

Keeping Friends Close, But Enemies Closer: Foreign Aid Responses to Natural Disasters

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Abstract

Natural disasters represent rare opportunities for strategic opponents to actively inflict harm, or at the very least, passively enjoy tactical advantages over afflicted countries. However, contrary to the robust existing literature that has found that aid donors are largely motivated by strategic considerations when dispensing aid, anecdotal evidence suggests that countries often receive substantial humanitarian aid following natural disasters, even from strategic opponents. In this paper, we square this seeming incongruity by arguing that natural disasters can serve to, at least temporarily, emphasize the humanitarian, as opposed to the political or economic, aspects of a bilateral relationship. Using a new measure of strategic interest, we find that donors are more likely to dispense aid if the recipient country experiences more natural disasters irrespective of their strategic relationship with that country. Our findings suggest that social context matters in foreign aid allocation. They also have important implications for the future of foreign aid allocation, as the number of natural disasters is likely to rise, not fall, with changing climate conditions.

Introduction

In the early morning hours of December 26, 2003, a massive earthquake measuring 6.3 on the Richter scale struck the city of Bam, Iran. Its effects were devastating. Out of Bam's 100,000 residents, approximately 26,000 to 40,000 were killed. Its remaining residents had to further grapple with the destruction of 70 to 90 percent of the city's housing infrastructure (Montazeri et al., 2005).¹ As part of the international response that followed, more than 44 countries sent aid, including the United States, which contributed 8 planeloads of medical and humanitarian supplies as well as several dozen teams of experts to the relief effort.

However, while the US response to the 2003 Bam earthquake was seemingly analogous to that of any foreign actor offering aid and support, *a priori*, it was not obvious whether the US would decide to send any humanitarian aid, to say nothing of whether Iran would accept it. Just the year prior, then-President George W. Bush had famously labeled Iran as being part of the "Axis of Evil" (Heradstveit and Bonham, 2007) and at the time of the earthquake, US-Iran relations were particularly delicate as the countries navigated the issue of nuclear weapons in Iran.² Indeed, given the broader context of contentious relations between US and Iran, the process of transferring aid from the US to Iran entailed greater intentionality than normal. For example, to facilitate aid flows to Iran, President Bush was obliged to institute a special 90-day measure to ease US sanctions on Iran (which had been in place since 1979 and which continue to be enforced to this day).³ For Iran's part, the U.S. military planes that flew in aid to Iran were the first to have landed there in over 20 years.⁴ For a country that had undergone a revolution in part because the US military was perceived to have had too strong a domestic influence, such an act was far from benign.⁵

¹Fathi, Nazila. "Deadly Earthquake Jolts City in Southeast Iran." *The New York Times*. 26 December 2003. Accessed October 2017: <https://web.archive.org/web/20090620230700/http://www.nytimes.com/2003/12/26/international/26CND-QUAKE.html?ex=1225166400&en=c550b50a2ad59dd6&ei=5070>

²http://news.bbc.co.uk/2/hi/middle_east/3362443.stm

³"US eases Iran sanctions to speed earthquake relief." *China Daily*. 1 January 2004. Accessed October 2017: http://www.chinadaily.com.cn/en/doc/2004-01/01/content_295063.htm

⁴"Iran Quake Toll May Hit 50,000." *China Daily*. 31 December, 2003. Accessed October 2017: http://www.chinadaily.com.cn/en/doc/2003-12/31/content_294833.htm

⁵<https://www.stratfor.com/geopolitical-diary/geopolitical-diary-tuesday-dec-30-2003>

What to make of this remarkable turn of events? Why did the US send aid to Iran despite its objectively chilly extant relations? And what drove Iran to accept it? Was this event *sui generis* or is it possible to observe other dyadic pairs acting in a similar fashion more generally? Answering these questions has important implications for our understanding of how donors allocate aid more broadly. Such an understanding is perhaps more important than ever given that the incidence of natural disasters is likely to increase with changing climate conditions. Meanwhile, given an existing literature which emphasizes strategic factors as driving foreign aid, a more nuanced understanding of what motivates donor's aid allocations is needed to answer these questions.

In this paper, we argue that natural disasters can drastically shift the social context of a dyadic relationship toward emphasizing its altruistic or humanitarian dimensions. This shift is greater depending on the severity of the natural disaster and the extent to which the baseline dyadic relationship can be characterized as contentious. We evaluate our argument using a new measure of strategic interest which we believe greatly improves on existing measures of strategic interest as it is able to: 1) capture the third-order effects that the broader literature on donor motivations generally neglects 2) incorporate many different dimensions of strategic interest more efficiently than existing variables.

In what follows, we first give a brief overview of the existing literature on natural disasters and foreign aid allocations before outlining our theory and hypotheses. We then present and validate our new measure of strategic interest before detailing the results of our analysis. To preview, our results suggest that aid allocations increase with both the severity of the natural disaster and the previous level of antagonism in a dyadic pair. Our analysis is based on a panel of the 18 donor countries and 167 recipient countries from 1975 and 2006.

Accounting for Natural Disasters in Determining Donor Motivations for Foreign Aid

Natural disasters can lead to the calamitous destruction or impairment of physical and social infrastructures to say nothing of provoking the devastating loss or disruption of human lives. For example, the 1985 Mexico City Earthquake killed at least 10,000 people⁶ and cost around 4 billion in 1985 dollars (around 9 billion in 2017 dollars).⁷ While the resulting devastation prompted the Mexican government to institute a number of regulatory measures to limit future damage, 32 years later, Mexico City's 2017 earthquake still resulted in a death toll of at least 360⁸ and the recovery effort could cost more than 2 billion dollars.⁹ The 2011 Fukushima incident meanwhile, stands out for both its death toll and high cost, leaving nearly 1,600 dead and more than 174,000 displaced.¹⁰ Recent 2017 projections estimate that it will cost around 187 billion dollars, double the 2013 estimate.¹¹ Similarly, estimates put the cost of responding to Hurricane Harvey, which left 82 dead,¹² at around 180 billion dollars, likely to be the most expensive natural disaster in US history.¹³

⁶The Editors of Encyclopaedia Britannica."Mexico City earthquake of 1985." *Encyclopaedia Britannica*. 20 September 2017. Accessed September 2017: <https://www.britannica.com/event/Mexico-City-earthquake-of-1985>

⁷Williams, Dan. 'Mexico Quake Loss put at \$4 Billion: Report by U.N. Panel Includes Damages to Economy.' *Los Angeles Times*. 25 October 1985. Accessed September 2017: http://articles.latimes.com/1985-10-25/news/mn-14160_1_mexico-city.

⁸The Associated Press. 'Death toll rises to 360 in Mexico earthquake.' *The Denver Post*. 21 September 2017. Accessed October 2017: <http://www.denverpost.com/2017/09/30/mexico-earthquake-death-toll-update/>

⁹The Associated Press. 'Economic Costs of MexicoâŽs Earthquake Could Surpass \$2B.' *Insurance Journal* 29 September 2017. <http://www.insurancejournal.com/news/international/2017/09/29/465995.htm>

¹⁰Hamilton, Bevan. 'Fukushima 5 years later: 2011 disaster by the numbers.' *CBC News*. 10 March 2016. Accessed September 2017: <http://www.cbc.ca/news/world/5-years-after-fukushima-by-the-numbers-1.3480914>

¹¹McCurry, Justin. 'Possible nuclear fuel find raises hopes of Fukushima plant breakthrough.' *The Guardian*. 30 January 2017. Accessed September 2017: <https://www.theguardian.com/environment/2017/jan/31/possible-nuclear-fuel-find-fukushima-plant>

¹²Moravec, Eva Ruth. "Texas officials: Hurricane Harvey death toll at 82, 'mass casualties have absolutely not happened.'" *The Washington Post*. 14 September 2017. Accessed September 2017: https://www.washingtonpost.com/national/texas-officials-hurricane-harvey-death-toll-at-82-mass-casualties-have-absolutely-not-happened/2017/09/14/bff3ffea-9975-11e7-87fc-c3f7ee4035c9_story.html?utm_term=.f5eecc9ee21

¹³'Hurricane Harvey Damages Could Cost up to \$180 Billion.' *Fortune*. 3 September 2017. Accessed September 2017: <http://fortune.com/2017/09/03/hurricane-harvey-damages-cost/>

Indeed, few countries are spared the devastation that natural disasters can wreak. Between 1980 and 2004, two million people were reported killed and five billion people cumulatively affected by around 7,000 natural disasters, according to the dataset maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at University of Louvain (Belgium). The economic costs are considerable and rising, with the direct economic damage from natural disasters between 1980-2012 estimated to be around \$3.8 trillion (Gitay et al., 2013).

While dealing with both the immediate and long-term damage wrought by natural disasters can seriously drain existing resources for any country, developing countries generally find it especially difficult to cope. Often, the existing physical infrastructure in developing countries is grossly unequal to the task of withstanding natural disasters. Meanwhile, the resilience and capacity of their institutional infrastructure is often ill-suited for dealing with the often long and complicated process of rebuilding. In general, when natural disaster strikes, developing countries are both more likely to experience more serious damage and have less state capacity to recover from it. For example, prior to its 2010 earthquake, Haiti had no building codes and many of its buildings were not designed to withstand even a mild earthquake.¹⁴ Meanwhile, the lack of governmental leadership and low state capacity, along with other factors, has meant that even 7 years after the disaster, Haiti has yet to fully recover (Hartberg et al., 2011).

From a purely strategic perspective then, natural disasters represent an opportune time to inflict harm on a strategic adversary, especially if it is a developing country, as both government officials and government resources are fully engaged with responding to the emergency. Yet, anecdotal evidence suggests that strategic adversaries rarely take advantage of this tactical opportunity. That is, at least as far as can be openly observed, the most famous deadliest natural disasters (which, incidentally, should present foreign opponents the best opportunity to inflict harm) do not seem to have been followed up by hostile overtures. For instance, Taiwan did not use the 1976 Tangshan earthquake, believed to be the largest earthquake in the 20th century by

¹⁴Watkins, Tom. ‘Problems with Haiti building standards outlined.’ CNN. 2010 January 14. Accessed September 2017: <http://edition.cnn.com/2010/WORLD/americas/01/13/haiti.construction/index.html>

death toll, as an opportunity to attack China. Similarly the 2011 Fukushima disaster was not followed by hostile gestures from China nor did Russia react to Hurricane Harvey with belligerence toward the US.¹⁵

Context of course matters. There is a sizable difference between taking advantage of a country that one has contentious relationship with and taking advantage of a country with which one is actively engaged in outright conflict. In the former context, while taking pre-emptive action against a strategic opponent might lead to short term gains, it could very well lead to long term losses. By this logic, we might expect countries to simply do nothing when tragedy befalls their strategic opponents. Such behavior would fit well with the larger literature that investigates donor motivations for allocating foreign aid. Indeed, scholars have produced a large body of evidence which suggests that donors overwhelmingly prioritize strategic considerations over developmental or humanitarian ones when dispensing aid (McKinlay and Little, 1977, 1978, 1979; Maizels and Nissanke, 1984; Schraeder et al., 1998; Alesina and Dollar, 2000; Berthélemy, 2006; Stone, 2006; De Mesquita and Smith, 2007; Bermeo, 2008; Hoeffler and Outram, 2011; Dreher et al., 2015).

Yet, there is much anecdotal evidence to suggest that rather than taking pre-emptive strikes or doing nothing, natural disasters encourages the flow of *aid* from strategic opponents. For example, during the famine that ravaged North Korea from 1994 to 1998, the United States, South Korea, Japan and the European Union were the primary donors of food aid (Noland, 2004). Meanwhile Taiwan was one of the biggest donors to China in the aftermath of the 2008 Sichuan earthquake.¹⁶ Taiwan also actively contributed to the rescue effort¹⁷ and further offered to share the technical expertise it learned from its own devastating earthquake experience in 1999.¹⁸ Similarly, following

¹⁵Note, the question of whether countries take advantage of their strategic opponents using more covert methods during times of natural disaster is a more open question.

¹⁶'FACTBOX-Earthquake aid for China.' 14 May 2008. <http://uk.reuters.com/article/idUKPEK29448220080514>

¹⁷French, Howard and Edward Wong. 'In Departure, China Invites Outside Help.' *The New York Times*. 16 May 2008. Accessed September 2017: <http://www.nytimes.com/2008/05/16/world/asia/16china.html>

¹⁸Hille, Kathrin. 'Taiwan shares quake lessons with Sichuan.' *Financial Times*. 9 June 2008. Accessed September 2017: <https://www.ft.com/content/b0204002-3641-11dd-8bb8-0000779fd2ac>

Hurricane Katrina, the United States accepted Russian aid, despite frosty relations.¹⁹

What explains this decidedly non-strategic behavior? Finding an answer to this question in the current literature is difficult. For one, in evaluating the relative roles that donor interest and recipient need play in foreign aid allocation, what researchers refer to as recipient need may be more precisely understood as 'developmental need' and as such, targeted towards addressing chronic poverty. To that end, development need is frequently measured using GDP or GNP per capita (McKinlay and Little, 1977, 1978, 1979; Maizels and Nissanke, 1984; Alesina and Dollar, 2000; Berthélemy, 2006; Stone, 2006; De Mesquita and Smith, 2007; Bermeo, 2008) and occasionally a more holistic measures of social outcomes such as the Physical Quality of Life Index (Maizels and Nissanke, 1984), the average life expectancy (Schraeder et al., 1998) or the daily caloric intake (McKinlay and Little, 1979; Schraeder et al., 1998)

Meanwhile, a much smaller body of research investigates the degree to which aid is given in response to acute crises, such as natural disasters, which will be referred to here as humanitarian need, at all. Considering that around 11% of ODA was officially categorized as being given for humanitarian reasons in 2015, the systematic failure to include natural disasters as a potential driver of foreign aid is puzzling.²⁰ What evidence that does exist suggests a null or small effect of humanitarian aid on foreign aid allocations. For instance, Bermeo (2008) finds no relationship between the number of people affected by disasters and the allocation of bilateral aid for France, Japan, the UK and the US.²¹ Similarly, David (2011) finds no statistically significant relationship between foreign aid flows and climatic or human disasters. Though he finds evidence for increased foreign aid following geological disasters, the effect is lagged by 2 years and substantively small.²² Yang (2008) also finds that ODA increases after a hurricane, but

¹⁹'U.S. accepts Russian Katrina aid.' *UPI*. 2 September 2005. Accessed September 2017. <https://www.upi.com/US-accepts-Russian-Katrina-aid/39221125680989/>.

²⁰Total ODA for DAC countries was 131.6 billion in 2015, 15.6 billion of which was designated as humanitarian assistance <http://www.oecd.org/dac/development-aid-rises-again-in-2015-spending-on-refugees-doubles.htm> <http://www.oecd.org/dac/stats/humanitarian-assistance.htm>

²¹Note, Bermeo (2008) also conceptualizes humanitarian aid using measures of the number of refugees and civil war, with mixed effects across countries for both

²²David (2011) defines climatic events as 'floods, droughts, extreme temperatures and hurricanes'; human disasters as: famines and epidemics; geological events as: earthquakes, landslides, volcano

only with a lag of 2 years. Finally, though Strömberg (2007) does find a positive and significant relationship between aid and natural disasters, his paper is concerned with emergency aid in particular, not foreign aid, that is official development assistance, more generally. Similarly, Olsen et al. (2003) find that donors are more likely to give aid for strategic reasons, though their analysis is confined to emergency aid.

Similarly, there is relatively little work that has explored whether there are interactive effects between donor's strategic interest and recipient's humanitarian need. One seeming exception is Drury et al. (2005) who find that between 1964 to 1995, the United States made its decision to dispense aid based on strategic considerations, but based the amount given on humanitarian considerations. However, their dependent variable of interest is humanitarian aid, not ODA. To our knowledge, our paper is to first to explore whether there may be an interactive relationship between donor's strategic interest and recipient's humanitarian need on foreign aid allocation decisions.

How Natural Disasters Change the Social Context of Foreign Aid Allocations

We seek to show that social context may matter more than previously thought in foreign aid allocations. We argue that natural disasters can encourage countries to increase aid to their strategic opponents because such disasters can drastically shift the social context of the relationship. In so doing, we draw on a rich literature from behavioral economics which shows that at least on the individual level, social context can have a substantial influence on behavior (Kahneman, 2003; Do, 2011).

To draw an illustrative example, in one experiment, Ariely (2008) finds that lawyers generally refused offers to work for \$30 an hour to help the elderly poor but generally agreed to work pro bono for the same group of people. He argues that the reason for this discrepancy is that in the former situation, the lawyers were generally primed to think about the transaction using market norms, for which \$30 would be much too

eruptions and tidal waves

little. The latter situation however, emphasizes the social aspect of the transaction, and the lawyers agreed to the terms as an act of charity. If we conceptualize countries as being composed of individuals who may be similarly sensitive to the same dynamics, we might also expect countries to also act differently based on social context. As yet, however, this issue remains unexplored when the relevant actor is a country, not an individual.

In the context of natural disasters, countries may be motivated to give more aid to their strategic opponents than they otherwise would because the social norms around natural disasters prompt them to act according to a more humanitarian frame of mind. That is, the loss of human life and destruction of infrastructure, which natural disasters provoke can serve to, at least temporarily, emphasize the human aspect of the bilateral relationship as opposed to the political, economic, and military aspects that generally typifies foreign relations between two countries. That is not to say that natural disasters can always bridge this divide. For example, India and Pakistan have had an uneasy history in accepting aid from each other following natural disasters.²³ In general, we contend only that natural disasters make it more *likely* that a strategic adversary will contribute aid because they reframe the context of bilateral relations toward empathy and altruism.

However, it is also possible that countries are motivated to give more aid to their strategic opponents because the temporary suspension in the normal dynamics of the relationship represents a unique opportunity to permanently shift the nature of the relationship. That is, donor countries may recognize all too well that the natural disaster offers an opportunity to shift the terms of their relationship with the affected country and may *strategically* decide to increase their aid in order to improve future relations. Disaster-afflicted countries appear to sensitive to this possibility. In 1999 for example, Venezuela experienced catastrophic flash floods and debris flows in Vargas State, which left as much as 10% of the Vargas population dead (Wieczorek et al., 2001). U.S. troops helped in the relief efforts by running helicopter rescue missions and

²³Ravishankar, Siddharth. 'Cooperation between India and Pakistan after Natural Disasters.' *Stimson Center*. 9 January 2015. Accessed September 2017: <https://www.stimson.org/content/cooperation-between-india-and-pakistan-after-natural-disasters>

working to provide clean water. However, consistent with his antagonism toward U.S. hegemony in the region, President Hugo Chavez declined U.S. assistance in rebuilding a critical highway, saying that while, "he would accept American equipment if Venezuelan soldiers operated it...he did not want U.S. troops in his country."²⁴ Meanwhile, Iran categorically refused any aid from Israel following the 2003 Bam earthquake, though the Israeli government still encouraged its citizens to donate privately.²⁵ Indeed, even the U.S. first turned down Russian aid for Hurricane Katrina before ultimately accepting it.²⁶ As such, while natural disasters may not be able to bridge the divide between two countries when the strategic relationship is contentious enough, generally the non-affected party seems to at least make the initial gesture of goodwill.^{27, 28}

According to the above theoretical reasoning then, donors should be more likely to give aid to strategic opponents that experience natural disasters, either because of humanitarian or strategic purposes. In this paper, we first seek to establish first whether natural disasters can prompt strategic opponents to give more aid, which no paper has previously systematically done. We reserve whether they do so for strategic or altruistic reasons for future research.

²⁴Brand, Richard. 'Chavez assailed on handling of Venezuelan flood disaster.' *The Miami Herald*. 5 August 2001. Accessed September 2017: <http://www.latinamericanstudies.org/venezuela/venezuela-disaster.htm>.

²⁵Popper, Nathaniel. "Israelis Help Iran Victims Despite Rebuff." *The Forward*. 2 January 2004. Accessed September 2017: <http://forward.com/news/6059/israelis-help-iran-victims-despite-rebuff/>

²⁶'U.S. accepts Russian Katrina aid.' *UPI*. 2 September 2005. Accessed September 2017. <https://www.upi.com/US-accepts-Russian-Katrina-aid/39221125680989/>.

²⁷Note an exception: following Iran's 2012 earthquake, Israeli did not offer aid stating: "We offered Iran assistance after earthquakes in the past, but they refused. So this time, we didn't even bother to ask if they're interested. Their refusal was pretty impolite, but we're not making a big fuss about it" Note despite its contentious relationship with Iran, Israel does explicitly practice 'disaster diplomacy' with other countries including Japan, Haiti, Azerbaijan, Jordan and Turkey (Ahren, Raphael. "Rebuffed in the past, Israel does not offer Iran earthquake aid." *The Times of Israel*. 14 August 2012. Accessed September 2017: <https://www.timesofisrael.com/having-been-rejected-by-iran-once-before-israel-does-not-renew-offer-for-earthquake-aid/>).

²⁸Regardless of the actual motivation of donors when they give aid to their strategic opponents, there is anecdotal evidence to suggest that aid given under such circumstances can be effective at improving perceptions of the bilateral relationship. For example, in the wake of US and South Korean aid for the North Korean famine, one refugee summarized his reaction to the US Institute for Peace this way: "We were taught all these years that the South Koreans and Americans were our enemies. Now we see they are trying to feed us. We are wondering who our real enemies are" Natsios (1999).

Measuring Strategic Relationships

One reason for evaluating the motivations for aid and not aid outcomes is that aid given for strategic reasons may still further development objectives, albeit incidentally, while aid given for humanitarian reasons may also bring unexpected strategic benefits (Maizels and Nissanke, 1984). However, evaluating the motivations for aid is not a straightforward process – any given aid project may work toward providing assistance to a recipient country as well as strategic benefits to a donor country.

Of critical importance to investigating whether strategic considerations (and by extension, the interaction between strategic considerations and humanitarian need) affect foreign aid considerations then is constructing a valid and reliable measure of strategic interest. In our review of the literature of the drivers of foreign aid however, we find that Alesina and Dollar (2000)'s remark that "unfortunately the measurement of what a 'strategic interest' is varies from study to study and is occasionally tautological," still holds true. Indeed, strategic interest has alternately been operationalized as: trade intensity (Berthélemy and Tichit, 2004; Bermeo, 2008; Hoeffler and Outram, 2011), UN voting scores (Alesina and Dollar, 2000; Weder and Alesina, 2002; Hoeffler and Outram, 2011; Dreher and Fuchs, Forthcoming), arms transfers (Maizels and Nissanke, 1984), colonial legacy (Alesina and Dollar, 2000; Bermeo, 2008; Berthélemy and Tichit, 2004; Berthélemy, 2006), alliances (Bermeo, 2008; Schraeder et al., 1998), regional dummies (Bermeo, 2008; Berthélemy, 2006; Maizels and Nissanke, 1984), bilateral dummies (Alesina and Dollar, 2000; Berthélemy and Tichit, 2004; Berthélemy, 2006)²⁹ or some combination of the above. Meanwhile other papers take a negative approach and argue that any shortfall between what would theoretically be expected from poverty-efficient aid allocation and actual aid allocation (Collier and Dollar, 2002; Nunnenkamp and Thiele, 2006; Thiele et al., 2007), or similarly between a theoretical allocation based on good governance and actual aid allocation(Dollar and Levin, 2006; Neumayer, 2005), is evidence of strategic interest at play.

Such inconsistency in the operationalization of strategic interest is not simply a mat-

²⁹A US-Egypt or US-Israel dummy seems to be the most common instance of a bilateral dummy

ter of using different variables to measure the same concept but a matter of using different variables to measure different *aspects* of the underlying concept. However, while a dyad's strategic bilateral relationship is quite multifaceted, to date, there has not been a readily available measure of strategic relationships which captures its various aspects the same way that scholars have done for other complex concepts.³⁰ To address this problem, we create a new measure of strategic interest that is able to capture different aspects of strategic interest into one variable, which we discuss more fully in the next section.

A new measure of strategic relationships

Our measure of strategic relationships introduces greater coherency to the literature by providing a more rigorous measure that captures two aspects of strategic interest strategic: military and political. We do so by first measuring the latent space of three different dyadic variables: dyadic alliances, UN voting and joint membership in an intergovernmental organizations (IGOs). Each of these variables captures to different degrees, the political and military relationship between two countries, with dyadic alliances better capturing the military aspect of the relationship and UN voting and joint membership in IGOs better capturing the political aspect of the relationship.

To calculate the latent distance between each dyad for each variable, we use a bilinear mixed effects model (Hoff, 2005). Finally, we combine the latent distances for each variable through a principal components analysis (PCA). As such, our political strategic relationship measure is the first principal component that results from the PCA of the latent distance between each variable.

The main advantage of calculating the latent space of different dyadic variables as opposed to using alternative specifications such as the S Score algorithm³¹ is that it

³⁰For example, Polity and Freedom House have provided measures of political institutions while the World Bank's World Governance Indicators (WGI) project provides measures for six dimensions of governance

³¹Leeds and Savun (2007), for example, measure a state's "threat environment" as the set of all states for which one is contiguous with or which is a major power and with an S score below the population median.

allows us to account for third order dependencies within the data. To review, first order dependency refers to the propensity for some actors to send or receive more ties than others, second-order dependency refers to reciprocity of exchange between actors, and a third-order dependency refers to interactions among three or more actors. Dyadic data are rife with these types of dependencies, and aside from first-order dependencies, they pose serious challenges to the basic assumption of independence between observations (Poast, 2010; Hoff and Ward, 2004).

More precisely, third order dependency includes the concepts of (a) transitivity, (b) balance and (c) clusterability. Formally, a triad ijk is said to be transitive if for whenever $y_{ij} = 1$ and $y_{jk} = 1$, we also observe that y_{ik} . This follows the logic of " a friend of a friend is a friend". Meanwhile, a triad ijk is said to be balanced if $y_{ij} \times y_{jk} \times y_{ki} > 0$. Conceptually, if the relationship between i and j is 'positive', then both will relate to another unit k identically, either both positive or both negative. Finally a triad ijk is said to be clusterable if it is balanced or all the relations are all negative. It is a relaxation of the concept of balance and seeks to capture groups where the measurements are positive within groups and negative between groups.

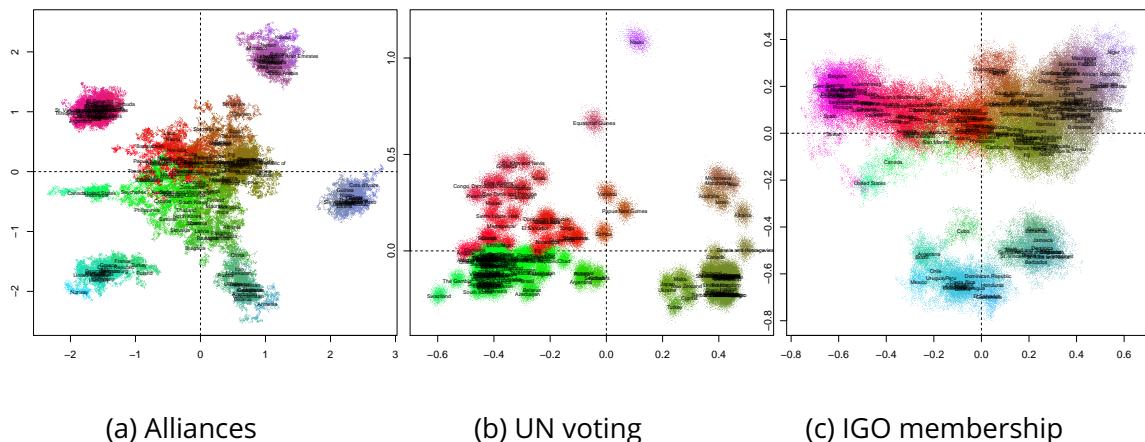
In other words, third order dependencies suggest that "knowing something about the relationship between i and j as well as between i and k may reveal something about the relationship between i and k , even when we do not directly observe it" (Hoff and Ward, 2004). Such a dependency is especially important to capture with regards to strategic relationships as dyadic relationships between two particular countries cannot help but be understood in the context of their relationship with other countries. The importance for accounting for these dynamics have long been acknowledged in the foreign aid literature. Trumbull and Wall (1994) for example, note that, "donors do make their decisions with knowledge of what each other are doing, and may actually act cooperatively. Any study that ignores the interrelationship of donor behavior risks problems with simultaneity bias." However, we find that until now, this critique has largely gone by unaddressed by the existing literature.

To do so, we run a null generalized bilinear mixed effects model (gbme)³² to estimate the latent space for each component of our strategic interest variables. Formally, it is represented as follows:

$$\theta_{i,j} = a_i + b_j + \gamma_{i,j} + z'_i z_j$$

where $\theta_{i,j}$ is the dyadic variable of interest (e.g., alliances), a_i estimates ‘sender’ effects, b_j estimates ‘receiver’ effects and $z'_i z_j$ is the bilinear effect which estimates the latent space and accounts for third order dependencies common in dyadic data. We estimate the model via Gibbs sampling of full conditionals of the parameters. For a more detailed discussion of this model, see Hoff (2005). In Figure 1, we present a visualization of the resultant latent space we calculated for each variable for the year 2005.

Figure 1: Latent Spaces for components of Political Strategic Interest Measure during 2005



Countries that cluster together in this two-dimensional latent space are more likely to interact with each other. The plots for alliances, UN voting and IGO membership suggest that there is distinct clustering among countries. Moreover, these clusters are different across the different measures, suggesting that each variable is indeed capturing different aspects of strategic interest.

³²Code for running the gbme can be found from Hoff’s website at http://www.stat.washington.edu/hoff/Code/hoff_2005_jasa/.

After estimating the latent spaces for these components, we calculate the euclidean distance between each dyad for each component. We then combine them in a principal components analysis (PCA) to reduce the dimensionality of our measure while retaining as much variance as possible. That is, alliances, UN voting and joint membership in IGOs all capture certain aspects of political strategic interest. Instead of choosing only one of them as our measure of strategic interest as other papers have done, we combine them in order to increase our explanatory power. We estimate the PCA of these variables for each year separately³³ and use the first principal component for each year as our measure of strategic interest. On average over all the years, we find that the first component of our PCA of alliances, UN voting and joint membership in IGOs, which we use as our measure of strategic interest, explains about 51% of its variance.

Validating our measure of strategic interest

We further conduct a series of post-estimation validation tests for our resulting strategic variable. In particular, we (1) evaluate the relationship between our political strategic interest variable against S scores and Kendall's τ_b for alliances and (2) investigate how our measure of strategic interest describe well-known dyadic relationships.

First, we perform a simple bivariate OLS with and with year fixed effects to evaluate how our measures compare to S scores and Kendall's τ_b .³⁴ Note in order to make our strategic measures somewhat interpretable, for the validation we scale our strategic measures to be between 0 and 1 just as S scores and Kendall τ_b is scaled. The results are shown in Table 1.

In brief, we find that our political strategic measure performs well against S scores and Kendall's τ_b for alliances with and without fixed effects. Note that because the PCA is of latent distances between any two dyads, dyads that are closer in space will

³³For each year, we conduct a bootstrap PCA of 1000 subsamples each

³⁴Note for comparison that the bivariate relationship of S scores on Kendall's τ_b is statistically significant with a coefficient of 0.62 while the bivariate relationship of Kendall's τ_b on S Scores is statistically significant with a coefficient of 0.31.

Table 1: Validation of Political Strategic Interest Variable against S scores and Kendall's τ_b

	Unweighted S Scores	Unweighted S Scores	Weighted S Scores	Weighted S Scores	Tau-B	Tau-B
(Intercept)	0.97*** (0.00)	1.03*** (0.00)	1.01*** (0.00)	1.02*** (0.00)	0.29*** (0.00)	0.25*** (0.00)
Strategic Interest	-0.80*** (0.00)	-0.84*** (0.00)	-1.22*** (0.00)	-1.26*** (0.00)	-0.89*** (0.00)	-0.87*** (0.00)
Year FE?	No	Yes	No	Yes	No	Yes

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

have smaller values and therefore represent a stronger strategic relationship. Therefore the negative relationship we find between the political strategic measure and S scores and τ_b are interpreted to mean the greater the foreign policy similarity as measured by the S score or Kendall's τ_b , the smaller the latent distance or the greater the political strategic relationship between a dyad.

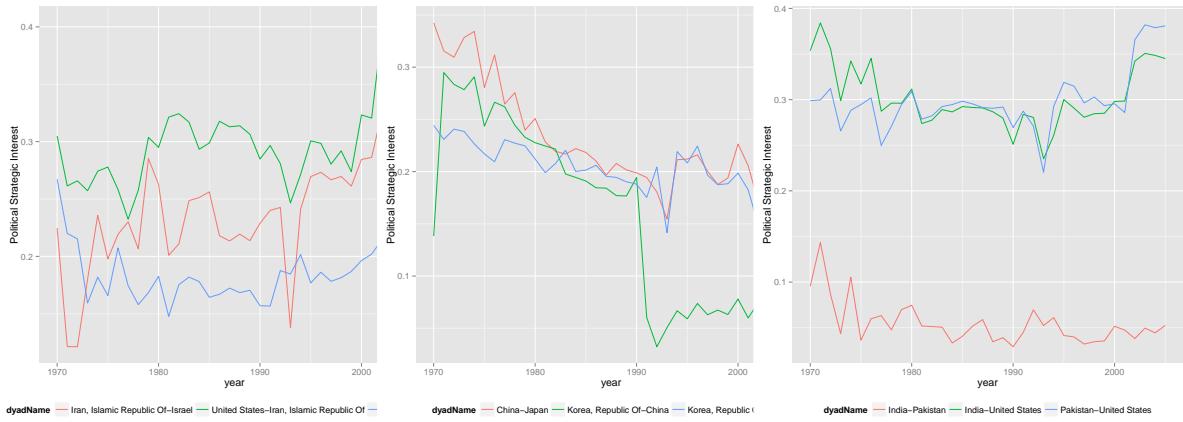
Second, we also investigate how our measure performs relative to well known dyadic relationships. In the figures below, we plot the dyadic relationships between countries that are well-known to have friendly or antagonistic relationships. For example, Figure 2 shows the dyadic relationship between Iran and Israel, the US and Israel, and the US and Iran. The plot suggests that the US and Israel have consistently had a stronger political strategic relationship throughout time except for the early 1970's when Iran and Israel is shown to have had a stronger political strategic relationship. This is in fact consistent with historical evidence which suggests that Iran and Israel enjoyed close ties before the Iranian revolution.

Meanwhile the plot of the dyadic relationships between China and Japan and, North Korea and China and North Korea and Japan suggest more or less indifferent relations among the three before 1990 after which the political strategic relationship between China and North Korea becomes markedly stronger. This is also consistent with the disappearance of Soviet support for North Korea following the end of the Cold War and the emergence of China as North Korea's new protector.

Finally, the plot of the dyadic relationship between India and Pakistan, India and

the US and Pakistan and the US suggest in fact that India and Pakistan have a much stronger political strategic relationship than either do with the US. Given the history of antagonism between India and Pakistan, this is a rather surprising result; it also suggests however that a dyad's political relationship and military relationship may be quite different and indeed as two large bordering countries, cooperation between India and Pakistan is important to the security of both.

Figure 2: Dyadic relationships over time as measured by the political strategic interest variable



Data

Aid flows

Our data from foreign aid flows is taken from the AidData project (Tierney et al., 2011). This database includes information on over a million aid activities from the 1940s to the present. We use the country level aggregated version of this database to create a directed-dyadic dataset of total aid dollars committed. For now we focus on only the 18 most active senders and 167 receivers of aid flows from 1975 to 2006. Accounting for all possible senders of aid during this timeframe is difficult because of the amount of missing data. However, even with the limited number of senders in this version of our analysis we still have approximately 40,000 observations worth of data to work with.

We note that bilateral ODA often represents only one channel through which a donor country may allocate foreign aid and that an increasing number of papers have argued for accounting for the heterogeneity of aid channels donors may use when estimating drivers of foreign aid (Nunnenkamp and Öhler, 2011; Dietrich, 2013). For our paper, we choose to focus solely on bilateral aid in order to maintain greater comparability with previous studies.

Political Strategic Relationships

To review, for our measure of political strategic relationships, we conducted a PCA on the latent distances for alliances, UN voting and joint IGO membership. Data for alliances was retrieved from the Correlates of War (COW) Formal Alliance dataset (Gibler, 2009). Following (Bueno de Mesquita, 1975) and (Signorino and Ritter, 1999), we distinguish between different types of alliances with the following weighting scheme: 0 = no alliance, 1 = entente, 2 = neutrality or nonaggression pact, 3 = mutual defense pact.

UN voting data was obtained from the United Nations General Assembly Data set (Strezhnev and Voeten, 2012). Here we calculate the proportion of times two states agree out of the total number of votes they both voted on. Agreement means either both vote yes, both vote no, or both abstain. This measure is similar to the ‘voting similarity index’ readily available from the dataset except the voting similarity index does not account for mutual abstentions.

Meanwhile IGO voting data was obtained from the Correlates of War International Governmental Organizations Data Set. (Pevehouse et al., 2010). Dyads were coded as 1 if they belonged to the same IGO as a full member or an associate member and coded as 0 if one or both of them was an observer, had no membership, was not yet a state or was missing data.³⁵

³⁵Note we had attempted to make distinctions between different types of membership much like for alliances but found that very few states were noted to be Associate Members or Observers of an IGO for the time period that we are conducting our analysis. Thus we chose to use the simpler coding scheme.

Developmental Need

In addition to our dyadic strategic relationship measures, we include a number of covariates to capture characteristics of the countries receiving aid.

For our measures of developmental need, we use (1) Log GDP per capita and (2) life expectancy at birth. This measure “indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.” Both of these measures are extracted from the World Bank (2013).

Humanitarian Need

Almost all the empirical work on natural disasters relies on the publicly available Emergency Events Database (EM-DAT) maintained by the Center for Research on the Epidemiology of Disasters (CRED) at the Catholic University of Louvain, Belgium³⁶. EM-DAT defines a disaster as a natural situation or event which overwhelms local capacity and/or necessitates a request for external assistance. For a disaster to be entered into the EM-DAT database, at least one of the following criteria must be met: i) 10 or more people are reported killed; ii) 100 people are reported affected; iii) a state of emergency is declared; or iv) a call for international assistance is issued. Disasters can be hydro-meteorological, including floods, wave surges, storms, droughts, landslides and avalanches; geophysical, including earthquakes, tsunamis and volcanic eruptions; and biological, covering epidemics and insect infestations (the latter are less frequent). The disaster impact data reported in the EM-DAT database consists of direct damages (e.g., value of damage to infrastructure, crops, and housing in current dollars), the number of people killed, and the number of people affected. As Cavallo and Noy (2011) observe, many of the events reported in this database are quite small and are unlikely to have any significant impact on aid disbursements and on the macro-economy more generally. We therefore limit our investigation to disasters in which the number of people

³⁶<http://www.emdat.be/>

killed is above the mean for the entire dataset (more on this below).

We also use (2) a count of the number of natural disasters a country has experienced a year from the Emergency Disasters Database (EM-DAT) database (Guha-Sapir et al., 2009). For a disaster to be included into the database, at least one of the following criteria must be fulfilled: (a) Ten or more people reported killed (b) A hundred or more people reported affected (c) Declaration of a state of emergency (d) Call for international assistance.

Additional Covariates

We also include a number of covariates in our model, including macroeconomic variables and measures for political institutions. For our macroeconomic indicators, we use GDP per capita, available from the World Bank (Bank, 2013). For our measure of political institutions, we use Polity IV data available from the Center for Systemic Peace (Gurr et al., 2010). Polity IV captures differences in regime characteristics on a 21 point scale ranging from -10 (hereditary monarchy) to +10 (consolidated democracy). Note we rescale Polity IV to range from 1 to 21 for greater ease of interpretation.

We also control for the incidence of civil war as incidence of civil war in a recipient country certainly informs the ability for a donor country to dispense aid. We do so with data retrieved from the Uppsala Conflict Data Program (UCDP)/International Peace Research Institute (PRIO) Armed Conflict Database. (Gleditsch et al., 2002). We code as civil war any armed conflict which either (a) "Internal armed conflict occurs between the government of a state and one or more internal opposition group(s) without intervention from other states" or (b) "Internationalized internal armed conflict occurs between the government of a state and one or more internal opposition group(s) with intervention from other states (secondary parties) on one or both sides."

Finally for our data on former colonies, we used the Colonial History Data Set from the Issue Correlates of War (ICOW) Project (Hensel, 2009). This variable is coded

as a one when the receiver in a sender-receiver dyad is a former colony of the sender and zero otherwise.

Analysis

$$\begin{aligned}
 \text{Log}(\text{Aid})_{sr,t} = & \beta_1(\text{Pol. Strat. Distance}_{sr,t-1}) \\
 & + \beta_2(\text{Colony}_{sr,t-1}) + \beta_3(\text{Polity}_{r,t-1}) \\
 & + \beta_4 \text{Log}(\text{GDP per capita}_{r,t-1}) + \beta_5(\text{Life Expect}_{r,t-1}) \\
 & + \beta_6(\text{No. Disasters}_{r,t-1}) + \beta_7(\text{Civil War}_{r,t-1})
 \end{aligned}$$

Estimation Method

To model aid flows using our directed-dyadic panel dataset, we utilize a hierarchical model. To implement this we nest receivers within senders and senders within years. We include random intercepts in our model for every sender and year. The results of this analysis are shown below in Figure 3.

The results for the political strategic relationship variable align with the extant literature, we can see that countries are likely to send greater levels of aid to those with whom they have strong political relationships.

Next we turn to particular characteristics of receiver countries that are associated with higher levels of aid flows. Our analysis finds that countries which are poorer, more democratic, or that have recently faced a natural disaster receive higher levels of aid on average.

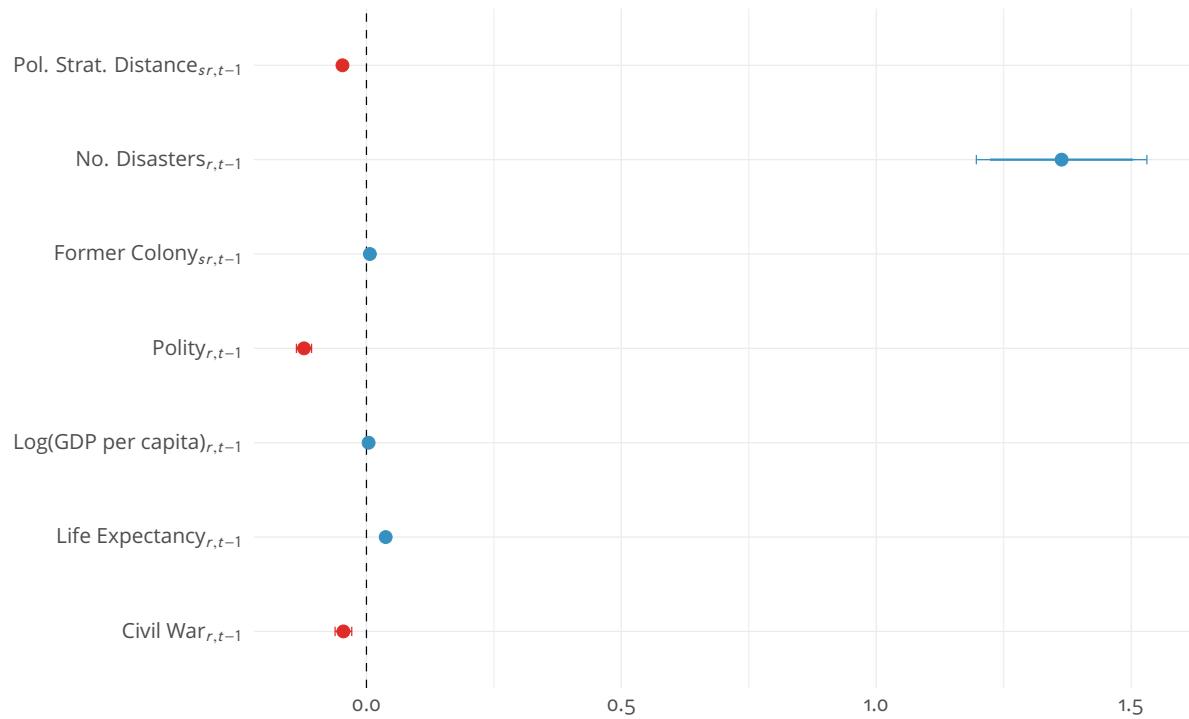


Figure 3: Darker colors indicates that the coefficient estimate is significantly different from zero at a 95% CI, while lighter the same for a 90% CI. Grey indicates that the estimate is not significantly different from zero at either of those intervals.

Conditional Effect of Disasters

$$\begin{aligned}
 \text{Log(Aid)}_{sr,t} = & \beta_1(\text{Pol. Strat. Distance}_{sr,t-1}) \\
 & + \beta_2(\text{Colony}_{sr,t-1}) + \beta_3(\text{Polity}_{r,t-1}) \\
 & + \beta_4 \text{Log}(GDP \text{ per capita}_{r,t-1}) + \beta_5(\text{Life Expect}_{r,t-1}) \\
 & + \beta_6(\text{No. Disasters}_{r,t-1}) + \beta_7(\text{Civil War}_{r,t-1}) \\
 & + \beta_8(\text{Pol. Strat. Interest}_{sr,t-1} \times \text{No. Disasters}_{r,t-1})
 \end{aligned}$$

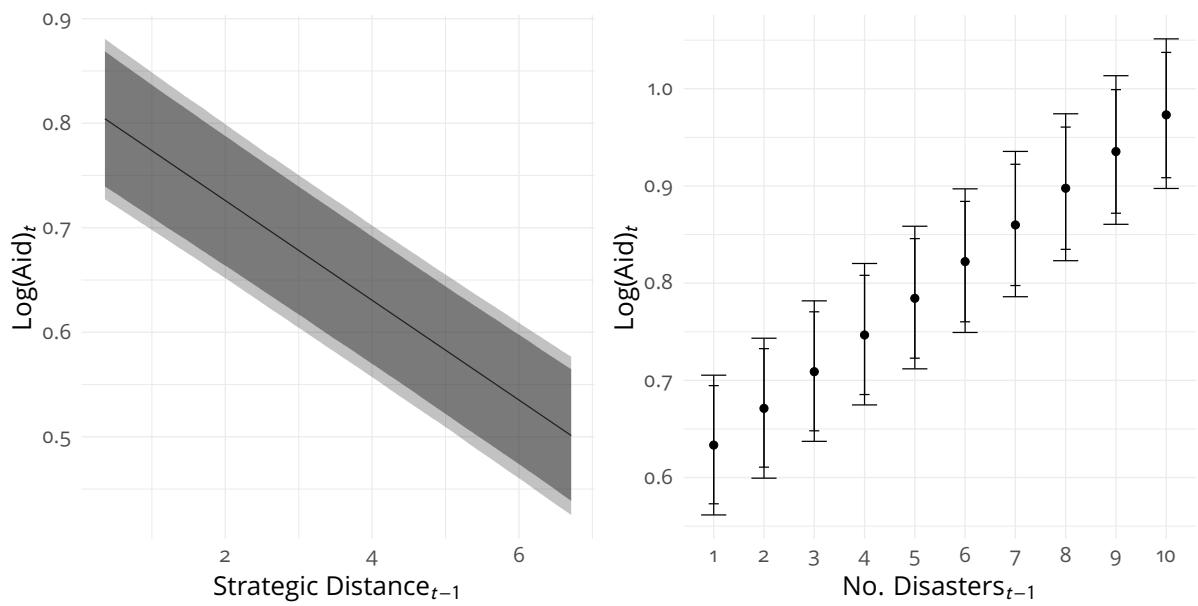


Figure 4: Expected values for GDP growth based on scenarios where all variables are held to their constants but $\text{Ln}(\text{Min. Conflict Dist.})$ varies from its minimum to maximum. The 90% interval of each distribution is shaded in dark grey and the 95% in a lighter color.

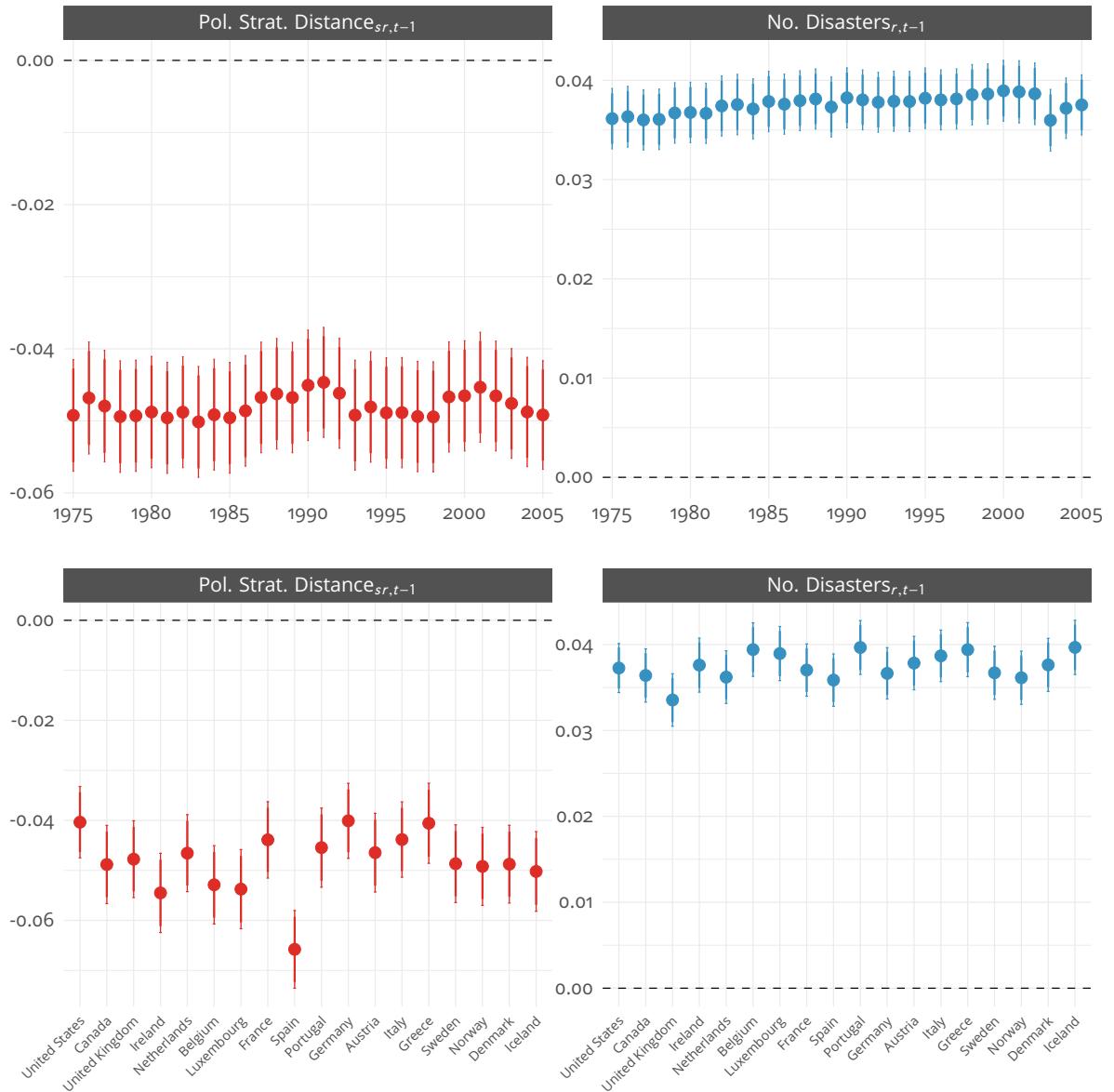


Figure 5: Each line here in the left panel shows the coefficient estimate of $\ln(\text{Min. Capital Dist.})_{i,t-1}$ from rerunning the model on six random subsamples within the dataset. The panel on the right shows the same for $\ln(\text{Min. City Dist.})_{i,t-1}$. All the covariates used in the initial model shown in figure 3 were included as well.

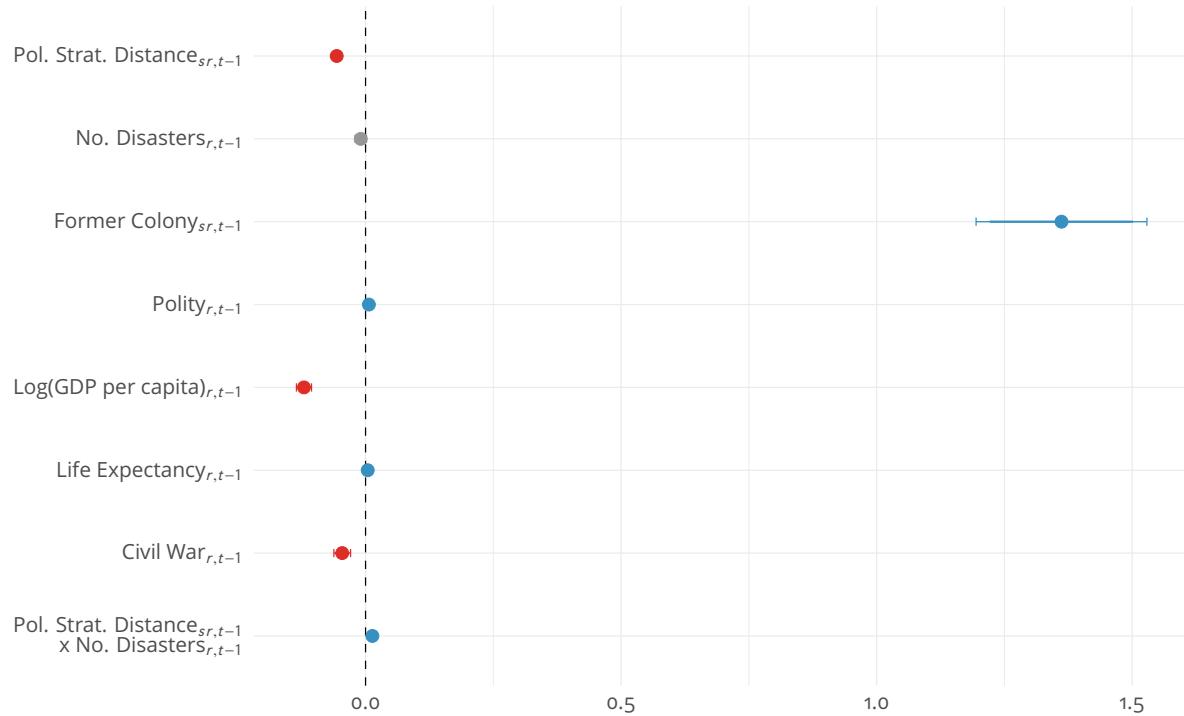


Figure 6: Regression results using conflict distance from capital city on the left, and the chart on the right shows regression results using minimum conflict distance from any major city. Darker colors indicates that the coefficient estimate is significantly different from zero at a 95% CI, while lighter the same for a 90% CI. Grey indicates that the estimate is not significantly different from zero at either of those intervals.

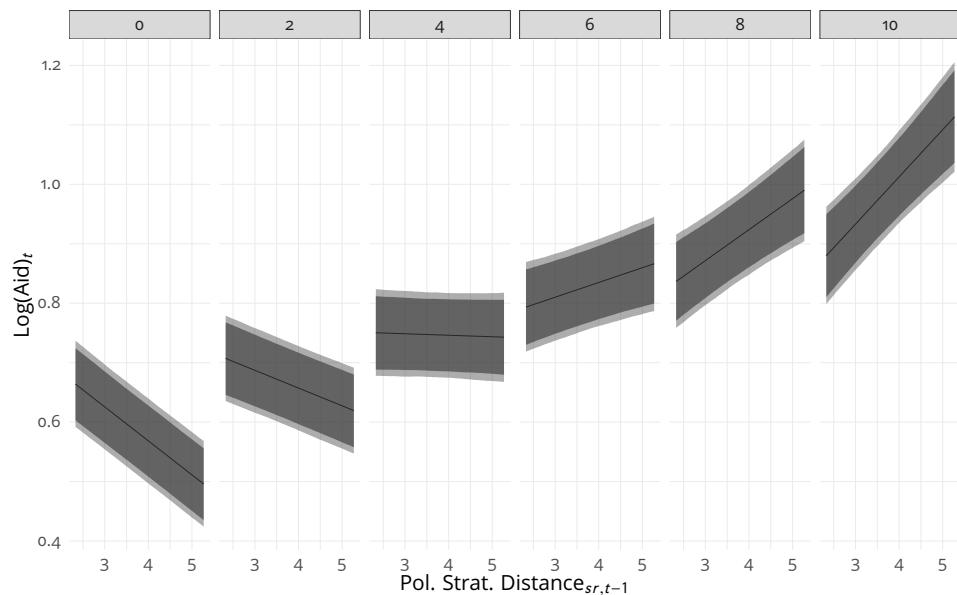


Figure 7: Expected values for GDP growth based on scenarios where all variables are held to their constants but $\ln(\text{Min. Conflict Dist.})$ varies from its minimum to maximum. The 90% interval of each distribution is shaded in dark grey and the 95% in a lighter color.

Conclusion

In brief, our preliminary results suggest that political strategic interest does play an important role in positively predicting foreign aid flows, although we find the opposite relationship for military strategic interest. We plan to undertake further work to explore the substantive meaning of our findings and how they may vary over time.

These results should interest us as climate change continues to increase the incidence and the intensity of natural disasters. During this hurricane season alone, residents in the United States have faced the wrath of Hurricane Harvey, Hurricane Irma . Meanwhile, wildfires continue to rage in Northern California. Neither is the rest of the world untouched, as the Mexico City earthquake, flooding in South Asia.³⁷

Meanwhile, to revisit the original illustrative example presented in the introduction, note that though the US' offer and Iran's acceptance of humanitarian aid was a head-turning deviation from the status quo, the swiftness with which both countries reverted back to it was equally remarkable. Indeed, following the immediate fallout of the earthquake a couple of weeks later, Iran declined US offers of further humanitarian aid³⁸. Meanwhile, President Bush denied attempts to interpret US aid as evidence of thaw in US-Iran relations.³⁹

In this particular case then, the exchange of aid led to only a temporary reprieve from the generally contentious bilateral relations. However, whether aid given exchanged between historically contentious dyads can lead to a more permanent softening of relations remains an open question. We plan to explore this question more fully in future work.

³⁷https://www.nytimes.com/2017/08/29/world/asia/floods-south-asia-india-bangladesh-nepal-houston.html?_r=0

³⁸"Iran to prosecute over building law breaches in Bam." *China Daily*. 3 January 2004. Accessed October 2017: https://web.archive.org/web/20090619204216/http://www.chinadaily.com.cn/en/doc/2004-01/03/content_295446.htm

³⁹http://news.bbc.co.uk/2/hi/middle_east/3362443.stm

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