Do disaster appeals reduce other donations? Evidence from the U.K.[1]

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Abstract: Appeals for emergency relief in the aftermath of natural disasters, such as the East Asia Tsunami or the Haiti Earthquake, prompt large responses in terms of donations of money to overseas aid charities. This paper presents new evidence from the UK on whether these come at the expense of other donations – whether to other charities or to the same overseas aid charities at a later point in time. We exploit a uniquely detailed panel of 130,000+ donors with information on the exact timing of donations and the charities they are made to, allowing us to track donations around the time that the appeals are made.

Keywords: Disaster appeals; donations; substitutability/ complementarity

JEL codes:

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1. Introduction

A key question in the private provision of public goods is whether moving people to increase their voluntary contributions to one public good (eg through fundraising activities on the part of a charitable organisation) comes at the expense of a decrease in giving to some other public good. This is significant for two reasons. First, some governments are seeking to increase the amount of public goods their citizens voluntary provide (for examples see Home Office, 2005; Cabinet Office, 2011; Smith, 2012; Steuerle, 2001; Bekkers et al, 2015). However, to the extent that success in increasing giving toward one public good comes at the expense of decreased giving toward other public goods, a shift in the composition is achieved but the objective of overall increase is undercut.[3] Second, fundraisers at specific charitable organizations continuously work to increase voluntary giving toward their organization with much scientific research devoted toward helping fundraisers achieve this goal (Isaac & Davis, 2006; Levitt & List, 2009; Science of Philanthropy Initiative, 2015). However, if the fundraising success of one organization, or more broadly speaking, of one charitable purpose, is about shifting the composition of public goods and not increasing the overall total provided, the social benefit of this activity is less clear.

Despite the significance of the substitution question only a few papers have been able to offer evidence which can be brought bear on it (Reinstein, 2011; Brown et al, 2012; Ek, 2015; Klar & Piston, 2015; Lange & Stocking, 2015). One reason is the lack of data strong in the four dimensions important in the empirical investigation

[3] Tax incentives for charitable donations, a common way for governments to incentivize private contributions for public goods, typically reduce the price of all donations. However, it has also been the case that additional tax incentives have been offered for specific charitable purposes with the explicit intention of increasing donations to these purposes, including overseas aid and universities (in the UK) and cultural organisations (in the Netherlands).

of substitution relationships between different types of charitable giving: data that (a) cover a time period before and after something in the external environment shocks an otherwise stable composition of donations toward different charitable purposes, (b) measure giving toward those different purposes starting immediately after the shock, (c) keep measuring giving for a long enough time period after the shock so that any substitution pattern can play itself out, and (d) measure giving to a comprehensive enough set of different charitable purposes to account for all the substitution possibilities that are *a priori* reasonable to consider. Previous papers offering evidence about substitution have used data collected via survey or generated in an experiment that are strong on a subset of these dimensions.

The first innovation in this paper is that we investigate substitution using a unique source of anonymized administrative data from the UK that are strong in all four dimensions. The data are from the Charities Aid Foundation which operates a charity account, essentially a checking account that a person uses in a dedicated way to make donations to UK charitable organizations. CAF administrative records contain the amount, recipient organization, and date of each donation. We analyze the donation behavior of roughly 130,000 people to approximately 80,000 charitable organizations over the time period June 2009 to July 2014.

The second innovation is that we identify substitution relationships by exploiting multiple exogenous shocks to contributions to one public good that occur in a natural setting – specifically we study the effect of fundraising appeals following overseas disasters. Studying shocks in a natural setting means that the adjustment period can be determined by the data without being in any way constrained by the time frame of a survey or the end time of an experiment.

During the time period we look at there were six disasters of such large scale that the UK Disasters Emergency Committee—a coordinating committee whose members are the 13 leading UK international relief and development organizations—initiated major appeals for charitable contributions to help the victims of the disasters. The DEC appeal involves nationwide mobilization of television and radio broadcasters, the Post Office and commercial banks and telecommunication companies, to make a nationwide appeal for contributions and to facilitate the collection of donations in-person, on-line, and by phone.

A number of features of the disaster appeals we study make them ideally suited for identifying substitution relationships. Sugden (1982) commented on the importance of disaster appeals as a way to raise significant funds for one particular cause; we show that this is the case here and that, on average, the appeals generated an immediate increase in donations to DEC member charities equivalent to 30% of the usual level of total giving. This sizeable increase in giving to one charitable purpose is large enough to evoke substitution effects, if substitution effects are important. The disasters all occur overseas, ruling out any other effects that might be associated with domestic disasters.[4] The timing of the disasters – and hence the appeals – is also unanticipated. The six DEC appeals occurred at different times of the calendar year (summarized in Table 1). Therefore, the appeals do not reflect a "disaster season" associated with seasonal weather patterns that are predictable, and potential donors cannot anticipate when they might experience a DEC appeal. Our

[4] These might include the direct impact of disasters on local economies, as well as the effect of subsequent government spending response (discussed in Fidrmuc et al, 2015). There may also be wider societal impacts that might affect giving. For example, De Alessi (1975) discusses changes in community feeling associated with natural disasters, while Bentzen (2015) identifies a link between natural disasters and religiosity.

identification strategy exploits the naturally-occurring variation in the timing of the appeals to identify the effect of disaster appeals on donations, controlling flexibly for systematic time effects. The fact that we observe multiple disaster appeals makes it less likely that any response can be explained by other unobserved factors since these would not tend to be correlated across all six disasters.

In order to investigate substitution relationships between charitable giving to different purposes, we aggregate donations to different charitable purposes by day and look before and after the exogenous shock of the six DEC appeals. Because we observe donations day-by-day, we can measure giving on the day an appeal was initiated and continuously thereafter for a long enough period of time that we can be reasonably sure that any substitution pattern has played itself out and that we have accounted for substitution relationships across a comprehensive set of different charitable purposes.

There are three main results. First, the large increase in giving to international relief in response to the disaster appeal does not come at the expense of reduced giving to international relief later on. Second, for the most part the large increase in giving to international relief does not come at the expense of giving to other charitable purposes. Looking at the effect of disaster appeals to donations to the combination of all other charitable purposes (except international relief), we fail to reject zero substitution. The failure to reject zero substitution is not due to large standard errors, but rather effects that are close to zero and precisely estimated. When we look within the "all other" category at more narrowly defined charitable purposes, we also fail to reject zero substitution in all but one case. Giving to health charities is the one case we cannot reject zero substitution, and even there the magnitude of substitution is small. Third, although the substitution we find between international relief and other

charitable purposes is statistically indistinguishable from zero (excepting health), we see that the disaster appeals are associated with a behavioural response in giving to other charitable purposes, but the response is a shift in the timing of giving to other purposes. That is, the disaster appeals have an effect on giving to other charitable purposes, but the effect is time-shifting, not substitution.

2. Conceptual framework

Previous theory (e.g., Rose-Ackerman, 1982), empirical investigations (e.g., Reinstein, 2011; Brown, Harris, & Taylor, 2012), and media coverage (e.g., Bernstein, 2005; MacAskill, 2014) have been motivated by the possibility that an exogenous shock that leads to increased giving to one charitable purpose, may have the unintended consequence of having that increased giving come from reduced giving to other purposes. A pure warm glow model with two charitable purposes can deliver this result if the two warm glow components are substitutes. The model can also deliver a result that a shock that increases giving to one purpose also induces an increase in giving to other purposes if the two warm glow components are sufficiently strong complements. The model we develop below shows that whether giving to one purpose is a substitute for giving to other purposes, or a complement to that giving, depends not only on the elasticity of substitution between them, but that price elasticity of aggregate donations in terms of foregone own consumption.[5]

[5] The opinions of prominent fundraising experts suggest that media coverage may have a tendency to overstate anecdotes of substitution. Henry Goldstein, then chairman of the Association of Fundraising Professionals, speaking about donations to help the victims of hurricane Katrina coming at the expense of other charitable organizations: "There is a short-run effect, but it won't last long" (Bernstein, 2004). Speaking about competitive fundraising, Timothy Seiler, former director of The Fundraising School at Indiana University: "Competition for philanthropic dollars is less about competition between nonprofits than it is competition with consumerism" (personal communication).

Substitution between giving to two different purposes can be modelled using standard tools. Let donors' preferences be represented by the quasi-linear utility function:

$$U(c, w_1, w_2) = c + \theta V(w_1, w_2)^{\eta} \tag{1}$$

where w_1 and w_2 are warm glow characteristics, following the characteristics/ household production model of Cornes and Sandler (1984); also see Ottoni-Wilhelm (2015). The warm glow characteristics in utility are generated by donations:

$$w_j = \alpha_j D_j, \quad j = 1, 2 \tag{2}$$

where D_1 and D_2 are the donations to two different charitable purposes, and α_1 and α_2 are parameters that convert donations into the respective warm glow characteristics. The units of the α_j are units of warm glow characteristic w_j generated per dollar given to purpose j. The units of the reciprocal $1/\alpha_j$ therefore are dollars given to purpose j per unit of warm glow characteristic w_j; hence $1/\alpha_j$ can be thought of as the "effective price" of the warm glow characteristic w_j. c is own consumption, the budget constraint is $c = Y - D_1 - D_2$, and Y is disposable income. $\theta > 0$ and $\eta \in (0, 1)$ are preference parameters.

We model the sub-utility function $V(D_1, D_2)$ as a constant-elasticity-of-substitution (CES) donation aggregation:

$$V(D_1, D_2) = \phi\left((\alpha_1 D_1)^{\mu} + (\alpha_2 D_1)^{\mu}\right)^{1/\mu}. \tag{3}$$

In this specification, $\mu = (\sigma - 1)/\sigma$ is a measure of substitutability with $\mu \in [-\infty, 1]$ and σ is the elasticity of substitution: $\sigma = 1/(1 - \mu)$ and $\sigma \in (0, \infty)$.

The dual representation in terms of the unit cost of achieving one unit of $V(D_1, D_2)$, the unit expenditure function, is:

$$C_V(\alpha_1, \alpha_2) = \varphi\left(\left(\tfrac{1}{2}\alpha_1\right)^{1-\sigma} + \left(\tfrac{1}{2}\alpha_2\right)^{1-\sigma}\right)^{1/(1-\sigma)}, \quad (4)$$

where $\varphi > 0$ is a constant and the $1/2$ inside the brackets simply rescales the φ and is added without loss of generality to simplify the comparative static results presented below (e.g., for $\alpha_1 = \alpha_2 = \alpha$ we can assume that $C_V(\alpha_1, \alpha_2) = \varphi\alpha$). Also for notational simplicity – and without loss of generality – we can assume that the scaling factor φ in the primal representation is chosen so that $\varphi = 1$ in the dual. Then, in the appendix we show that donations to purpose $j = 1,2$ are equal to:

$$D_j(\alpha_1, \alpha_2) = \frac{\gamma}{2} C_V(\alpha_1, \alpha_2)^{\zeta+\sigma} \alpha_j^{\sigma-1}, \quad j = 1,2 \quad (5)$$

where $\gamma \equiv (\theta\eta)^{1/(1-\eta)}$ and $\zeta = 1/(\eta - 1) < -1$ is the elasticity of aggregate donations $\mathfrak{D} \equiv D_1 + D_2$ with respect to $\mathfrak{D}$'s composite price, which is a function of both $1/\alpha_1$ and $1/\alpha_2$.

Turning to the comparative statics, we model a successful fundraising appeal for purpose j as a positive shift in α_j. This is equivalent to a fall in the "effective" price of the warm glow characteristic $w_j = \alpha_j D_j$, that is, to a fall in $1/\alpha_j$. In the appendix we show that in order for an increase in α_j to have a stronger effect on donations towards j than on donations towards $-j$, it must be the case that $\sigma > 1$. Without loss of generality, focusing on initial conditions whereby $\alpha_1 = \alpha_2 = 1$, the effect of an increase in α_j on D_{-j} —a fundraising appeal-induced cross-effect—is

$$-\frac{(\sigma + \zeta)\gamma}{4}, \quad (6)$$

which is positive if $|\zeta| = -\zeta$ is greater than σ and negative otherwise. So the condition for D_1 and D_2 to be gross complements in expenditure terms, rather than in quantity terms, is $|\zeta| > \sigma$. Otherwise, D_1 and D_2 will be gross substitutes.[6]

The model explains the underlying intuition of the substitution relationship between giving to two charitable purposes. Consider a fundraising shock that increases the warm glow derived from donating to purpose 1, that is, consider an increase in α_1. One possibility is that the fundraising appeal raises the guilt a person would feel, should she not give while continuing to see images of suffering in the aftermath of a disaster; giving to purpose 1 is a way to reduce that guilt.[7] In the above model there would be two effects. First, giving to purpose 1 is now more effective in producing the warm glow characteristic (reducing guilt) than is giving to purpose 2, causing substitution toward purpose 1, away from purpose 2. Second, guilt involves feeling that own consumption is too high, and could be reduced in order to give more to both purposes in aggregate; the increase in α_1 (fall in $1/\alpha_1$) leads to a fall in the composite price of aggregate donations $\mathfrak{D}$ relative to own consumption. If the elasticity of substitution between purposes 1 and 2 is less than the price elasticity of aggregate donations $\mathfrak{D}$, then the second effect dominates the first and giving would

[6] Substitution/complementarity in quantity terms would be defined in terms of the warm glow characteristics, w_1 and w_2, whereas D_1 and D_2 are the expenditures on those respective quantities/characteristics. Although the exogenous shock we are modeling, the change in α_j induced by a fundraising appeal, is equivalent to a change in price of the warm glow characteristic w_j, empirical work does not focus on Hicksian and Marshallian notions of substitution between quantities/characteristics, but instead focuses on substitution between the expenditures D_1 and D_2, the amounts given. Substitution in amounts given has been called expenditure substitution (e.g., Reinstein, 2011), competitive fundraising (e.g., Lange & Stocking, 2015), and behavioral spillovers (e.g., Ek, 2015).

[7] This is "empathy–specific–punishment" from the psychology literature (See Dovidio, et al. 2006). We will discuss other possibilities below.

increase to both purposes, not just the purpose that was the direct object of the fundraising appeal.

The above model uses the CES specification so that the underlying intuition can be expressed in terms of substitution parameters. Our model is similar to the model developed by Lange and Stocking (2015). In their model the underlying intuition is expresses in terms of changes in marginal utilities: if the fundraising shock increases giving to purpose 1 by one dollar, and does so by reducing own consumption by one dollar while at the same time increases the warm glow marginal utility of giving to purpose 2 more than the reduced dollar of consumption increases the marginal utility of consumption, then increased giving to purpose 1 will be accompanied by increased giving to purpose 2.

The CES model and the model in Lange and Stocking (2015) make clear that substitution relationships are not just a matter of trade-offs between different types of charitable purposes, but also depend upon substitution between charitable giving and own consumption.[8] Moreover, the models remind us that economic theory gives us an analytical framework within which to think about substitution relationships, but does not predict whether or not there will be substitution in observed behavior. In other words, economic theory does not predict that increased giving to one charitable purpose, in our case international relief, necessarily comes from reduced giving to other purposes. Giving to international relief and to other purposes may move together. Furthermore, from a theoretical perspective it may be that giving to international relief has no relationship to giving to other purposes.

[8] Obviously, own consumption should be broadly conceptualized to include own future consumption. That is, giving to charity also can come at the expense of savings.

Similarly, theory in psychology about specific types of warm glow characteristics does not necessarily predict that giving to two different purposes will necessarily be substitutes, but rather suggests that different types of warm glow characteristics might operate as substitutes, complements, or have no relationship to each other at all. The specific types of warm glow examined in the psychology literature include giving to alleviate guilt, to reduce one's own personal distress at seeing other people suffer, to relieve oneself from a general negative mood state, to do one's duty (to do one's bit), to seek the approval of others, and to avoid receiving the disapproval of others (Ottoni-Wilhelm, 2015). For instance if both warm glow components—the one for giving to international relief and the other for giving to other purposes—derive from "doing one's bit," it may be that doing my bit by giving to international relief relieves me from feeling the responsibility of doing of an "additional" bit by giving to other purposes. This kind of moral licensing argument implies that the two warm glow characteristics are substitutes. As an alternative example, it could be that if I don't give to international relief now I'll feel guilty, and that reminds me that if I don't give to health charities I'll also feel guilty. In this case the two warm glow characteristics are complements. Another example: if I give to international relief because seeing/hearing about people suffering from the disaster increases my immediate personal distress and I give now to reduce my own distress, it would likely have no relationship to giving to other purposes that derive (to return to the first example) from doing my bit.[9]

[9] In addition to the mechanisms we have discussed, there are behavioral mechanisms that might be relevant. For example, being induced to give in response to the disaster appeal, a donor may learn that she enjoys giving much more than she had thought, and consequently gives more in the future, even to other charities (e.g., in parallel with the results in Aknin, Dunn, & and Norton, 2012). Or the disaster appeal may nudge the donor into giving, to international relief and to other charities, by reminding her that it is time to give.

Hence, a theoretical framework grounded both in economics and psychology implies that giving to one purpose may substitute for, be a complement of, or have no relationship with giving to other purposes. In turning to empirical work to acquire evidence about substitution there are four fundamental challenges. First, giving must be measured before and after the giving environment is shocked in a way that has the potential to shift giving around between different charitable purposes. Second, any response in giving to other purposes, whether it is a reduction or increase, need not occur immediately at the same time as the increase in giving to international relief; this implies the need to begin measuring giving responses immediately from the time of the shock forward. Third, the length of the time period over which any substitution pattern plays out is not predetermined, implying the need to keep measuring giving for a long enough time period after the shock so that we can be reasonably sure that any substitution pattern has played itself out. Fourth, specific pairs of charitable purposes that may exhibit substitution relationships also are not predetermined; this implies the need to measure giving to a comprehensive enough set of different charitable purposes to ensure that all substitution relationships that are reasonable to consider have been accounted for.

These four dimensions establish a perspective from which previous empirical investigations of substitution can be viewed in order to assess what has been learned and what kind of evidence remains to be provided. Reinstein (2011) and Brown et al. (2012) have used survey data from the *Philanthropy Panel Study* (*PPS*), the charitable giving module within the United States' *Panel Study of Income Dynamics* (*PSID*). Hence, the data they use measure a comprehensive set of charitable purposes, and over a long time period. However, the *PSID* has a biennial data collection cycle (typical among national socioeconomic panel studies), which implies gaps in

measurement during which substitution may have been occurring. And, as would be the case with any survey, the timing of data collection will not necessarily align well with exogenous shocks that happen in the giving environment. For instance, Reinstein (2011) estimates fixed effects models and finds negative associations between changes in giving to health charities and changes in giving to education charities, and between health and to combined funds (like the United Way), but shocks are not observed in the analysis making it hard to adjudicate whether the observed negative associations are exogenously driven. In one case, however, an exogenous shock occurred at the very beginning of a *PSID* data collection cycle—the Indian Ocean tsunami that struck at the end of 2004. Brown et al. (2012) therefore are able to investigate giving before and after this disaster, and find that giving during 2004 before the disaster was positively associated with giving in response to the Tsunami, regardless of which charitable purpose was being supported during 2004. In addition, Tsunami giving was positively associated with giving in 2006, again to all charitable purposes, over and above the controls for previous giving to those purposes in 2004. This finding suggests complementarity, although "shorter-term" substitution may have occurred in 2005's giving, which would not have been detectable in the *PSID*.

Experiments can generate evidence about substitution in response to experimentally-generated shocks, and are well-suited to measure giving responses immediately from the time of that shock continuously forward. However, it is more difficult for an experiment to continue to measure giving responses for a long period of time (i.e., after the experimental session ends), and to include a comprehensive set of charitable purposes. Harwell and Eckel (2015) use a real-donation laboratory experiment in which participants can make contributions to three charitable organisations (an animal shelter, a food bank and an environmental organisation) to

explore the effect of shocks in the form of targeted fundraising campaigns. They find that the increase in contributions to the targeted charity comes at the expense of contributions to two other organisations, with no increase in total contributions. Ek (2015) allows participants to give to two charitable organizations, and across treatments pairs the two charities so that they range from *a priori* close substitutes (UNICEF and Save the Children) to much less substitutable (UNICEF and a local Swedish conservation organization). The shocks are to the multiplier that converts experimental points available to donate into euros; these "productivity shocks," like the α_j shocks above, are inversely-isomorphic to price shocks. The result is that for two organizations that would seem closer substitutes *a priori*, giving to one organization indeed is a stronger substitute for giving to the other organization. Lange and Stocking (2015) make progress measuring giving responses over a very long period of time (two years) after a shock within a field experiment. The two organizations are *a priori* close substitutes—both are environmental advocacy organizations—and the shock is a fundraising shock: people on the e-mail subscriber list of one organization were invited by that organization to volunteer for the other organization, and vice versa. Rather than substitution, however, the results indicate complementarity in the number of time donations (volunteering) between the two organizations, among the people who accepted the treatment to volunteer for the second organization. Evidence about donations of money was more mixed. Finally, results may depend on characteristics of the shocks under investigation: Klar and Piston (2015) investigate fundraising shocks that evoke the participant's anger that she can then assuage by donating, and find that the two types of organizations in their study that *a priori* would seem not to be close substitutes—an organization helping children in need and a political advocacy organization—are perfect substitutes.

The kind of evidence that has yet to be provided is about substitution relationships following an exogenous shock (like in the experiments and Brown et al., 2015), and then giving is measured immediately after the shock, and furthermore continuously for a long time thereafter (like Lange & Stocking, 2015) for a comprehensive set of different charitable purposes (like the *PSID* papers). The innovation in our paper is that we use anonymized data that are simultaneously strong in all four of these dimensions. In addition, the evidence we provide identifies substitution relationships using six exogenous shocks in a natural setting.

The six exogenous shocks are fundraising appeals following large-scale overseas disasters. This kind of shock—a sudden increase in need accompanied by a well-organized fundraising appeal—is one of several kinds of shocks that are of interest. Another is a sudden increase in need that is not accompanied by a widespread appeal of the sort the DEC initiates. A third type of shock is a fundraising appeal that is based on an ever-present, on-going need. These appeals may be regularly scheduled (such as the annual Children in Need appeal run by the BBC in the UK) or unanticipated and one-off, such as the ice-bucket challenge. In the final section of this paper we present some preliminary evidence on the effect of regular fundraising appeals in the UK. The shocks in the experimental studies discussed above (Harwell and Eckel, 2015; Ek, 2015 and Lange and Stocking, 2015) are unanticipated.

Finally, the opportunity cost of time suggests patterns that may be uncovered in our empirical work.[10] In our application the donor is a CAF account owner who must take time to open her CAF account in order to make a gift to international relief.

[10] See Knowles and Servátka (2014) for experimental evidence on the importance of opportunity costs of time in making donations.

While she has her CAF account open, she may economize on her opportunity cost of time and make gifts to other charities now, gifts that she would have otherwise made at a later time. The pattern then would be an increase in giving to other charitable purposes at the time they respond to the exogenous need for international relief, offset one-to-one with reduced giving to those other charitable purposes in the future. Furthermore, the pattern would be that this "shift-giving-from-the-future-to-the-present" pattern is seen among the people who open up their CAF accounts to give to international relief, and not among people who are not giving in response to the disaster appeal.

3. UK disaster appeals

We investigate substitution relationships following disaster appeals launched by the UK Disasters Emergency Committee. The DEC is an umbrella organisation that brings together 13 leading UK aid charities to co-ordinate fundraising efforts in times of crisis.[11] The main activities of DEC are to launch public appeals for funds and to channel donations to its member charities. DEC decides whether or not to make an appeal in response to a disaster on the basis of three criteria: the scale of the disaster, the ability of the member charities to provide effective and swift humanitarian assistance, and the likely success of a public appeal in terms of fundraising. Once DEC has decided to make an appeal, it alerts the Rapid Response Network. Broadcasters are part of this network, and they produce appeal packages for national television and radio, typically delivered by well-known celebrities.[12] The network is

[11] The thirteen charities are Action Aid, Age International, British Red Cross, CAFOD, Care International, Christian Aid, Concern Worldwide, Islamic Relief, Oxfam, Plan UK, Save the Children, Tearfund and World Vision

[12] For a recent example, see https://www.youtube.com/watch?v=-Q7BcU7tddY

also comprised of commercial banks, the Post Office, and telecommunication companies who work together to facilitate the collection of donations in person, online and by phone. Donations made in response to an appeal are routed to the DEC who allocates them to the member charities.

Over June 2009 to July 2014 (the period of our data) the DEC launched six disaster appeals. These are summarized in Table 1. Note that the six disasters are a subset of all the disasters that occurred around the world during the period. Although the DEC's decisions to launch an appeal are based on their three formal criteria, we cannot rule out that media interest and political factors were also important, as discussed by Eisensee and Stromberg (2007).

The amounts of money raised varied considerably across the appeals. The appeal following the Haiti earthquake raised £103 million, while the appeal following the Sumatra earthquake raised only £9.3 million. This type of variation is common in DEC appeals. In Appendix A we show for a larger set of historic DEC appeals from 1968 to 2015 that there is a relationship between the scale of a disaster (measured by the number of people affected) and the amount raised; the responses to the DEC appeals we study are broadly in line with this relationship.[13]

For our purpose, a key feature of the timing of the six disaster appeals is that they occurred, for the most part, with a gap of several months between one appeal and the next. This allows us to statistically test for the end of the response period following an appeal, during which substitution patterns are playing themselves out, before the beginning of the response period initiated by the next appeal. The one exception to

[13] Although previous research has suggested that donations are larger in response to natural disasters compared to human-made disasters (Zagefka, et al., 2011), we find no evidence of this across the DEC appeals in Appendix A. This may reflect the DEC's decision to launch an appeal only when it is confident of a public response.

this is the relatively short gap between the first disaster in our data (Sumatra earthquake) and the second (Haiti earthquake), 102 days. However, the donation amount response to the first of these appeals was relatively small which implies limited, if any, lingering effects still in play when the Haiti appeal was launched.

Also worth noting is that the six appeals were made at different times of the calendar year. Hence, it is not the case that there is a particular "disaster season" associated with weather patterns. This is important for our identification strategy which relies on variation in the timing of disaster appeals to identify the subsequent substitution patterns. Specifically, because the disasters occur at different times during the calendar year we can use flexible controls for unobserved time effects, and thereby identify the effect of the disaster appeals independent of other time-varying unobservable factors.

4. **Data**

Our data consist of anonymized donations made through Charities' Aid Foundation (CAF) charity accounts.[14] CAF, a registered charity, provides a range of financial services for the sector, including banking and investment advice, payroll giving services for firms and a donation facility for individuals, the CAF account. This is effectively a dedicated checking account for making donations. Donors set up an account with a minimum £100 one-off of payment or £10 monthly direct debit and use the funds to make donations in a variety of ways, including online, by phone or check. The advantages of the account for donors are in helping them to manage their

[14] The data were accessed on a secure CAF server with all information regarding name, address, ID details, telephone number and town/city removed by CAF prior to being made available thus ensuring complete anonymity. One of the benefits to individuals of a CAF account is the anonymity it affords. We have therefore only used data which has been fully anonymised and cannot identify individuals All the results reported in the paper are based on aggregated data, implying that no individual behavior can be identified.

giving, lowering donation transactions costs (CAF validates all charities, including overseas, for example) and making it easier to give tax effectively.[15]

Table 2 presents summary statistics on our sample. We have anonymized data on all transactions from June 2009 – July 2014 (a total of more than 4 million individual donations). We observe 133,879 account-holders making at least one donation over the period. Focusing on the subset of donors present in all five years, the mean (median) amount donated per year is £1,593 (£550) and the mean number of donations made is 18.5. Table 3 provides information on the charitable purposes supported by CAF donors. We use a classification system derived by the National Council for Voluntary Organisation, which matches charity registration numbers (which we observe) to a standardized set of causes, the International Classification of Non-Profit Organisations http://ccss.jhu.edu/wp-content/uploads/downloads/2011/09/CNP_WP19_1996.pdf. Continuing with the five-year donors in the CAF data (Table 3, columns 3 and 4) International is the most common cause (24.5% donations), followed by Social Services (23.2%) and Religious (15.4%). Religious donations assume the largest share of the total by amount (24.2% of the total amount) indicating that the donations to religious charities tend to be larger on average (and the reverse is true for International (21.8% by amount) and Social Services (19.0% by amount).

[15] Unlike the US, where tax subsidies for donations are in the form of a deduction, the UK system, known as Gift Aid, allows charities to claim tax relief on donations made by taxpayers at the basic rate of tax, currently 20 per cent. Since CAF is a charity, this applies to the initial payment into the CAF account allowing individuals to give out of a "grossed up" fund without having to make a separate Gift Aid declaration on each donation. Higher-rate taxpayers can additionally reclaim a rebate equal to the difference between their marginal rate of tax and the basic rate of tax. Giving through a CAF account provides a record of donations for this purpose.

It is important for the interpretation of our results to consider what population CAF account holders represent. Appendix B compares annual giving estimates from the CAF sample with annual giving estimates from a random sample drawn from the UK population (*UK Giving*). Compared to the *UK Giving* sample, the CAF sample contains fewer donors giving very small amounts (<£10 a month) and more donors giving larger amounts of £100 a month or more, referred to as "high-level donors" in the UK Giving report (NCVO/CAF, 2010). The CAF sample looks more similar to the UK Giving's subset of Gift Aid donors who claim tax relief on their donations, although there remain more high-level donors in the CAF sample relative to UK Giving.

Note that any random sample from the population is likely to include few donors who give substantial amounts. The highest-level of annual giving in the UK Giving sample is £15,940, which is well below the maximum in the CAF sample. In this respect, studying CAF account-holders allows us to study the behaviour of an important group of donors who might not be captured in a more general household survey. The reason that they are important is that they account for a relatively large share of total donations. The mean level of giving among the CAF sample would place them at the 92nd percentile of the UK Giving sample; the top 8 per cent of the UK Giving sample account for just over 60 per cent of total donations. In short, substitution patterns among CAF donors may, or may not, not represent substitution patterns for the typical UK donor, but they do represent substitution patterns among donors who do a substantial amount of the UK's giving.

In Table 4, we show responses to the six disaster appeals among CAF donors. We define giving in response to the disaster appeal in terms of the timing of the donations and the charity given to. We observe donations given directly to DEC and

we count them as being in response to an appeal if they are made within the first six weeks after the date of the appeal. We also include donations made to the thirteen member charities within the same period.[16] The pattern of responses among CAF donors mirrors that in the aggregate population – the smallest proportion of donors responded to the Sumatra appeal (19% of donors observed for all five waves) and the greatest proportion to the Haiti appeal (41%). There is also some variation on the intensive margin – mean donation size was smaller in response to the Sumatra appeal and the Syria appeal than to the other four appeals.

5. Empirical strategy and estimated responses to disaster appeals

5.1 Empirical strategy

We aggregate donations by day and by charitable purpose and estimate the following specification:

$$d_t^i = a^i + \sum_{n=-2}^{N} \beta_n^i W_n + \theta_t^i + u_t^i \qquad (7)$$

Where d^i_t is the (natural log) of all donations made to purpose *i* on day *t*. In the first round of analysis, we group donations into two charitable purposes: 1 = DEC = donations made to DEC and the 13 member charities; 2 = OTH = donations made to all other charities. W_n is a set of weekly indicators relating to the date of the disaster appeal. Week = 0 defines the first seven-day period from the date of the appeal. We

[16] This definition may be subject to both type 1 and type 2 errors – i.e. people who give to one of the DEC member charities, but not because of the disaster appeal and people who give to DEC or one of the member charities because of the disaster appeal, but not within the six-week period. In practice, most of the increase in donations is driven by donations made directly to DEC not to the member charities (reducing type 1 errors) and we show in the next section that the increase in disaster giving is concentrated within the initial six week period (reducing type 2 errors). Note that we focus on the date of the appeal, rather than the date of the disaster itself. In the next section we confirm that the increase in donations is related to the appeal date.

allow for two weeks prior to the date of the appeal to test for any pre-existing trends in donations. In our estimation, we set the number of weeks N equal to 20. We show below that the effect of the disaster appeal runs out well before this date.

Our identification strategy exploits the fact that the disaster appeals occur at varying intervals and at different points in time (by year and month) and that we are able to control for systematic time effects. We include a number of controls for systematic time variation (θ^i_t). These include indicators for year, month, day of month and day of week. We also create separate indicators for Christmas, Boxing Day and New Year's Day and extended public holidays which occurred in 2011 and 2012 which are associated with lower levels of giving and for the weeks after the two major nationwide telethons that take place in the UK which are associated with a higher level of giving.[17] A number of tests, reported in the final column of the table under Figure 1, reject the presence of serial correlation in the residuals from this specification. This implies that the week-based dummies associated with the time of the disaster appeal, along with the set of indicators we are using for systematic time effects, are sufficient to capture all of the time-based correlation in daily giving.[18]

We estimate the two equations (one for each charitable purpose) using OLS. Separately, we also estimate the same equation for (the natural log of) total donations. The set of coefficients β^i_n captures the difference in (log) daily donations for purpose *i* in each of the (two weeks before and) twenty weeks following a disaster appeal, compared to baseline daily giving during non-disaster periods. We interpret these

[17] These are the BBC Children in Need appeal (20 Nov 2009, 19 Nov 2010, 18 Nov 2011, 16 Nov 2012, 15 Nov 2013) and the Comic Relief appeal, which alternates with the Sports Relief appeal, (19 Mar 2010, 18 Mar 2011, 23 Mar 2012, 15 Mar 2013, 21 Mar 2014)

[18] Hence the model is dynamically complete. The only advantage of imposing structure on the dynamics and estimating a VAR model be parsimony. An advantage of the dummies for the 20 weeks after the appeal is transparency in the presentation of the results.

coefficients as the effect of the disaster appeal on giving to different charitable purposes. We cannot rule out that there may be other, unobservable time-varying factors that affect giving during the period after a disaster appeal. Our identifying assumption is that these average out across the six disaster appeals that we observe.

Figure 1 illustrates the timing of the disaster periods and the baseline, non-disaster periods to make clear the basis for comparison. The figure presents residuals from a regression of log total donations on all of our controls for yearly, monthly, daily, and seasonal variation—that is, all of our time-based controls except for the 20 dummies for the weeks after the DEC appeals (and the two pre-appeal weeks). The daily residuals are then put into weekly averages. Hence, the figure shows the weekly pattern of total donations over time. Although there is a lot of unexplained variation in the series (even after including controls for systematic time effects), the disaster appeals are visible. Of the five biggest "spikes" in donations, four are associated with the largest four disaster appeals[19] while the non-disaster spike (in December 2010) differs from the others because it is more quickly reversed. The table under Figure 1 confirms that the pattern of donations is not autocorrelated in the non-disaster periods (column 1), but is autocorrelated in the disaster periods (column 2).

Column 3 then shows that after adding the 20 dummies for the weeks after the DEC appeals, there is no remaining autocorrelation in the residuals—the model is dynamically complete. This result, along with the lack of autocorrelation in the non-disaster periods, confirms that looking 20 weeks after the appeal is sufficiently long ensure that substitution pattern has played itself out.

[19] Note that the second disaster (Haiti) occurred within twenty weeks of the first disaster (Sumatra), which explains the wider, first shaded bar and the fact that the Haiti spike occurs in the middle of the bar.

In our main empirical specification, we estimate the average response over all six disaster appeals. The benefit of pooling is that other time-varying shocks that might be correlated with the timing of a single appeal disaster are likely to average out. However, to confirm that our results are not driven by a single appeal, we also test our main hypotheses in relation to the six disaster appeals separately, comparing the period after each disaster appeal individually with all non-disaster periods.

5.2 Main results

Figure 2 plots estimated coefficients (and standard errors) associated with the weekly indicators before and after the disaster appeal for the two charitable purposes: the DEC-13 charities and all other charities. Full regression results are given in Appendix C. In the week immediately following disaster appeal, the figure indicates that average daily donations to the DEC-13 are 200% (2.090) higher than average daily donations to the DEC-13 in non-disaster period (i.e, outside the 22 week window surrounding each of the six disaster appeals.) In each of the three weeks that follow, average daily donations to the DEC-13 are about 160% (1.535 to 1.564) higher than non-disaster average daily donations. Then, in weeks four through nine after the first week of the appeal, average daily donations to the DEC-13 remain larger relative to non-disaster periods, but by a declining percent and the week eight coefficient is statistically significant at only the 10% level. During the next ten weeks, differences relative to non-disaster periods are small and are not statistically significant. The observed pattern strongly indicates that the response to the disaster has played out by the end of the 20-week period. Notably, the large increase in donations to the DEC-13 during the first six to eight weeks after the appeal is launched is not reversed in subsequent weeks.

The indicators for the weeks before disaster appeals are not statistically significant. This confirms the absence of pre-existing giving trends. It also indicates that the appeal is important in triggering a response since, in four out of the six appeals (Sumatra, Haiti, Pakistan and Philippines), the natural disaster itself occurred within the week prior to the appeal (see Table 1). In separate results (not reported) we have included an additional indicator equal to one from the date of the disaster (until the disaster appeal is launched) and found this to be insignificant.

The magnitude of the response in other donations is much smaller (albeit relative to a higher baseline level of giving). There is evidence of an *increase* in donations in the weeks immediately after the appeal. The coefficients in week 0 and week 2 are statistically significant and indicate that donations to other charities are around 20 per cent higher in each of these weeks than in non-disaster periods. The positive effect is less persistent than for donations to DEC-13 and it is also later reversed. Starting in week 6 there is a sustained period during which the coefficients are negative and are statistically significant in weeks 8 and 11, with the coefficients indicating that donations are around 20 per cent lower in each of these weeks than in non-disaster periods. Again, the observed pattern strongly indicates that the response to the disaster has played out by the end of the period; the coefficients are close to zero and statistically insignificant by week 12.

We perform a number of hypothesis tests in relation to the estimated coefficients. First, in Table 5, row 1, we focus on the response in donations to DEC-13. To fix magnitudes, column 1 indicates that average daily giving to the DEC-13 in non-disaster periods by CAF account holders is £10,769. We test the overall response to the disaster appeal, guided by the observed responses, focusing on weeks 0-13. Specifically, our test is whether the average of the 14 coefficients in weeks 0-13 is

statistically different than zero, which it is. The .748 coefficient indicates that in the 14 weeks from the launch of the disaster appeal, average daily giving is 74.8% higher compared to the £10,769 in non-disaster periods.

Columns 2 and 3 indicate, as did Figure 2, that this response is stronger in the weeks immediately after the appeal is begun (1.460) than in weeks 6-13 (.215). Column 4 shows that the average response across weeks 14-19 is small and insignificant. Hence, the response to the disaster appeal is limited to weeks 0-13, the first three months (N = 13). More importantly, there is no evidence of any offsetting reduction in donations to emergency relief after the initial strong positive response.

We then test whether the increase in donations to emergency relief comes at the expense of donations to other charities. Following the same pattern, we test whether the average of the 14 coefficients in weeks 0-13 is statistically different than zero and we fail to reject the null of no substitution. Note that we do not reject the null because the effect is imprecisely estimated, rather the average effect over this three month period is very close to zero. Taken together with the increase in donations to emergency relief, this means that total giving is significantly greater (row 3).

This zero net effect does not mean that there is the absence of any sort of behavioural response in giving to other charities. The results in row 2, column 3, confirm the pattern of timing effects in Figure 2, that is an increase in giving to other charities in the immediate aftermath of the disaster appeal – average daily donations are 8.3% higher during the first six weeks after an appeal, compared to non-disaster periods. However, this increase is subsequently reversed over the following eight weeks, as shown in column 4.

The increase in all other donations during the immediate aftermath cannot all be explained by giving to other international aid charities outside the 13 member charities of DEC. This is shown in the second panel of results in Table 5 which breaks down all other donations into other international (i.e. all other international aid charities besides the 13 member charities of DEC) and all non-international purposes. We find a stronger immediate positive response in giving to other international, which is 23.7 per cent higher compared to non-disaster periods, but donations to all non-international charities are also higher in the immediate aftermath period.

To shed further light on responses to disaster appeals, panel c breaks down giving to non-international charities into six further purposes: religious, health, social services, education, environment and other. One possibility is that charities that are defined as having one of these as their main charitable purpose may nevertheless additionally be involved in providing disaster relief. To address this, we define a subset of "non-disaster" charities comprising large charities that are not involved in international aid and which are UK-focused in terms of their activities. These are plausibly not involved in emergency relief in the aftermath of a disaster appeal.[20]

The results in column 2 show that we fail to reject the null of no substitution for each of the disaggregated purposes, including the subset of non-disaster charities, with the exception of donations to health charities. However, the same behavioral response in terms of timing is also observed for all the purposes, i.e. higher donations

[20] These are Cancer Research UK, Salvation Army, National Society for the Prevention of Cruelty to Children, Macmillan Cancer Relief, Shelter, Age UK, Royal Commonwealth Society for the Blind, Royal National Lifeboats Institution, Marie Curie, British Heart Foundation, Alzheimers, Samaritans, Barnados, World Wildlife Fund. These are the largest non-International charities in our dataset (by total donations).

during the immediate aftermath (significant in the case of health, social services and the selected non-disaster charities), which are later reversed.

6. Alternative specifications and robustness checks

[needs to be written up]

Table 6 summarizes responses to each of the six disasters, confirming that the pattern of responses is not driven by a single disaster (table 6)

Figure 3 plots simulated responses to pseudo-disasters (i.e. a set of six randomly chosen disaster dates). These results provide strong confirmation that our main results in the previous section capture the effects of the disaster appeals and are not an artefact of other (unobserved) time-varying factors.

Figure 4 presents some preliminary evidence on responses to UK telethons. These are a different type of exogenous shock than disaster appeals (see discussion on page 15) representing a targeted fundraising appeal for an ongoing need. However, this preliminary analysis also points to a zero substitution result, suggesting that our results from disaster appeals may be more generalizable beyond this particular type of exogenous shock.

7. Discussion and conclusions

To be completed.

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Table 1: Disaster Emergency Committee (DEC) Appeals

Date of appeal	Date of disaster	Location	Type	Total donations
10/04/2009	09/30/2009	Sumatra (Indonesia, Philippines, Vietnam)	Earthquakes & Typhoons	£9.3 m
01/14/2010	01/10/2010	Haiti	Earthquake	£107m
08/03/2010	07/28/2010	Pakistan	Floods	£71m
07/06/2011		East Africa	Famine	£79m
03/20/2013		Syria	Civil War	£27m
11/11/2013	11/08/2013	Philippines	Typhoon	£95m

Sumatra: Over five million were affected in Indonesia, the Philippines and Vietnam after they were hit by a series of devastating natural disasters (typhoons and quakes) within a number of days.
Haiti: An earthquake devastated the capital, Port au Prince, and the surrounding area in January 2010. Three million people were affected. About 1.5 million people lost their homes, 300,000 were injured and about 220,000 died.
Pakistan: Floods swept the country in July and August of 2010 following the worst monsoon rains in the country's history. More than 18 million people were affected by the disaster.
East Africa: In 2011 more than 13 million people in Ethiopia, Kenya, Somalia, and the newly-formed Republic of South Sudan were left in need of food, water and emergency healthcare because of one of the worst droughts in at least 25 years. Hundreds of thousands of people fled Somalia due to the drought and conflict, with parts of the country afflicted by famine.
Syria: Two years of war had devastated the lives of many Syrian families and had left more than nine million people in need of aid. In many parts of the country the health system had effectively collapsed, water supplies had been cut and food was in short supply. At that time, about 1.2 million houses had been damaged, with 400,000 totally destroyed. An estimated 6.5 million people were displaced inside Syria, and 2.5 million people had fled to the neighbouring countries of Jordan, Lebanon, Turkey and Iraq. Refugees were arriving at camps which were already stretched to capacity, and many families were living in crude shelters they had built themselves, with host families in overcrowded conditions or in partially finished buildings.
Philippines: Typhoon Haiyan tore a path of destruction over 100 miles wide through the central Philippines. It brought torrential rain, winds of over 170mph and a storm surge of up to 25 feet that devastated coastal areas. Over 14 million people where affected, including five million who have seen their homes damaged or destroyed. Over 6000 people lost their lives.

Notes to table: All information from Disasters Emergency Committee (http://www.dec.org.uk/). The disasters in East Africa and Syria do not have a single disaster date since the underlying causes were prolonged

Table 2: Sample Summary Statistics

	N	Mean	Min	5%	50%	95%	Max
Full sample							
Donation size (£)	4,153,977	69.5	.01	5	25	250	1,000
# donations per donor (total)	133,879	31.0	1	1	7	137	3,042
Total donations per donor per year (£)	323,253	1,189.0	.06	20	345	3,996	2,002,280
# donations per donor per year	323,253	12.9	1	1	6	48	856
Donors observed in all five waves							
Donation size (£)	3,182,599	66.7	.32	5	25	250	1,000
# donations per donor (total)	34,379	92.6	5	13	55	296	3,042
Total donations per donor per year (£)	171,895	1,593.1	1	60	550	5,140	2,002,280
# donations per donor per year	171,895	18.5	1	1	10	62	856
Disaster givers							
Donation size (£)	2,438,882	60.0	.50	5	25	200	1000
# donations per donor (total)	21,978	110.97	5	16	68	349	3042
Total donations per donor per year (£)	109,890	1671.2	1.7	84	625	5200	2,002,280
# donations per donor per year	109,890	22.2	1	2	13	74	145
Non-disaster givers							
Donation size (£)	743,717	87.4	.32	5	30	400	1000
# donations per donor (total)	12,401	59.9	5	11	38	348	2827
Total donations per donor per year (£)	62,005	1454.7	1	50	431.2	5024.5	526,215
# donations per donor per year	62,005	12.0	1	1	7	39	856

Notes to table:
Donation size is winsorized at the 99th percentile (=£1000).
Of the 133,879 donors, 73,226 make donations in one year, 9,636 in two years, 7,692 in three years, 8,946 in four years and 34,379 in five years.
Disaster givers are defined as donors who give to DEC or to one of the 13 member charities during a six-week window after the disaster appeal is launched. Disaster givers and non-givers are defined for the sample present in all five years

Table 3: Sample composition (%)

	Full sample		Five-wave sample		Disaster givers		Non Disaster Givers	
Gender								
Male	60.3		65.7		65.0		66.8	
Female	36.9		31.7		32.2		30.9	
Giving to different causes	#dons	£dons	#dons	£dons	#dons	£dons	#dons	£dons
Culture&recreation	1.6	3.6	1.6	3.6	1.3	2.8	2.6	5.5
Education&research	8.6	8.6	8.2	8.1	7.7	7.1	9.9	10.4
Health	11.4	9.9	11.2	9.6	10.7	9.2	12.7	10.5
SocialServices	23.1	18.8	23.2	19.0	23.4	19.7	21.7	17.4
Environment	7.6	4.6	7.7	4.6	7.2	4.5	9.3	5.0
Development&housing	3.7	3.3	3.8	3.4	3.9	3.4	3.6	3.3
Law,advocacy&pols	1.6	1.3	1.6	1.6	1.6	1.7	1.7	1.7
PhilanthropicAssoc'ns	2.9	4.0	2.7	3.8	2.3	5.1	3.9	5.1
International	24.2	21.5	24.5	21.8	27.8	26.4	13.8	11.3
Religious	15.1	23.9	15.4	24.2	13.8	21.8	20.7	29.5
Bus&ProfServices	0.1	0.2	0.1	0.2	0.1	0.1	0.2	0.3
NotElsewhereClassified	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Notes: Although the majority of account holders are male, many of these accounts will carry out giving decisions made jointly by men and women at the household level.

Table 4: Giving in response to disaster appeals

	All donors		Present for five waves	
	Proportion of sample	Mean donation (>0)	Proportion of sample	Mean donation (>0)
Sumatra	0.215	94.46	0.186	97.16
Haiti	0.350	146.33	0.411	148.36
Pakistan	0.289	148.07	0.349	149.55
EastAfrica	0.277	152.31	0.344	150.93
Syria	0.202	111.40	0.246	109.19
Philippines	0.340	163.62	0.373	156.31

Notes to table:
Disaster givers are defined as donors who give to DEC or to one of the 13 member charities during a six-week window after the disaster appeal is launched. In this table, disaster givers and non-givers are defined for the sample present in all five years

Table 5: Response to disaster appeals during different post-appeal windows

	Average donations per day (£) baseline	Overall Effect Weeks 0-13	Immediate aftermath Weeks 0-5	Post-disaster Weeks 6-13	Check for longer-term effects Weeks 14-19
DEC + 13 charities	10,769	0.748**	1.460**	0.215**	0.058
		(0.039)	(0.053)	(0.048)	(0.053)
All other donations	136,232	-0.015	0.083**	-0.090**	-0.020
		(0.025)	(0.035)	(0.030)	(0.035)
Total	147,051	0.098**	0.310**	-0.060**	-0.006
		(0.025)	(0.034)	(0.031)	(0.034)
Breakdown all other:					
Other international	17,099	0.052*	0.237**	-0.086**	-0.020
		(0.029)	(0.040)	(0.036)	(0.039)
All non-internat'l	,619	-0.031	0.055*	-0.095*	-0.022
		(0.025)	(0.034)	(0.031)	(0.034)
Breakdown all non-international:					
Religious	36,463	-0.032	0.034	-0.081**	-0.311
		(0.029)	(0.040)	(0.036)	(0.039)
Health	28,199	-0.067**	0.075*	-0.174**	-0.058
		(0.030)	(0.040)	(0.036)	(0.040)
Social services	15,024	-0.013	0.093**	-0.093**	0.000
		(0.031)	(0.043)	(0.039)	(0.042)
Education	13,022	-0.019	0.044	-0.067	-0.011
		(0.036)	(0.049)	(0.045)	(0.049)
Environment	6,993	-0.011	0.032	-0.043	0.050
		(0.040)	(0.055)	(0.049)	(0.054)
Other	19,478	-0.043	0.044	-0.108**	-0.012
		(0.034)	(0.0440)	(0.040)	(0.044)
Selected non-disaster charities	15,502	-0.032	0.083*	-0.118**	-0.014
		(0.036)	(0.049)	(0.044)	(0.049)

Notes to table: Difference in average daily (ln) donations compared to baseline (=non-disaster periods) during different post-appeal windows. Baseline levels of giving in non-disaster periods are given (in £) for comparison. Effects are estimated using OLS and include controls for year, month, day of month, day of week, Christmas, New Year, royal bank holidays and major telethons. Selected non-disaster charities are the largest non-international charities (=Cancer Research UK, Salvation Army, National Socicty for the Prevention of Cruelty to Children, Macmillan Cancer Relief, Shelter, Age UK, Royal Commonwealth Society for the Blind, Royal National Lifeboats Institute, Marie Curie, British Hear Foundation, Alzheimers, Samaritans, Barnados, World Wildlife Fund). ** $p<0.05$; * $p<0.10$.

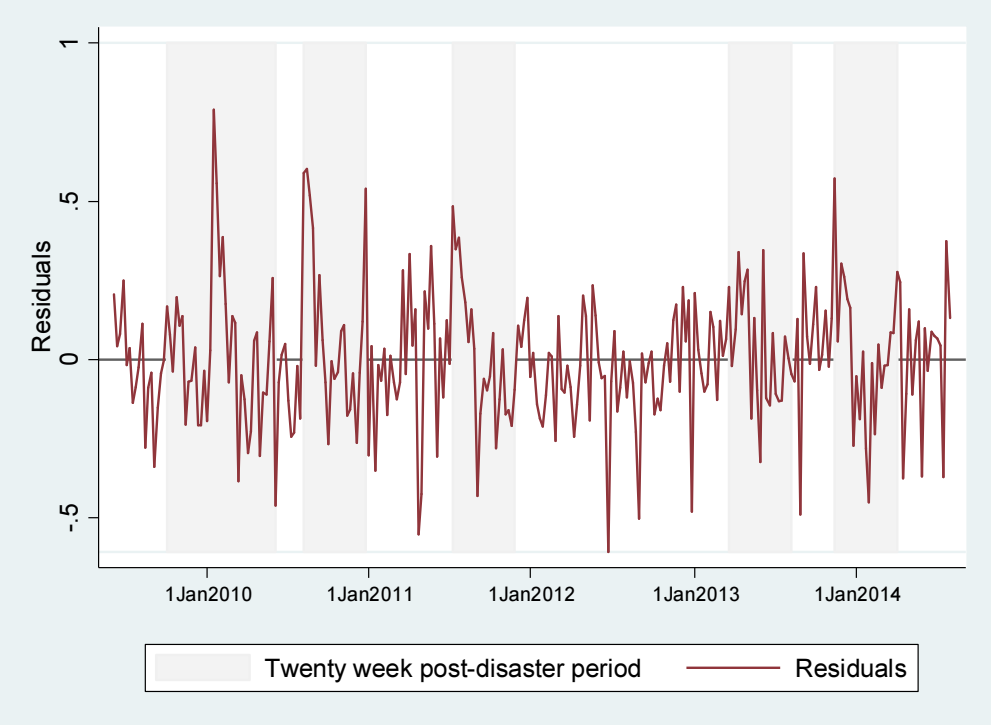
Table 6: Response to disaster appeals during different post-appeal windows

Separate results for each disaster appeal

	DEC + 13 charities			All other donations		
	Weeks 0-13	Weeks 0-5	Weeks 6-13	Weeks 0-13	Weeks 0-5	Weeks 6-13
Sumatra	0.434**	0.773**	0.181**	-0.058	-0.008	-0.096**
	(0.064)	(0.127)	(0.047)	(0.041)	(0.082)	(0.030)
Haiti	0.894**	1.839**	0.185**	0.013	0.156*	-0.094**
	(0.105)	(0.134)	(0.047)	(0.041)	(0.086)	(0.030)
Pakistan	1.912**	1.880**	0.185**	0.009	0.153*	-0.098**
	(0.062)	(0.124)	(0.047)	(0.061)	(0.062)	(0.030)
East Africa	0.827**	1.678**	0.189**	-0.028	0.060	-0.095**
	(0.059)	(0.120)	(0.047)	(0.038)	(0.077)	(0.030)
Syria	0.585**	1.118**	0.185**	-0.017	0.085	-0.094**
	(0.061)	(0.123)	(0.047)	(0.040)	(0.080)	(0.030)
Philippines	0.732**	1.463**	0.185**	-0.032	0.053	-0.095**
	(0.062)	(0.125)	(0.048)	(0.040)	(0.081)	(0.030)

Notes to table: Difference in average daily (ln) donations compared to baseline (=non-disaster periods) during different post-appeal windows. The effects are estimated for each disaster relative to pooled non-disaster periods. Effects are estimated using OLS including controls for year, month, day of month, day of week, Christmas, New Year, royal bank holidays and major telethons. Regressions include controls for year, month, day of month, day of week, Christmas, New Year and major telethons. ** $p<0.05$; * $p<0.10$.

Figure 1: Donations during disaster and non-disaster periods

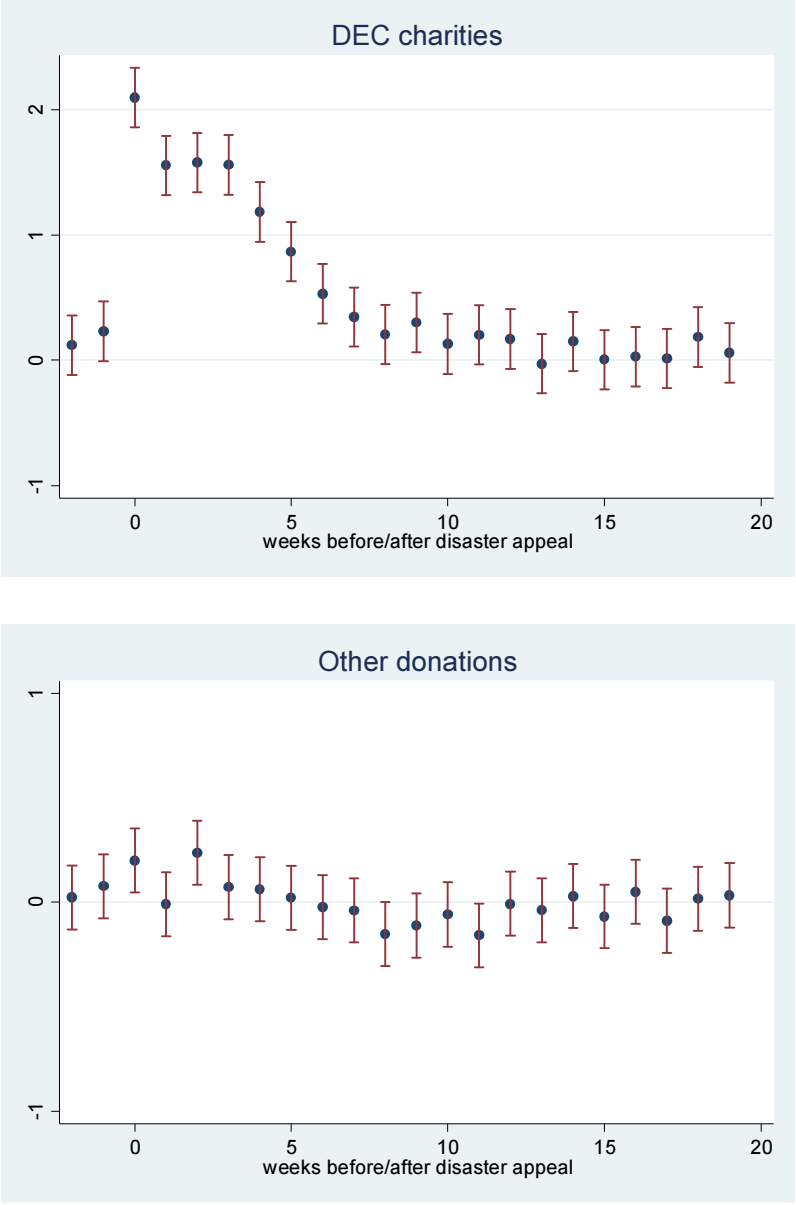


Note to figure: Weekly-averaged residuals from regressing ln (total donations) per day on indicators for year, month, day of month, day of week, Christmas, New Year and major telethons. The figure illustrates the basis for identifying the effect of the disaster appeals, i.e. comparing levels of giving during the twenty-week post-disaster periods (disaster=1) with levels of giving during the pooled non-disaster periods (disaster=0).

Tests for serial correlation:

	Disaster = 0	Disaster = 1	All periods (including weekly indicators)
Durbin Watson statistic	1.97	1.72	1.92
Durbin's alternative test (p-value)	.424	.040	.383
Breusch Godfrey test (p-value)	.438	.024	.373
Regress $\hat{u}_t$			
$\hat{u}_{t-1}$ (p-value)	.487	.012	.326
$\hat{u}_{t-2}$ (p-value)	.616	.131	.446
$\hat{u}_{t-3}$ (p-value)	.994	.028	.395
N	1624	260	1884

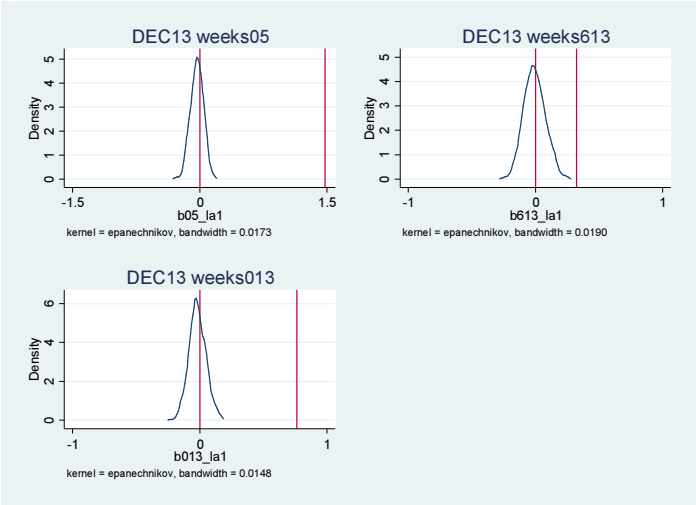
Figure 2: Estimated response to disaster appeals, by week



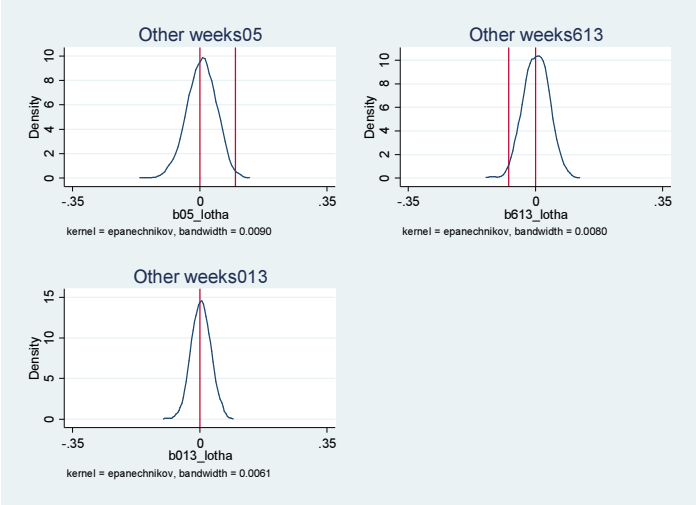
Notes to table: Difference in average daily (ln) donations, relative to baseline of non-disaster periods, during weeks before/after disaster appeals. The figures plot estimated coefficients plus confidence intervals. Regressions (estimated using OLS) include controls for year, month, day of month, day of week, Christmas, New Year, royal bank holidays and major telethons.

Figure 3: Simulated effects of pseudo-disasters

a. Giving to DEC + 13 member charities

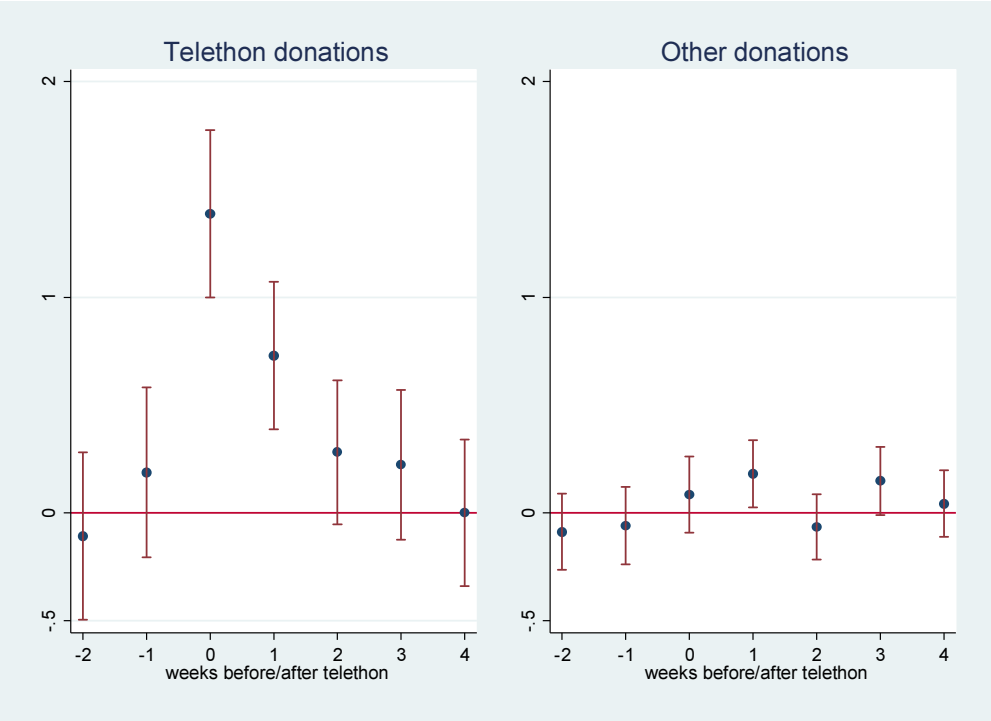


b. Giving to all other charities



Notes to figure: Simulated responses to pseudo-disaster appeals generated as six random dates during the non-disaster period. Distribution based on 1000 simulations. Effects are estimated using OLS including controls for year, month, day of month, day of week, Christmas, New Year, royal bank holidays and major telethons. Vertical lines are plotted at zero and to indicate the estimated effects based on the actual disaster appeals (from Table 5).

Figure 4: Estimated response to telethon appeals, by week



Average responses

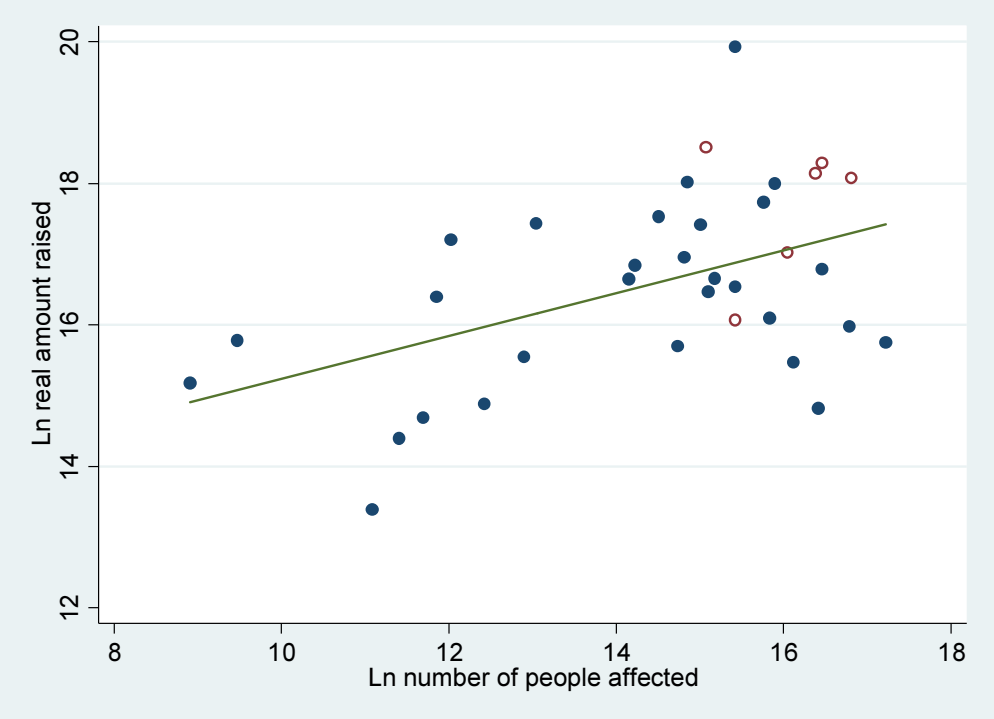
	Weeks 0 – 4
Telethon donations	0.524**
	(0.054)
All other donations	0.078
	(0.053)
Total donations	0.107**
	(0.054)

Notes to table: Difference in average daily (ln) donations, relative to baseline of non-disaster periods, during weeks before/after major telethons. The figures plot estimated coefficients plus confidence intervals. Regressions include controls for year, month, day of month, day of week, Christmas, New Year and royal bank holidays.
Telethons are for BBC Children in Need (taking place annually in November) and Comic Relief/ Sports Relief (taking place in alternate years in March.

Appendix A: DEC Disaster Appeals

The figure below plots the total amount raised (in logs) in DEC disaster appeals over the period 1968 – 2015 against the number of people reported being affected (in logs), together with the line of best fit. The six disaster appeals in our dataset are shown as hollow circles.

Information is taken from the DEC website. Information on the number of people affected is missing for 14 out of 49 disaster appeals over the period. The number of people who died is available for an additional seven of these disasters, but regression analysis shows that the number affected is more strongly correlated with the amount raised than with the number of deaths (β_{AFF} = 0.262; p=0.017. β_{DEATH} = 0.081; p=0.279). Separate dummies for Manmade disasters and for disasters in Commonwealth countries are not statistically significant.



Appendix B

Comparison of CAF account holders with data from UK Giving 2010

We can benchmark anonymized data from the sample of CAF account holders against data on donations from *UK Giving*, a representative sample of UK adults aged 16 and older commissioned by CAF/NCVO as part of the Omnibus survey carried out by the Office for National Statistics. The Omnibus is a multipurpose survey using a random probability sample from the UK population.

The Omnibus survey is carried out in people's homes, using Computer-Assisted Personal Interviewing (CAPI). Questions are asked about donations made during the previous four weeks. Note that this type of recall question is likely to be subject to measurement error, including both forgetting and telescoping (see Crossley and Winter, 2015, for discussion). Telescoping (i.e. including events that happened outside the designated time period) may be more likely than forgetting for charitable donations since giving may be seen as a desirable activity leading individuals to include older donations.

To estimate annual giving for CAF donors, we aggregate all the donations for each account holder made during the calendar year; we create a monthly figure by dividing annual giving by twelve. We obtain an estimate of annual giving in the Omnibus sample by multiplying the reported level of giving in the past four weeks by twelve. This assumes that giving during the previous four weeks is typical of giving throughout the year.

The table below summarizes information on the distribution of donations among CAF account holders and in UK Giving. For UK Giving, we look both at all donors and

also at the subset of donors who report that their giving includes Gift Aid (the UK system of tax relief for donations) since this group may be more comparable to the sample of CAF donors (see discussion in footnote 15).

As a random sample drawn from the entire population, UK Giving captures relatively few people who give substantial amounts. The maximum amount of reported annual giving in UK Giving is £15,960 a year. Compared to using information from a general survey, focusing on CAF account holders allows us to study the behaviour of a wider group of donors including those who give above this level. This is potentially important for understanding what happens to aggregate donations since this group accounts for a relatively high share of total giving.

	UK Giving		CAF account holders	
	All donors	Gift Aid donors	<£15,960 a year	All
<£10 a month < £120 a year	37.0%	17.5%	24.5%	24.3%
£10 - £24.99 a month £120 - £299 a year	31.2%	33.6%	18.8%	18.7%
£25 - £99.99 a month £300 - £1,199 a year	23.9%	34.3%	34.1%	33.8%
£100 - £999 a month £1,200 - £11,999 a year	7.9%	14.5%	22.2%	22.0%
£1,000+ a month £12,000+ a year	0.1%	0.1%	0.4%	1.2%
Mean (annual)	£401	£636	£999	£1359
Median (annual)	£156	£264	£385	£393

Appendix C: Regression results

	All six disasters			Sumatra		Haiti		Pakistan		East Africa		Syria		Philippines	
	TOTAL	DEC	OTH	DEC	OTH	DEC	OTH	DEC	OTH	DEC	OTH	DEC	OTH	DEC	OTH
w-2	0.006	0.099	0.001	0.085	-0.003	0.085	-0.003	0.082	-0.003	0.084	-0.000	0.075	-0.005	0.081	-0.006
	(0.076)	(0.118)	(0.074)	(0.116)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.116)	(0.074)	(0.117)	(0.075)	(0.116)	(0.075)
w-1	0.068	0.210	0.053	0.208	0.040	0.206	0.041	0.212	0.044	0.206	0.041	0.211	0.041	0.206	0.042
	(0.076)	(0.118)	(0.074)	(0.116)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.116)	(0.074)	(0.117)	(0.075)	(0.116)	(0.075)
w0	0.571***	2.090**	0.193**	1.283**	-0.054	2.946**	0.615**	2.062**	0.270	2.093**	0.159	1.617**	0.105	2.538**	0.065
	(0.076)	(0.118)	(0.074)	(0.283)	(0.182)	(0.296)	(0.189)	(0.284)	(0.183)	(0.280)	(0.179)	(0.282)	(0.183)	(0.284)	(0.183)
w1	0.249**	1.547**	-0.017	0.822**	-0.133	2.043**	0.274	2.244**	0.388*	1.757**	-0.029	0.830**	-0.196	1.634**	-0.371*
	(0.076)	(0.118)	(0.073)	(0.283)	(0.182)	(0.298)	(0.190)	(0.284)	(0.183)	(0.280)	(0.179)	(0.280)	(0.184)	(0.286)	(0.181)
w2	0.448***	1.564**	0.223**	0.450	0.240	1.882**	0.191	2.010**	0.340	2.077**	0.110	1.340**	0.108	1.478**	0.337
	(0.076)	(0.118)	(0.073)	(0.283)	(0.182)	(0.296)	(0.189)	(0.284)	(0.182)	(0.281)	(0.179)	(0.283)	(0.182)	(0.282)	(0.183)
w3	0.282***	1.535**	0.046	0.946**	0.154	1.974**	0.057	1.786**	-0.240	1.643**	0.123	1.422**	0.091	1.386**	0.091
	(0.076)	(0.119)	(0.074)	(0.284)	(0.182)	(0.299)	(0.191)	(0.284)	(0.182)	(0.278)	(0.178)	(0.283)	(0.182)	(0.283)	(0.183)
w4	0.197**	1.166**	0.044	0.838**	-0.082	1.533**	-0.041	1.564**	0.104	1.548**	-0.022	0.595*	0.104	0.995**	0.183
	(0.076)	(0.118)	(0.074)	(0.285)	(0.183)	(0.299)	(0.191)	(0.282)	(0.181)	(0.283)	(0.181)	(0.283)	(0.182)	(0.283)	(0.183)
w5	0.111	0.857**	0.010	0.300	-0.170	0.658*	-0.161	1.617**	0.053	0.950**	0.022	0.903**	0.103	0.748**	0.206
	(0.076)	(0.118)	(0.074)	(0.285)	(0.183)	(0.290)	(0.185)	(0.283)	(0.182)	(0.283)	(0.181)	(0.283)	(0.182)	(0.283)	(0.183)
w6	0.012	0.511**	-0.040	0.468**	-0.061	0.493**	-0.049	0.493**	-0.096	0.533**	-0.053	0.507**	-0.061	0.496**	-0.047
	(0.076)	(0.118)	(0.073)	(0.126)	(0.081)	(0.127)	(0.081)	(0.124)	(0.080)	(0.127)	(0.081)	(0.127)	(0.081)	(0.126)	(0.082)
w7	-0.027	0.323**	-0.063	0.329**	-0.066	0.332**	-0.065	0.328**	-0.065	0.327**	-0.066	0.323**	-0.067	0.325**	-0.069
	(0.076)	(0.118)	(0.073)	(0.116)	(0.074)	(0.117)	(0.074)	(0.117)	(0.075)	(0.116)	(0.074)	(0.116)	(0.074)	(0.116)	(0.075)
w8	-0.146	0.178	-0.181*	0.147	-0.189*	0.148	-0.189*	0.156	-0.184*	0.148	-0.189*	0.146	-0.188*	0.148	-0.189*
	(0.076)	(0.118)	(0.073)	(0.116)	(0.074)	(0.116)	(0.074)	(0.116)	(0.075)	(0.116)	(0.074)	(0.116)	(0.074)	(0.116)	(0.075)
w9	-0.092	0.285*	-0.132	0.249*	-0.137	0.251*	-0.137	0.251*	-0.137	0.250*	-0.136	0.252*	-0.134	0.258*	-0.135
	(0.076)	(0.119)	(0.074)	(0.116)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.116)	(0.076)
w10	-0.067	0.107	-0.085	0.072	-0.086	0.076	-0.087	0.072	-0.086	0.074	-0.086	0.071	-0.087	0.070	-0.087
	(0.077)	(0.119)	(0.074)	(0.117)	(0.075)	(0.118)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.117)	(0.075)	(0.117)	(0.076)
w11	-0.148	0.177	-0.180*	0.134	-0.179*	0.135	-0.179*	0.133	-0.179*	0.135	-0.178*	0.132	-0.179*	0.135	-0.179*
	(0.076)	(0.118)	(0.073)	(0.115)	(0.074)	(0.116)	(0.074)	(0.116)	(0.075)	(0.116)	(0.074)	(0.116)	(0.074)	(0.115)	(0.075)
w12	0.035	0.185	0.017	0.129	0.006	0.131	0.006	0.132	0.010	0.129	0.007	0.133	0.007	0.129	0.008
	(0.076)	(0.118)	(0.073)	(0.116)	(0.074)	(0.117)	(0.074)	(0.116)	(0.075)	(0.116)	(0.074)	(0.116)	(0.074)	(0.116)	(0.075)
w13	-0.048	-0.043	-0.052	-0.082	-0.055	-0.083	-0.054	-0.083	-0.054	-0.081	-0.054	-0.083	-0.055	-0.083	-0.054
	(0.076)	(0.118)	(0.074)	(0.116)	(0.074)	(0.117)	(0.074)	(0.117)	(0.075)	(0.116)	(0.074)	(0.116)	(0.074)	(0.116)	(0.075)
w14	0.043	0.137	0.016	0.016	-0.017	0.043	-0.016	0.013	-0.018	0.013	-0.016	0.010	-0.020	0.009	-0.019
	(0.076)	(0.118)	(0.073)	(0.120)	(0.077)	(0.118)	(0.075)	(0.121)	(0.077)	(0.120)	(0.077)	(0.120)	(0.077)	(0.120)	(0.078)
w15	-0.069	-0.014	-0.086	-0.187	-0.171*	-0.176	-0.159*	-0.186	-0.171*	-0.187	-0.171*	-0.185	-0.171*	-0.190	-0.170*
	(0.076)	(0.118)	(0.073)	(0.126)	(0.081)	(0.121)	(0.077)	(0.126)	(0.081)	(0.126)	(0.081)	(0.126)	(0.081)	(0.126)	(0.082)
w16	0.036	0.011	0.031	-0.032	0.013	-0.097	-0.008	-0.034	0.012	-0.033	0.015	-0.034	0.013	-0.034	0.013
	(0.076)	(0.118)	(0.073)	(0.126)	(0.081)	(0.122)	(0.078)	(0.127)	(0.082)	(0.127)	(0.081)	(0.127)	(0.081)	(0.126)	(0.082)
w17	-0.087	-0.004	-0.108	-0.125	-0.139	-0.090	-0.116	-0.123	-0.138	-0.123	-0.138	-0.134	-0.141	-0.131	-0.143
	(0.076)	(0.119)	(0.074)	(0.127)	(0.081)	(0.123)	(0.078)	(0.128)	(0.082)	(0.127)	(0.081)	(0.128)	(0.082)	(0.127)	(0.082)
w18	0.025	0.179	0.007	0.104	0.010	0.085	-0.002	0.099	0.007	0.101	0.011	0.097	0.008	0.101	0.008
	(0.076)	(0.118)	(0.074)	(0.127)	(0.081)	(0.122)	(0.078)	(0.127)	(0.082)	(0.127)	(0.081)	(0.127)	(0.081)	(0.126)	(0.082)
w19	0.017	0.039	0.010	-0.045	0.013	0.003	0.016	-0.044	0.012	-0.043	0.012	-0.033	0.017	-0.040	0.018
	(0.077)	(0.119)	(0.074)	(0.128)	(0.082)	(0.123)	(0.078)	(0.128)	(0.083)	(0.128)	(0.082)	(0.128)	(0.082)	(0.127)	(0.083)