Field study of charitable giving reveals that reciprocity decays over time

Amanda Chuan[a], Judd B. Kessler[a], and Katherine L. Milkman[a,1]

[a]The Wharton School, University of Pennsylvania, Philadelphia, PA 19104

We examine how reciprocity changes over time by studying a large quasiexperiment in the field. Specifically, we analyze administrative data from a university hospital system. The data include information about over 18,000 donation requests made by the hospital system via mail to a set of its former patients in the 4 months after their first hospital visit. We exploit quasiexperimental variation in the timing of solicitation mailings relative to patient hospital visits and find that an extra 30-day delay between the provision of medical care and a donation solicitation decreases the likelihood of a donation by 30%. Our findings have important implications for models of economic behavior, which currently fail to incorporate reciprocity's sensitivity to time. The fact that reciprocal behavior decays rapidly as time passes also suggests the importance of capitalizing quickly on opportunities to benefit from a quid pro quo.

behavioral economics | charitable giving | reciprocity | time | field study

> Gather ye rosebuds while ye may,
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> Old Time is still a-flying;
>
> And this same flower that smiles today
>
> Tomorrow will be dying.
>
> Robert Herrick (1591–1674)

Reciprocity motivates a wide range of cooperative behaviors that are crucial to the functioning of modern society (1). Reciprocity can involve rewarding kind actions or punishing unkind actions. In this paper, we focus on positive reciprocity, defined as any costly behaviors taken to reward a past action that was either kind or beneficial (2, 3). We present evidence from a large-scale field study of a fundamental and previously underappreciated feature of positive reciprocity: it decays over time. Our findings have important implications for long-term relationships between individuals as well as the relationships between individuals and organizations. In particular, if feelings of reciprocity diminish over time, interactions between parties may need to be temporally close to sustain strong reciprocal relationships. Our findings also provide guidance for governments and organizations interested in leveraging reciprocity to generate compliance or contributions. Policymakers and fundraisers may want to capitalize quickly on the reciprocal motives that they induce in others.

Successful fundraising is critical to the survival of most not-for-profit organizations. We study positive reciprocity in a setting where individuals receive a service from a not-for-profit organization and subsequently have the option to reciprocate by making a charitable gift. Specifically, we study giving to a massive hospital system that provides patients with medical care and later solicits them for charitable contributions. We examine how patients' propensity to donate relates to the delay separating their first-ever visit to the hospital and their subsequent receipt of a donation solicitation. Many nonprofit organizations that provide services depend on charitable contributions from those whom they have served, just like our partner hospital system. Schools, hospitals, religious organizations,

humane societies, and disaster relief providers all deliver services to individuals and later solicit donations from them. Reciprocity may play a large role in the success of these donation solicitations (4). Hospitals alone, the focus of our paper, take in over $9.6 billion in donations each year in the United States (5).

Past research in economics and psychology has shown that donation decisions are extremely sensitive to context effects (6). Nevertheless, standard theories of economic behavior do not allow the delay separating a service interaction from a donation solicitation to affect generosity, holding all else constant (e.g., the arrival of new information or an income shock). However, psychology research suggests that the timing of a solicitation relative to a recent interaction could indeed affect generosity. Past research on psychological reactance suggests that requesting a donation too quickly after a service interaction could be off-putting, as it might seem opportunistic and manipulative (7, 8). If this were the case, a longer delay separating a service interaction from a donation solicitation would be expected to increase generosity by reducing reactance. However, there are also reasons to believe that a longer delay separating a service interaction from a donation solicitation could decrease generosity. Memories decay rapidly over time (9), and therefore, if more time separates a service encounter from a donation solicitation, the gratitude and reciprocity produced by that encounter should be less vividly recalled. Likewise, to the extent that reciprocity is driven by gratitude—a transient, "hot" state—longer delays between a service interaction and a solicitation would be expected to reduce generosity (10–12).

Significance

Reciprocity motivates a wide range of cooperative behaviors (e.g., tipping, exchange of favors, customer loyalty, etc.). It is typically assumed that, after a reciprocal relationship is triggered, reciprocal motives remain stable over time. Using a large-scale field study, we show that this is not the case. Instead, we find that reciprocity decays rapidly over time. We analyze donation solicitations sent from a university hospital system to its patients and show that patients are less likely to donate when more time has elapsed since they were treated. In addition to informing our understanding of reciprocity, our results have considerable practical importance, as many charitable organizations raise funds from those who they previously served (e.g., schools, hospitals, religious organizations, humane societies, etc.).

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Past empirical research has been limited in its ability to isolate the effects of time delays on positive reciprocity, and studies exploring this topic have yielded mixed results. Some past experiments suggest that positive reciprocity completely dies out within a day (13–16). However, these studies could not disentangle decaying reciprocity from decaying energy, as they measured reciprocity by examining study participants' work output in response to a wage hike, and exhaustion is a powerful alternative explanation for the decay in output detected over time. Other wage experiments have shown that reciprocity stays constant over the course of several hours (17, 18), but these results could easily be due to the short follow-up periods studied. Finally, two wage experiments showed increases in reciprocity over the course of several hours (19, 20). However, these studies again measured reciprocity by examining worker output, and the findings could well be the result of learning effects, whereby practice allows workers to improve their performance on a task over time.

Past psychology studies offer some support for the possibility that longer delays may decrease generosity. Using a laboratory experiment and hypothetical scenarios, Burger et al. (21) showed that the likelihood of returning a small favor (e.g., the gift of a soda from a confederate, the loan of pizza money or help with class notes from a hypothetical acquaintance) decreases the longer the time delay between receiving the favor and an opportunity to reciprocate. Similarly, Flynn (22) finds that, in workplace surveys and a laboratory experiment, the recipients of favors report valuing them less when more time has elapsed since the favor. However, these intriguing studies relied on small samples and idiosyncratic stimuli, and they often could not disentangle forgetting about a past favor from a decaying desire to reciprocate.

One field experiment by Becker et al. (23) examined how the usefulness of a gift influenced the likelihood that its recipient will choose to reciprocate by completing a survey. Although the relationship between reciprocity and time was not the focus of this research, the authors present evidence that a gift encouraged reciprocal behavior 6 mo later but not 18 mo later (23). Importantly, the same individuals were asked to reciprocate twice, and therefore, the lack of reciprocity 18 mo after the receipt of a gift may be due to the fact that those who reciprocated at 6 mo did not feel the need to reciprocate again.

We build on these past findings with a field study that precisely explores how reciprocity decays over time periods ranging from several weeks to a few months. To investigate how reciprocity changes over time in the field, we partnered with a large university hospital system composed of a network of eight hospitals. Using data from 82,231 outpatient hospital visits as well as 18,515 donation solicitations and responses to those solicitations, we exploit quasiexperimental variation in the delay separating the hospital system's solicitation mailings from patients' hospital visits to study how this delay affects giving. Specifically, the hospital system solicits donations by mailing solicitations to thousands of recent patients on the same date. Because the timing of patients' hospital visits is random with respect to the date of this mailing, we can examine how the delay separating a patient's recent hospital visit from the receipt of a solicitation affects donations. Our key finding is that an additional 30-d delay in requesting a donation shortly after the provision of medical care decreases the likelihood of a donation to the hospital system by over 30%.

Our paper makes several key contributions to our understanding of the relationship between reciprocity and time. First, we document the decay of reciprocity over time in a consequential field setting rather than the laboratory. Second, we isolate a decay in reciprocity separately from a decay in social pressure. In our study, prospective donors receive a request to donate via a mailing that they open in the privacy of their own homes. Past studies of the sensitivity of reciprocity to time delays have always examined people's decisions to return a favor either during a face-to-face interaction, where the request to reciprocate was made by the individual who had already performed a favor for the subject (21), or when the potential beneficiary was in the same room (24–26). These designs not only prevented researchers from separating decays in reciprocity from decays in social pressure, but also introduced the possibility that study participants distorted their behavior because they were aware that they were participating in a research study (21, 22, 24–26). Because the individuals that we study were not aware that their behavior would be observed by researchers, our data are not subject to concerns about experimenter demand effects. Third, our paper isolates the effect of time delays on reciprocity, while many prior studies of gift exchange in the workplace are unable to disentangle the effect of reciprocity from the effects of exhaustion or learning (13–16, 19, 20). Fourth, our study benefits from an extremely large participant sample, which improves the precision of our estimates and allows us to detect statistically significant evidence of positive reciprocity where other studies were underpowered to do so (24).

This large-scale field study explicitly explores the endurance of reciprocity over time. Our evidence that positive reciprocity decays dramatically over time informs economists' understanding of repeated cooperative interactions and suggests the value of capitalizing quickly on opportunities to benefit from a quid pro quo. Our findings are important for practitioners who often choose to wait before soliciting donations from prospective donors after rendering them a service. This common practice of waiting to solicit could lead nonprofit organizations to lose substantial fundraising revenue. Our findings indicate that the loss in fundraising revenue from waiting to solicit is quite large: a back of the envelope calculation comparing our treatment effect with others in the literature suggests that avoiding an additional 30-d delay between providing a service and requesting a donation could improve donation rates by as much as offering a one-to-one matching donation (27). In addition to improving our understanding of how to promote the provision of public goods, the findings that we present have important implications for leading economic models of reciprocity, which currently fail to incorporate sensitivity to time (28).

Methods

Human Subjects Protections. Before the start of this project, the Institutional Review Board at the University of Pennsylvania reviewed and approved our study procedure. Since our project involved analysis of archival data, a waiver of informed consent was deemed appropriate by the Institutional Review Board per Federal Regulation HHS CFR 45.46.117(c) (2).

Data. We received donation solicitation data on adult outpatients who visited the hospital system between May 2013 and April 2015.* Please see Datasets S1–S3 for complete data. To explore the endurance of reciprocity over time, we focus on outpatients who were solicited for a donation by the hospital system's Annual Giving Department in our data window and for whom we have complete information about all hospital visits. This focus leads to two data restrictions. First, we restrict our analysis to patients whose first visit was within our data window, allowing us to observe their full visit history at any of the eight hospitals in the network. Second, we restrict our analysis to patients who were solicited in response to their first-ever visit to the hospital system,† which allows us to cleanly estimate how reciprocal giving is affected by the delay in the

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*The data that the hospital system chose to share with us on charitable giving included all adult outpatients except those who (i) had Medicaid as a form of insurance; (ii) were behavioral health patients; (iii) were younger than 40 y old and therefore, were never mailed solicitations following the hospital system's solicitation protocols; (iv) were patients of certain special medical care divisions (e.g., hospices); (v) had incomplete contact information; (vi) were on the do-not-solicit list; (vii) were employees of the hospital system; or (viii) visited a medical location that was not immediately identifiable as a medical care location within the hospital system.

†The hospital system relied on somewhat ad hoc rules (based on patients' demographic characteristics) that varied from mailing to mailing to determine who would receive solicitations. However, we only study those who received mailings and include fixed effects for mailing date in all analyses, ensuring that these selection criteria do not impact our causal estimates of the relationship between delay and reciprocity.

timing of a solicitation relative to that first visit. These sample restrictions leave us with a large pool of patients ($N_{unique\_patients}$ = 18,515; $N_{outpatient\_visits}$ = 82,231) who were solicited for a donation by our partner hospital system. It is worth noting that our results replicate when we do not make these conservative restrictions and instead include the first observed solicitations by the hospital system to all patients in our dataset (this expands our sample to 149,817 patients, but we are forced to ignore all hospital visits before May 2013, which do not appear in our data) (Table S1).

Table 1 provides main summary statistics for our analysis sample. We report on the demographic characteristics of patients in our sample, the average number of visits that patients made to the hospital system before receiving a donation solicitation, and the average number of hospital visits that a patient made in the 132 d after her first visit[‡] as well as the percentage of patients who donate on receiving a solicitation and the average gift conditional on donation, which was $49.14. The full list of summary statistics is available in Table S2. In Table S2, Models 1 and 2 present balance regressions confirming that the time delay separating a patient's first hospital visit from her first solicitation is (as we will assume throughout our analyses) approximately random with respect to observable patient characteristics.

Econometric Model. Our empirical approach leverages the fact that, while patients' first hospital visits occur continuously throughout the year, donation solicitation mailings from our partner hospital system are sent in batches on fixed dates. On these fixed dates, solicitation mailings are sent simultaneously to all patients whose first visit to the hospital system occurred at any time during a predetermined preceding 2-mo visit window called a mailing cycle. The timing of these batch mailings is such that two patients whose first visits occurred up to 60 d apart but whose first visits occurred during the same mailing cycle would receive solicitations on the same date.

Table 2 shows the range of potential dates of a patient's first hospital visit within each mailing cycle and the associated month and year in which solicitations were sent to patients. The dates associated with a mailing cycle always include two consecutive calendar months (e.g., the first mailing cycle in our data includes patient visits in May and June of 2013). The solicitation mailing date for a mailing cycle is generally a few weeks after the last recorded patient visit date associated with that cycle, as this gives the development office time to organize the relevant patient information and send out mailings.[§] We estimate our effects within mailing cycles. That is, we compare people whose first visit falls earlier in a specific mailing cycle with people whose first visit falls later in that same mailing cycle by including mailing cycle fixed effects in all of our regression analyses.[¶] We take two complementary econometric approaches to estimating the effect of time delays on reciprocity.

Econometric approach 1—time delay between a patient's first visit and solicitation. Our first strategy is to examine the effect of the time delay between a patient's first hospital visit and the mailing of a solicitation request on that patient's donation decision by estimating the following ordinary least squares (OLS) regression:

$$Any\_Donation_i = \beta_0 + \beta_1 First\_Visit\_Delay_i + \beta Controls_i + \epsilon_i, \quad [1]$$

where $Any\_Donation_i$ equals 0 if individual i did not donate in our dataset and 100 if individual i made a donation (therefore, estimated coefficients can be interpreted in percentage points). $First\_Visit\_Delay_i$ is the delay between

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[‡]One hundred thirty-two days is the longest period separating a first hospital visit from a donation solicitation in our data sample. We use the number of visits that a patient made within 132 d of her first visit as a control for a patient's sickliness in some of our analyses.

[§]There are some exceptions to this rule, but we avoid any confounds from these exceptions by estimating our effects within mailing cycles. Namely, if a particular mailing cycle is delayed, this will not bias our estimates, since we will only compare patients from a delayed mailing cycle with each other when estimating the effect of a time delay on giving. Additional details are in SI Methods.

[¶]Since the timing of the first patient visit relative to the end of a mailing cycle is presumably exogenous, we are able to use this variation to generate a causal estimate of the effect of the delay between service provision and solicitation on donation decisions. Patients would need to be strategically timing first visits to the hospital around unannounced and variable solicitation mailing cycle dates for this assumption to be violated. While it is possible for unobserved factors to influence both the timing of each patient's visit and the donation decision, this is unlikely. These factors would have to influence first visit timing relative to the date of the solicitation mailing and simultaneously influence the donation decision. This possibility seems to be ruled out by our tests of the balance of our sample across solicitation mailing delays shown in Models 1 and 2 of Table S2.

Table 1. Summary statistics for main analysis sample

Variable	Summary statistic
Patient demographics	
Age, y	Avg. = 64.19 (SD = 11.45)
Female name, %	45.71
Male name, %	46.14
Gender of name unknown, %	8.15
Hospital visits	
No. of hospital visits between first visit and solicitation	Avg. = 3.42 (SD = 3.11)
No. of hospital visits within 132 d of first visit	Avg. = 4.44 (SD = 4.74)
Donations	
Donate, %	0.83
Donation | donation >0	Avg. = $49.14 (SD = $36.68)
Patients	18,515

The table presents main summary statistics describing our study sample. Sample means are shown, with SDs in parentheses. Several patients' age data were missing from our primary age data source (solicitation administrative data); for these patients, we imputed age from the date of birth in the administrative health data (N = 3,695). To protect patient privacy, imputed age was top-coded at 90 y old in the data. Gender was imputed from patients' first names using the mapping in the work by Morton et al. (30). Avg., average.

patient i's first hospital visit and the date on which he or she was solicited by mail to donate, and β_1 is the coefficient of interest. $Controls_i$ is a vector of controls. In all of our regressions, this vector of controls includes dummies for mailing cycle to restrict comparison with patients within the same mailing cycle as well as hospital and medical department dummies, since different types of individuals may visit different hospitals and medical departments.[#]

We test the robustness of all of our analyses to the addition of additional control variables. One (uninteresting) way that the time delay separating a patient's first visit from a solicitation could affect her donation decision is by changing the number of subsequent visits to the hospital that she has time to make before being solicited, since additional hospital visits may alter a patient's willingness to donate. Therefore, in some regressions, we add controls for the number of hospital visits that a patient made between her first visit and the date when a donation solicitation was mailed. We include dummy variables for each possible number of visits before the solicitation to nonparametrically control for presolicitation hospital visits. When we add controls for the number of presolicitation visits, however, our analyses compare patients with the same number of visits spread out over different time durations (i.e., different time lags between first visit and solicitation), making it critical to also control for the sickliness of patients, since a patient who visits the hospital three times in 1 wk is likely sicklier than a patient who visits three times in 1 mo. In these regressions, we thus also control nonparametrically for the number of visits that patients make within 132 d of their first hospital visit. The addition of these controls along with indicators for the medical department that a patient visited (previously mentioned) proxy for a patient's sickliness. Finally, we also add controls for all observable patient demographic characteristics deducible from data provided by the hospital system, which include gender, age (at date of solicitation), marital status, and state of residence.

As noted above, these empirical specifications rely on the assumption that the delay between a patient's first hospital visit and her first receipt of a solicitation from the hospital system is exogenous after including our vector of controls. Given that it would be nearly impossible for patients to time their hospital visits strategically around (unknown) future solicitation dates,[‖] we are confident that this assumption is valid. Also noted above, consistent with this assumption, Models 1 and 2 of Table S2 report the results of balance regressions, which show that the date of a patient's first visit within a mailing cycle is uncorrelated with observable patient characteristics with either set of controls in place.

Econometric approach 2—time delay between a patient's last visit and solicitation. The large majority of patients in our sample (77.16%) make multiple hospital visits before they receive a solicitation triggered by their first visit. It could be

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[#]Our identification assumption is that a patient's first visit occurs on a random date within a mailing cycle conditional on the hospital and medical department that patient visits.

[‖]Note that the solicitation schedule is set in advance and does not respond to the characteristics of recent hospital patients.

Table 2. Mailing cycle dates

Associated range of dates of patients' first visits	Associated solicitation mailing date
May 1 to June 30, 2013	July 2013
July 1 to August 31, 2013	September 2013
September 1 to October 31, 2013	December 2013
November 1 to December 31, 2013	January 2014
January 1 to February 28, 2014	March 2014
March 1 to April 30, 2014	July 2014
May 1 to June 30, 2014	July 2014
July 1 to August 31, 2014	September 2014
September 1 to October 31, 2014	December 2014
November 1 to December 31, 2014	February 2015
January 1 to February 28, 2015	March 2015
March 1 to April 30, 2015	May 2015

The table describes the timing of mailing cycles and solicitation mailings. The first column reports the range of hospital visit dates associated with the mailing cycle. The second column reports the month and year in which the corresponding solicitation mailing was sent. For example, all patients who visited the hospital between July 1, 2014 and August 31, 2014 would have their solicitations sent on a single date in September 2014. The minimum delay between hospital visit and the solicitation mailing is 24 d. The maximum is 132 d. The median is 68 d, and the mean is 67.34 d (SD 20.94 d).

argued that the delay after service provision most likely to impact reciprocity would be the delay separating a patient's last visit before solicitation and the receipt of a mailing. Thus, our second econometric approach to estimating the impact of a time delay on reciprocity investigates how a delay between a patient's last visit and the date of a solicitation mailing affects giving. This exercise is complicated by the fact that the timing of a patient's last visit is endogenous to her total number of hospital visits, such that more frequent visitors are more likely to have a last visit closer to a solicitation date.

To take advantage of the fact that we expect the timing of a patient's first visit to be exogenous with respect to total hospital visits, conditional on our controls, our second empirical strategy relies on an instrumental variables approach (29), treating the timing of the first visit as an instrument for the timing of the last visit. We estimate our two-stage least squares instrumental variables regressions as shown in Eqs. **2** and **3**:

$$Last\_Visit\_Delay_i = \alpha_0 + \alpha_1 First\_Visit\_Delay_i + \alpha Controls_i + u_i, \quad \text{[2]}$$

$$Any\_Donation_i = \gamma_0 + \gamma_1 \widehat{Last\_Visit\_Delay}_i + \gamma Controls_i + v_i. \quad \text{[3]}$$

As defined previously, $Any\_Donation_i$ equals 0 if individual i did not donate in our dataset and 100 if individual i made a donation (therefore, estimated coefficients can be interpreted in percentage points). $Last\_Visit\_Delay_i$ is the delay between patient i's last presolicitation hospital visit and the date of solicitation. Also, as defined previously, $First\_Visit\_Delay_i$ is the delay between patient i's first hospital visit and the date of solicitation, and $Controls_i$ is a vector of controls, which includes the same sets of variables included in our previously described regressions. $\widehat{Last\_Visit\_Delay}_i$ is the predicted delay between patient i's last presolicitation visit and the solicitation date; it is the exogenous component of $Last\_Visit\_Delay_i$ estimated from Eq. **2**, and γ_1 is the coefficient of interest.

Note that interpreting γ_1 as the causal effect of $Last\_Visit\_Delay_i$ on $Any\_Donation_i$ requires both that the $First\_Visit\_Delay_i$ be exogenous conditional on our vector of controls (which we justify above) and that the only effect $First\_Visit\_Delay_i$ has on $Any\_Donation_i$ is through its influence on $Last\_Visit\_Delay_i$. This means that our second specification is valid only under the assumption that donation decisions are driven primarily by the last presolicitation visit to the hospital and that earlier visits play a negligible role in the decision to donate. Under this assumption, our first specification can be viewed as the reduced form of our second specification.

Results

Donation rates decline as the time separating a patient's hospital visit and solicitation increases. This result holds in both of our empirical approaches described above. Fig. 1 presents the raw correlation between the time delay separating a patient's (first or last) hospital visit from her receipt of a solicitation mailing and the likelihood that a patient made a donation to our partner hospital system.

It shows that the percentage of patients who donate decreases considerably (from almost 1.5 to 0.4%) as the time delay separating a visit from a solicitation increases. This decline over time holds for both the first and the last presolicitation hospital visits.

We observe the same relationship depicted in the raw data in Fig. 1 in our regression analyses reported in Table 3. Models 1 and 2 of Table 3 report the coefficient estimates from our first regression specification, in which we estimate the effect of the delay between a patient's first hospital visit and her first receipt of a donation solicitation on the likelihood of giving. In Model 1 of Table 3, we only include our key controls: fixed effects for mailing cycle, hospital visited, and medical department visited. We find that increasing the delay separating a patient's first visit and her solicitation by an additional 30 d decreases the probability that the patient will donate by 0.30 percentage points ($P < 0.05$). This effect represents a 36% decrease in the donation rate relative to the mean donation rate across the whole sample of 0.83 percentage points. In Model 2 of Table 3, we add additional controls to eliminate the possible impact of "extra" opportunities to visit the hospital presolicitation that may arise when patients' first visits come earlier in a mailing cycle. In particular, as described previously, we add nonparametric controls for the total number of visits that a patient made to the hospital before a solicitation was mailed, nonparametric controls for the number of visits within a fixed window of 132 d after a patient's first hospital visit (a proxy for sickliness), and demographic controls. Our results in Table 3, Model 2 remain extremely similar to those presented in Table 3, Model 1: increasing the lag time separating a patient's first visit from her receipt of a solicitation by an additional 30 d decreases the probability of donation by 0.25 percentage points ($P < 0.05$), a 30% decrease relative to the donation rate.

In Models 3 and 4 of Table 3, we present the results of our instrumental variable regressions. These regressions estimate the effect of the delay separating a patient's last hospital visit from the mailing of a donation solicitation on donation likelihood using the delay between a patient's first hospital visit and the date of the solicitation mailing as an instrument. As shown in Table 3, both F statistics are above 3,000, showing a strong first stage and avoiding any potential concerns about weak instruments (29). Model 3 of Table 3 includes the same controls as Model 1 of Table 3 and estimates that an additional 30 d separating a patient's last hospital visit from the date of her first donation solicitation decreases the

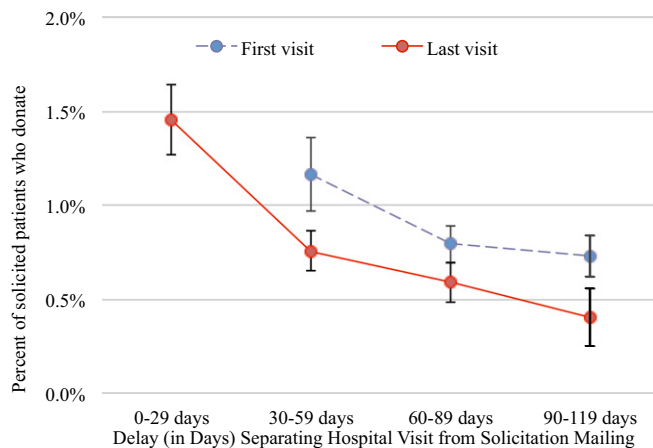**Fig. 1.** This graph presents raw data. The x axis shows the delay separating a patient's hospital visit and the date of the patient's solicitation for a donation. The y axis shows the percentage of solicited patients who donated. The dashed line corresponds to data on patients' first hospital visits, while the solid line corresponds to data on patients' last hospital visits before being solicited.

Table 3. Effect of time delay on reciprocity

Dependent variable: Any donation (0 or 100)	Model 1	Model 2	Model 3	Model 4
Delay (d) between first visit and solicitation ×30	−0.298* (0.122)	−0.247* (0.125)		
Delay (d) between last visit and solicitation ×30			−0.509* (0.208)	−0.407* (0.204)
R^2	0.006	0.019	0.006	0.019
Key controls	Yes	Yes	Yes	Yes
Additional controls		Yes		Yes
First-stage F statistic			3,092	6,757

Models 1 and 2 report OLS coefficient estimates from regressions predicting a patient's decision to donate with the time delay separating that patient's first hospital visit from the date when she was solicited. Models 3 and 4 report coefficient estimates from instrumental variables analyses in which the delay between a patient's first hospital visit and the date of a solicitation mailing is used as an instrument for the delay between a patient's last presolicitation hospital visit and the date of a solicitation mailing. Models 1 and 3 include key controls: dummies for mailing cycle, hospital visited, and medical department visited. Models 2 and 4 add additional controls: dummies for a patient's total number of hospital visits before the solicitation mailings were sent, dummies for a patient's number of hospital visits within 132 d of her first hospital visit (a proxy for sickliness), and controls for gender, age, marital status, and state of residence. SEs are in parentheses.
*$P < 0.05$.

probability of a donation by 0.51 percentage points ($P < 0.05$), a 61% decrease relative to the donation rate. Model 4 of Table 3 includes the same additional controls as Model 2 of Table 3 and estimates a comparable 0.41-percentage point decrease in the probability of donation for an additional 30 d separating a patient's last visit and the date on which the hospital system sent her a donation solicitation ($P < 0.05$). As shown in Table S3, these results remain similar when we include a wide range of different subsets of the full set of controls included in Models 2 and 4.**

We conducted a series of supplemental analyses detailed in *SI Methods* to shed additional light on the psychological mechanism responsible for our findings. If gratitude is a hot state that decays over time, driving reductions in reciprocity, we would expect reciprocity to decay more rapidly among patients with more severe ailments who have more reason to be grateful for their care. To measure ailment severity, we asked three physicians at our partner hospital system to independently rate each of the 11 medical departments that handled more than 1,000 outpatients in our dataset. The physicians unanimously rated oncology, cardiology, and surgery as departments with the most severe cases. We thus classified patients who visited the oncology, cardiology, or surgery departments as "severe" and patients who only visited other rated departments as "not severe." The summary statistics for severe and not severe patients are presented separately in Table S4. We then reproduced our primary analyses (presented in Table 3) separately for severe patients and for not severe patients (presented in Table S5). The results show that severe patients show significantly more pronounced decays in reciprocity over time than other patients ($P < 0.05$ in all Wald tests). While these results suggest that those who were more grateful display more decay, consistent with the possibility that gratitude is a hot state that wanes quickly, we cannot rule out other explanations for the decay in reciprocity among patients with severe illnesses (e.g., income effects).††

To bolster our interpretation that gratitude is central to our decay results, *SI Methods* provides three additional empirical exercises comparing the decay observed among patients who likely had better experiences with the hospital system with the decay observed among patients who likely had worse experiences with the hospital system. In particular, we proxy for better experiences with the hospital system using (*i*) the likelihood of

returning to the hospital system for additional outpatient care, (*ii*) having visited a higher-ranked hospital, and (*iii*) having visited a higher-ranked medical provider based on survey data collected by the hospital system. These three analyses all suggest that reciprocity decays faster (directionally but not significantly) among patients whose experiences were better, consistent with gratitude playing a central role in driving our results.

Discussion

Past research indicates that reciprocity is a major driver of generosity (6, 13). Thus, when an individual receives a service, she may feel inclined to behave reciprocally (e.g., perhaps by donating to the provider of the service in the form of a tip). In this paper, we provide field evidence that such reciprocity wanes over time. Currently, behavioral models of reciprocal motives do not incorporate time sensitivity; instead, they implicitly assume that the willingness to reciprocate is constant (28). Some psychological theories suggest that soliciting reciprocity too soon (e.g., asking a beneficiary of a charitable organization to donate soon after receiving a service) could decrease reciprocity, because the request may be viewed as opportunistic or manipulative (7, 8). Other theories leave open the possibility that reciprocity could decline over time due to either forgetfulness (9) or the fleeting nature of visceral states that may contribute to it (e.g., gratitude) (10–12, 21–22, 24). Our findings inform both economic and psychological theories of reciprocity by providing field evidence that reciprocity declines precipitously over the course of a few months.

We study decays in reciprocity by examining patient decisions about giving to a university hospital system that has provided them with medical care. We show that reciprocity decreases as the delay between a visit to the hospital and a solicitation for a donation increases. An additional 30-d delay in requesting a donation after a patient's first hospital visit decreases the likelihood of a donation by 30% or more, while a 30-d added delay separating a patient's last hospital visit from a solicitation decreases donations by ~50%.

Our results significantly extend past research by cleanly isolating the relationship between reciprocity and time in a field setting. The rate of decay reported in our paper is roughly five times slower than that reported in the study of favors by Burger et al. (21), which finds that the tendency to return a small favor declines by 64% over 1 wk. However, given that we study positive reciprocity toward a hospital system providing potentially life-saving treatment and Burger et al. (21) explored positive reciprocity toward someone who provided a trivial favor (e.g., offering a stranger a soda), it is unsurprising that we find more persistent reciprocity. It is also likely that participants in the studies by Burger et al. (21) simply forgot that they had received a small gift 2 wk prior, while the donation solicitation letters that we studied ensured that

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**We also examine the effect of a time delay on the donation amount (in natural logs, with log donation amount equal to zero for nondonors) in Table S10 to determine if a time delay influences the amount donated. Consistent with our main result that a time delay in soliciting a donation decreases the proportion of individuals who give, we find that the unconditional donation amount decreases as the solicitation delay increases.

††For example, patients with more severe illnesses have to spend more money on treatment, leaving them less able to donate to the hospital over the duration of the treatment.

participants recalled their interactions with the hospitals requesting reciprocal donations. In addition, the rate of decay in reciprocity that we detect is roughly four times faster than the rate detected by Becker et al. (23). However, Becker et al. (23) measure decay in reciprocal behavior by examining whether households agree to participate in a national survey both 6 and 18 mo after receiving a gift and therefore cannot isolate a decay in reciprocity from the possibility that households are unwilling to reciprocate twice for a single gift.

Our findings have immediate practical implications for charitable organizations. Organizations that provide a service or otherwise interact with potential donors may be able to dramatically increase donation rates and fundraising revenue by decreasing the delay between an interaction with a prospective donor and a donation request. Comparing our effect size estimates with those from past research suggests that, for an organization like the one that we studied that sends out solicitation requests every 2 mo, changing to a schedule involving solicitation mailings every month could increase donation rates by as much as introducing a one-to-one donation match incentive.[‡‡]

Finally, while our analysis focuses on charitable giving to a university hospital system, our results speak to contexts outside of charitable giving. Since reciprocity is important across a wide variety of contexts, our findings have implications for our understanding of myriad social interactions. For example, stores may increase long-term customer loyalty if they can decrease the time between a customer's initial purchase and her next visit. Partnerships may enjoy greater longevity and success if both parties engage in frequent contact early on in relationships. Also, after two people first meet, they may be more prone to collaborate toward a shared goal the sooner that such an opportunity presents itself. To the extent that the time delays separating interactions can be controlled, it may be valuable for individuals and organizations to consider our findings regarding the time sensitivity of reciprocity when scheduling such interactions.

[‡‡]In our setting, we find that a 30-d decrease in delay increases donation rates by at least 0.3 percentage points. Estimates from previous experimental work have found a similar 0.3 percentage point increase in donation rates due to the introduction of a one-to-one match (27).

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