estimated coefficient for *Colony* is roughly eight for each of the data sets.

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[18] As we show in the appendix, including the quadratic term of *Resources* does not change our conclusion.

Table 1: Regression results of the simulated data

	Case 1	Case 2	Case 3	Case 4	Case 5
Colony	7.82***	7.88***	7.95***	8.42***	7.84***
	(0.48)	(0.37)	(0.25)	(0.16)	(0.26)
Resources	−0.13	−0.13*	−0.21***	−0.12	−0.09
	(0.10)	(0.08)	(0.07)	(0.08)	(0.07)
Intercept	5.99***	5.94***	8.77***	8.21***	6.43***
	(0.61)	(0.46)	(0.38)	(0.41)	(0.39)
Observations	400	400	400	400	400
Adjusted R^2	0.40	0.54	0.72	0.87	0.70
Note:			*p<0.1; **p<0.05; ***p<0.01		

However, each synthetic data set tells a different causal story about how aid comes about (1) as a result of observable differences in the distributions of *Resources* and (2) depending on how they translate into *Aid*. We call the former difference *observable* and the latter *behavioral* effects. They are *behavioral* because the decision-maker acts differently depending on the saliency when encountering the same level of observable *Resources*. This is coterminous with the saliency interpretation discussed in the previous section.

In Case 1, there is a clear *observable* difference between colonial and non-colonial observations in terms of the distributions of *Resources*. Specifically, observations are clustered around the inflection point (around 5) for colonial dyads as shown in the rugs on the top axis, whereas the distribution of *Resources* is bimodal for non-colonial dyads as shown in the rugs on the bottom axis. At the same time, the *behavioral* effect of *Colony* is set equal to zero in this case; the relationship between *Resources* and *Aid* is identical across different groups. We add a solid curve that shows the relationship between the *Resources* and *Aid* for colonial dyads and a dashed curve for the non-colonial dyads. Since the relationships are identical, the curves overlap in this panel. In this case, *Aid* is higher for colonial observations not because donors *behave* differently in reaction to observables of colonies and non-colonies, but because colonial observations are *observably* different from non-colonial observations. This corresponds to a case where the positive coefficient for the colony dummy would *overstate*

the difference in saliency.

In contrast, Case 4 features no *observable* difference in the distribution of *Resources* between colonial and non-colonial observations; the upper and lower rugs look identical. The differences in *Aid* between the groups are therefore driven entirely by how donors respond to *Resources*; i.e., there is a *behavioral* difference between aid to colonies and aid to non-colonies. Specifically, the *Resources-Aid* curve (solid) governing colonial observations is much steeper than its counterpart for non-colonial observations (dashed). The lack of *observable* differences in *Resources* paired with a much stronger *behavioral* reaction to these *Resources* corresponds to a situation where a positive coefficient for the colony dummy would correctly estimate the importance of saliency. This means that the entire pro-colony bias would be driven by *behavioral* effects in the donor-recipient relationship.

Between these two polar cases lie Cases 2 and 3, where there are both *observable* and *behavioral* differences. In Case 2, the *observable* effects are stronger than the *behavioral* effects, whereas the opposite holds in Case 3. Both Cases 2 and 3 correspond to a situation where a positive coefficient for the colony dummy would *overstate* the effect of saliency, and more so in Case 2 than in Case 3.

Finally, Case 5 illustrates a situation where the distribution of *Resources* is reversed between colonial and non-colonial observations such that data are clustered around the inflection point in non-colonial group whereas they are not in colonial group. *Aid* would be higher for non-colonial observations were it not for any *behavioral* difference, and yet we observe higher *Aid* for colonial observations due to a huge *behavioral* difference. This corresponds to a situation where a positive coefficient for the colony dummy would actually *understate* the effect of saliency.

This simulation exercise presents a simple and stylized version of the identification issue that incorporating the knowledge from the political economy of development within the model by Bueno de Mesquita & Smith (2009) presents. Each substantively different scenario from Figure 1 results in roughly the same coefficient estimates in a regression of aid on a colony indicator as shown in Table 1. Therefore, a positive coefficient on *Colony* by itself

cannot tell us the extent of the *behavioral* effect — corresponding to the saliency explanation—
that Bueno de Mesquita & Smith (2009) and Heinrich (2013) hypothesized. As we show in
the appendix, running quadratic models (i.e., fitting a curve instead of a line) or interactive
models (i.e., fitting separate regression curves for colonial and non-colonial observations)
does not solve the issue, either.

5   Empirical analysis

To determine the relative importance and directions of *behavioral* and *observable* effects, we
turn to a statistical approach that can distinguish between the cases just illustrated.[19] Specif-
ically, we use a decomposition method developed in labor econometrics and that has been
used in applications in political science lately.[20]

Decomposition method

The idea to decompose an outcome difference between groups comes from the microecono-
metrics literature on wage discrimination (Oaxaca 1971, Oaxaca 1973, Blinder 1973). Differ-
ences in wages might be driven by *behavioral* effects (i.e., discrimination by employers) and
by differences in *observable* characteristics (e.g., education and labor market experience). This
research seeks to answer the following question: How would the distribution of wages look
for women if they were operating under the *behavioral* regime of males (i.e., if there were no
discrimination against women)? That is, is the difference in wages caused by differences in
coefficients between the two groups or by differences in the values of covariates between the
two groups?

In our study, the analogous question is: How would the distribution of foreign aid look
for colonial dyads if aid-for-policy deals for former colonies were equally salient for non-

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19   As the aid literature has relied almost exclusively on uniform effects of a colonial history, ignoring inter-
colonizers differences that the development literature identifies, we retain such focus.
20   See work by Dow (2009), Reed & Chiba (2010), Conrad & Milton (2013), and Chiba, Martinez Machain &
Reed (2014).

colonial dyads? With an answer to this question, we can determine the extent to which the pro-colony bias in aid is due to *behavioral*, saliency-related effects. As the decomposition approach is not a standard item in political scientists' toolkits, we first develop its intuition by relying on a linear regression model. Subsequently, we present a non-linear extension of the approach suitable for a Tobit model used in foreign aid research. Assume the standard linear regression model,

$$E(Y) = \bar{Y} = \bar{X}\beta, \tag{1}$$

where Y is the vector of some outcome of interest, $\bar{Y}$ is the mean of Y, and $\bar{X}$ is a row vector that contains mean values of the covariates, and β is a column vector of coefficients. The mean outcome gap, G, between the two groups (C for colonial dyads and N for non-colonial dyads) is,

$$G = \bar{Y}^C - \bar{Y}^N$$
$$= \bar{X}^C\beta^C - \bar{X}^N\beta^N. \tag{2}$$

This mean difference can be rewritten by adding and subtracting $\bar{X}^C\beta^N$ from the right-hand side and gathering the relevant terms together,

$$G = \bar{X}^C\beta^C - \bar{X}^C\beta^N + \bar{X}^C\beta^N - \bar{X}^N\beta^N$$
$$= \underbrace{\left(\bar{X}^C - \bar{X}^N\right)\beta^N}_{Observables} + \underbrace{\bar{X}^C\left(\beta^C - \beta^N\right)}_{Behavior}. \tag{3}$$

The first part of equation (3), *Observables*, is the difference in the foreign aid flows between the groups that differences in measurable variables can explain.[21] If the groups were

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[21] The coefficients from the sample of non-colonial dyads (β_N) are used for the vector of benchmark coefficients that is multiplied with $\bar{X}^C - \bar{X}^N$. This is comes from the convention in labor economics of using the sample of males as the benchmark because this group is not expected to experience wage discrimination. Isomorphic results entail if colonial-dyads served as the baseline.

identical as in Case 4 in the synthetic data above ($\bar{X}^C = \bar{X}^N$), the difference in the foreign aid flows would stem entirely from *behavioral* differences (i.e., β^C and β_N). However, the literature on political economy of development argues that this is not the case; $\bar{X}^C$ should be different from $\bar{X}^N$ (as in Cases 1–3 and 5 in the synthetic data exercise).

The second part of equation (3), *Behavior*, corresponds to the difference in aid flow that stems from *behavioral* differences between the two groups (i.e., differences in how colonial and non-colonial dyads respond to values of the *observable* variables). If $\beta^C = \beta^N$, all of the difference in aid flows between colonial and non-colonial dyads is a function of differences in *observable* variables. However, the saliency explanation advanced by Bueno de Mesquita & Smith (2009) and Heinrich (2013) suggests that differences in βs explain the bulk of the pro-colony bias in aid.

The decomposition method allows us to derive a data-based assessment of the relative merit of the two effects by generating percentages attributable to *observables* and *behavior*. For example, if we apply this method to the five synthetic data sets presented above, the results are 100% *observables* & 0% *behavior* in Case 1, 70% *observables* & 30% *behavior* in Case 2, 20% *observables* & 80% *behavior* in Case 3, 0% *observables* & 100% *behavior* in Case 4, and -15% *observables* & 115% *behavior* in Case 5.

Data and results

Using the the decomposition method, we can provide estimates of the relative merits of the saliency argument (focusing on βs) and from the colonization literature (focusing on Xs) in explaining the pro-colony bias. We now turn to the data set compiled and the covariate specifications used by Bueno de Mesquita & Smith (2009) to perform the decomposition. The data set spans the time frame of 1960–1999 and contains annual information on 21 potential donors and 134 potential recipients; this gives 81,144 donor-recipient-year observations of which about 3% are colonial dyads.[22] The outcome variable, Bilateral Aid, is the natural logarithm of the gross amount of bilateral foreign aid (in constant U.S. dollars) given by the

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[22]   For a list of countries included as donors and recipients as well as their colonial status, see Appendix B.

prospective donor to the recipient in a given year. The mean of this variable is 8.3 for colonial dyads and 3.5 for non-colonial dyads. We seek to understand how much of the gap between these two is attributable to differences in terms of observable and behavioral characteristics.

For our main analyses, we focus on a set of covariates that Bueno de Mesquita & Smith (2009) introduced and justified as operationalization of parameters in their theoretical model. Aside from the colonial dummy, we treat these as sources of *observable* differences. Specifically, we look at donor's and recipient's resources, recipient's winning coalition size and population, their geographic distance, and a dummy variable for the Cold War period.[23] To capture the theoretically expected inverse-u shaped effects of the recipient government's resources, we include the squared term for this variable. The non-linear effect of the recipient's winning coalition size is modeled by creating dummy variables corresponding to each of the ordered categories of this variable. All these covariates are taken directly from the replication data set for Bueno de Mesquita & Smith (2009). Figures A.3 and A.4 in Appendix C show the distributions of these variables for colonial and non-colonial dyads.[24]

To apply the decomposition method, we first need to regress the outcome on these covariates separately for colonial and non-colonial samples and obtain $\hat{\beta}^C$ and $\hat{\beta}^N$. As foreign aid is given only to selected recipient countries, bilateral aid flows between a donor i and a prospective recipient j in year y are zero in many observations. We thus estimate a Tobit model. To account for the potential non-independence across units and time, we use random intercepts as well a cubic polynomial of calendrical time. Specifically, we have

$$
\begin{aligned}
Y_{ijt} &= \max\left(0, Y_{ijt}^*\right) \\
Y_{ijt}^* &= x_{ijt}\beta + \gamma_1 t + \gamma_2 t^2 + \gamma_3 t^3 + \nu_{1i} + \nu_{2j} + \epsilon_{ijt},
\end{aligned}
\tag{4}
$$

where Y_{ijt}^* is the natural logarithm of foreign aid given by donor i to recipient j in time t,

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[23]   The latter three are additional operationalizations of a donor's winning coalition's saliency for policy concessions.

[24]   We also report test statistics comparing their distributions for colonial and non-colonial samples in Table A.3 in Appendix C. The results suggest that there is a substantial difference between the two groups for *all* the variables, except for the Cold War dummy and Multilateral Aid.

x_{ijt} is a vector of time-varying covariates, β is a vector of coefficients, and γs are coefficients for cubic polynomial of time.[25] The model captures the effects of unmeasured heterogeneity by donor and recipient by incorporating two random effects, ν_{1i} and ν_{2j}, respectively. We assume that these are independent from x_{ijt} and t, and are distributed according to $N(0, \eta_D^2)$ and $N(0, \eta_R^2)$, respectively. ϵ_{ijt} is an error term distributed according to $N(0, \eta_\epsilon^2)$.

We estimate this model for the two separate samples for the decomposition as well as for the pooled data for illustrative purposes. Model parameters are estimated using Markov Chain Monte Carlo (MCMC) under Bayesian framework with diffuse priors, relying on the implementation by Hadfield (2010). We ran 11,000 MCMC iterations and discarded the first 1,000 iterations as burn-in.[26] Table 2 reports the summary statistics of the posterior distributions of the model parameters. The first column in the table shows the estimates for pooled dyads, the second for colonial dyads (β^C), and the third for non-colonial dyads (β^N). Cell entries are the mean of the posterior distribution along with 95% central credible intervals. These estimates indicate the estimated marginal changes in Y_{ijt}^* in response to the changes in observable variables x_{ijt}.[27] Interestingly, there appear to be several important differences between colonial and non-colonial dyads in terms of how donors respond to changes in the values of observable covariates. For example, donor's resource is positively associated with aid in colonial dyads, whereas the relationship is negative in non-colonial dyads.

To see how these differences in *behavior* compare with the differences in *observables*, we apply the decomposition method. Before proceeding though, we need to briefly revisit equation 3. We derived it using a linear regression to demonstrate the intuition behind the decomposition idea. However, since we are working with a Tobit model, we need to introduce

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[25] As Wooldridge (2002, 517–520) points out, there are two alternative interpretations of a Tobit model. In the first, observed zeros are assumed to be censored; we simply could not observe the true (positive) values of our outcome variable for these observations. This is clearly not the case here. Any positive aid would be observed as such, so our zeros are indeed zeros. We thus adopt the second interpretation, called "corner solution model", that assumes that the actor's optimal choice is indeed the corner solution, $Y = 0$, for these observations. In this interpretation, the goal is to characterize features of the distribution of Y, such as $E(Y)$, $\Pr(Y > 0)$, or $E(Y|Y > 0)$, but not the distribution of Y^* itself.

[26] For all models and parameters, we monitored the $\hat{R}$ statistic and found no signs of non-convergence.

[27]   Of course, in non-linear models such as Tobit, these marginal effects of x_{ijt} on Y_{ijt}^* themselves are usually not of substantive interests.

Table 2: Bayesian Mixed-Effects Tobit Models of Bilateral Foreign Aid

	Without controls			With controls		
	Pooled	Colonial	Non-colonial	Pooled	Colonial	Non-colonial
Colony	4.50			2.94		
	[4.30; 4.70]			[2.75; 3.14]		
Donor Resource	−0.07	3.29	−0.27	−0.07	4.33	−0.18
	[−0.20; 0.06]	[2.77; 3.80]	[−0.40; −0.12]	[−0.18; 0.06]	[3.71; 4.97]	[−0.30; −0.06]
Recipient Resource	1.40	1.00	1.50	0.79	1.67	0.61
	[1.11; 1.67]	[0.08; 1.93]	[1.21; 1.78]	[0.40; 1.17]	[0.49; 2.95]	[0.17; 1.03]
Recipient Resource^2	−0.11	−0.14	−0.11	−0.07	−0.16	−0.06
	[−0.12; −0.09]	[−0.20; −0.08]	[−0.13; −0.10]	[−0.10; −0.05]	[−0.24; −0.09]	[−0.08; −0.03]
Recipient Population	1.47	1.45	1.49	0.93	0.60	0.93
	[1.27; 1.67]	[1.10; 1.81]	[1.28; 1.71]	[0.71; 1.14]	[0.30; 0.93]	[0.71; 1.16]
Recipient W == 0.25	0.08	0.38	0.07	−0.03	0.15	−0.04
	[−0.09; 0.25]	[−0.21; 0.93]	[−0.11; 0.24]	[−0.20; 0.15]	[−0.37; 0.65]	[−0.21; 0.14]
Recipient W == 0.50	−0.55	−0.39	−0.56	−0.00	−0.23	0.01
	[−0.71; −0.39]	[−0.90; 0.14]	[−0.73; −0.39]	[−0.18; 0.16]	[−0.79; 0.31]	[−0.18; 0.19]
Recipient W == 0.75	0.21	1.39	0.12	0.36	1.05	0.30
	[0.06; 0.36]	[0.85; 1.91]	[−0.04; 0.29]	[0.19; 0.51]	[0.54; 1.56]	[0.14; 0.47]
Recipient W == 1	0.17	2.47	0.01	0.48	1.71	0.38
	[−0.10; 0.43]	[1.60; 3.46]	[−0.30; 0.29]	[0.19; 0.79]	[0.85; 2.57]	[0.08; 0.67]
Cold War	−0.37	−1.51	−0.28	0.05	−0.13	0.06
	[−0.53; −0.21]	[−2.10; −0.93]	[−0.45; −0.10]	[−0.12; 0.22]	[−0.68; 0.43]	[−0.13; 0.23]
Distance	−2.23	−0.52	−2.23	−0.99	0.53	−1.06
	[−2.32; −2.13]	[−1.68; 0.68]	[−2.33; −2.14]	[−1.12; −0.87]	[−0.41; 1.43]	[−1.19; −0.93]
Multilateral Aid				0.42	0.52	0.42
				[0.38; 0.47]	[0.39; 0.67]	[0.38; 0.47]
Trade				0.68	0.60	0.63
				[0.63; 0.73]	[0.36; 0.85]	[0.58; 0.68]
Alignment				−1.09	−3.13	−0.98
				[−1.71; −0.52]	[−5.82; −0.53]	[−1.58; −0.35]
Alignment^2				−0.71	9.23	−0.83
				[−1.60; 0.20]	[0.56; 17.66]	[−1.72; 0.05]
Time	2.02	−0.05	2.15	1.01	0.86	0.99
	[1.89; 2.15]	[−0.42; 0.35]	[2.02; 2.28]	[0.86; 1.18]	[0.35; 1.38]	[0.82; 1.14]
Time^2	−1.03	−0.84	−1.06	−0.25	−0.23	−0.25
	[−1.09; −0.96]	[−1.06; −0.63]	[−1.12; −0.99]	[−0.29; −0.20]	[−0.37; −0.10]	[−0.30; −0.21]
Time^3	0.30	0.42	0.29	−0.12	−0.28	−0.10
	[0.25; 0.34]	[0.25; 0.58]	[0.24; 0.34]	[−0.18; −0.07]	[−0.46; −0.11]	[−0.15; −0.04]
Intercept	14.31	−23.72	15.68	5.80	−52.45	8.12
	[11.45; 17.15]	[−36.86; −12.09]	[12.72; 18.43]	[2.67; 8.87]	[−64.16; −41.44]	[4.97; 11.09]
η_ϵ^2	17.29	8.528	17.41	10.61	4.952	10.73
	[17.02; 17.52]	[7.97; 9.08]	[17.16; 17.68]	[10.4; 10.77]	[4.59; 5.32]	[10.55; 10.94]
η_D^2	24.24	9.33	27.29	16.67	21.39	18.8
	[11.34; 41.07]	[0.006766; 24.97]	[13.25; 45.78]	[7.11; 27.83]	[1.98; 58.32]	[8.43; 32.88]
η_R^2	5.92	4.70	5.97	4.79	2.30	4.88
	[4.32; 7.49]	[3.02; 6.64]	[4.47; 7.43]	[3.54; 6.16]	[1.30; 3.42]	[3.60; 6.33]
Observations	81,144	2,659	78,485	44,916	1,781	43,135

95% credible interval in bracket.

the non-linear generalization proposed by Fairlie (2005). The non-linear generalization of the equation 3 is

$$G = \left\{ \sum_{k=1}^{n^C} \frac{F(X_k^C \hat{\beta}^N)}{n^C} - \sum_{k=1}^{n^N} \frac{F(X_k^N \hat{\beta}^N)}{n^N} \right\} + \left\{ \sum_{k=1}^{n^C} \frac{F(X_k^C \hat{\beta}^C)}{n^C} - \sum_{k=1}^{n^C} \frac{F(X_k^C \hat{\beta}^N)}{n^C} \right\}, \tag{5}$$

where the first component (what's inside the first curvy brackets) is the portion of the gap attributable to *observable* differences, and the second component (what's inside the second curvy brackets) is the portion attributable to *behavioral* differences. In this equation, X_k^g is a row vector of covariates for the kth observation in group g with $g \in \{C, N\}$, $\hat{\beta}^g$ is a vector of coefficients estimated separately for each group g and n^g is the number of observations in each sample. $F(\cdot)$ is a function that converts the linear predictor $(X_k^g \hat{\beta}^g)$ into a quantity of interest, such as $E(Y)$, $\Pr(Y > 0)$, or $E(Y|Y > 0)$.[28]

As we adopt the corner-solution interpretation of Tobit models, there are three quantities of interest. We can obtain each of the three by replacing $F(\cdot)$ in equation 5 with the following. The first quantity of interest is the expected value of Y_{ijt}, which is calculated as follows,[29]

$$E(Y_{ijt}) = \Phi \left(\frac{x_{ijt}\hat{\beta}}{\hat{\eta}} \right) (x_{ijt}\hat{\beta} + \hat{\eta}\hat{\lambda}), \tag{6}$$

where $\hat{\eta} = \sqrt{\hat{\eta}_\epsilon^2 + \hat{\eta}_R^2 + \hat{\eta}_D^2}$ is the square root of the estimated total variance, $\hat{\lambda} = \frac{\phi(x_{ijt}\hat{\beta}/\hat{\eta})}{\Phi(x_{ijt}\hat{\beta}/\hat{\eta})}$ is the estimated inverse Mills ratio, $\Phi(\cdot)$ is the standard Normal distribution function, and $\phi(\cdot)$ is the standard Normal density function. This is the (unconditional) expected value of aid flows given values of x_{ijt} implied by our Tobit model. As equation 6 makes clear, this quantity is composed of two parts: the first part represents the probability of $Y_{ijt} > 0$, and the second part represents the conditional predicted value of Y_{ijt} given $Y_{ijt} > 0$. These two

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[28] Technically, it is necessary for the two groups to have the same number of observations. Following convention, this is accomplished by sampling observations from the group with the larger number of observations in the data to match the number of observations in the smaller group.

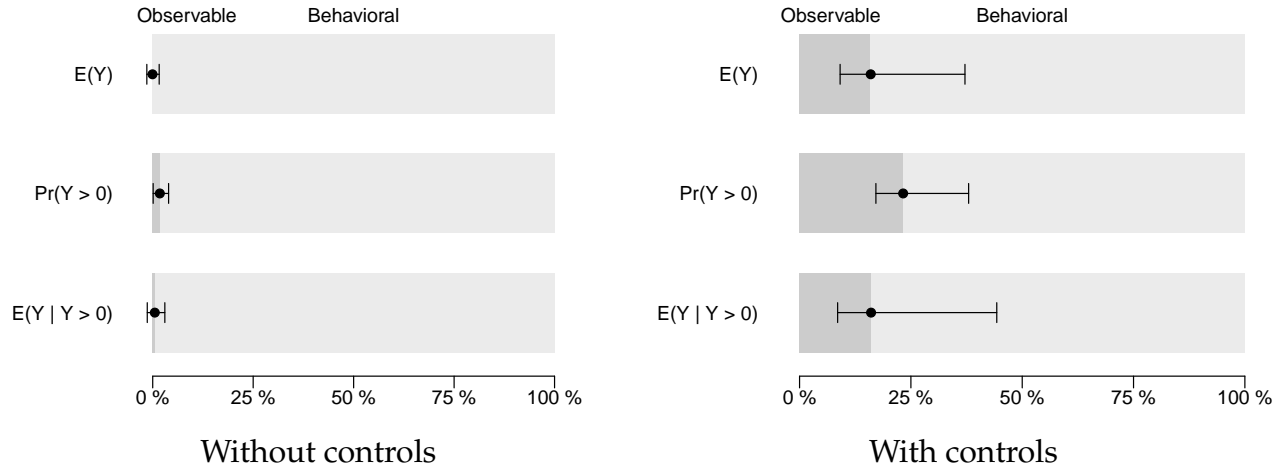[29] For the following results, see Wooldridge (2002, Ch. 16).

Figure 2: Decomposition results

Notes. This figure shows the results of the non-linear decomposition analysis using Fairlie's (2005) formula for the three quantities of interests $E(Y)$, $\Pr(Y > 0)$, and $E(Y|Y > 0)$. In each panel, the black circle shows the median estimate of the percentage attributable to observable differences and the horizontal line shows 95% central credible interval of the estimate.

components of equation 6 are our second and third quantities of interest:[30]

$$\Pr(Y_{ijt} > 0) = \Phi\left(\frac{x_{ijt}\hat{\beta}}{\hat{\eta}}\right) \tag{7}$$

$$E(Y_{ijt}|Y_{ijt} > 0) = x_{ijt}\hat{\beta} + \hat{\eta}\hat{\lambda}. \tag{8}$$

The results of the non-linear decomposition analysis are shown on the left hand side in Figure 2. We report the percentage of the gap in $E(Y)$, $\Pr(Y > 0)$, and $E(Y|Y > 0)$ attributable to differences in *observable* covariates (shown in darker gray) and that attributable to differences in *behavior* (shown in lighter gray). The percentage *observable* is calculated by dividing the first component in equation (5) by the total gap G. Median posterior estimates (shown with black dots) are obtained from using 1,000 posterior draws; 95% credible intervals (shown with horizontal bars associated with black circles) are constructed by taking the 2.5^{th} and 97.5^{th} percentile values of the posterior distribution of the target quantity.

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[30] These last two quantities have been of interest to foreign aid scholars (Neumayer 2005, Fariss 2010). This is motivated by the so-called gate keeping step that occurs in the U.S. foreign aid process: decision makers draw a list of who is eligible for U.S. aid, and then decide how much aid each eligible state gets.

The results strikingly favor the *behavioral* arguments. From the model with only the theory-motivated covariates, the estimated behavioral effects are between 98–100 % of the pro-colony bias. Specifically, the estimates of the *behavioral* effect are 100.1% with the 95% credible interval of $[98.4; 101.5]$ for $E(Y)$, 98.3% with the 95% credible interval of $[96.1; 99.9]$ for $\Pr(Y > 0)$, and 99.5% with the 95% credible interval of $[97.0; 101.4]$ for $E(Y|Y > 0)$. The remaining roughly 0–2 percentage-points are attributable to difference in *observables* that arose from colonization. That is, the variables that the new political economy of colonization literature emphasizes explain barely anything of the colony-bias in aid allocation nowadays.

As a robustness check, we expand the list of covariates we include. Following Bueno de Mesquita & Smith (2009), we added a few more variables that are not implied by the theoretical models. The idea is to see whether the inclusion of several other mainstays of the empirical aid allocation regressions challenges our findings. To this end, we also use the logarithm of bilateral trade (which is well known to be affected by colonial history), the volume of multilateral aid (as a proxy of internationally perceived recipient need), and the security alignment (and its square) between the countries. Data come again from Bueno de Mesquita & Smith (2009). The model parameter estimates and the associated decomposition results are shown in the right sides of Table 2 and Figure 2, respectively. These auxiliary variables increase the extent to which *observable* heterogeneity explains the pro-colony bias, although the *behavioral* effect still dominates the *observable* effect. The estimated observable effect ranges between 15–23% across our three different aid outcomes.[31]

We repeat the analyses using an alternative specification for recipients' resources as an additional robustness check. Bueno de Mesquita & Smith (2009) argue that the size of the recipient population, which is a constituent element of governmental resources, is also an appropriate measure of saliency. In order to show that the resources variable does not just

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[31] Specifically, the estimated *observable* effect is 16.0% [9.1; 37.1] for $E(Y)$, 23.3% [17.1; 38.0] for $\Pr(Y > 0)$, and 16.1% [8.6; 44.3] for $E(Y|Y > 0)$. Just as in the article by Bueno de Mesquita & Smith (2009), the inclusion of the additional covariates generates many missing values. Trade data before 1975 is largely missing and numerous recipients have no records for multilateral aid. Therefore, we want to verify that the change in sample is not what is driving this smaller *behavioral* effect. We re-estimated the original model specification on this smaller data set and it turns out, that the *behavioral* component actually grows even larger ($\approx 105\%$) in that sample.

pick up saliency via its population component, they repeat the estimation by including all the constituent elements of the resources variable (population, GDP per capita, government's share of the economy) and their respective squares. Results shown in Table A.4 and Figure A.5 in the appendix confirm that the *behavioral* effects still dominate when we disaggregate the resources variable.

Finally, we also replicate our four specifications on a sample that omits all recipients that had never been colonized by any country. The goal of this analysis is to render the set of recipients more homogeneous between colonial and non-colonial samples. In the previous analysis, that latter sample included also all cases that were never colonized at all. Results in Section G in the appendix show that our findings are robust to this modification.

6 Conclusions

The estimated preponderance of *behavioral* effects as well as the results from our survey experiment strongly support our claim that a higher saliency the donor-side public attaches to former colonies is the primary reason why former colonies receive more foreign aid. We began our analysis by substantiating the assumption of higher saliency via a survey experiment in the United Kingdom. We find that, when a donor government sends funds to a foreign government to induce policy changes in the recipient country, voters in the donor country appreciate such policy changes more if they occur in the donor's former colonies than if they occur in other recipients.

While this higher saliency leads to greater aid in the aid-for-policy model proposed by Bueno de Mesquita & Smith (2009), however, the theoretical model allows for an alternative causal path via institutions and wealth through which a colonial history influences aid. We thus conduct decomposition analyses that allow us to assess the relative merit of the saliency explanation (i.e., the *behavioral* effect) for the colony bias against the alternative explanation (i.e., the *observable* effect). The extent to which the *behavioral* effect dominates is remarkable: notwithstanding the huge effects of colonization on today's recipients' wealth and institu-

tions (Nunn 2009, Sokoloff & Engerman 2000, Spolaore & Wacziarg 2013, Pepinsky 2015), in the context of foreign aid they are actually transcended by their legacy on people in the *donor* countries and thereby on how former colonies are treated by some of the richest and most influential states nowadays. That is, today's preferences and behaviors by the constituents in donor countries has deep historical roots (Acharya, Blackwell & Sen 2016, Acharya, Blackwell & Sen 2015, Spolaore & Wacziarg 2013). Understanding these effects in the context of a theoretical model of foreign aid opens up many venues for future research. We would like to offer three broader implications.

First, while we view our findings on saliency-based interpretation as an important initial step toward understanding deeply colonial effects on foreign aid, we recognize that the specific contents of saliency still remain unexplained. We need further research to directly and fully identify what kind of policy changes the donor-side public appreciates more from former colonies. Toward this end, we can begin by gleaning some insights by revisiting our alternative, less true-to-the-theory model specifications (the right half of columns in Tables 2 and A.4). After including trade between the donor and the recipient, the security-related alignment, and the extent of "recipient need" as perceived by the global development community, our estimate of the *behavioral* effect shrinks by about 16–23 percentage points (from about 95%). In other words, *observable* differences between colonial and non-colonial dyads in terms of trade, security-related interest alignment, and developmental concerns account for about 20 percent of the difference in aid between colonial and non-colonial dyads. This implies that in the sparser model specification, bought policies concern trade, security, and poverty. This is not surprising as these variables are staples in the aid literature (Neumayer 2005, Milner & Tingley 2013*b*). However, even after accounting for these three prominent policies, the *behavioral* effect remains much bigger than the *observable* effect and much of its content remains unexplained. Aid dealings are probably rather idiosyncratic in their detailed content so that the broad categorization of trade, security, and poverty may be too crude to capture exactly what donors seek.

This suggests that even though we understand correlational patterns of aid flows well

nowadays, scholars need to develop richer accounts of donors' preferences over various foreign aid projects and their intended policy changes in the recipients. Whereas the model by Bueno de Mesquita & Smith (2009) that guides our research presumes that the voting public's preferences over policies in former colonies matter, other work highlights the influence of different actors in the donor country. These include contractors (Fleck & Kilby 2001, McLean 2015), holders of capital (Milner & Tingley 2010), migrants (Lahiri & Raimondos-Møller 2000, Bermeo & Leblang 2015), and highly educated bureaucrats (Lumsdaine 1993).[32] While there has been more research into people's preferences on aid (see for example Milner & Tingley 2013*a*), only limited efforts have been made to specify what these other actors expect to gain from supporting aid to *particular* recipients. While the focus here is on explaining the pro-colony bias, a similar lacuna exists for the other mainstay variables that purport to capture donor-interest, such as foreign direct investment, exports, distance, and military alliance between the donor and the recipient. Our results suggest that much explanatory power is to be had by considering donor-side preferences as well.

Second, several scholars argue and show empirical support that aid which arrives as part of an aid-for-policy deal is ineffective, perhaps detrimental, for development goals (Dunning 2004, Bermeo 2011, Bearce & Tirone 2010, Girod 2012). In statistical analyses, a colonial past is one repeatedly used measure for when such policy concessions play a big role in the provision of aid. However, the inferential issue we diagnosed in this paper suggests that caution is warranted. If the pro-colony bias were fully reflective of *observable* differences between colonies and non-colonies, then donors would not act differently toward former colonies and thus the operationalization would not be appropriate. Since we find that the colony indicator captures such *behavioral* effects which is crucial for these arguments, the use of the colonial dummy is justified here. However, the broader point is that theoretical arguments that rely on assumptions about donors acting differently in some cases require that the chosen operationalization needs to capture *behavioral* and not *observable* differences.[33]

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[32] Milner & Tingley (2015) explore a great variety of other actors as well.
[33] Therefore, it remains unclear whether other donor-intent operationalizations, such as troop deployments or Cold War alliances, capture the *behavioral* differences asserted by scholars.

Third, our results suggest an under-explored mechanism for how colonial history shapes wealth nowadays. Previous studies of colonization have focused on transfers of human capital, political and legal institutions, and technology, while a consideration of foreign aid is largely missing in that literature. The reason, presumably and understandably, is that the common wisdom used to suggest that aid does not work for development purposes as it is deployed as a political tool (see among many Easterly 2009). However, scholars have recently arrived at the view that there is actually a wide range of conditions that enable aid to be productive for economic growth and even for institutional development (Wright & Winters 2010).

Results from Acemoglu, Johnson & Robinson (2001) (and many others) demonstrate that former colonies nowadays are more democratic, and it is well known that their former colonizers provide them with more aid (e.g. Alesina & Dollar 2000).[34] Importantly, it turns out that these former colonizers happen to be democracies today. Evidence from much recent work suggests that aid *to* democracies (Kosack 2003, Kosack & Tobin 2006, Robinson & Torvik 2013, Dutta, Leeson & Williamson 2013) and *by* democracies (Kilby & Dreher 2010, Bermeo 2011) works well in spurring growth and growth-conducive institutions. As our results show that aid flows more abundantly in exactly such cases, it seems that a colonial history generates a confluence of factors in which aid might function for development purposes. With that, the positive long-run effect of colonization on prosperity should in part be driven by aid policies of the last several decades. While much recent research has considered the cultural, symbolic, and social mechanisms by which colonization long ago reverberates with prosperity today (Spolaore & Wacziarg 2013), we propose looking at how more recent relations with others, such as former colonizers, were affected to explain prosperity today. Given the aforementioned and our research, we believe that colonial effects on wealth today may have been mediated by foreign aid patterns. We leave that for future research.

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[34] In light of our findings, we can say that they receive more aid for donor-related *behavioral* reasons independent of *observable* differences in correlates of aid.

References

Acemoglu, Daron, Simon Johnson & James A Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." *The American Economic Review* 91(5):1369–1401.

Acemoglu, Daron, Simon Johnson & James A Robinson. 2002. "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution." *The Quarterly Journal of Economics* 117(4):1231–1294.

Acharya, Avidit, Matthew Blackwell & Maya Sen. 2015. "A Culture of Disenfranchisement: How American Slavery Continues to Affect Voting Behavior." Unpublished.

Acharya, Avidit, Matthew Blackwell & Maya Sen. 2016. "The Political Legacy of American Slavery." *The Journal of Politics* .

Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat & Romain Wacziarg. 2003. "Fractionalization." *Journal of Economic Growth* 8(2):155–194.

Alesina, Alberto & David Dollar. 2000. "Who gives foreign aid to whom and why?" *Journal of Economic Growth* 5(1):33–63.

Ambrose, Stephen E. & Douglas G. Brinkley. 2011. *Rise to globalism: American foreign policy since 1938*. 9 ed. Penguin.

Bearce, David H & Daniel C Tirone. 2010. "Foreign aid effectiveness and the strategic goals of donor governments." *The Journal of Politics* 72(3):837–851.

Becker, Sascha O, Katrin Boeckh, Christa Hainz & Ludger Woessmann. 2016. "The empire is dead, long live the empire! Long-run persistence of trust and corruption in the bureaucracy." *The Economic Journal* 126(590):40–74.

Bermeo, Sarah Blodgett. 2011. "Foreign aid and regime change: A role for donor intent." *World Development* 39(11):2021–2031.

Bermeo, Sarah Blodgett & David Leblang. 2015. "Migration and Foreign Aid." *International Organization* 69(3):627–657.

Berthélemy, Jean-Claude & Ariane Tichit. 2004. "Bilateral donors' aid allocation decisionsa three-dimensional panel analysis." *International Review of Economics & Finance* 13(3):253–274.

Blinder, Alan S. 1973. "Wage Discrimination: Reduced Form and Structural Estimates." *Journal of Human Resources* 8(4):436–455.

Bruhn, Miriam & Francisco A Gallego. 2012. "Good, bad, and ugly colonial activities: do they matter for economic development?" *Review of Economics and Statistics* 94(2):433–461.

Bueno de Mesquita, Bruce & Alastair Smith. 2009. "A political economy of aid." *International Organization* 63(2):309–340.

Carey, Sabine C. 2007. "European Aid: Human Rights versus bureaucratic inertia?" *Journal of Peace Research* 44(4):447–464.

Chiba, Daina, Carla Martinez Machain & William Reed. 2014. "Major Powers and Militarized Conflict." *Journal of Conflict Resolution* 58(6):976–1002.

Clist, Paul. 2011. "25 Years of Aid Allocation Practice: Whither Selectivity?" *World Development* 39(10):1724–1734.

Conrad, Justin & Daniel Milton. 2013. "Unpacking the Connection Between Terror and Islam." *Studies in Conict & Terrorism* 36:315–336.

Dollar, David & Victoria Levin. 2006. "The increasing selectivity of foreign aid, 1984–2003." *World Development* 34(12):2034–2046.

Dow, Jay K. 2009. "Gender Differences in Political Knowledge: Distinguishing Characteristics-based and Returns-based Differences." *Political Behavior* 31(1):117–136.

Dudley, Leonard & Claude Montmarquette. 1976. "A model of the supply of bilateral foreign aid." *The American Economic Review* 66(1):132–142.

Dunning, Thad. 2004. "Conditioning the effects of aid: Cold War politics, donor credibility, and democracy in Africa." *International Organization* 58(2):409–423.

Dutta, Nabamita, Peter T Leeson & Claudia R Williamson. 2013. "The Amplification Effect: Foreign Aid's Impact on Political Institutions." *Kyklos* 66(2):208–228.

Easterly, William. 2009. "Can the West Save Africa?" *Journal of Economic Literature* 47(2):373–447.

Easterly, William & Claudia R Williamson. 2011. "Rhetoric versus reality: the best and worst of aid agency practices." *World Development* 39(11):1930–1949.

Easterly, William & Tobias Pfütze. 2008. "Where does the money go? Best and worst practices in foreign aid." *Journal of Economic Perspectives* 22(2):29–52.

Fairlie, Robert W. 2005. "An Extension of The Blinder-Oaxaca Decomposition Technique to Logit and Probit Models." *Journal of Economic and Social Measurement* 30(4):305–316.

Fariss, Christopher J. 2010. "The strategic substitution of United States foreign aid." *Foreign Policy Analysis* 6(2):107–131.

Feyrer, James & Bruce Sacerdote. 2009. "Colonialism and modern income: islands as natural experiments." *The Review of Economics and Statistics* 91(2):245–262.

Fleck, Robert K. & Christopher Kilby. 2001. "Foreign Aid and Domestic Politics: Voting in Congress and the Allocation of USAID Contracts Across Congressional Districts." *Southern Economic Journal* 67(3):598–617.

Gartzke, Erik & Dominic Rohner. 2011. "The political economy of imperialism, decolonization and development." *British Journal of Political Science* 41(3):525–556.

Girod, Desha M. 2012. "Effective Foreign Aid Following Civil War: The Nonstrategic-Desperation Hypothesis." *American Journal of Political Science* 56(1):188–201.

Hadfield, Jarrod D. 2010. "MCMC methods for multi-response generalized linear mixed models: the MCMCglmm R package." *Journal of Statistical Software* 33(2):1–22.

Hariri, Jacob Gerner. 2012. "The Autocratic Legacy of Early Statehood." *American Political Science Review* 106(3):471–494.

Heinrich, Tobias. 2013. "When is Foreign Aid Selfish, When is it Selfless?" *The Journal of Politics* 75(2):422–435.

Kilby, Christopher & Axel Dreher. 2010. "The impact of aid on growth reivisited: Do donor motives matter?" *Economic Letters* 107(3):338–340.

Kim, Keuntae & Joel E Cohen. 2010. "Determinants of International Migration Flows to and from Industrialized Countries: A Panel Data Approach Beyond Gravity1." *International Migration Review* 44(4):899–932.

King, Gary & Langche Zeng. 2006. "The dangers of extreme counterfactuals." *Political Analysis* 14(2):131–159.

Knack, Stephen, F Halsey Rogers & Nicholas Eubank. 2011. "Aid quality and donor rankings." *World Development* 39(11):1907–1917.

Kosack, Stephen. 2003. "Effective aid: How democracy allows development aid to improve the quality of life." *World Development* 31(1):1–22.

Kosack, Stephen & Jennifer Tobin. 2006. "Funding self-sustaining development: The role of aid, FDI and government in economic success." *International Organization* 60(1):205–243.

Lahiri, Sajal & Pascalis Raimondos-Møller. 2000. "Lobbying by ethnic groups and aid allocation." *The Economic Journal* 110(462):62–79.

Lee, Alexander & Kenneth A Schultz. 2012. "Comparing British and French Colonial Legacies: A Discontinuity Analysis of Cameroon." *Quarterly Journal of Political Science* 7(4):365–410.

Lumsdaine, David H. 1993. *Moral vision in international politics: the foreign aid regime, 1949–1989*. Princeton University Press.

Maizels, Alfred & Machiko K Nissanke. 1984. "Motivations for aid to developing countries." *World Development* 12(9):879–900.

McGillivray, Mark. 1989. "The allocation of aid among developing countries: A multi-donor analysis using a per capita aid index." *World Development* 17(4):561–568.

McKinlay, Robert D & Richard Little. 1977. "A foreign policy model of US bilateral aid allocation." *World Politics* 30(1):58–86.

McLean, Elena V. 2015. "Multilateral Aid and Domestic Economic Interests." *International Organization* 69(1):97–130.

Milner, Helen V. & Dustin Tingley. 2010. "The political economy of US foreign aid: American legislators and the domestic politics of aid." *Economics & Politics* 22(2):200–232.

Milner, Helen V & Dustin Tingley. 2013*a*. "Public opinion and foreign aid: A review essay." *International Interactions* 39(3):389–401.

Milner, Helen V. & Dustin Tingley. 2015. *Sailing the Water's Edge: The Domestic Politics of American Foreign Policy*. Princeton University Press.

Milner, Helen V. & Dustin Tingley, eds. 2013*b*. *The Geopolitics of Foreign Aid*. Edward Elgar.

Morgenthau, Hans. 1962. "A political theory of foreign aid." *American Political Science Review* 56(2):301–309.

Neumayer, Eric. 2003. "Do Human Rights Matter in Bilateral Aid Allocation? A Quantitative Analysis of 21 Donor Countries." *Social Science Quarterly* 84(3):650–666.

Neumayer, Eric. 2005. *The pattern of aid giving*. Routledge.

Niksch, Larry. 2007. "Abu Sayyaf: Target of Philippine-U.S. Anti-Terrorism Cooperation." CRS Report for Congress.

Nunn, Nathan. 2009. "The Importance of History for Economic Development." *Annual Review of Economics* 1:65–92.

Oaxaca, Ronald L. 1971. Male-Female Wage Differentials in Urban Labor Markets. PhD thesis Princeton University.

Oaxaca, Ronald L. 1973. "Male-Female Differentials in Urban Labor Markets." *International Economic Review* 14(3):693–709.

Pepinsky, Thomas B. 2015. "The New Political Economy of Colonialism." *Emerging Trends in the Social and Behavioral Sciences: An Interdisciplinary, Searchable, and Linkable Resource* .

Reed, William & Daina Chiba. 2010. "Decomposing the Relationship Between Contiguity and Militarized Conflict." *American Journal of Political Science* 54(1):61–73.

Robinson, James A & Ragnar Torvik. 2013. Institutional Comparative Statics. In *Advances in Economics and Econometrics: Tenth World Congress*. Vol. 2 Cambridge University Press p. 97.

Rosenstein-Rodan, Paul Narziss. 1961. "International aid for underdeveloped countries." *The Review of Economics and Statistics* 43(2):107–138.

Schraeder, Peter J, Steven W Hook & Bruce Taylor. 1998. "Clarifying the foreign aid puzzle." *World Politics* 50(2):294–323.

Sokoloff, Kenneth L & Stanley L Engerman. 2000. "History lessons: Institutions, factors endowments, and paths of development in the new world." *The Journal of Economic Perspectives* 14(3):217–232.

Spolaore, Enrico & Romain Wacziarg. 2013. "How Deep Are the Roots of Economic Development?" *Journal of Economic Literature* 51(2):325–369.

Steinwand, Martin C. 2015. "Compete or Coordinate? Aid Fragmentation and Lead Donorship." *International Organization* 69(2):443–472.

Voigtländer, Nico & Hans-Joachim Voth. 2012. "Persecution perpetuated: the medieval origins of anti-Semitic violence in Nazi Germany." *Quarterly Journal of Economics* 127(3):1339–1392.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

Wright, Joseph & Matthew Winters. 2010. "The politics of effective foreign aid." *Annual Review of Political Science* 13:61–80.

Why do former colonies receive more foreign aid? Decomposing the colonial bias

Web Appendix

Not for Print Publication

A   Survey experiment on saliency of colonial history

The goal of the survey experiment is to substantiate the foundational assumption behind the colonial dummy interpretation within the model by Bueno de Mesquita & Smith (2009). As explained in the body of the manuscript, the assumption is that the winning coalition in a donor country derives more utility from a given generic aid project if the project is targeted at the donor's former colony. Therefore, we need people who are of voting age and citizens of a country that is a former colonizer and that provides (substantial) foreign aid. The United Kingdom fits these desiderata. The company Prolific facilitates an easy access to a wide pool of potential survey-takers in the United Kingdom.

This section provides a full analysis of our survey experiment. We first introduce our vignette, then discuss how we recruited the respondents, and last provide a full analysis.

A.1   Vignette design

Each survey-taker is asked to evaluate his/ her extent of support for an aid project that is shown. A research assistant collected summaries of currently ongoing development projects that the Department for International Development (DfID), Britain's main development agency, was pursuing in October/ November 2016. The summaries contain various information about the project, including purpose, funds, anticipated results, etc. We whittled the collected summaries down to 20 that in principle could take place in any developing country. They fall in four categories depending on their nominal aid sectors: health, education, (general) poverty, and governance. See Section A.4 for the texts of all of them.

In a next step, we minimally edited them so that we can randomize the country in which a given project is implemented. For example, references to specifics of the target country were removed, some acronyms spelled out, some large numbers (of, say, beneficiaries of aid) reduced to not obviously exceed a randomized country's population, and replaced all country names with a generic *COUNTRYNAME* tag.

We selected the set of countries by considering two aspects. First, to increase the homo-

geneity of our countries, we restricted the attention to Sub-Saharan African country names. It speaks to geographic area that is (generally) of greatest concern to the development community,[35] and naturally removes prominent cases (Egypt, India, Iraq, and Afghanistan). Second, we also account for the (well-known) fact that DfID has consolidated its aid programs to focus on a small number of countries. Thus, we use only countries that actually had ongoing aid projects in Fall 2016. These choices lead to the following country names that we insert in the vignette (former colonies are denoted by *): Burkina Faso, Burundi, Cameroon, Central African Republic, Democratic Republic of the Congo, Ethiopia, Ghana*, Kenya*, Lesotho*, Liberia, Malawi, Mali, Mauritania, Mozambique, Nigeria*, Sudan*, Rwanda, Senegal, Sierra Leone*, Somalia*, South Africa*, South Sudan*, Tanzania*, Togo, Uganda*, Zambia*, and Zimbabwe*.

Each person saw four vignettes in sequence, each of which corresponding to one of the four aid sectors (in random order). The first and third shown vignettes serve as the control conditions, the second and fourth as the treatments. In the control condition, we randomly draw a name from the countries that were never part of the British Empire. In the treated summaries, we insert a country that used to be a British colony. In one of the two treated summaries, we append a sentences that explicitly states that the country used to be part of the British Empire. Below each vignette, we ask "To which extent do you support or oppose the development described above?" and give five levels of support as answer options. A sample screenshot is shown in Figure A.1.

A.2 Sample and demographic questions

Our survey included several additional questions about a survey-taker's demographics. We took these from the British Election Study (BES), which provides nationally representative data, against which we can compare our sample.[36] The questions cover age, gender, party

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[35] See William Easterly, "Can the West Save Africa?", *Journal of Economic Literature*, Vol. 47, Number 2, June 2009.

[36] Specifically, we take Version 2.2. 2015 Face-to-face Post-election Survey, their latest available data from May–September 2015. See `http://www.britishelectionstudy.com/data-objects/cross-sectional-data/`.

Figure A.1: Sample survey screen

Please read this short description of a project that the British government is currently pursuing in Somalia.

Description of development aid project

To improve the use of public finances so that they benefit the people of **Somalia**. The expected results include contributing to increasing tax collection from large tax payers by some £170 million. The UK will provide £12 million to a World Bank led programme to work with Ministries of finance and planning to improve their ability to manage public funds. It will also work with parliament to improve their oversight of public spending. The UK will also provide £5 million to civil society to increase their scrutiny over public spending and £3 million to improve financial transparency in oil, gas and mining sectors. Today's **Somalia** used to be a British colony.

To which extent do you support or oppose the development project described above?

- ○ Strongly oppose
- ○ Oppose
- ○ Indifferent
- ○ Support
- ○ Strongly support

identification, and left-right ideological spectrum.

In late November 2016, we recruited 547 participants from Prolific, a British crowdsourcing platform for survey research. We drop 7% of survey-takers that failed our screener excessively often or took unbelievably little time on our vignette screens. However, our results are qualitatively very similar if we include these participants.

As expected, our sample differs from the British adult population. Our survey-takers are younger, more ideologically left-leaning, and have a higher proportions of males, of those unaffiliated with a party, and a lower proportion affiliated with the Conservatives. These departures of sample vis-à-vis national characteristics may jeopardize the external validity of our results below. However, while the treatment effects are affected by the aforementioned variables, the effects only differ in magnitudes and never by sign or confidence in the results.[37]

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[37] Throughout, we obtain strong evidence that showing the name of a former colony increases support for the project. Specifically, we replicate the model from the first column in Table A.1, interact the treatments iteratively with each of the aforementioned deviating variables, and then calculate the support that the treatment effect is positive for either minima and maxima of the deviating variable.

A.3 Analysis

We perform two analyses here: a simple one for which we dichotomize the levels of support, and one accounting for all ordinal levels. We first examine the simpler one, which includes the estimates discussed in the manuscript.

A.3.1 High support for aid project?

The first analysis are simple mean and differences-in-means estimates. As each respondent saw four vignettes, we have to account for intra-subject correlations; we do this by applying a cluster-bootstrap.[38] The proportion of respondents that are highly supportive of projects in non-colonies is 0.51 [0.48; 0.53]. In contrast, the proportions rise to 0.69 [0.65; 0.73] and 0.71 [0.67; 0.75] when the project takes place in former colony and when it is mentioned that the country used to be a colony, respectively. The differences in means are 0.19 [0.14; 0.23] and 0.21 [0.17; 0.25], respectively. These are the numbers discussed in the text.

We extend the analysis by estimating simple linear probability models which include random effects for each subject to account for clustering. The model allows us to include additional covariates as well.[39] The first three columns in Table A.1 give the results. The first column (essentially) replicates the differences-in-means estimates. The second model adds covariates related to design features, such as whether a rating was shown as the early pair of vignettes (i.e., position one and two), and dummies for the aid sector (education is the omitted category). These adjustments reduce the effect estimates by about 0.03. The third model also includes the additional demographic variables.

A.3.2 Level of support for aid project?

As we elicited subjects' ratings on a five-level ordinal scale, we also want to make use of all the data. In the fourth through sixth columns of Table A.1, we replicate the specifications of

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[38] See the procedure outlined by Jeffrey J. Harden, "A Bootstrap Method for Conducting Statistical Inference with Clustered Data", *State Politics & Policy Quarterly*, Volume 11, Number 2, June 2011. We used 10,000 bootstrap draws.

[39] We rely on the implementation in MCMCglmm.

Table A.1: Bayesian Random Effects Models of Support for Aid Projects

|	High support for aid project??			Level of support for aid project??		
Colony, not mentioned	0.19	0.16	0.16	0.63	0.57	0.57
	[0.14; 0.24]	[0.11; 0.20]	[0.11; 0.20]	[0.48; 0.79]	[0.41; 0.73]	[0.41; 0.73]
Colony, mentioned	0.20	0.19	0.19	0.65	0.64	0.64
	[0.16; 0.25]	[0.14; 0.23]	[0.14; 0.23]	[0.50; 0.81]	[0.48; 0.80]	[0.49; 0.80]
Shown early in survey		0.16	0.16		0.57	0.57
		[0.12; 0.19]	[0.12; 0.19]		[0.45; 0.70]	[0.45; 0.70]
Sector: governance		-0.25	-0.25		-0.90	-0.89
		[-0.30; -0.21]	[-0.30; -0.20]		[-1.07; -0.73]	[-1.06; -0.72]
Sector: health		0.07	0.07		0.26	0.26
		[0.02; 0.12]	[0.03; 0.12]		[0.09; 0.43]	[0.09; 0.43]
Sector: poverty		0.02	0.02		-0.03	-0.03
		[-0.03; 0.07]	[-0.03; 0.07]		[-0.20; 0.14]	[-0.20; 0.14]
Age			0.00			0.00
			[0.00; 0.00]			[-0.01; 0.01]
Gender (female)			0.03			0.14
			[-0.02; 0.07]			[-0.02; 0.30]
Ideology			-0.03			-0.15
			[-0.04; -0.02]			[-0.20; -0.11]
Party: none			-0.02			-0.16
			[-0.08; 0.04]			[-0.39; 0.07]
Party: Labour			0.03			0.06
			[-0.02; 0.08]			[-0.14; 0.25]
Party: Conservative			0.05			-0.03
			[-0.02; 0.11]			[-0.29; 0.22]
Intercept	0.51	0.50	0.59	2.14	2.28	2.89
	[0.48; 0.53]	[0.46; 0.54]	[0.51; 0.68]	[2.01; 2.28]	[2.10; 2.46]	[2.54; 3.23]
Cut point 1				1.02	1.07	1.08
				[0.91; 1.12]	[0.96; 1.18]	[0.97; 1.20]
Cut point 2				2.05	2.19	2.20
				[1.93; 2.18]	[2.07; 2.33]	[2.07; 2.34]
Cut point 3				3.68	3.97	3.98
				[3.53; 3.83]	[3.81; 4.13]	[3.82; 4.14]
Residuals (SE)	0.47	0.44	0.44	1.00	1.00	1.00
	[0.45; 0.48]	[0.43; 0.45]	[0.43; 0.45]			
Random effects (SE)	0.12	0.14	0.12	0.55	0.65	0.54
	[0.08; 0.15]	[0.11; 0.17]	[0.09; 0.15]	[0.46; 0.65]	[0.56; 0.75]	[0.44; 0.64]
Observations	2545	2545	2545	2545	2545	2545
Surveytakers	509	509	509	509	509	509

95% credible interval in brackets.

the first batch of analyses by using an ordered probit model. In each, the lower bounds of the 95% credible intervals for the coefficients on the two treatments are (far) away from zero.

Since these are non-linear models, we illustrate the substantive effects of the treatment graphically. Figure A.2 takes the estimates from the fourth column and presents the predicted probabilities that a survey-taker would choose each level of support under the three conditions.[40] Comparing the control (black dots/lines) against either treatment (light and dark grey), we see that the probabilities of support for "strongly oppose", "oppose", and

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[40] We marginalize analytically over the random effects. Dots present median estimates, the line segments the 95% central credible intervals.

Figure A.2: Predicted support for aid projects under different treatments.
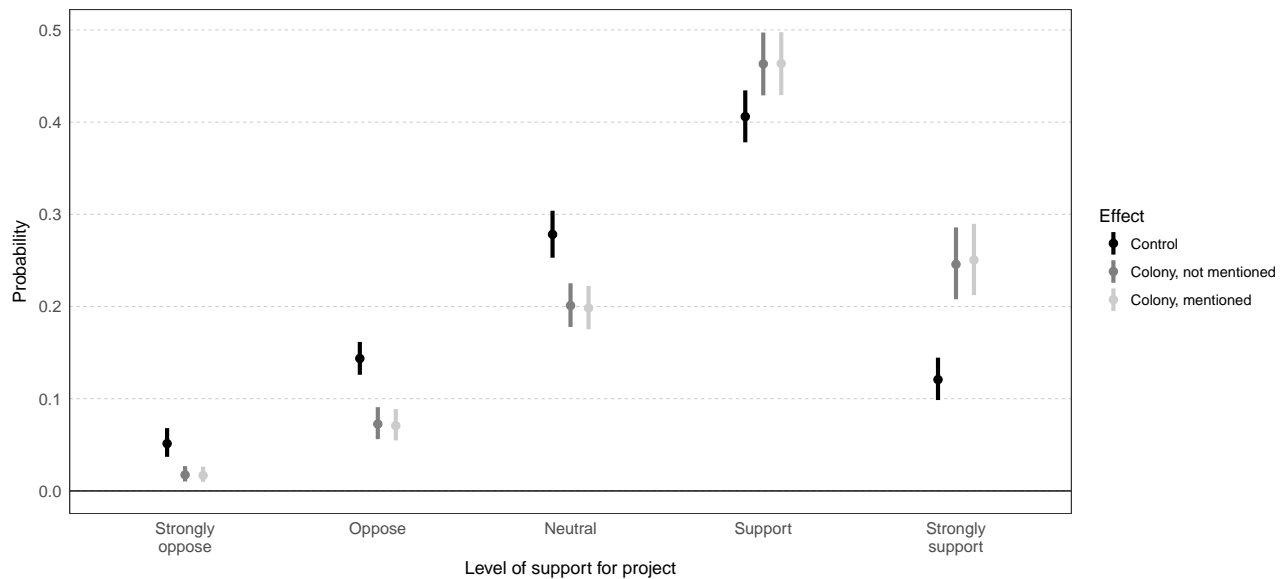
Notes. Calculated from the model in the fifth column of Table A.1.

"neutral" all decline whereas the probabilities for "support" and in particular for "strongly"
increase. The effect of a colonial history occurs at the highest levels of enthusiasm for aid.

A.4   Project vignettes

Below are the baseline project summaries that we modify as described above; they are grouped
by nominal purpose of the aid: governance, health, (general) poverty, and education. The
term *COUNTRYNAME* gets replaced by the randomly assigned actual Sub-Saharan country.

A.4.1   Education projects

- "To increase participation and the quality of secondary education in *COUNTRYNAME*
  by providing disadvantaged girls with secondary level scholarships and Colleges of
  Education with targeted support to improve teacher education and management. This
  will benefit 81,000 girls and 38 Colleges of Education and improve gender parity and
  quality of teaching and learning. This contributes towards our MDGs by improving
  better access and gender parity."

- "Building on the successful completion of Phase I to improve learning conditions and education institutional capacity by providing teaching and learning materials, teacher training and school grants designed to improve the quality of teaching and learning in schools in *COUNTRYNAME*. DFID *COUNTRYNAME* support will help enhance learning outcomes for over 2.6 million children (of which 1.5 million will be girls). This contributes towards MDG 2 by ensuring every child attends primary school and increasing the number of children who stay in school by 2017."

- "The purpose of ESM is to improve access to and quality of education in *COUNTRYNAME*. An £11.59m investment comprising £7m capital for education infrastructure, £4.4 million support to *COUNTRYNAME* Early Reading Improvement Activity and £0.19 million for technical support over two years. These high impact investments delivered by the private sector and non-state partners support national education priorities and complement DFIDs ongoing major investment in girls education in *COUNTRYNAME*.*"

- "To reach 1 million teachers across *COUNTRYNAME* with classroom focused instructional materials collaboratively produced by the UK Open University and specialists and distributed using the internet and mass media thereby transforming teacher competence and enhancing learning for the poorest children. Delivery through DFID support to UKs Open University as a charitable trust DFID support to Teacher Education through School based Support in *COUNTRYNAME* will cease as of March 2017."

- "To improve learning outcomes for all girls and boys in *COUNTRYNAME* through an effective and accountable education system. Support will be directed mainly at primary education but there will be some support for improved pre-primary and secondary education, including through Public Private Partnerships. The programme will ensure that at least 325,000 children (half of whom are girls) are supported to gain a decent education and so contribute to Global Goal 4 on education."

A.4.2   Health projects

- "To improve the health and socio-economic status of poor people by providing access to clean water, sanitation and hygiene services in rural areas of *COUNRTYNAME*. This will benefit 1.1 million people. This contributes towards our MDGs by supporting development of water infrastructure and promotion of hygiene and sanitation services. And will result in sustainability of water and sanitation services by 2019."

- "To improve the health system in *COUNRTYNAME*, by providing the Ministry of Health with direct budget support, materials, goods and technical assistance. This support will improve coverage and quality of primary care services and create a sustainable health system. In addition to improving the health sector as a whole, estimates show that by 2015, our Sector Budget Support will contribute towards MDG 4 and 5 by saving 1,400 newborn lives, preventing 425 stillbirths and saving 450 maternal lives. We also estimate this to prevent approximately 2,000 child deaths."

- "To improve utilisation of quality, effective essential health services in *COUNRTY-NAME*, especially for the poor and deliver the following outputs through Essential Health Package (EHP): 1.1 million underfive treated for pneumonia; 63,000 patients treated for tuberculosis; 210,000 million baby deliveries by skilled health worker; 363,000 additional family planning users; 416,000 adults on ART in 2016; 120,000 children fully immunised; 205,000 children treated for malaria and 1 million bednets distributed."

- "To increase the coverage and use of effective family planning in *COUNRTYNAME* by increasing access to family planning services to the rural, poor and young women; and procurement of family planning commodities. This will benefit 1.0 million people and increase the national contraceptive rate (CPR) from 42% to 55% by 2016. This contributes towards our Millennium Development Goals by reducing Maternal mortality."

- "The Three Millennium Development Goal Fund to increase access to and availability of essential maternal and child health services for the poorest and most vulnerable in

townships in *COUNRTYNAME* and HIV, TB, and malaria interventions for populations and areas not readily covered by the Global Fund. This contributes to our Millennium Development Goals by averting the death of 11,569 children under five and 1,450 pregnant women, and helping control major communicable diseases in *COUNRTYNAME* by December 2016."

A.4.3 Governance projects

- "To strengthen the political system of *COUNRTYNAME* by improving the responsiveness of Parliament and political parties to citizens expectations and needs, and supporting civil society to work more effectively with government. This will be achieved by building the institutional capacity of parliament and political parties to deliver more accountable and responsive governance, and supporting MPs and civil society organisations to take action to stop corrupt behaviours through activities such as public information campaigns, influencing new legislation, and promoting improved working practices in the public sector."

- "To overcome barriers to collective action against corruption in *COUNRTYNAME* via a £2 million Opportunity Fund, to be managed in-house by DFID *COUNRTYNAME* supporting a range of initiatives and activities. Scaling up an existing programme of technical support to key law enforcement agencies through an accountable grant with ICAR (International Centre for Asset Recovery), including the Anti-Corruption Bureau (ACB), the Director of Public Prosecutions (DPP) and the Financial Intelligence Unit (FIU), to address capacity gaps and advise on legal and regulatory reform."

- "To improve the use of public finances so that they benefit the people of *COUNRTYNAME*. The expected results include contributing to increasing tax collection from large tax payers by some £170 million. The UK will provide £12 million to a World Bank led programme to work with Ministries of finance and planning to improve their ability to manage public funds. It will also work with parliament to improve their over-

sight of public spending. The UK will also provide £5 million to civil society to increase their scrutiny over public spending and £3 million to improve financial transparency in oil, gas and mining sectors."

- "To provide up to £6.3 million between November 2012 and March 2017 to support long-term institutional strengthening of the electoral process in *COUNRTYNAME*, as outlined in the DFID *COUNRTYNAME* Operational Plan. £6.1 million of this will be focussed on supporting the lead up to, the event and immediate aftermath of the 2016 Presidential, Parliamentary and Local Elections. Post-election support (2016 onwards) will be subject to the results of a post-election strategic review in DFID *COUNRTYNAME* and the new UK HMG spending round."

- "To assist *COUNRTYNAME* in creating an enabling environment for investments and business development through UK technical expertise and experience that will help to increase *COUNRTYNAME*'s GDP and enable the economy keep up its levels of public expenditure on development outcomes. UKs technical assistance will support implementation of key economic reforms with capacity building, institutional strengthening, knowledge transfer, evidence building and collaborative working"

A.4.4 Poverty projects

- "The project in partnership with National Housing Bank will enable first-time home ownership for the poor bankable families in Low Income States of *COUNRTYNAME* and stimulate the growth of the affordable housing market, by providing loans to build 17,000 housing units and 10,000 home loans for first-time home owners. This will result in 27,000 construction jobs for the poorest people in low income states in *COUNRTYNAME* by 2020."

- "To increase food availability and incomes of 1-1.2 million target beneficiaries. To increase livelihoods' resilience and nutrition of 2.2 million people. To improve the incomes and nutrition status of over 1.13 million poor people in *COUNRTYNAME*

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by promoting resilient livelihoods and food security food security through agricultural commercialisation and climate smart agriculture, financial inclusion, business and skills development, and targeted nutrition support to mothers and children in the 'One thousand day' window between conception and a childs second birthday."

- "To deliver humanitarian assistance to over 400,000 individuals in *COUNRTYNAME* over three years across a range of sectorial interventions including health, food, nutrition, water and sanitation and shelter which will save lives and reduce suffering of people of *COUNRTYNAME* affected by disasters. This contributes towards Millennium Development Goals 1, 4, 6 and 7 by providing ready to use funds to enable humanitarian agencies deliver timely and coordinated assessments and humanitarian response by December 2016."

- "To increase food security, reduce hunger and malnutrition and accelerate agricultural output growth in *COUNRTYNAME* by providing affordable high quality maize and legume seeds to 1.4 million households (across the whole Government programme, of which 945,000 households supported by DFID). To achieve a sustainable increase in agricultural productivity and production in *COUNRTYNAME* (focused on maize, legumes and dairy)."

- "To reduce poverty and improve living standards and educational attainment in the poorest families by providing regular payments to the female head of household. 315,000 additional beneficiary families in *COUNRTYNAME* will benefit by 2020. This programme will contribute to 1.05 million primary school children being supported in school and directly contribute to Millennium Development Goals 1: Eradicating extreme poverty and hunger; and Millennium Development Goals 2: Achieve universal primary education."

B Synthetic data illustration and subsetting

In this section, we show that introducing an interaction term or quadratic term is insufficient to solve the identification problem about the extent to behavioral effects explain the difference colonial and non-colonial cases. To obtain estimates from a model that has an interaction term between the colony dummy and other covariates, we subset the synthetic data by the colonial history. For each of the subsets, we fit a quadratic regression model of *Aid* and *Resources*.[41] Table A.2 reports the regression results. Models correctly detect that there is little behavioral difference in Case 1, as the estimated coefficients for colonial and non-colonial samples are indistinguishable from one another. On the other hand, while the estimates from Cases 2–5 confirm that there are some behavioral differences, we cannot understand how much of the difference in *Aid* is explained by these behavioral differences relative to the differences in the distribution of *Resources* based on these models.

Table A.2: Regression results of the simulated data by sample

	Case 1		Case 2		Case 3		Case 4		Case 5	
	Colonial	Non-colonial	Colonial	Non-colonial	Colonial	Non-colonial	Colonial	Non-colonial	Colonial	Non-colonial
Resources	9.70***	9.76***	9.70***	6.76***	9.70***	4.68***	10.51***	5.16***	7.08***	5.09***
	(0.30)	(0.12)	(0.30)	(0.12)	(0.30)	(0.17)	(0.46)	(0.51)	(0.17)	(0.23)
$Resources^2$	-0.97^{***}	-0.98^{***}	-0.97^{***}	-0.68^{***}	-0.97^{***}	-0.47^{***}	-1.05^{***}	-0.51^{***}	-0.70^{***}	-0.50^{***}
	(0.03)	(0.01)	(0.03)	(0.01)	(0.03)	(0.02)	(0.04)	(0.05)	(0.02)	(0.02)
Intercept	-9.19^{***}	-9.33^{***}	-9.19^{***}	-4.83^{***}	-6.69^{***}	-1.49^{***}	-9.07^{***}	-4.89^{***}	-0.72^{*}	-5.65^{***}
	(0.78)	(0.23)	(0.78)	(0.23)	(0.78)	(0.39)	(1.16)	(1.29)	(0.39)	(0.59)

Note: *p<0.1; **p<0.05; ***p<0.01

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[41] Such quadratics are used by Alesina & Dollar (2000) and Bueno de Mesquita & Smith (2009) for different theoretical reasons, respectively.

C   List of Donor and Recipient Countries

Among the 21 countries included as potential donors, nine countries (Australia, Belgium, France, Japan, the Netherlands, Portugal, Spain, the United Kingdom, the United States) are former colonial masters. On the other hand, the remaining 12 countries (Austria, Canada, Denmark, Finland, Greece, Ireland, Italy, Luxembourg, New Zealand, Norway, Sweden, and Switzerland) are non-colonial donors. The nine former colonial masters have the following potential recipients as their former colony.

Australia: Papua New Guinea

Belgium: Burundi, The Democratic Republic Of Congo, and Rwanda

France: Algeria, Benin, Burkina Faso, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Djibouti, Gabon, Guinea, Haiti, Lao People's Democratic Republic, Lebanon, Madagascar, Mali, Mauritania, Morocco, Niger, Republic Of Congo, Senegal, Syrian Arab Republic, Togo, Tunisia

Japan: South Korea

Netherlands: Indonesia

**Portugal:** Angola, Cape Verde, Guinea-Bissau, Mozambique, Sao Tome And Principe

Spain: Costa Rica, Cuba, Dominican Republic, El Salvador, Equatorial Guinea, Guatemala, Honduras, Mexico, Nicaragua, Panama

United Kingdom: Antigua & Barbuda, Bahamas, Bahrain, Barbados, Belize, Botswana, Cyprus, Dominica, Egypt, Fiji, Gambia, Ghana, Grenada, India, Israel, Jamaica, Jordan, Kenya, Kuwait, Lesotho, Malawi, Malaysia, Malta, Mauritius, Nigeria, Pakistan, Qatar, Saint Lucia, Saint Vincent and The Grenadines, Seychelles, Sierra Leone, South Africa, Sri Lanka, Sudan, Swaziland, Tanzania, Trinidad and Tobago, Uganda, Yemen, Zambia, Zimbabwe
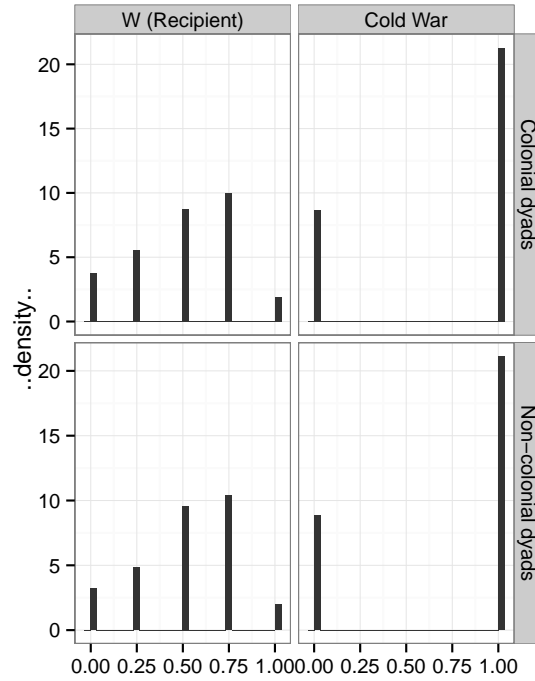
United States: Philippines

D   Observable Differences

Figure A.3: Observable differences: continuous variables
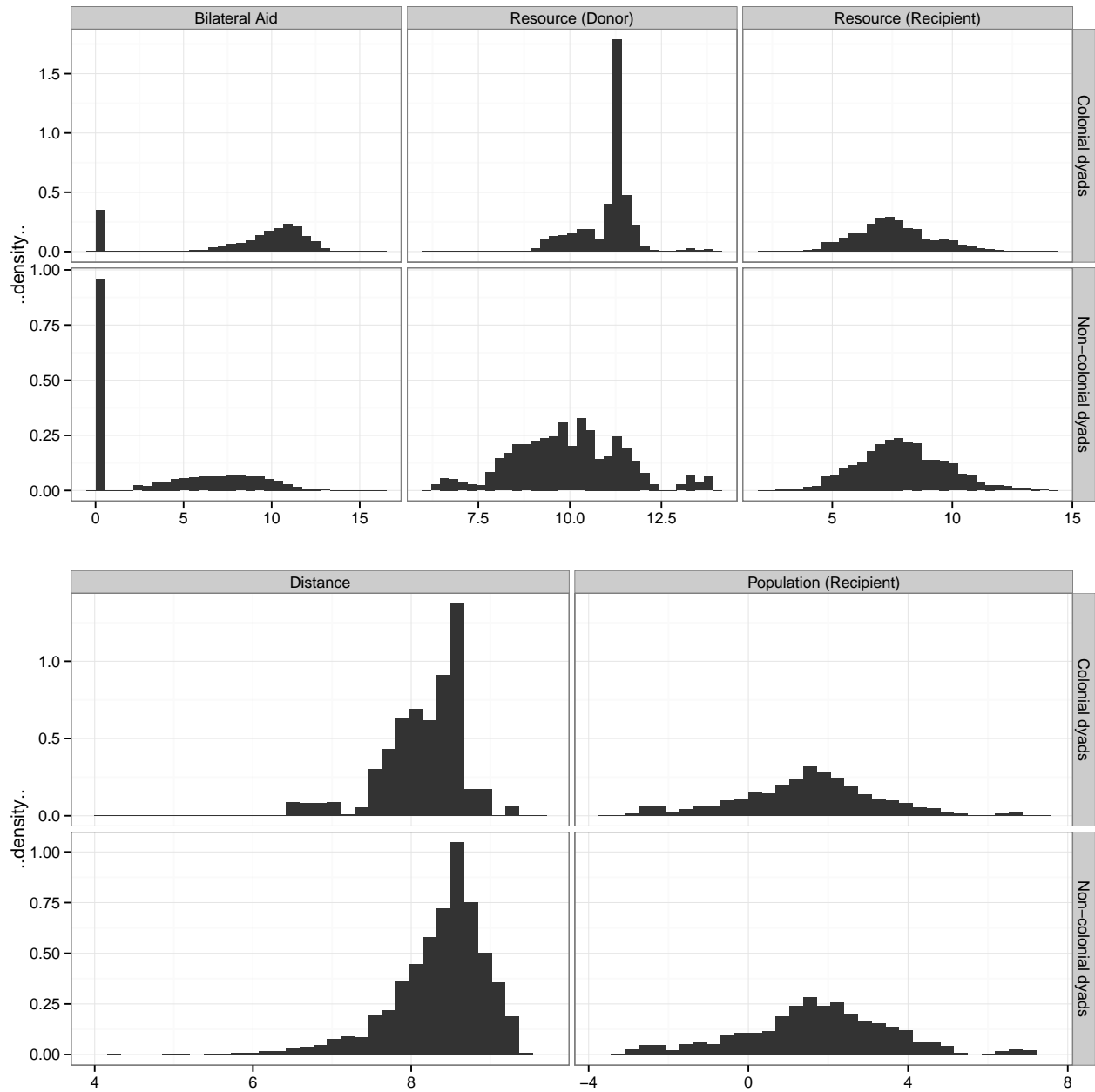
Notes. The figure shows the empirical distributions of continuous variables for two sub-samples: colonial observations (top row, $n = 2,659$) and non-colonial observations (bottom row, $n = 78,485$). All the variables are in the natural logarithm scale. For observations where bilateral aid flows are zero (the natural logarithm of which is undefined), we replace the values of zero with one (the natural logarithm of which is zero) for presentation.

Figure A.4: Observable differences: categorical variables

Notes. The figure shows the empirical distributions of categorical variables for two sub-samples: colonial observations (top row, $n = 2,659$) and non-colonial observations (bottom row, $n = 78,485$).

Table A.3: Observable differences: numerical results

Variable	Mean		Test statistic	
	Colonial	Non-colonial		
Bilateral Aid	8.28	3.51	0.53**	KS
Donor Resource	11.09	9.95	0.49**	KS
Recipient Resource	7.61	7.93	0.11**	KS
Recipient Population	1.48	1.72	0.07**	KS
Recipient W	0.51	0.53	108016082**	MW
Cold War	0.71	0.70	0.38	χ^2
Distance	8.16	8.37	0.27**	KS
Multilateral Aid	3.58	3.59	0.02	KS
Trade	4.45	2.41	0.47**	KS
Alignment	-0.04	-0.02	0.17**	KS

$^{**}p < 0.01, \, ^{*}p < 0.05$

Notes. The table reports the mean values for colonial and non-colonial observations as well as test statistics that compare the two samples. We calculated Kolmogorov-Smirnov (KS) statistic for continuous variables, Mann-Whitney-Wilcoxon (MW) statistic for an ordered variable, and χ^2 statistic for a dummy variable.

E   Posterior summaries under alternative specification

Table A.4: Bayesian Mixed-Effects Tobit Models of Bilateral Foreign Aid (Alternative Specification)

	Without controls			With controls		
	Pooled	Colonial	Non-colonial	Pooled	Colonial	Non-colonial
Colony	4.49			2.86		
	[4.30; 4.67]			[2.67; 3.05]		
Donor Resource	−0.09	3.24	−0.29	−0.07	3.97	−0.18
	[−0.22; 0.04]	[2.76; 3.74]	[−0.42; −0.16]	[−0.19; 0.05]	[3.35; 4.63]	[−0.30; −0.06]
Recipient W == 0.25	0.02	0.27	0.02	−0.07	0.11	−0.08
	[−0.13; 0.18]	[−0.20; 0.78]	[−0.15; 0.18]	[−0.24; 0.10]	[−0.36; 0.59]	[−0.25; 0.08]
Recipient W == 0.50	−0.43	−0.34	−0.44	−0.03	−0.46	−0.01
	[−0.58; −0.28]	[−0.81; 0.13]	[−0.61; −0.27]	[−0.21; 0.15]	[−0.95; 0.07]	[−0.19; 0.18]
Recipient W == 0.75	0.28	1.42	0.18	0.30	0.97	0.25
	[0.13; 0.42]	[0.96; 1.96]	[0.03; 0.34]	[0.16; 0.46]	[0.47; 1.45]	[0.09; 0.41]
Recipient W == 1	0.47	2.56	0.31	0.50	1.73	0.40
	[0.20; 0.74]	[1.66; 3.42]	[0.02; 0.61]	[0.19; 0.81]	[0.84; 2.52]	[0.09; 0.70]
Recipient Wealth	14.46	14.45	14.44	6.97	18.55	5.81
	[13.13; 15.80]	[9.98; 19.07]	[13.04; 15.88]	[5.14; 8.86]	[13.89; 23.47]	[3.98; 7.68]
Recipient Wealth^2	−1.00	−1.03	−1.00	−0.54	−1.30	−0.46
	[−1.09; −0.92]	[−1.32; −0.74]	[−1.09; −0.91]	[−0.66; −0.43]	[−1.61; −1.00]	[−0.58; −0.34]
Recipient Population	1.16	0.40	1.23	0.46	−0.44	0.52
	[0.89; 1.44]	[0.04; 0.78]	[0.97; 1.50]	[0.25; 0.70]	[−0.77; −0.10]	[0.29; 0.74]
Recipient Population^2	−0.17	−0.11	−0.18	−0.06	−0.03	−0.05
	[−0.22; −0.13]	[−0.22; −0.01]	[−0.22; −0.14]	[−0.11; −0.02]	[−0.11; 0.04]	[−0.10; −0.00]
Recipient Government Share	4.38	6.72	4.00	2.14	6.36	1.78
	[3.45; 5.29]	[3.41; 10.37]	[3.06; 4.93]	[1.21; 3.08]	[3.18; 9.56]	[0.78; 2.77]
Recipient Government Share^2	−2.71	−9.89	−2.19	−1.67	−8.52	−1.19
	[−3.47; −1.95]	[−13.72; −6.27]	[−2.95; −1.44]	[−2.33; −0.98]	[−11.66; −5.58]	[−1.94; −0.47]
Cold War	−0.55	−1.43	−0.47	−0.07	−0.26	−0.05
	[−0.72; −0.38]	[−1.95; −0.91]	[−0.64; −0.30]	[−0.25; 0.10]	[−0.77; 0.27]	[−0.24; 0.12]
Distance	−2.22	−1.03	−2.23	−0.91	0.22	−0.98
	[−2.31; −2.13]	[−2.16; 0.20]	[−2.32; −2.14]	[−1.03; −0.79]	[−0.70; 1.19]	[−1.11; −0.85]
Multilateral Aid				0.34	0.35	0.34
				[0.29; 0.39]	[0.20; 0.50]	[0.30; 0.39]
Trade				0.74	0.93	0.69
				[0.69; 0.78]	[0.67; 1.17]	[0.64; 0.73]
Alignment				−1.13	−1.41	−1.01
				[−1.69; −0.51]	[−3.74; 0.99]	[−1.65; −0.34]
Alignment^2				−0.62	7.32	−0.74
				[−1.50; 0.26]	[−1.09; 15.49]	[−1.69; 0.29]
Time	2.21	0.23	2.32	1.10	1.00	1.07
	[2.08; 2.34]	[−0.15; 0.60]	[2.19; 2.46]	[0.95; 1.27]	[0.53; 1.47]	[0.89; 1.24]
Time^2	−0.92	−0.48	−0.96	−0.21	−0.17	−0.23
	[−0.98; −0.86]	[−0.67; −0.29]	[−1.02; −0.90]	[−0.26; −0.17]	[−0.30; −0.03]	[−0.27; −0.18]
Time^3	0.26	0.25	0.26	−0.11	−0.28	−0.09
	[0.21; 0.31]	[0.09; 0.40]	[0.21; 0.31]	[−0.16; −0.06]	[−0.44; −0.13]	[−0.14; −0.03]
Intercept	−31.41	−68.57	−29.47	−13.26	−107.62	−7.40
	[−37.32; −25.45]	[−90.24; −48.34]	[−35.62; −23.15]	[−20.94; −5.62]	[−128.57; −86.68]	[−15.08; 0.33]
η_ϵ^2	16.62	7.513	16.77	10.46	4.548	10.59
	[16.37; 16.86]	[7.022; 8.014]	[16.51; 17.05]	[10.28; 10.64]	[4.227; 4.895]	[10.39; 10.76]
η_D^2	24.28	8.431	27.09	16.79	19.95	18.41
	[12.21; 40.8]	[0.0004486; 21.66]	[13.47; 45.15]	[5.98; 28.53]	[1.44; 52.59]	[9.46; 32.98]
η_R^2	6.14	2.30	6.27	3.30	2.04	3.43
	[4.51; 7.93]	[1.30; 3.42]	[4.65; 8.14]	[2.31; 4.20]	[1.19; 2.93]	[2.53; 4.59]
Observations	78,330	2,601	75,729	44,441	1,770	42,671

95% credible interval in bracket.

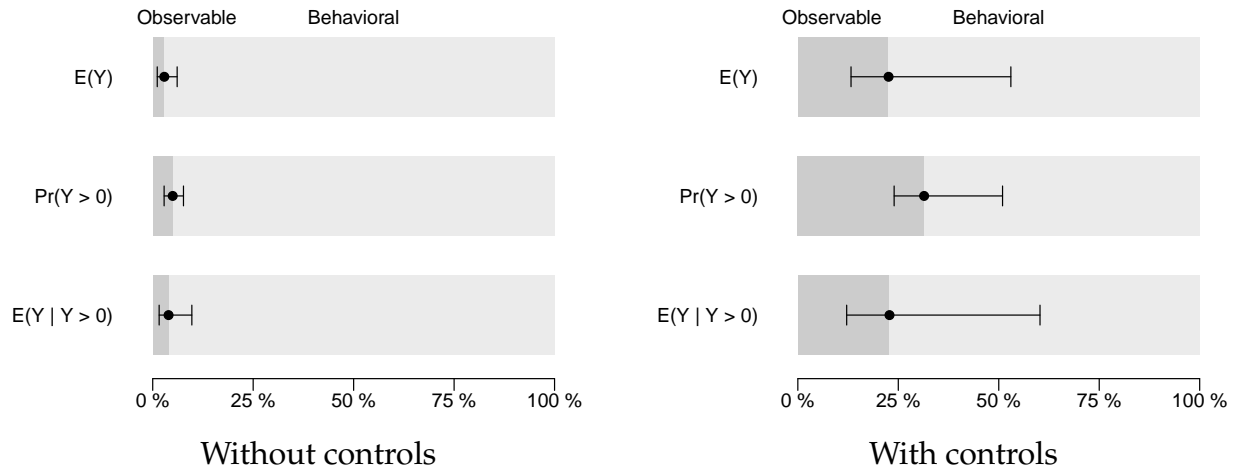# F Decomposition under alternative specification

Figure A.5: Decomposition results under the alternative model specification

Notes. This figure shows the results of the non-linear decomposition analysis using the formula by Fairlie (2005) for the three quantities of interests $E(Y)$, $\Pr(Y > 0)$, and $E(Y|Y > 0)$. In each panel, the black circle shows the median estimate of the percentage attributable to observable differences and the horizontal line shows 95% central credible interval of the estimate. Posterior summaries of the model parameters are shown in Table A.4.

G   Analyses without recipients that were never colonized
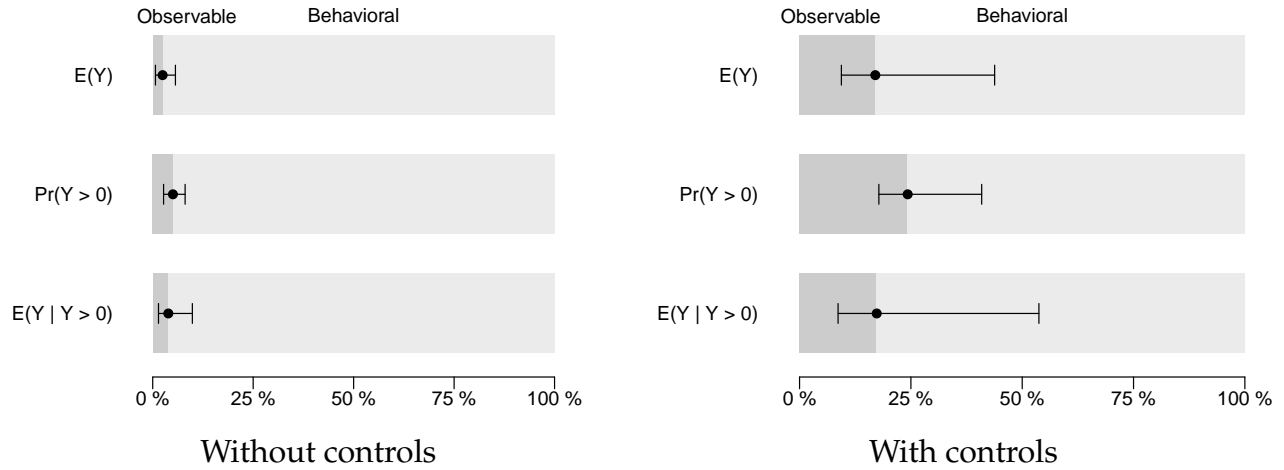

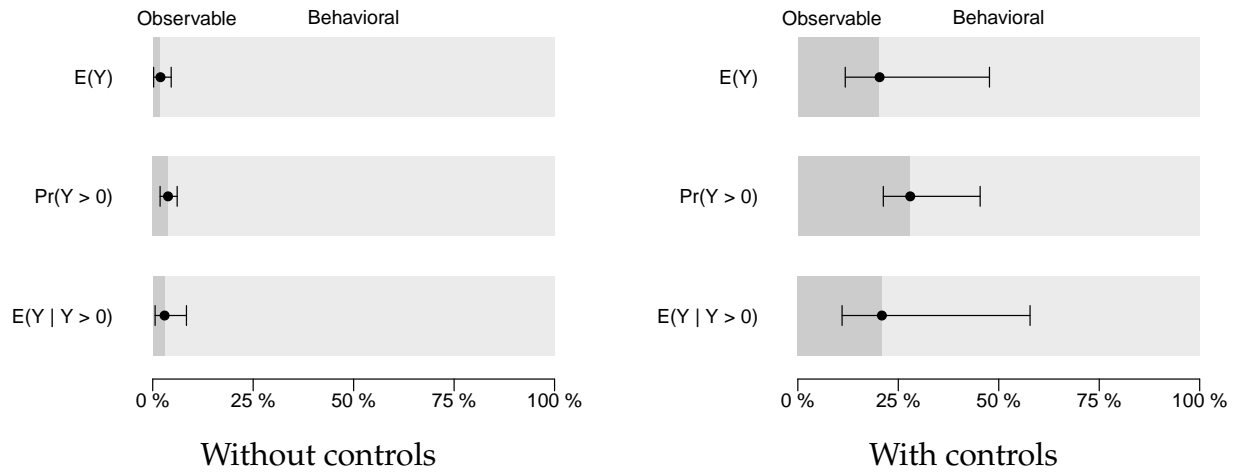Figure A.6: Decomposition results dropping recipients that were never colonized

Figure A.7: Decomposition results dropping recipients that were never colonized: alternative specification