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Losing Hearts & Minds: Aid and Ideology

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Abstract: ‘Hearts and minds’ theory contends development aid strengthens community support for counterinsurgents by providing jobs and public goods. Based on field interviews in Kabul, we develop an alternative theoretical framework emphasizing instead the non-pecuniary interests of civilians. In our model, some aid projects are ideologically contentious while others are benign. Given a mix of foreign aid, each civilian supports either the counterinsurgents or rebels, depending on his/her idiosyncratic political preferences. In this setting, greater provisions of aid can actually erode community support. Donors therefore calibrate the mix of foreign aid to appease population groups with relatively strong ideological sensibilities. Correlations from unique Afghan data are consistent with our novel theory. Benign projects are associated with favourable opinions of development, and stronger support for government and counterinsurgents. Contentious aid, by contrast, is accompanied by poor assessments of development efforts and greater support for rebels.

Keywords: hearts and minds, foreign aid, public opinion, ideology, conflict

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*“We’re invariably going to get it wrong. Let’s be honest –
it’s almost impossible to avoid unintended consequences of our work here.”*
(foreign donor, Kabul, 2013)

1 Introduction

For almost two decades Western governments have been embroiled in protracted missions to rebuild Afghanistan and Iraq. To this end, the US government alone has spent over \$200 billion on development aid in theater (SIGIR 2013; SIGAR 2018). Despite considerable financial outlays, it remains unclear whether post-conflict aid has been successful. A ‘hearts and minds’ perspective was long espoused by American military forces (US Army 2006), and later formalized by Berman et al. (2011). That theory suggests development assistance builds popular support for counterinsurgents by providing jobs and public goods otherwise absent under rebel control. In exchange for aid, the community ostensibly shares intelligence with counterinsurgents regarding the plans, identities, and whereabouts of rebel forces.

Despite the tremendous amount of resources dedicated to leveraging community support for counterinsurgents, few empirical studies have validated the hearts and minds theory. Berman et al. (2011) provide evidence that the US Commander’s Emergency Response Program (CERP) mitigated violence in Iraq. But the combined findings of Chou (2012), Child (2014), and Adams (2015) imply CERP projects in Afghanistan were generally inconsequential. In a broader survey of the literature, Zürcher (2017) shows aid in conflict settings is actually more likely to *exacerbate* than alleviate violence.

Careful empirical studies have extended hearts and minds theory by identifying conditions surrounding counterproductive aid. Many attribute aid’s deleterious effects to strategic behaviour by insurgents (e.g., Crost et al. 2014; Sexton 2016; Weintraub 2016; Khanna & Zimmerman 2017). Other studies acknowledge the important role of community-based grievances. In Afghanistan, Karell and Schutte (2018) show conflict increases in the wake of non-inclusive aid projects. Child (2019) suggests ideological sensitivities could explain

heightened conflict following military-led education projects. These recent empirical strides add nuance to the hearts and minds perspective, but they remain unaccompanied by progress in formal theory.

Standard hearts and minds theory emphasizes the pecuniary interests of communities. Under this characterization, civilians support counterinsurgents to secure aid provisions and economic support. But in practice we know local allegiances may rest on political or ideological views, rather than material or financial considerations. Local perspectives may even be shaped through grievances induced by foreign intervention itself. In Afghanistan, for example, qualitative research has connected grievances to aid in general (Fishstein & Wilder 2012; Jackson & Giustozzi 2012), and to education projects in particular (Giustozzi 2010; Giustozzi & Franco 2011).

This paper contributes a formal theory of aid and conflict in which community-based grievances are pivotal. In our model, foreign aid generates an array of allegiances across community members, based on their underlying ideological preferences. Certain aid projects are controversial from the community's perspective, and citizens are differentiated by their sensitivity to those projects. Given a bundle of foreign aid, some community members support the development effort, while others do not. Based on their assessments, each civilian casts their allegiance to either the counterinsurgents or rebels. Both combatant groups rely on community support for their success. The relative strength of (counter)insurgency therefore depends on how ideological preferences in the community interact with foreign aid disbursements.

Empirical research on victimization and support for combatants confirms the importance of heterogeneous political preferences. Lyall et al. (2013) document anti-ISAF and pro-Taliban biases across Pashtun communities in Afghanistan. Condra and Shapiro (2012) argue political preferences underpin civilian responses to victimization in Iraq. Both studies stress the need to consider heterogeneous political preferences when studying community support in conflict settings. Still, no formal theory leverages political preferences to understand aid's ability to win hearts and minds. This paper fills that gap by developing a model of community support for combatants in the presence of foreign aid, with heterogeneous political preferences at its core.

Formal models of conflict often abstract from the political agency of civilians, but important exceptions are relevant to this study. Bueno de Mesquita and Dickson (2007) and Rueda (2017) invoke heterogeneous preferences to examine competition between rebels and counterinsurgents for community support. In these models, civilians are acknowledged as strategic actors with varying predispositions to support rebels. Both studies focus on the effects of victimization, however, while aid is not discussed. Siqueira and Sandler (2006) also allow for heterogeneous political priors among community members. Like Berman et al. (2011), they develop a model in which governments compete for community support by combining public goods with hard counterinsurgency. In both models, government-provided goods are regarded as inherently beneficial to civilians. In our model, by contrast, civilians with idiosyncratic preferences disagree on the value of aid. Consequently, greater public goods provision can actually *erode* community support, and thereby strengthen rebel capacity for rent-seeking and conflict. By implication, donors calibrate the nature of development spending to appease population segments with relatively strong ideological sensibilities - a novel policy lever in this formal literature.

Taking stock of the literature more broadly, Sanín and Wood (2014) call for a greater focus on the role of ideology. They argue existing theories of conflict undermine the importance of ideology under the pretense that (a) it is a rhetorical device; or (b) it can be reduced to some structural variable (e.g. the pursuit of economic gains, or power over resources). Indeed, formal theories have widely characterized insurgency as an outcome of economic calculus (see Blattman & Miguel 2010). But notable exceptions do treat ideology as a mobilizing factor (Gates 2002; Rosendorff & Sandler 2004; Bueno de Mesquita 2005). Later empirical work supports the notion that ideology constitutes a *normative* commitment among conflict stakeholders (Asal et al. 2013; Hegghammer 2013). Our paper contributes to this stream of literature by offering a novel theory of aid provision and community support emphasizing ideological preferences.

Our theoretical perspective is premised on anecdotal evidence from field interviews conducted in Kabul, Afghanistan. In November 2013 the author carried out 21 unstructured on-site interviews with development stakeholders. Interviewees included foreign government donors (9), local and foreign NGOs (4), private companies (3), research organizations and journalists (4), and a special forces operative (1). The views expressed by our interlocutors

are reflected in the core assumptions underpinning our theoretical framework.¹

Our formal model is consistent with correlational findings from unique data on public opinion and aid provision across Afghanistan. Public opinion data were secured by the author through a pilot data-sharing agreement providing access to ISAF and Resolute Support HQ’s Afghanistan Nationwide Quarterly Assessment Research (ANQAR) surveys. From these data we obtain information on civilian attitudes toward aid efforts and combatant groups (including government, international, and anti-government forces). Aid data were acquired through a rare hardcopy of the now-defunct NATO C3 Agency’s Afghanistan Country Stability Picture (ACSP). Those data permit us to track foreign aid projects by sector at a fine level of spatiotemporal granularity.

We present cross-sectional results demonstrating the relationship between sector-specific aid and support for combatants, between July 2008 and September 2009. Our data permit us to compare household views on development across districts with varying levels of foreign aid, while controlling for important household characteristics. We then link household opinions of aid to support for combatant groups. Throughout our empirical analysis we operationalize education projects as contentious, while remaining projects are deemed benign. These priors are based on field interviews and other evidence discussed in the next section. Our correlations show contentious aid is associated with lower appraisals of development efforts and stronger trust in rebels. On the other hand, benign projects are accompanied by favourable opinions of development and stronger trust in government and counterinsurgents.

The remainder of our paper is structured as follows. Section 2 substantiates the key underlying assumptions of our theory. Section 3 presents our formal model. Section 4 presents data and correlational findings consistent with our theory. Section 5 concludes.

2 Theoretical Premise

Our model regards community members as the support base upon which both rebellion and counterinsurgency rest. Each citizen decides which combatant group to support based on an idiosyncratic assessment of foreign aid activity. Not all projects are viewed similarly by the

¹To preserve anonymity we reference field interviews in general terms (e.g. Donor *X*, Afghan NGO *Z*).

community - a foreign-built school may elicit ideological resistance while a road construction project wins hearts and minds. Community support for insurgency therefore depends on how contentious is the bundle of aid chosen by the donor. Through development the donor pursues overarching political-economic goals related only *indirectly* to security of the host nation. The degree of misalignment between donor and community preferences determines the distribution of community allegiances, and ultimately the capacity of rebels to conduct violence and extract rents. Implicit in this theoretical framework are some underlying assumptions regarding the nature of community and donor preferences. Here we motivate those assumptions with material gleaned from field interviews in Kabul and other piecemeal evidence.

2.1 Ideological community members

One critical notion underpinning our model is that certain aid projects are ideologically controversial. Intercepted Taliban and Al-Qaeda correspondence reflect sensitivity to foreign involvement in the sectors of oil (CTC 2006; 2007b), media (CTC 2007a), and education (CTC 1999; 2009). Among development stakeholders, education projects are regarded as particularly contentious (Afghan Company 2013; Donor E 2013; Journalist F 2013; Donor G 2013; Donor H 2013). One Afghan NGO recounted to the author how three of their teachers were killed after an education project was monitored by armoured vehicles, degrading community support for the initiative (Afghan NGO J 2013). Resistance from conservative communities to foreign involvement in education is documented by Giustozzi (2010) and Giustozzi and Franco (2011). Curriculum design has been a particular point of tension between local insurgents and the international community (Foreign NGO I 2013; Research Organization C 2013). To illustrate, Al-Qaeda's *Jihad* magazine states "among the most dangerous things that the West introduced in order to put an end to Islam in the long-term are the curriculums that concentrated on demolishing the language, the religion, and Islamic history" (CTC 2007a). At the same time, most other aid projects are regarded as innocuous from an ideological standpoint (Journalist F 2013; Donor G 2013; Donor H 2013; Afghan NGO J 2013; Foreign NGO K 2013). Child (2019) provides evidence consistent with these reports, suggesting education projects exacerbate conflict in Afghanistan while the converse is true of health and security projects.

2.2 Self-interested donors

In our model the donor’s development goals are shaped by domestic political-economic considerations. Donors face enormous pressure to expend resources as a metric for success, and local sensitivities are secondary concerns in that pursuit (Donor G 2013; Donor E 2013). The allocation of funds across program sectors is a political decision made in consultation with parliamentarians back home, and based more on national priorities (Donor L 2013; Donor H 2013) or global poverty solutions (Donor L 2013; Donor E 2013) than on local community preferences. The reconstruction and development effort is not a purely altruistic endeavour. This is well understood by private contractors (Afghan Company 2013; Foreign Company M 2013) and other development stakeholders (Afghan NGO J 2013; Journalist F 2013; Donor G 2013; Donor N 2013). As one foreign official in Kabul candidly remarked:

“Every project here is hugely political. It’s all part of a big political process. There are many, many projects around the country which I’m sure have a strong economic justification for doing them. And maybe a strong social justification for doing them. But overriding all of that are strong political reasons for doing them.”
(Donor H, 2013)

3 Model

Our model depicts a one-shot game between two decisionmaking agents - a single donor and a continuum of community members.² The donor maximizes utility by allocating aid across two ‘sectors’. Each community member either cooperates with counterinsurgents or supports the rebels, depending on his/her idiosyncratic (dis)taste for the mix of projects chosen by the donor. Cooperating with counterinsurgents involves sharing intelligence on the plans, identity, or whereabouts of rebels, thereby weakening the insurgency. Supporting the rebels, by contrast, involves providing them information or resources, effectively strengthening their capacity. Rebels sabotage and/or tax development projects, so their capacity ultimately

²Counterinsurgents and rebels enter the model with no decisionmaking authority. Rebels uniformly target or tax aid projects, while counterinsurgents restrict rebel capacity.

determines the efficiency of aid provision.³ The donor moves first with perfect foresight, and individual community members then decide which combatant group to support. The allocations of aid and community support determine final development output and payoffs, then the game ends.

3.1 Specifications

Donor utility, $V(b, k)$, depends positively on the output of aid in sectors b and k , but exhibits decreasing marginal returns (hence $V_b > 0, V_k > 0, V_{bb} < 0$, and $V_{kk} < 0$). Utility of all community members i , $U^i = U(b, k; \alpha_i)$, depends positively on the provision of sector b projects ($U_b^i > 0$), and negatively on the presence of sector k projects ($U_k^i < 0$).⁴ Thus, there exists tension between donor and community preferences. The notation b and k denotes ‘benign’ and ‘contentious’ to reflect community perceptions of foreign-led development in the corresponding sectors. Individual utilities are differentiated across community members by the ideological preference parameter α_i .

Community member utility exhibits decreasing marginal returns to both benign and contentious projects (hence $U_{bb}^i < 0$ and $U_{kk}^i < 0$). In this sense, sector k projects are similar to a pollutant whose marginal damage becomes more severe at high levels of output. For analytical simplicity, the marginal utility of benign output also declines with (or is unaffected by) greater output in the contentious sector (i.e. $U_{bk}^i \leq 0$).⁵ This implies difficulty appreciating benign projects in the presence of contentious development activity. Lastly, the individual preference parameter α_i positively affects the marginal utility derived from all projects ($U_{k\alpha_i} > 0$, and $U_{b\alpha_i} > 0$), and it is drawn from a distribution such that $\alpha_i \in [0, \infty)$.⁶

The donor faces convex development costs $C(B, K)$, such that $C_B > 0, C_K > 0, C_{BB} \geq 0, C_{KK} \geq 0$, and $C_{BK} \geq 0$. B is sector b spending, and K is sector k spending - both of which ultimately translate into output. The output $b(B, R)$ depends on B and rebel capacity for

³Strategic insurgents are found to sabotage aid programs in Crost et al. (2014) and Sexton (2016). Rebel taxation is documented by Sabates-Wheeler and Verwimp (2014) and Krauser (2020).

⁴The condition $U_k^i < 0$ can be relaxed for some i without meaningfully affecting results.

⁵In Appendix A we numerically solve a parameterization of the model relaxing this condition.

⁶One class of admissible utility functions under these criteria is $U^i = \alpha_i f(b, k) - h(k)$, where f resembles a standard production function satisfying the Inada conditions. In particular, f is positive, concave, and increasing in both its parameters. As output of either sector approaches zero (infinity), the partial derivative of f with respect to that sector approaches infinity (zero). The function h is positive, convex, and increasing. Lastly, both f and h are continuously differentiable.

conflict and rent-seeking R , such that $b_B > 0$ and $b_R < 0$. We impose $b_{BB} \leq 0$, implying a constant or decreasing marginal product; and $b_{RB} < 0$, implying rebels inflict greater absolute damage and/or taxation in the presence of larger outlays. The conditions on output $k(K, R)$ are analogous.

From the hearts and minds perspective, community support determines the strength of (counter)insurgency. Let the binary indicator s^i reflect citizen i 's support for insurgents, and let S be the share of community support for insurgency (hereafter - *rebel support*). Rebel capacity R depends on rebel support S , such that $dR/dS > 0$. Since rebels serve to sabotage or tax development initiatives, the individual decision s^i depends on whether citizen i benefits from a reduction in aid output (to be shown below).⁷

3.2 Equilibrium

The model's equilibrium is characterized by an optimal spending bundle (B^*, K^*) chosen by the donor; and an optimal decision by each community member regarding which combatant group to support. Decisions in the community are summarized by a threshold value α_i^* in the preference distribution. Community members observe the spending bundle before casting their support. With perfect foresight, the donor's choice is optimized accounting for the resulting allocation of community support and, by extension, rebel capacity to hinder development efficiency. The equilibrium obtained is a Stackelberg (subgame perfect Nash) equilibrium. To solve the model, we first calculate the response of each community member to a given project bundle: this determines s^i as a function of spending inputs B and K , and preference parameter α_i . The individual s^i then aggregate to rebel support S , which influences rebel capacity R . Using the correspondence between s^i and R , together with the output functions $b(\cdot)$ and $k(\cdot)$, we characterize the donor's optimization problem. From this, the donor chooses an optimal spending mix, which ultimately depends on donor preferences, community preferences, and the relationship between aid output and rebel capacity.

⁷The distinction between the ideological preference parameter α_i and the political action s^i is important. The decision s^i derives from preferences α_i , following a personalized evaluation of the aid bundle (b, k) .

3.2.1 Community support

First we substitute into the community member utility function: (i) the output functions; and (ii) the relation between rebel support and rebel capacity. From this we express - $U^i(b(B, R(S)), k(K, R(S)); \alpha_i)$. We then determine the impact of rebel support on individual utility through the total derivative:

$$\frac{dU^i}{dS} = \frac{\partial U^i}{\partial b}(b, k; \alpha_i) \frac{\partial b}{\partial R} \frac{dR}{dS} + \frac{\partial U^i}{\partial k}(b, k; \alpha_i) \frac{\partial k}{\partial R} \frac{dR}{dS} \quad (1)$$

The first term on the right-hand side of Equation 1 is negative, and the second term is positive. The sign of dU^i/dS indicates whether community member i would perceive his/herself to be better or worse off with a marginal increase in rebel support. By setting $\frac{dU^i}{dS} = 0$, we can extract the identity of the marginal supporter (MS) described by α_i^* (herefrom α^*), who is just indifferent between a stronger and weaker insurgency. It is straightforward to show the marginal benefit of rebel support (dU^i/dS) is monotonically decreasing in α_i .⁸ It therefore follows that the MS - α^* - is unique (if it exists).⁹ Given a MS, all community members for whom $\alpha_i < \alpha^*$ would benefit from greater rebel capacity (i.e. lower aid output), and those for whom $\alpha_i \geq \alpha^*$ would not benefit. Because the individual act of support lends strength to combatants, each individual's binary decision regarding which combatant group to support can be described by the assignment rule:

$$s^i = \begin{cases} 1 & \text{if } \alpha_i < \alpha^* \Leftrightarrow dU^i/dS > 0 \\ 0 & \text{if } \alpha_i \geq \alpha^* \Leftrightarrow dU^i/dS \leq 0 \end{cases}$$

where $s^i = 1$ corresponds to supporting rebel forces, and $s^i = 0$ involves supporting counterinsurgents. The total share of rebel support can then be calculated by integrating the individual support decisions over the entire population distribution, where $f(\cdot)$ is the density function pertaining to the distribution of α_i , and $F(\cdot)$ is the cumulative distribution

⁸ $\frac{d}{d\alpha_i} \frac{dU^i}{dS} = \left(\frac{d}{d\alpha_i} \frac{\partial U^i}{\partial b} \right) \frac{\partial b}{\partial R} \frac{dR}{dS} + \left(\frac{d}{d\alpha_i} \frac{\partial U^i}{\partial k} \right) \frac{\partial k}{\partial R} \frac{dR}{dS} < 0$.

⁹In Appendix B we formally prove the existence and uniqueness of α^* under additional functional form restrictions.

function.¹⁰

$$S = \int_0^\infty s^i(\alpha_i; b, k) f(\alpha_i) d\alpha_i = F(\alpha^*)$$

Our primary interest lies in how different types of aid projects influence support for (counter)insurgents. To understand this relationship, we first calculate the change in returns to rebel support when spending in sector k increases. Using Equation 1 we evaluate:

$$\frac{d}{dK} \left(\frac{dU^i}{dS} \right) = U_k^i k_{RK} R_S + U_{kk}^i k_K k_R R_S + U_{bk}^i k_K b_R R_S > 0$$

From section 3.1, the first and second terms on the right-hand-side are positive, and the third term is non-negative. So individual returns to rebel support are higher when outlays to K are greater. Accordingly, it must be true that the MS faces strictly positive returns to rebel support with an incremental increase in K , and therefore individually contributes his/her support to the rebels. For the spending allocation with comparatively larger K , the new MS (α^{**}) lies somewhere further to the right on the distribution of α_i (i.e. $\alpha^{**} > \alpha^*$), and rebel support is stronger since $F(\alpha^{**}) > F(\alpha^*)$.

Hypothesis I: For a fixed level of benign development spending, and fixed community preferences, an increase in contentious aid programming will strengthen rebel support and weaken cooperation with counterinsurgents. *Ceteris paribus*, $\Delta S / \Delta K > 0$.

By comparison, the change in community member incentives following an injection of B takes the form:

$$\frac{d}{dB} \left(\frac{dU^i}{dS} \right) = U_b^i b_{RB} R_S + U_{bb}^i b_B b_R R_S + U_{kb}^i b_B k_R R_S$$

The first term on the right-hand-side is negative, the second term is positive, and the third

¹⁰It is worth mentioning that the model can also be solved in discrete form. In that case, $S = \sum_{i=1}^N s^i / N$, where N is the finite population measure. Under this discrete framework the individual contribution to rebel capacity is positive and measurable. We can then solve the model by eliciting the MS instead from the micro-founded condition: $\frac{dU^i}{ds^i} = \frac{\partial U^i}{\partial b} \frac{\partial b}{\partial R} \frac{dR}{dS} \frac{dS}{ds^i} + \frac{\partial U^i}{\partial k} \frac{\partial k}{\partial R} \frac{dR}{dS} \frac{dS}{ds^i} = 0$. This yields an analogous outcome since $\frac{dS}{ds^i} = \frac{1}{N} > 0$, and $\frac{dR}{dS} > 0$. Having established that the two formulations are qualitatively equivalent, we proceed under the simpler and more elegant continuous framework. Suffice to note, under the discrete framework we could also account for homogeneous participation costs of rebel support (assumed to be zero until now). The introduction of costs associated with rebel allegiance would simply reduce the support for insurgency in equilibrium, without affecting the tradeoffs central to our analysis.

term is non-negative. The net result implies, surprisingly, that spending on benign aid projects does not necessarily boost citizens' incentives to support counterinsurgents. In case the latter two terms dominate, a counterintuitive result emerges in which public goods provision actually fuels support for rebels. Ultimately, the direction of the total effect will depend on the valuation of benign projects, their diminishing returns, and the technology of rebel capacity. Based on our fieldwork (see section 2), we suspect B will have the intuitive countereffect to K . In that case the MS would strictly prefer to support counterinsurgents following a marginal increase in B . On this basis, we formulate our second hypothesis.

Hypothesis II: For a fixed level of contentious development activity, and fixed community preferences, an increase in benign aid programming will diminish rebel support and strengthen cooperation with counterinsurgents. Ceteris paribus, $\Delta S/\Delta B < 0$.

In Appendix B we impose: (i) linear homogeneity on the community member utility functions; (ii) symmetry and separability conditions on the production functions; and (iii) limit conditions on the marginal utilities of extreme ideologues. These conditions enable us to formally derive the theoretical predictions of Hypotheses I and II.

3.2.2 Project Choice

We next consider the donor's optimization problem which can be summarized as:

$$\max_{B,K} \Pi = V(b(B, R(S(B, K; f(\cdot)))), k(K, R(S(B, K; f(\cdot))))) - C(B, K)$$

This implies the following first-order conditions:

$$V_k k_K = C_K - (V_b b_R R_S + V_k k_R R_S) S_K \quad (2)$$

$$V_b b_B + (V_b b_R R_S + V_k k_R R_S) S_B = K_B \quad (3)$$

The left-hand sides of Equations 2 and 3 capture marginal benefits of outlays to K and B , respectively. The right-hand sides capture the associated marginal costs. The costs of

investment in sector k are two-fold, consisting of a direct cost C_K , and the indirect cost of greater rebel support (which strengthens rebel capacity and dampens output efficiency across both sectors). By contrast, the *benefits* of investment in sector b are two-fold, consisting of the direct benefit $V_b b_B$, and the indirect growth in output across sectors resulting from constrained rebel capacity for conflict and taxation. The donor accounts for these different within-sector tradeoffs through its optimal allocation. In equilibrium the donor allocates less to sector k and more to sector b than would be optimal in the absence of a (counter)insurgency reliant on community support. This constitutes a form of political compromise by the foreign government entity - a novel policy lever in the conflict-aid literature which arises endogenously in our model.

Depending on donor and community preferences, an equilibrium is reached in which some combination of B^* , K^* , and $R(S(\alpha^*))$ prevails. The donor's utility is bounded from above by $V(b(B, 0), k(K, 0))$, which is concave in B and K . Because the cost function is convex, B offsets cannot endlessly compensate for damages incurred by K . If we impose the Inada conditions on V , the equilibrium is contained within a limited set of feasible allocation bundles.

4 Analysis

4.1 Data

We next examine correlations between public opinion and aid disbursements in Afghanistan between June 2008 and September 2009. Aid data in our study comes from NATO C3 Agency's Afghanistan Country Stability Picture (ACSP). This database covers aid projects from Q1 2002 to Q3 2009, funded by USAID, UN agencies, and a host of other donors. Individual project data include information on timing, location, and sector of implementation. The ACSP contains over 30,000 foreign-led development projects, accounting for at least \$28.2 billion spent across 398 districts.¹¹ Aid volumes are expressed as the daily average number of projects (per capita) in a district-quarter.¹² The spatial distribution of aid projects across Afghanistan is depicted in

¹¹These figures account for excluded project data due to missing geolocations and timestamps. Reassuringly, Child (2019) provides evidence that missing ACSP data does not significantly bias the estimated impact of aid on conflict.

¹²For descriptive purposes we scale these measures to the average-sized district (63,000 inhabitants). Population data is for 2011/12, and obtained from the Central Statistics Organization of Afghanistan.

Figure 1a. The distribution of education projects in Figure 1b is highly correlated with total aid, but offers residual variation crucial for the identification of aid’s sector-specific relationship with public opinion.

Public opinion data come from the Afghanistan Nationwide Quarterly Assessment Research (ANQAR) surveys sponsored by ISAF and Resolute Support HQ. We use the first five waves of ANQAR, covering over 40,000 households sampled across the country from Q3 2008 to Q3 2009.¹³ These data include household demographics, and opinions of aid and combatant groups (i.e. government, international forces, and anti-government elements). Figure 1c depicts average perceptions of development efforts among Afghan households (expressed as the inverse of *poor R&D Afg* from Table 1). Visually we observe that perceptions of aid are roughly more favourable in districts with large disbursements.

4.2 Aid and support for combatants

We next present correlational findings consistent with our model’s predictions. In what follows, based on the qualitative and field research of section 2, education is operationalized as the contentious sector while remaining projects are benign.¹⁴ Public opinion towards aid initiatives and conflict actors is captured by the survey questions in Panels A and B of Table 1. Table 2 presents descriptive statistics for all variables in the analysis.

In a cross-sectional setting, we first examine the relation between aid volumes (at the district level) and public opinion of aid initiatives (at the household level). Table 3 reports these correlations conditional on numerous household-level confounds (listed in Panel C of Table 1). Columns 1–3 show that households in districts with more benign aid projects tend to favourably assess development efforts by all levels of government. But that relationship is reversed when focusing on education projects in particular. Conditional on age, gender, educational background, economic and security conditions, life satisfaction, and ethnicity, respondents from districts with more education projects held *less* favourable views of aid

¹³Interviews were proportionally distributed across districts according to population. Within each district, settlements were selected randomly; 10 households were interviewed per settlement, using random walks and kish grids to select respondents. Further detail regarding sampling design and methodology is available upon request.

¹⁴Consistent with this characterization, Child (2019) finds education projects to spur conflict in Afghanistan, whereas health and security projects improve stability.

initiatives. Given our premise that foreign-led education projects are relatively more contentious in Afghanistan, these results may be regarded as consistent with theoretical predictions.

In our model community members judge overall development efforts based on the sectoral allocation of projects. The results of Table 3 shed light on that process. Our model subsequently suggests the individual’s assessment of aid determines his/her allegiance in the conflict. This analytical step closes the loop between sector-specific aid disbursements and the extent of rebel support. Accordingly, Table 4 reports cross-sectional correlations between opinions of aid and perceptions of combatants. These tests are conducted at the household level, controlling for the same potential confounds as above. Columns 1–3 show that households with low appraisals of development efforts do not believe the government cares about community needs. Importantly, this relationship holds even after conditioning on age, gender, educational background, economic and security conditions, life satisfaction, and ethnicity.¹⁵ Columns 4–6 show that poor perceptions of aid are positively correlated with mistrust in the Afghan government (again, conditional on a host of candidate confounds). That same relationship extends to international forces in columns 7–9. Finally, columns 10–12 actually show that poor assessments of development initiatives are associated with *greater* trust in anti-government combatants.

The results of Table 4 suggest when citizens approve of aid initiatives, they are more likely to trust government and counterinsurgents. When community members disapprove of development efforts, however, they hold greater trust in rebel forces. Taken together, the results of this section are consistent with Hypotheses I and II which suggest contentious aid bolsters rebel support, while benign projects ‘win hearts and minds’. These findings add nuance to earlier empirical work demonstrating a beneficial impact of aid on support for the Afghan government (Bohnke & Zürcher 2013; Beath et al. 2016). Importantly, these results also support our novel theory of aid and allegiances in which ideological preferences are crucial.

¹⁵Granted, this vector of household controls may be insufficient to rule out the possibility that perceptions of aid and combatants are jointly determined by omitted household factors.

5 Concluding Remarks

We extend the standard hearts and minds theory by emphasizing heterogeneous political preferences among civilians. Based on field interviews in Kabul, we develop a formal model in which some aid projects are ideologically contentious while others are benign. A given bundle of foreign aid chosen by the donor elicits a range of support towards combatants, based on the community's underlying distribution of political preferences. Accordingly, increases in aid disbursements can lead to a degradation of support for counterinsurgents and a strengthening of rebel capacity. Donors therefore calibrate the nature of development spending to appease population segments with relatively strong ideological sensibilities.

In this paper we treat the *sector* (education in particular) as an ideological fault line. This emphasis follows from related research and field interviews conducted in Afghanistan. But importantly, there exists many other dimensions along which projects may inflict grievances. Karell and Schutte's (2018) focus on the exclusivity of aid projects is one such example. Child, Wright, and Xiao (2020) offer another example, suggesting fragmented aid facilitates corruption and thereby erodes community support. Two implications of our theoretical framework apply equally to alternative accounts of aid-related grievances. First, donors are self-interested. Second, citizens are strategic actors with distinct political preferences. Together these imply for policymakers that winning hearts and minds involves a trade-off between the political interests of aid providers and those of aid recipients. The extent to which donors are willing to sacrifice their own goals will therefore impact the level of support enjoyed by counterinsurgents and rebels on the ground.

Our model constitutes a rare contribution of formal theory to a burgeoning discussion around the impact of aid in conflict zones. Additional models linking conflict to aid through grievances (or rebel strategy) would offer further guidance to the growing empirical extensions of hearts and minds theory. Further theoretical inroads may then facilitate more nuanced empirical investigation. Establishing causal evidence is beyond the scope of data analysis in this paper. But well-identified empirical studies in the future will shed much needed light on the complicated relationship of foreign aid and public opinion which underpins the hearts and minds perspective.

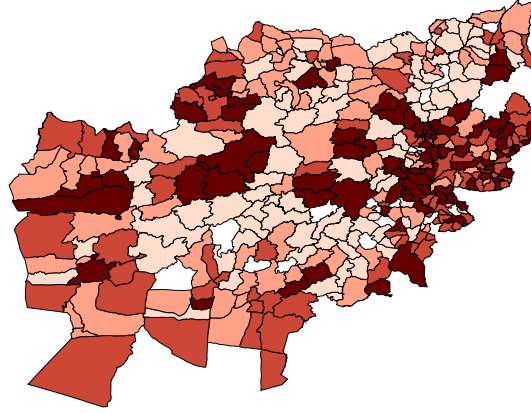
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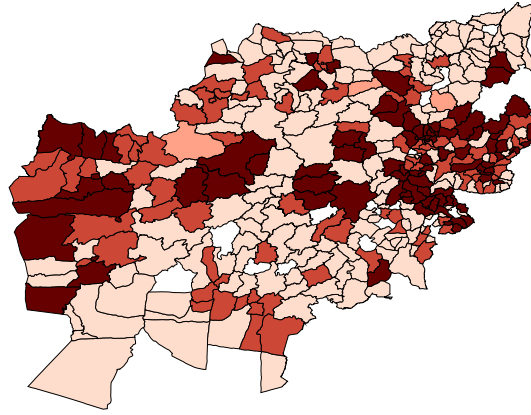
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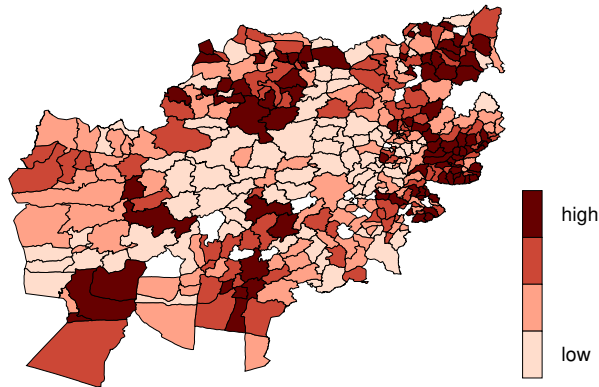
Figure 1: Spatial distributions of aid and public opinion



(a) aid project disbursements



(b) education project disbursements



(c) appraisals of development efforts

Notes: This figure depicts spatial variation in (a) general aid project disbursements, (b) education projects in particular, and (c) public perceptions of development efforts (expressed as the inverse of *poor R&D Afg*). Aid project data are from NATO C3 Agency's Afghanistan Country Stability Picture (ACSP), covering aid from various donor agencies. Public opinion data are from Afghanistan Nationwide Quarterly Assessment Research (ANQAR) sponsored by ISAF and Resolute Support HQ. Sample period runs from June 2008 until September 2009.

Table 1: Public opinion and control variables

Variable	Survey question	Range of response
<i>Panel A: Opinions of aid initiatives</i>		
poor R&D Afg	How well does the GoA do its job at development and reconstruction in Afghanistan?	1 (very well) – 5 (very poorly)
poor R&D province	How well does the Governor of this province do his job at development and reconstruction of the province?	1 (very well) – 5 (very poorly)
poor R&D district	How well does the District Governor do his job at development and reconstruction of the district?	1 (very well) – 5 (very poorly)
<i>Panel B: Opinions of conflict actors</i>		
government care	Does the government care about your needs or the needs of your community?	1 (do not care at all) – 3 (completely care)
government trust	How trustworthy is the messaging of the government?	1 (not trustworthy at all) – 4 (totally trustworthy)
ISAF trust	How trustworthy is the messaging of the international forces?	1 (not trustworthy at all) – 4 (totally trustworthy)
AGE trust	How trustworthy is the messaging of the anti-government elements?	1 (not trustworthy at all) – 4 (totally trustworthy)
<i>Panel C: Controls</i>		
age	How old were you on your last birthday?	15–90 years
secular education	What is your highest level of education (secular schooling)?	1 (no schooling) – 5 (university)
religious education	What is your highest level of education (Islamic studies - madrassa, mosque)?	0–12 years
economic status	Has your family's economic situation gotten better, stayed the same, or gotten worse compared to 12 months ago?	1 (worse) – 3 (better)
food shortage	Have there been times in the past 12 months when you or your family had difficulty finding food for your family?	0 (no), 1 (yes)
price change	Have you noticed any changes in price of goods in the last 3 months that are not based on the season?	1 (decrease) – 3 (increase)
life satisfaction	How satisfied are you with the current quality of your life?	1 (not satisfied at all) – 4 (very satisfied)
security	How is the security situation in your mantaqa?	1 (bad) – 3 (good)

Notes: Public opinion and control variables are based on survey questions from Afghanistan Nationwide Quarterly Assessment Research (ANQAR), sponsored by ISAF and Resolute Support HQ. For each measure included in our analysis we indicate the corresponding survey question and the range of possible responses.

Table 2: Descriptive statistics

	N	mean	sd	min	max
aid (general)	1,990	5.0	6.7	0	38
aid (education)	1,990	5.8	14.1	0	82
poor R&D Afg	39,902	2.9	1.2	1	5
poor R&D province	39,532	3.0	1.2	1	5
poor R&D district	39,429	3.1	1.2	1	5
government care	33,846	2.4	0.7	1	3
government trust	33,342	2.0	0.9	1	4
ISAF trust	32,430	2.8	1.0	1	4
AGE trust	32,886	2.1	1.0	1	4
age	40,624	33.8	13.1	15	90
female	40,624	0.5	0.5	0	1
secular education	40,544	1.8	1.2	1	5
religious education	40,219	1.3	1.9	0	12
economic status	39,977	2.0	0.7	1	3
food shortage	39,778	0.5	0.5	0	1
price change	38,108	2.2	0.8	1	3
life satisfaction	40,080	2.7	1.0	1	4
security	40,205	2.2	0.7	1	3

Notes: Aid project data are from NATO C3 Agency’s Afghanistan Country Stability Picture, covering aid from various donor agencies between Q3 2008 and Q3 2009. Project volumes are measured at the district-quarter level of aggregation. For descriptive purposes we scale project volumes to the average-sized district (63,000 inhabitants). Remaining data are from Afghanistan Nationwide Quarterly Assessment Research (ANQAR) sponsored by ISAF HQ and Resolute Support HQ. We use the first five waves of ANQAR, from Q3 2008 to Q3 2009. Public opinion data and controls are measured at the household-respondent level.

Table 3: Support for combatants and assessments of aid

	(1)	(2)	(3)
	poor R&D Afg	poor R&D province	poor R&D district
aid (general)	-0.004*** (0.001)	-0.004*** (0.001)	-0.007*** (0.001)
aid (education)	0.005*** (0.000)	0.005*** (0.000)	0.004*** (0.000)
age	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
female	-0.073*** (0.013)	-0.102*** (0.014)	-0.131*** (0.013)
secular education	-0.022*** (0.006)	-0.020*** (0.006)	-0.034*** (0.006)
religious education	0.024*** (0.003)	0.023*** (0.003)	0.014*** (0.003)
economic status	-0.162*** (0.010)	-0.156*** (0.010)	-0.183*** (0.010)
food shortage	-0.009 (0.013)	-0.006 (0.013)	0.012 (0.013)
price change	0.009 (0.008)	0.026*** (0.008)	0.030*** (0.008)
life satisfaction	-0.178*** (0.007)	-0.186*** (0.007)	-0.178*** (0.007)
security	-0.231*** (0.009)	-0.229*** (0.009)	-0.265*** (0.009)
ethnicity	✓	✓	✓
survey quarter	✓	✓	✓
N	33,978	33,712	33,615
R^2	0.090	0.091	0.104

Notes: This table reports cross-sectional correlations between assessments of aid and sector-specific aid volumes. Each column estimates the following model: $y_{ikt} = \alpha + \beta \mathbf{a}_{kt} + \theta \mathbf{x}_{ikt} + \gamma_t + \epsilon_{ikt}$, where i indexes household, k indexes district, and t indexes quarter. \mathbf{a} is a vector containing project volumes in education and other sectors, and \mathbf{x} is a vector of household characteristics. The outcome y varies across columns, capturing household opinions of whether the government is doing a good job at reconstruction and development (at the national, provincial, and district level, respectively). Sample period spans five quarters, from Q3 2008 to Q3 2009. Standard errors are reported in parentheses (**p < 0.01, **p < 0.05, *p < 0.1).

Table 4: Aid volumes and assessments of aid

	(1) govt care	(2) govt care	(3) govt care	(4) govt trust	(5) govt trust	(6) govt trust	(7) ISAF trust	(8) ISAF trust	(9) ISAF trust	(10) AGE trust	(11) AGE trust	(12) AGE trust
poor R&D Afg	-0.061*** (0.003)	-0.078*** (0.003)	-0.083*** (0.003)	-0.077*** (0.005)	-0.067*** (0.004)	-0.053*** (0.005)	-0.019*** (0.005)	-0.021*** (0.005)	-0.039*** (0.005)	0.076*** (0.005)	0.055*** (0.005)	0.024*** (0.005)
poor R&D province												
poor R&D district												
age	0.001* (0.000)	0.001** (0.000)	0.001** (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
female	0.013 (0.008)	0.012 (0.008)	0.008 (0.008)	0.017 (0.011)	0.012 (0.011)	0.014 (0.011)	0.096*** (0.013)	0.089*** (0.013)	0.088*** (0.013)	-0.023* (0.013)	-0.020 (0.013)	-0.025* (0.013)
secular education	0.013*** (0.003)	0.014*** (0.003)	0.013*** (0.003)	0.004 (0.003)	0.005 (0.005)	0.003 (0.005)	0.016*** (0.005)	0.016*** (0.005)	0.014*** (0.005)	0.022*** (0.005)	0.023*** (0.005)	0.020*** (0.005)
religious education	0.001 (0.002)	0.001 (0.002)	0.000 (0.002)	-0.007** (0.003)	-0.007** (0.003)	-0.007** (0.003)	-0.016*** (0.003)	-0.016*** (0.003)	-0.015*** (0.003)	0.005 (0.003)	0.006* (0.003)	0.007** (0.003)
economic status	0.114*** (0.006)	0.111*** (0.006)	0.110*** (0.006)	0.077*** (0.008)	0.080*** (0.008)	0.078*** (0.008)	0.054*** (0.009)	0.052*** (0.009)	0.049*** (0.009)	0.022** (0.010)	0.014 (0.010)	0.010 (0.010)
food shortage	0.001 (0.008)	-0.001 (0.008)	-0.001 (0.008)	-0.034*** (0.011)	-0.030*** (0.011)	-0.029*** (0.011)	0.047*** (0.012)	0.055*** (0.012)	0.051*** (0.012)	-0.066*** (0.012)	-0.067*** (0.012)	-0.066*** (0.012)
price change	-0.082*** (0.005)	-0.080*** (0.005)	-0.080*** (0.005)	-0.031*** (0.006)	-0.029*** (0.006)	-0.033*** (0.006)	-0.044*** (0.007)	-0.041*** (0.007)	-0.043*** (0.007)	-0.053*** (0.007)	-0.056*** (0.007)	-0.053*** (0.007)
life satisfaction	0.065*** (0.004)	0.061*** (0.004)	0.060*** (0.004)	0.084*** (0.006)	0.085*** (0.006)	0.090*** (0.006)	0.030*** (0.007)	0.029*** (0.007)	0.026*** (0.007)	-0.060*** (0.007)	-0.065*** (0.007)	-0.071*** (0.007)
security	0.026*** (0.006)	0.023*** (0.006)	0.020*** (0.006)	0.149*** (0.008)	0.151*** (0.008)	0.150*** (0.008)	0.120*** (0.009)	0.118*** (0.009)	0.113*** (0.009)	-0.151*** (0.009)	-0.155*** (0.009)	-0.156*** (0.009)
ethnicity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
survey quarter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	28,712	28,538	28,372	28,329	28,166	28,010	27,745	27,610	27,455	28,029	27,879	27,725
R ²	0.075	0.082	0.084	0.080	0.077	0.075	0.061	0.060	0.061	0.064	0.061	0.057

Notes: This table reports cross-sectional correlations between perceptions of combatant groups and assessments of aid. Each column estimates the following model: $s_{ikt} = \alpha + \beta y_{ikt} + \theta \mathbf{x}_{ikt} + \gamma_t + \epsilon_{ikt}$, where i indexes household, k indexes district, and t indexes quarter. The outcome s varies across column groups, reflecting household perceptions of government, international forces, and anti-government elements. y captures household opinions of whether the government is doing a good job at reconstruction and development (at the national, provincial, and district level). \mathbf{x} is a vector of household characteristics. Based on availability of outcome data, sample period spans four quarters, from Q4 2008 to Q3 2009. Standard errors are reported in parentheses (***p < 0.01, **p < 0.05, *p < 0.1).

Appendix A

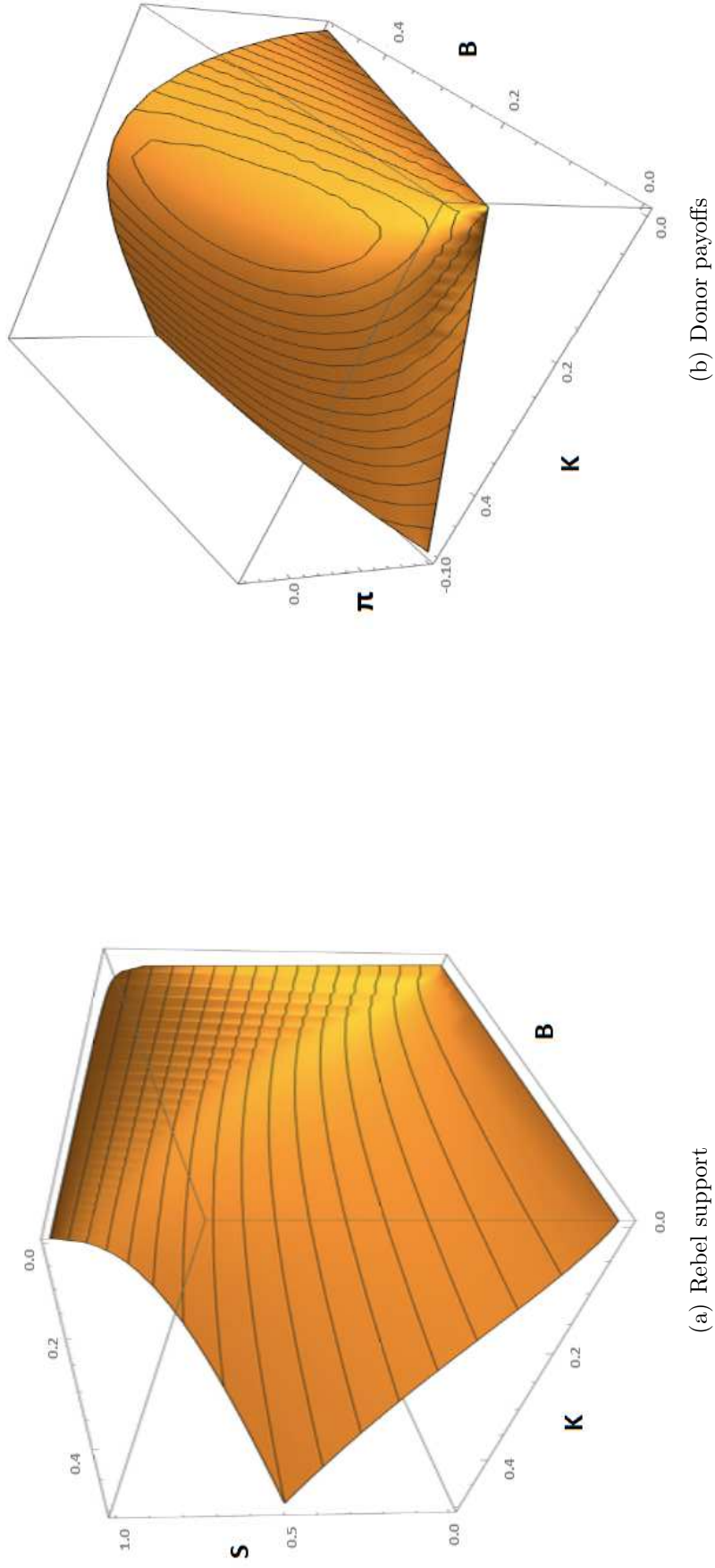
To visually demonstrate our model's results, in this section we adopt a concrete parameterization. For ease of exposition, we choose the following:

$$\begin{aligned}
 V &= 5b^{1/4}k^{3/4} \\
 U^i &= \alpha_i\sqrt{bk} - k^2; \quad \alpha_i \sim \text{U}(0, 1) \\
 b &= B(1 - R); \quad k = K(1 - R) \\
 C &= B + K; \quad R = S
 \end{aligned}$$

From this specification, two items are particularly noteworthy: (i) the donor has a relatively strong preference for sector k output, and (ii) $U_{bk}^i > 0$. We present a utility function fulfilling the latter condition to demonstrate our results are not contingent on the potentially controversial $U_{bk}^i \leq 0$ (from section 3.1).

Given the parameterization above, we can calculate the level of rebel support for each allocation bundle, and also map the corresponding value function for the donor. Figure A1a depicts a surface reflecting levels of rebel support (S) resulting from various spending allocations (B, K) by the donor. As expected under Hypothesis I, rebel support is increasing in outlays to the contentious sector K . In line with Hypothesis II, rebel support is decreasing in outlays to the benign sector B . Intuitively, there is no support for resistance when $K = 0$, and maximal support when $B = 0$. Next in Figure A1b we depict the donor's value function (II). The function takes a negative slope as spending extends in a single direction from the origin, reflecting the constant cost of outlays. In equilibrium we see greater devotion to B than to K , despite the donor's direct preference for the latter (see i above). Because spending on K generates a negative externality on the efficiency of both sectors by increasing rebel capacity, its output is relatively constrained in the optimum allocation.

Figure A1: Rebel support and donor payoffs



Notes: Panel (a) depicts level curves of rebel support (S) for various sectoral allocations of foreign aid. Panel (b) depicts level curves of donor payoffs (Π) for the same allocations. Simulations are based on the model parameterization described in Appendix A.

Appendix B

In this appendix we impose additional properties to prove uniqueness and existence of the equilibrium, and to formally derive Hypotheses I and II.

Property 1: Separability and symmetry of the output functions.

$$\begin{aligned} b(B, R) &= b(B, 0)h(R) \equiv \tilde{b}(B)h(R) \\ k(K, R) &= k(K, 0)h(R) \equiv \tilde{k}(K)h(R) \\ \text{where } h'(R) &< 0 \end{aligned}$$

Property 2: Linear homogeneity of the community member utility function.

$$U(\lambda b, \lambda k; \alpha_i) = \lambda U(b, k; \alpha_i) \implies \begin{cases} \frac{\partial U}{\partial b}(\lambda b, \lambda k; \alpha_i) = \frac{\partial U}{\partial b}(b, k; \alpha_i) \\ \frac{\partial U}{\partial k}(\lambda b, \lambda k; \alpha_i) = \frac{\partial U}{\partial k}(b, k; \alpha_i) \end{cases}$$

Property 3: Limit conditions on marginal utilities of extreme community members.

$$\begin{aligned} \lim_{\alpha_i \rightarrow 0} U_k^i &= -D < 0 & \lim_{\alpha_i \rightarrow +\infty} U_k^i &= +\infty \\ \lim_{\alpha_i \rightarrow 0} U_b^i &= 0 & \lim_{\alpha_i \rightarrow +\infty} U_b^i &= +\infty \end{aligned}$$

Uniqueness and existence

Given the properties above, we can proceed with our proofs. We begin with the first-order condition (FOC) of $U^i = U(b, k; \alpha_i) = U(\tilde{b}(B)h(R(S)), \tilde{k}(K)h(R(S)); \alpha_i)$ with respect to S for individual i .

$$\begin{aligned} \frac{dU^i}{dS} &= \frac{\partial U}{\partial b}(\tilde{b}(B)h(R), \tilde{k}(K)h(R); \alpha^*) \tilde{b}h'R' + \frac{\partial U}{\partial k}(\tilde{b}(B)h(R), \tilde{k}(K)h(R); \alpha^*) \tilde{k}h'R' = 0 \quad (\text{FOC}) \\ &\implies \frac{\partial U}{\partial b}(\tilde{b}(B)h(R), \tilde{k}(K)h(R); \alpha^*) \tilde{b} + \frac{\partial U}{\partial k}(\tilde{b}(B)h(R), \tilde{k}(K)h(R); \alpha^*) \tilde{k} = 0 \quad (\text{from Property 1}) \\ &\implies \frac{\partial U}{\partial b}(\tilde{b}(B), \tilde{k}(K); \alpha^*) \tilde{b} + \frac{\partial U}{\partial k}(\tilde{b}(B), \tilde{k}(K); \alpha^*) \tilde{k} = 0 \quad (\text{from Property 2}) \\ &\implies H(B, K; \alpha^*) = 0 \quad (\text{Implicit Function}) \end{aligned}$$

The last step defines H as an implicit function to simplify notation in what follows. Now for uniqueness, we differentiate H with respect to α_i : $H_{\alpha_i} = U_{b\alpha_i}\tilde{b} + U_{k\alpha_i}\tilde{k}$. Recall $U_{b\alpha_i} > 0$ and $U_{k\alpha_i} > 0$ by assumption, then it is clear that $H_{\alpha_i} > 0$. Since $H_{\alpha_i} = \frac{d}{d\alpha_i} \frac{dU^i}{dS}$, then $\frac{d}{d\alpha_i} \frac{dU^i}{dS} > 0$, implying there is at most one α^* fulfilling the FOC for a given expenditure bundle (B, K) .

Hence, $S^*(\alpha^*(B, K))$ is unique. But does α^* exist?

$$\begin{aligned}\lim_{\alpha_i \rightarrow 0} dU^i/dS &= \lim_{\alpha_i \rightarrow 0} [U_b^i \tilde{b} + U_k^i \tilde{k}] = -D\tilde{k} < 0 \\ \lim_{\alpha_i \rightarrow +\infty} dU^i/dS &= \lim_{\alpha_i \rightarrow +\infty} [U_b^i \tilde{b} + U_k^i \tilde{k}] = +\infty\end{aligned}$$

Since dU^i/dS spans the interval $(-D\tilde{k}, \infty)$, there exists an α^* for which the FOC is satisfied ($H = 0$), conditional on H being continuous and differentiable with respect to α_i .

Hypotheses

Our first hypothesis is $\Delta S/\Delta K > 0$, which follows directly from $\alpha_K^* > 0$. In order to establish the latter, we make use of the implicit function theorem (i.e. $\partial\alpha^*/\partial K = -H_K/H_{\alpha^*}$).

$$\begin{aligned}H_{\alpha^*} &= U_{b\alpha^*}^* \tilde{b} + U_{k\alpha^*}^* \tilde{k} \\ H_K &= U_{bk}^* \tilde{k}' \tilde{b} + U_{kk}^* \tilde{k}' \tilde{k} + U_k^* \tilde{k}' = \tilde{k}' (U_{bk}^* \tilde{b} + U_{kk}^* \tilde{k}) + U_k^* \tilde{k}'\end{aligned}$$

Note that by the property of homotheticity, $U_b^* b + U_k^* k = U^*$. So the following obtains:

$$\begin{aligned}\frac{d}{d\tilde{k}} (U_b^* b + U_k^* k) &= \frac{d}{d\tilde{k}} (U^*) \implies U_{bk}^* b + U_{kk}^* k + U_k^* = U_k^* \\ &\implies U_{bk}^* b + U_{kk}^* k = 0 \\ &\implies U_{bk}^* \tilde{b} h + U_{kk}^* \tilde{k} h = 0 \\ &\implies U_{bk}^* \tilde{b} + U_{kk}^* \tilde{k} = 0\end{aligned}$$

So $H_K = U_k^* \tilde{k}'$, and we can express the following.¹³

$$\alpha_K^* = \frac{-H_K}{H_{\alpha^*}} = \frac{-U_k^* \tilde{k}'}{U_{b\alpha^*}^* \tilde{b} + U_{k\alpha^*}^* \tilde{k}} > 0$$

Following analogous logical steps, we can also derive Hypothesis II ($\Delta S/\Delta B < 0$) under properties 1-3.

$$\begin{aligned}H_B &= U_{bb}^* \tilde{b}' \tilde{b} + U_{kb}^* \tilde{b}' \tilde{k} + U_b^* \tilde{b}' = U_b^* \tilde{b}' \\ \alpha_B^* &= \frac{-U_b^* \tilde{b}'}{U_{b\alpha^*}^* \tilde{b} + U_{k\alpha^*}^* \tilde{k}} < 0\end{aligned}$$

¹³ $U_k^* < 0$ for the MS by definition, so long as $k, b > 0$