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Generosity during COVID-19: investigating socioeconomic shocks and game framing

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This paper investigates two research questions. First, we examine the impact of the negative socioeconomic shock of the COVID-19 pandemic on generosity towards different types of recipients, and changes in generosity as the shock worsens over time. This is carried out by analysing the responses of 1255 US citizens to four dictator games played over 8 weeks of the early stages of the COVID-19 pandemic, corresponding to four different recipients: relatives, neighbours, strangers, and the state. Second, we investigate whether the order in which the games are played create a framing effect that influences social preferences in terms of generosity towards the different recipients. Results capture an increase in generosity despite the worsening pandemic, indicating strong perceived increasing marginal benefits of generosity in times of hardship. There is significant heterogeneity in the effects of additional regressors, such as perceived contagion risk, on the likelihood and amount donated to strangers, family members, or the government. At the same time, some significant effects of framing bring new evidence regarding the stability of social preferences.

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Introduction

During the Second World War, thousands of citizens protected European Jews from the Holocaust. The "Righteous Among the Nations" bravely put their lives and their families' lives at risk, saving neighbours, friends, as well as perfect strangers from an atrocious destiny through acts of altruism. Although such generous acts are generally overshadowed by the grave crimes against humanity during the war, indeed many other circumstances in history—for example, natural disasters such as the 2004 Indian Ocean Tsunami—have revealed how altruism and generosity flourish during hard times. This provides a strong indication for the proliferation—in some capacity—of positive social preferences amidst a negative socioeconomic shock.

The COVID-19 pandemic is a unique epidemiological event in modern times with severe socioeconomic consequences, presenting an academic opportunity to investigate social preferences within the context of negative socioeconomic shocks. Prolonged isolation through virus containment measures, and its direct economic consequences, along with fear inflicted through unrelenting media coverage of increasing deaths likely affected social preferences in different ways. In fact, mixed outcomes have been witnessed; whilst positive altruistic behaviours were rife (e.g. large donations to hospitals for ventilators, shopping for neighbours in high-risk categories), other actions such as not complying with lockdown regulations were displays of self-oriented preferences.

This paper analyses altruism trends and the stability of social preferences during the COVID-19 pandemic in the United States (US)—one of the worst-hit countries. For instance, at over 0.9 million, the US has recorded the highest number of deaths in the world since the start of the pandemic as of April 2022 (Johns Hopkins University, 2022). This paper regards as a large negative socioeconomic shock the drastic effects on the US economy of the first emergency lockdown measures enforced by the US government to contain the rapid spread of the novel coronavirus, including an unprecedented increase in unemployment rates and shrinking GDP (Economic Commission for Latin America and the Caribbean, 2020).

As the primary objective of this paper, altruistic behaviour trends towards relatives, neighbours, strangers, and the government (to support social services) are examined in an online experiment: participants from the states of California, New York, and Washington play four dictator games, each for the four types of recipients considered. Results of the experiment are from a period of eight weeks of data collection, where each week a different set of individuals play four dictator games. Eight weeks are assigned to the experiment to allow for a dynamic concept of generosity in place of a static vision, given that when exposed to negative exogenous shocks, altruistic behaviours are not likely to remain constant but instead could change over time.

Results from the experiment show how generosity towards each category evolves: there is an increasingly positive correlation of time spent in lockdown with the amount and likelihood of donations towards all types of recipients, with self-reported concern for the pandemic playing a positive and significant role as well. These findings are remarkable, as one might expect generosity to fall as a consequence of the high price of donating (in the context of the drop in employment rates and financial resources recorded in the US in that period). However, whilst negative economic circumstances do influence self-regarding preferences to some extent, (for example, results show low mean donations towards anonymous recipients compared to the rest of the literature), the overall conclusion of this paper is that there appears to be an increase in the perceived marginal benefit of donating. Of course, the marginal benefit of donating is not homogeneous across different recipients – for instance, as one might expect,

being concerned by COVID-19 has a stronger effect on generosity towards familiar recipients.

As a secondary objective, this paper analyses the stability of social preferences. Specifically, the design of the study provides a comparative advantage, which allows for an investigation of the effect of framing on the stability of social preferences. Perfectly rational answers on the four games should not depend on their order (in fact, the games were administered in random order). If however, the order the games are played in has an influence on the amount donated, it could mean that some decisions may be a reference point for other ones. For example, since donations towards relatives are the highest on average, one could expect that if the dictator game with a relative is played first, this would set a reference point to cap the set of possible donations for all the following tasks, thus negatively affecting donations in the remaining games. Indeed, the results in some cases capture this framing effect, with lower donation amounts recorded when a relative's game is played first. The results also detect another framing effect: the order in which the dictator games are played has a significant influence on the donations towards anonymous recipients. This suggests that when a direct bond between the agents is lacking, social preferences are more unstable.

Understanding generosity is far from straightforward. Economic models view social preferences as a composition of a wide array of motivations such as reciprocity, efficiency concerns (Charness and Rabin, 2002), trust (Berg et al., 1995), or the cold prickle effect (Korenok et al., 2014). In the particular case of a crisis or perceiving another in pain or difficulty, social preferences are likely to be linked to feelings of empathy and compassion (Adena & Harke, 2002; De Waal, 2008; Story et al., 2015). For example, when investigating the role of empathy, Story et al. (2015) find that participants respond with stronger altruism towards those clearly in distress: when asked to divide money versus dividing pain (electric shocks) with recipients, a larger share of individuals allocate more painful stimuli to themselves. Within the context of the COVID-19 pandemic, such feelings of empathy are the more likely source of generosity observed within this particular experiment, given the extensive media coverage of individuals in pain or suffering strong negative consequences. Baseline altruism displayed towards anyone in pain however—irrespective of one's relationship to the recipient—has been found to be related to the "warm-glow" effect (Andreoni, 1989) and its feeling of reward in helping others, as well as pure distributive concerns fuelled by sentiments of fairness and justice (Fehr and Schmidt, 1999).

In the last decade however, extensive literature has challenged previous models of social preferences as being only related to monetary outcomes, highlighting contradictions in individuals' behaviours during dictator games (Krupka and Weber, 2013; Capraro and Vanzo, 2019). In reality, generosity could significantly differ depending on the nature of the relationship one has with the recipient—i.e. the "social distance" with others (Bohnet and Frey, 1999). As such, perceived social and personal norms have been found to influence behaviours, with the latter being particularly explanatory in dictator games (Capraro and Perc, 2021). For example, Leider et al. (2009) demonstrates that in the case of directed altruism, which favours friends over random strangers, the former is stronger than baseline altruism. Moreover, directed altruism is stronger even in the case where the individual takes into account possible reciprocity in future interactions. Similarly, Guala and Filippin (2017) find group identity—the part of an individual's self-concept derived from the affiliation with a social group—is a relational factor which can significantly influence people's attitudes towards monetary allocations.

Of course, individuals also behave very differently depending on context (Laury and Taylor, 2008), their gender (Heinz et al., 2012), or whether the resources to donate are earned with effort (Cherry et al., 2002). Additionally, framing effects can influence altruistic behaviours, with Guala and Filippin (2017) demonstrating a significant role of framing on attitudes towards monetary allocations, which is observed in this experiment, and discussed at length in the following sections. Dreber et al. (2013) also investigate the assumption of preference stability by exploiting social framing effects, although they find that dictator games are not that sensitive to social framing effects (yet details like the name given to a game or the order of the tasks do still affect behaviours).

Taking this literature into consideration, the analysis of relationally-differential dictator games in this experiment is accompanied by an examination of the role of other variables such as gender, demographics, and the effect of anxiety on generosity. Additionally, in line with the rest of the literature (Andreoni and Miller, 2002; Guala and Filippin, 2017), the four dictator games are presented to players in randomised order to control for framing effects.

The next sections of the paper are organised as follows: the section "Methodology" summarises the design of the experiment, sampling methods, participants' characteristics, procedure, and a description of the main variables of interest; the section "Results" is divided into descriptive and inferential statistics; concluding remarks and possible future developments are then presented in the "Discussion" section.

Methodology
Data. A total number of 1255 subjects were recruited on Amazon Mechanical Turk over eight weeks for an online experiment, resulting in a repeated cross sections data set. Each participant was paid 0.30 dollars, and recruitment was run between Monday and Wednesday for 8 weeks starting on the 30th of March 2021.

To best observe how individuals with similar backgrounds reacted to varying COVID-19 pandemic intensities across the weeks, the recruitment was focused on three states in the United States: New York, Washington, and California (the distribution of the sample by state was 36.58%, 22.16%, and 41.26%, respectively). These three states were chosen as their populations displayed similar sociodemographic indicators (see Appendix 2: Table 9) and similar political preferences (the Democratic Party won the majority of electoral votes during the 2020 Presidential elections in all three states), their state governance measures for COVID-19 were similar and were implemented in similar timeframes (see Appendix 2: Table 10), but the three states experienced different intensities of the pandemic. For instance, the cumulative COVID-19 cases within the period of the experiment per 10,000 population were 595 for California, 965 for Washington, and 6819 for New York (see Appendix 2: Figs. 7–10 for a presentation of these trends).

The original intention was, for the desired power of 0.80, to be able to detect effects between 0.30 and 0.35 standard deviations, in line with other dictator game experiments (Engel, 2011). Across the 8 weeks, a total of 1255 participants currently living in the US were recruited, which corresponds to 156 observations per week on average, in line with the initial target.

Table 1 shows the main characteristics of the sample investigated. Compared to the population of reference from the three states considered, age categories 25–34 and 35–44 are over-represented, while lower percentages of individuals above 65 years old participated in the experiment (as is frequently the case with M Turk data collections (McDuffie, 2019)). Such an over-representation of youth would expect to yield average donations lower than that of a sample with a higher proportion of older participants. This is due to the literature finding older adults to be more generous and more inclined towards equitable donations than younger adults (Romano et al., 2021; Roalf et al., 2012; Bekkers, 2007). In terms of educational attainments,

Table 1 Descriptive statistics.					
Variables	**Percentage**		**Variables**	**Percentage**	
	Population	**Sample**		**Population**	**Sample**
Gender			**Age**		
Males	49.0	50.6	15–24	13.0	14.8
Females	51.0	48.3	25–34	14.0	42.2
Non-binary		1.1	35–44	12.6	19.4
Other		0.1	45–54	12.6	12.3
			55–64	12.8	9.0
			65–74	9.8	2.0
Education			75+	6.6	0.3
Some high school no diploma		0.58			
Trade/technical/vocational		2.66			
High-school graduate diploma		7.66			
Some college credit no degree		13.26			
Professional degree		1.62			
Degree level		74.20			
Employment			**Employment 1 month before**		
Employed		57.13	Employed		61.37
Self-employed		16.61	Self-employed		17.07
Homemaker		4.36	Homemaker		4.36
Student		6.91	Student		7.17
Out of work (looking for)		8.93	Out of work (looking for)		5.73
Out of work (not looking for)		3.32	Out of work (not looking for)		1.95
Unable to work		2.02	Unable to work		1.63
Military Retired		0.20	Military Retired		0.20
Other (please specify)		0.52	Other (please specify)		0.52
Number of observations 1355.					

the share of the population without a high-school diploma is under-represented as more than 70% of the sample holds at least a bachelor's degree. Finally, when evaluating differences between the employment status once the experiment is completed and one month before, there is a 4.7 percentage point net shift from working to unemployment positions, in line with the drastic increase in unemployment recorded during the COVID-19 pandemic.

Regarding the games, as a first task, participants were required to complete four dictator games, administered in random order; each game had similar wording: "Imagine that today you have been given 1000 dollars. How much of this amount are you willing to give to […]". However, the four games differed in the hypothetical recipient: an anonymous person X, the current government ("to support public services"), a relative, and a neighbour. These four decisions were all independent, and an integer number between 0 and 1000 could be typed as an answer.

After the dictator games, participants were required to fill in a questionnaire on socio-demographics, attitudes and feelings. In particular, information was collected on gender, age, current and previous (one month before) employment status, education, and marital status. In the second part of the questionnaire, respondents were asked about their feelings in the previous week, including their considerations towards COVID-19, the current government, the ability to complete daily tasks (related to the ability to manage workload and home duties), and their financial security. To conclude, the dataset obtained online was enriched with state-specific information on COVID-19 (number of total deaths and cases, and their percentage increase from the previous day, as well as unemployment statistics)[1].

Econometric model specifications. Starting from Ledyard's (1995) model, we assume that an individual i's utility depends on her own payoff, and on the payoffs of two groups of subjects: those who are in close contact with i, js (such as relatives), and others that i does not know directly, anonymous individuals ks. The utility function for i then becomes:

$$U_i\left(x_i, y_{1\ldots\ldots J}, z_{1\ldots\ldots K}\right) = x_i + \sum_{j=1}^{J} \beta_{ij} y_j + \alpha_i \sum_{k=1}^{K} E[z_k]$$

where x_i is i's monetary payoff, β_{ij} an individual-specific altruism coefficient for individuals known to i, and α_i a generic coefficient that represents i's altruism towards anonymous individuals. Furthermore, y_j and z_k are the payoffs of known and anonymous individuals respectively.

The analysis of this paper aims to investigate three main hypotheses through econometric estimation:

H1: The negative socioeconomic shock caused by the pandemic is significantly and positively related with the marginal benefit of donating, and hence increases dictator game donations across the eight-week period.

H2: The magnitude of the increase in donations significantly differs when different recipients are considered.

H3: The order in which the dictator games are played i.e. framing effects, have a significant impact on the amount donated.

In order to investigate these hypotheses, we estimate the econometric model on the amount donated such that:

$$Y_{im} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \varepsilon_{im}$$

where Y_{im} is the amount donated by the individual i to the recipient m_k, X_{1i} a vector of variables on the information i gets on the negative socioeconomic shock, X_{2i} represents self-reported i's feelings towards the pandemic (including the concern),

X_{3i} summarises demographic variables, and X_{4i} a vector of ordering-related regressors to investigate the role of framing.

The main estimation strategy for analysing the experiment results is a Tobit regression on the amount donated for each dictator game (continuous variable with a range of 0–$1000). A Tobit model is used as the main regression since, in line with the rest of the literature, our data shows a corner solution of the dependent variable at 0 (Fig. 3), and a Tobit model allows us to consider this accumulation. Under the Tobit model, the partial effect of each x_{ij} on the conditional expectation of $y > 0$ is given by $\frac{\partial E(y|y>0, X)}{\partial x_j}$. Other models are then proposed within the robustness checks, for example, OLS and Logit models are estimated, with the latter a regression on the probability of donating (i.e. the dependent variable is a dummy which is equals to one for a positive donation).

Several regressors are considered in inferring the dynamic effect of the pandemic on generosity. The first vector of regressors includes the total number and daily percentage changes in deaths and cases (see Figs. 7–10 in Appendix 2 for plots of these variables by state), the state-specific unemployment rate and amount of individuals receiving benefits, together with answers on financial security and employment (current and one month before). It is worth noting that percentage change variables take into account the time of the daily announcement for a certain state: this is because doing the experiment before or after a certain announcement (a positive or negative change of the situation) could impact the respondents' answers. The second vector of regressors includes further information collected in the questionnaire such as the role of concern for COVID-19, trust in the government, personal mood (including anxiety), and the week in which the experiment is completed. The third vector captures demographic variables (gender, age, marital status, education, and the state of residence).

As an identification strategy, we use the variable on self-reported concern for COVID-19 to infer how the dictators are emotionally affected by varying levels of exposure to the negative socioeconomic shock, investigating then its correlation with donations. "Concerned by COVID-19" is a categorical variable capturing the level of concern for the pandemic's impacts: it is explicitly included to control for possible endogeneity on the amount donated, if we consider the possibility that generous people might also be those easily affected by shocks in general. The presence of such endogeneity would result in a misleading conclusion on the significance level and direction of relationships. The solution we adopt explicitly accounts for such endogeneity by controlling for generosity being affected by inherent levels of emotion.

To conclude the description of the variables, given the order of the different games were randomised for each respondent, the fourth vector takes into account when a certain dictator game is completed compared to the other three, and a dummy variable to consider the cases in which the game on relatives is played first. To see why this is important for capturing possible framing effects (which, in theory, should not affect our preferences and decisions), consider the following example. Let us imagine that a respondent needs to divide funds with an anonymous person as first game, and the choice would be a number between 0 and $1000. In theory, the same range of options would be available in the case the participant played the anonymous game second and the relatives (or known person) game first. However, as stated in H3, our prior is that in the latter case the players' (subconscious) perceived range of possible donations towards the anonymous recipient would be reduced from zero up to the donation to the relative - their new reference point—therefore recalibrating the

donations to lower numbers than would've been the case had the range of possible donations been within 0 and $1000.

Results

Descriptive statistics. Data collected across the 8 weeks show how participants exhibit a diverse range of generosity behaviours towards each of the recipients. Figure 1 summarises mean donations in the four different dictator games. As expected, given a stronger emotional bond, donations to relatives are strikingly higher than any other dictator game considered: on average, participants are willing to give relatives $300—almost one-third of the total amount received. The other three dictator games exhibit average donations closer to each other, with anonymous recipients receiving the least on average ($90), followed by donations to neighbours ($120) and the government ($136) (through donations to finance public services).

How participants' self-regarding and other-regarding preferences discriminate between recipients is reflected in the contrasting differences in probability densities of donations by recipient (Fig. 2). The density mapping of donations to relatives appears much smoother, whilst donation densities to anonymous individuals in particular, and non-relatives in general appear to be skewed towards donations less than $50. This indicates stronger other-regarding preferences for known recipients. Additionally, plotting the cumulative donations by recipients shows that whilst only around 10 percent of the sample donate 0 to relatives,
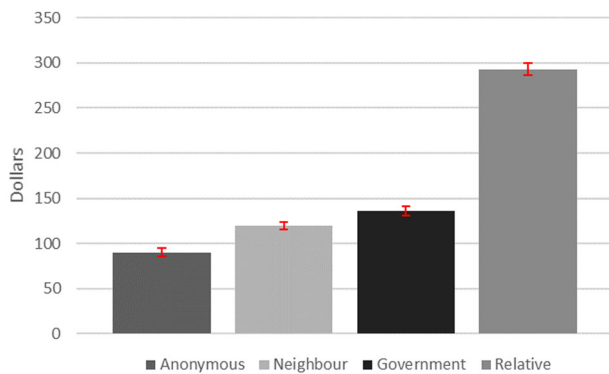
around half do not share anything with anonymous recipients, and 40% do not donate to neighbours and government (Fig. 3).

There also appears to be between-state variation in responses from the three states (Fig. 4), with New York residents' donations in all four dictator game types being the lowest compared to respondents in other states. New York respondents' donations to anonymous recipients are also the lowest average donations overall. Washington residents seem particularly generous towards neighbours and relatives (compared to government). Lastly, Californians appear more altruistic towards anonymous individuals and the government compared with the other two states.

Considering demographic information, women appear to donate less than men on average, in all dictator games except on relatives: Fig. 5 shows the discrepancy in donations by gender, which will be discussed further in the inferential statistics section.

To conclude the descriptive statistics, it is crucial to focus on the dynamics of donations across the 8 weeks of investigation: as time passes during this period, the coronavirus pandemic becomes more burdensome in the US, and citizens are in lockdown for an increasing amount of time. Figure 6 shows how donations change over time, providing preliminary insights into our hypothesis on increasing generosity over time. Overall, all four mean donations increase between the 1st and the 8th week, following similar patterns even if with different gradients: while donation increases are flatter for relatives, donations corresponding to anonymous games more than double in 2 months, and double in the case of dictator games on neighbours and government.

Inferential statistics. In this section, regression results from the main estimation strategy as well as the robustness checks are presented, with results for all four recipients presented together under each regression model, for ease of comparison.

The main estimation strategy for analysing the experiment results is a Tobit regression, and Table 2 summarises the results of the four dictator games. The first two variables in Table 2, "Concerned by COVID-19" and "Percentage change in deaths" attempt to capture sentiments of anxiety and fear. The ordinal variable on being concerned by COVID-19 shows varying degrees of significance across dictator games, with the relatives game donations increasing significantly with increasing concern. In fact, concern for COVID-19 generally is significantly and positively related to donations for all recipients except anonymous individuals. It is also interesting to note that this is the only variable of significance in the Tobit regression for the relatives game. The daily percentage change in deaths on the other hand have no significant relation with any of the dictator game donations, although interestingly there is a positive

Fig. 1 Mean donations by receiver. Average donations in the four dictator game types are given, along with mean standard error bars.
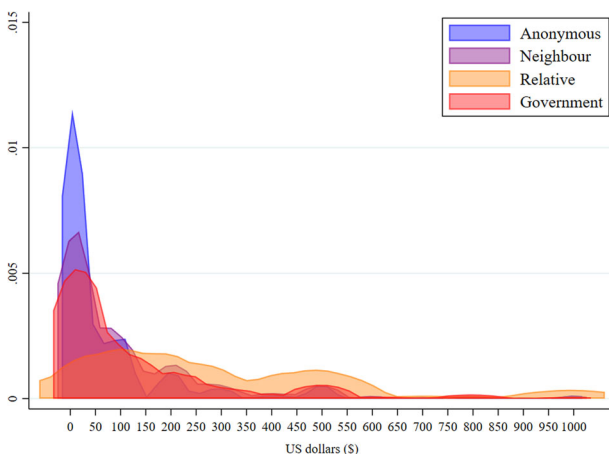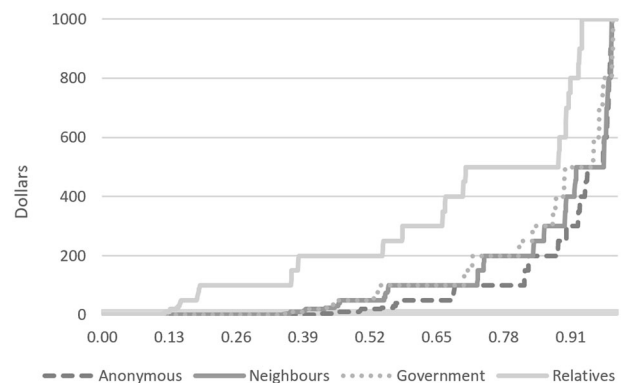

Fig. 2 Probability densities of donations by receiver. Distributions of the probability of donations falling within 0 and US$1000, for each of the four dictator game types.

Fig. 3 Cumulative donations by receiver. Cumulative distribution of donations in the sample of each of the four dictator game types.
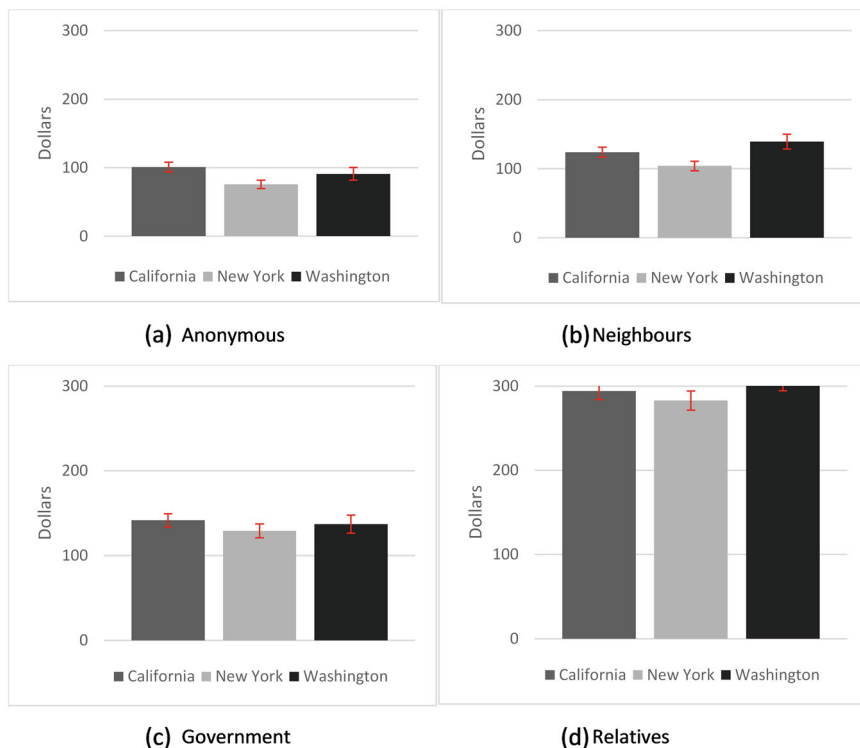
Fig. 4 Average donations by state, for each dictator game type. Mean donations in California, New York and Washington states, by the four dictator game types: **a** anonymous **b** neighbour **c** government **d** relative.
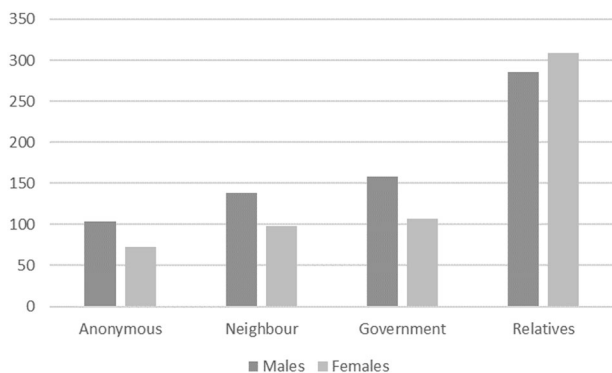

Fig. 5 Average donations by gender, for each dictator game type. Mean donations by female and male for each of the four dictator game types.
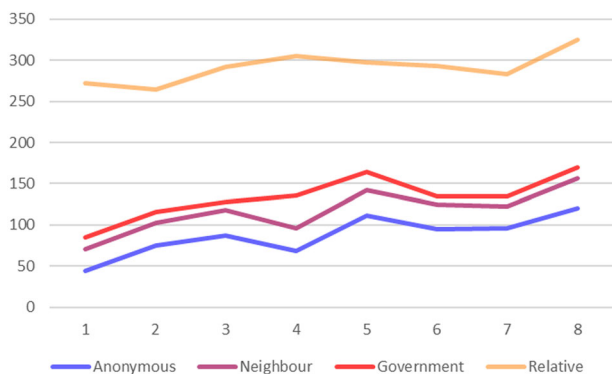

Fig. 6 Average donations by week. Mean donation recorded in each week of the 8-week experiment, by dictator game types.

correlation with donations in the relatives and neighbours games, whilst anonymous and government games see a negative estimate.

Some interesting results emerge when analysing the effect of time spent as the pandemic worsens. For neighbours in particular, there is a significant correlation of every additional week with the amount donated, with a peak of an additional $243 being donated by week 8 compared with the first week. A similar pattern of increasing generosity over time is observed for the anonymous and government dictator games. In fact, week 8 captures the highest increase in donations against week 1 in *all* games, with neighbour, anonymous and government games showing significance at the 1% level. This provides evidence for H1.

Lastly, some compelling results emerge on the framing effects of changing the positions in which the four dictator games are played. Focusing on anonymous recipients, whenever the anonymous game is not played first, the amount donated to anonymous recipients drastically reduces. In particular, playing this game second brings the lowest amount donated, as well as a significant reduction in the probability of donating. Focusing on neighbours as recipients, a significant negative impact is seen for donations to neighbours when the relatives game is played first. On the other hand, playing the neighbour game second or third compared to first has a significantly positive effect in the Tobit regression on donations to neighbours. Similarly, second and third positions significantly increase the likelihood of a positive donation by nine percentage points (compared to playing it first). Lastly, for both the games towards a relative and the government, the ordering does not bring significant effects.

Robustness checks
OLS regressions. The first check is done through OLS regressions on the same independent variables as in the Tobit regressions (Annex 1—Table 3) (please refer to section "Econometric model specifications" for a full rationale on the choice of Tobit over OLS

Table 2 Tobit regressions on amount donated, by receiver.

Variables	Relatives	Neighbours	Anonymous	Government
Concerned by COVID-19				
(against baseline of "Strongly disagree")				
Disagree	251.64* (142.22)	251.54* (149.95)	125.50 (101.74)	241.66* (134.27)
Neither Agree nor Disagree	235.49* (138.17)	238.77 (145.83)	32.84 (95.33)	236.05* (125.42)
Agree	281.32** (134.87)	244.41* (144.61)	39.07 (92.97)	235.81* (122.84)
Strongly Agree	357.64*** (135.61)	258.67* (144.90)	43.83 (93.76)	265.14** (123.13)
Percentage Change Deaths	1.19 (1.09)	0.60 (.85)	−0.78 (0.93)	−0.14 (1.01)
Week				
(against baseline of first week)				
2nd	51.32 (57.61)	128.82*** (40.89)	64.63 (42.58)	79.31* (45.96)
3rd	91.01 (64.69)	135.9*** (46.54)	59.62 (48.55)	107.31** (52.90)
4th	133.59 (81.56)	193.45*** (60.00)	105.58** (59.93)	150.07** (68.54)
5th	107.57 (77.85)	198.90*** (56.55)	106.94** (57.90)	155.16** (64.45)
6th	112.03 (82.46)	221.07*** (61.72)	124.78*** (62.99)	133.74* (69.36)
7th	56.44 (77.48)	158.81*** (53.52)	95.96* (55.95)	120.16* (61.75)
8th	145.34* (80.99)	243.88*** (60.50)	149.21*** (63.26)	200.18*** (66.83)
Relatives Game First		−42.54*** (16.21)	−3.71 (15.87)	−25.30 (17.56)
Game Position				
(against baseline of game of interest being played first)				
2nd	3.24 (23.62)	32.88* (19.62)	−59.7*** (21.44)	−4.30 (22.28)
3rd	1.58 (24.78)	49.02** (20.30)	−44.12*** (19.97)	−18.56 (21.77)
4th	−2.06 (22.59)	25.87 (20.13)	−39.81** (21.44)	18.11 (23.60)

Other control variables added to each regression were: Education; Age; Marital Status; Gender; State dummies; Agreeing with the statement "COVID-19 could harm my family"; Agreeing with the statement "The current government is credible"; Self-reported anxiety in the previous week; Employment Status; Employment Status one month before; Unemployment Rate (weekly, by state of interest); and New Unemployment Benefits (weekly, by state of interest). Standard errors are heteroskedastic-consistent. Significance levels: *10%; **5%, ***1%. Observations: 1245.

as the main estimation model). As with the Tobit regressions, there is a particularly strong and significant relation with the amount donated for those who select "Agree" or "Strongly Agree" for the question on "Concerned by COVID-19" in the relatives games, and there are also similar results considering the number of weeks passed. Additionally, playing in the weeks after the first one significantly increases the amount donated in all games, and is highly significant in the neighbours and anonymous games (and highly significant for week 8 in the government game).

Quantile regressions. As shown in Fig. 2, answers from the experiments are in line with findings in the rest of the literature on dictator games, where a large share of participant give zero to the recipient. For this reason, second and third quantile regressions are performed for all games (Annex 1—Tables 4 and 5, respectively). Regarding self-reported concern for the pandemic, the quantile regressions for the relatives games show a significant effect once again. The amount donated also increases across the period of analysis, even if not always in a monotonic way: in fact, in both quantile regressions there is a small drop in the increase in week seven (this is also seen in Tobit and OLS regressions). From the neighbours game, we see a positive and highly significant effect of weeks from week 5 onwards, with the Q.75 regression showing larger effects. Lastly, a result in the relatives game which is uncommon to the other dictator games is the effect of the percentage change in deaths on the amount donated: for high amounts (Q.75), a positive change significantly increases donations by around 3%, on average.

Logit regressions. Logit regressions are also run, which show the average marginal estimates of the same independent variables in the Tobit regressions on the probability of donating (Annex 1—Table 6). As with the Tobit regressions, there is a clear indication of increasing probability of donating as the weeks progress, with the week 8 regressor capturing the highest effect in all games. This provides further evidence for H1. In the relatives game, being concerned by the pandemic as well as the percentage change in deaths have a significant relation with the probability of donating (these variables are not significant for the other games).

Number of weeks as a discrete variable. As an alternative robustness check, a Tobit using the number of weeks as a discrete variable has been considered: in this case, the interpretation of the point estimate would change from the average donation in the nth week to the change in average donation from each additional week. As shown in Table 7, this regressor brings similar results compared to the initial model: it remains positive and significant for government (5%), neighbours (1%), and anonymous (5%) recipients.

Other regressors. Table 8 in Appendix 1 reports the correlations of a few carefully selected additional regressors—given their prominence in the wider literature on dictator games—with the dependent variable. Overall, these regressors rarely show any significant correlations with donations towards relatives.

Regarding socio-demographic variables, respondents who are married or in a domestic relationship donate more than single respondents in anonymous, neighbour and government games. Gendered effects are captured as female respondents donate significantly less to the government, and significantly more to relatives, than male respondents (see also Fig. 5). Higher unemployment rates significantly reduce donations to known recipients. Lastly, older respondents donate less than those aged 18–24.

There is a significant positive correlation between self-reported anxiety, as well as believing in the credibility of the current government, with the donation amount elicited in all games (except the relatives game). Interestingly, living in different states brings some significant estimates: donations from Washington are significantly higher for all four dictator games, while New York participants donate less than Californians.

Discussion
The results of this experiment show that a negative socio-economic shock such as COVID-19 and its associated lockdown

measures are related to a largely positive change in altruistic behaviours. This is unexpected since we can exclude a possible decrease in price of donations due to forced savings, considering the mostly negative answers on self-reported financial security. These findings are also contrary to evidence from two other recent studies conducted on the effects of COVID-19 lockdown on social preferences; Buso et al. (2020) find selfishness increasing in participants when lockdown measures become longer— although this effect is partially explained by a lack of "social embeddedness" i.e. circumstances where lockdown spent away from one's hometown and/or without housemates. Likewise, Lohmann et al. (2020) find a significant increase in antisocial behaviour for those individuals more intensively exposed to the virus.

On the possibility of a skewed sample affecting results (since the sample recruited through M Turk displays some population over-representation (Table 1)), Berinsky et al. (2012) find M Turk to have sufficient internal and external validity, being more representative and diverse than student samples or local convenience samples typically used for behavioural economics enquiries. They also note habitual responding or self-selection to be a minor concern. In any case, an attention check carried out with respondents asked to select "Strongly Agree" helps eliminate concerns regarding invalid responses.

In a sense, policies adopted during the pandemic can be viewed as a different form of social distancing depicted in the dictator game literature so far (Hoffman et al., 1996; Bohnet and Frey, 1999). In Hoffman's research, however, "isolation" of the donor through single and double blinded dictator games results in data to support the hypothesis that as social isolation increases, there is a further shift toward lower offers. Given that this is not in line with the current study, a closer look at the regressors is warranted.

When considering the regressors capturing negative sentiment around the health aspects of the pandemic (anxiety; concerned by COVID-19), positive correlations on donations are strongest in the anonymous dictator games. Similarly, regressors capturing negative economic impacts (unemployment rate; employment status before and after experiment; financial status), have the strongest positive relation on donations and likelihood of donations in the anonymous and government dictator games. A likely explanation here is that the increase in overall economic and health fallout from the pandemic increases the perceived marginal benefit of donating. This effect is stronger towards anonymous recipients for whom we have the least amount of direct information about, and where perceptions are instead fed by media, thus evoking sentiments of empathy described in De Waal, F. B. (2008). It is worth noting here that we are able to dismiss changes in unobservable personal characteristics impacting social preferences systematically week on week, since all personal characteristics (for which data was collected) are controlled for, and a robustness check verifies that the relative composition of the sample by age, sex, and education does not vary that much during the experiment.

Whilst the different model specifications in the robustness checks indicate generally consistent results with the Tobit regressions, some regressors such as the order in which the individual game are played provide different results. Additionally, regressors which help to explain the phenomenon of increasing donations during lockdown do not have homogeneous effects across the different dictator games. For instance, the percentage change in deaths is not a significant regressor in general, with one interesting exception: for high donations towards relatives, it has a positive effect on the amount donated. High donations could indicate a positive bond with relatives, and intuitively a negative context in terms of deaths could trigger empathy sentiments and the need to protect whoever is part of the family. Furthermore,

almost all the other independent variables in the relative's dictator game are not significant. Donations towards relatives probably depend on much deeper social dynamics, built across years of relationship – these aspects are probably not captured by the regressors considered. For example, direct lines of communication (not recorded in this dataset) would have a strong effect in bridging perceptions to reality.

On the reasons why individuals donate, this is not the main focus of this paper. However, the results could be interpreted with the most classic concepts mentioned in the literature, such as the impure altruism of the "warm-glow effect" (Andreoni, 1989): with the pandemic getting worse, dictators could perceive even higher benefits from donating, selfishly caring mostly about the act itself rather than the effects on others. There are no elements that allow us to disregard pure altruism either, and at the same time other interpretations could follow the recent findings on personal norms (Bicchieri, 2016; Capraro and Perc, 2021): in fact, during a negative socioeconomic shock such as the US lockdown, the act of donating to strangers in (potential) need could be due to stronger-than usual moral motives.

Overall, given the negative socioeconomic shock, the price of donating at the onset of the pandemic is higher than other dictator game experiments, and hence would explain why donations towards anonymous recipients are lower than the ones documented in the literature (e.g. Engel (2011) calculates an average of 28% of the available sum donated). Nevertheless, it is worth mentioning that the sample shows high absolute levels of unemployment and financial insecurity remains more or less constant across time, suggesting the price of donating is high but does not increase over the 8 weeks.

A few other explanations for lower overall donations could come from Güth et al. (2007), who describe internet users as more self-regarding, and from Ben-Ner et al. (2008) who find some differences between games played with hypothetical and real money depending on individuals' personality traits. Alternatively, there might be an endowment effect at play contributing to the lower than average donations, given our hypothetical endowment value of $1000 is relatively high compared to other studies: Engel (2011) shows that usual amounts in the literature are lower, and that as stakes increase donations tend to decrease. Indeed, one of the limitations of this study is that responses are stated preference and not revealed preference data. This presents an important opportunity for further research to conduct the same experiment, but with real payoffs generated through the use of actual money to improve the external validity of the paper's findings.

On the stability of social preferences, results appear to support our H3 that framing would have a significant effect on the investigated altruistic behaviours. If an anonymous game is *not* played first, donations to the anonymous category drop drastically compared with the instance when it is played first (e.g. −$59 if anonymous is played second, −$41 if played third, and −$39 if played fourth). The same effect is observed in the logit regressions i.e. the probability of donating to anonymous recipients drastically reduces when the anonymous game is not played first. This significant negative impact on donations only appears to occur for anonymous games—the relative game position for relatives, neighbours and government games do not record the same effect. This suggests the instability of social preferences when the recipient in question is unknown or in the absence of a strong bond between players. The instability of social preferences has been documented in the wider literature where the "degree of reciprocity that subjects believe exist within a social interaction" i.e. the "social distance" can significantly affect other-regarding preferences (see Hoffman et al. (1996) and Bohnet and Frey (1999) for an in-depth discussion).

We also note an interesting observation on the variable for "Relative Game First": playing the relatives game first has a negative effect on donations in the other games (this is highly significant for neighbour games). Therefore, there appears to be a reference point created during the relative game which negatively impacts the donation less familiar or unfamiliar recipients. The reference point mechanism may be explained as follows: when one plays the first game to a relative, one has in mind all options, from 0 to $1000. If one donates $350 in this first game, for the second game, the range of options available reduces from between 0 and $1000, to between 0 and $350 i.e., there is a subconscious restriction of the set of possible donations to a smaller subset (only values smaller than $350 in this case). This observed reference point effect brings evidence against Dreber (2013) who finds social preferences "less sensitive" to framing than the previous literature thought. The findings also demonstrate a possible entry point for influencing charitable donations as individuals could end up creating reference points depending on how tasks are framed.

At the same time, findings on gender show higher altruism in men (but not in the case of a relative recipient), which is not in line with Heinz et al. (2012) and Selten and Ockenfels (1998). On this note, Andreoni and Vesterlund (2001) show how men are more generous when this has cheap consequences. However, it could be argued that the price of generosity in our experiment is higher than average (considering the negative socioeconomic shock and related consequences), de facto suggesting that gendered differentials could be mostly due to the relationship between dictator and receiver than the price of donating.

With respect to age, it is possible that the two categories "34–44" and "45–54" consistently donate less than the others because they have family members (children) financially relying on them. However, findings are not in line with Güth et al. (2007), which describes how older age categories care more about equality in sharing: this result could be related with the fact that those participants are the ones more at risk during the COVID-19 pandemic.

Finally, the role of reciprocity cannot be ruled out, especially in the case of government dictator games. In fact, the "anxiety" regressor effect is significant and the highest for government as a receiver. A negative socioeconomic shock which evokes anxiety across the population could raise the expectation that if donations are made to the state, there is a much greater chance of the state then reciprocating by providing safety measures such as unemployment benefits, cash handouts, or other financial relief packages. Further evidence, such as a specific ultimatum game experiment, could clarify the mechanisms behind this last hypothesis.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Note

1 Number of total deaths and cases, and their percentage increase from the previous day, were obtained from the official websites of each state: Washington https://www.coronavirus.wa.gov/, California https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/ncov2019.aspx, and New York https://coronavirus.health.ny.gov/home. Unemployment statistics including unemployment insurance weekly claims and insured unemployment rates were taken from the United States Department of Labor Employment & Training Administration https://oui.doleta.gov/unemploy/claims.asp.

References

Adena M, Harke J (2022) COVID-19 and pro-sociality: How do donors respond to local pandemic severity, increased salience, and media coverage? Exp Econ 25:824–844

Andreoni J (1989) Giving with impure altruism: applications to charity and Ricardian equivalence. J Political Econ 97(6):1447–1458

Andreoni J, Miller J (2002) Giving according to GARP: an experimental test of the consistency of preferences for altruism. Econometrica 70(2):737–753

Andreoni J, Vesterlund L (2001) Which is the fairer sex? Gender differences in altruism. Q J Econ 116:293–312

Bekkers R (2007) Measuring altruistic behavior in surveys: The All-or-Nothing Dictator Game. Survey Res Methods 1(3):139–144

Ben-Ner A, Kramer A, Levy O (2008) Economic and hypothetical dictator game experiments: Incentive effects at the individual level. J Socio-Econ 37(5):1775–1784

Berg J, Dickhaut J, McCabe K (1995) Trust, reciprocity, and social history. Games Econ Behav 10(1):122–142

Berinsky A, Huber G, Lenz G (2012) Evaluating online labor markets for experimental research: Amazon.com's Mechanical Turk. Political Anal 20(3):351–368

Bicchieri C (2016) Diagnosing norms. Penn Social Norms Group (PennSoNG), p. 11

Bohnet I, Frey BS (1999) Social distance and other-regarding behavior in dictator games: comment. Am Econ Rev 89(1):335–339

Buso IM, De Caprariis S, Di Cagno D, Ferrari L, Larocca V, Marazzi F, Spadoni L (2020) The effects of COVID-19 lockdown on fairness and cooperation: evidence from a lablike experiment. Econ Lett 196:109577

Caparro V, Perc M (2021) Mathematical foundations of moral preferences. J R Soc Interface 18(175):20200880

Caparro V, Vanzo A (2019) The power of moral words: Loaded language generates framing effects in the extreme dictator game. Judgm. Decis. Mak 14(3):309–317

Charness G, Rabin M (2002) Understanding social preferences with simple tests. Q J Econ 117(3):817–869.

Cherry TL, Frykblom P, Shogren JF (2002) Hardnose the dictator. Am Econ Rev 92(4):1218–1221

De Waal, F. B. (2008) Putting the altruism back into altruism: the evolution of empathy. Annu Rev Psychol. 59:279–300

Dreber A, Ellingsen T, Johannesson M, Rand DG (2013) Do people care about social context? Framing effects in dictator games. Exp Econ 16(3):349–371

Economic Commission for Latin America and the Caribbean (2020) Impact of COVID-19 on the United States economy and the policy response. https://repositorio.cepal.org/bitstream/handle/11362/45984/1/S2000540 en.pdf. Accessed 15 Sept 2021.

Engel C (2011) Dictator games: a meta study. Exp Econ 14(4):583–610.

Fehr E, Schmidt KM (1999) A theory of fairness, competition, and cooperation. Q J Econ 114(3):817–68

Guala F, Filippin A (2017) The effect of group identity on distributive choice: social preference or heuristic? Econ J 127(602):1047–1068

Güth W, Schmidt C, Sutter M (2007) Bargaining outside the lab—a newspaper experiment of a three-person ultimatum game. Econ J 117(518):449–469

Heinz M, Juranek S, Rau HA (2012) Do women behave more reciprocally than men? Gender differences in real effort dictator games. J Econ Behav Organ 83(1):105–110

Hoffman E, McCabe K, Smith VL (1996) Social distance and other-regarding behavior in dictator games. Am Econ Rev 86(3):653–660

Johns Hopkins University (2022) Coronavirus resource centre: mortality analyses. https://coronavirus.jhu.edu/data/mortality. Accessed 25 Apr 2022.

Korenok O, Millner EL, Razzolini L (2014) Taking, giving, and impure altruism in dictator games. Exp Econ 17(3):488–500

Krupka EL, Weber RA (2013) Identifying social norms using coordination games: why does dictator game sharing vary? J Eur Econ Assoc 11(3):495–524

Laury SK, Taylor LO (2008) Altruism spillovers: are behaviors in context-free experiments predictive of altruism toward a naturally occurring public good? J Econ Behav Organ 65(1):9–29

Leider S, Mˆobius MM, Rosenblat T, Do QA (2009) Directed altruism and enforced reciprocity in social networks. Q J Econ 124(4):1815–1851

Ledyard, J. O (1995) Public goods: a survey of experimental research. In J. H. Kagel, & A. E. Roth (Eds.), Handbook of experimental economics (pp. 111–194). Princeton: Princeton Univ. Press.

Lohmann P, Gsottbauer E, You J, Kontoleon A (2020). Social preferences and economic decision-making in the wake of COVID-19: experimental evidence from China. Available: SSRN 3705264.

McDuffie D (2019) Using Amazon's mechanical Turk: benefits, drawbacks, and suggestions. APS Obs 32(2):34–35

Roalf DR, Mitchell SH, Harbaugh WT, Janowsky JS (2012) Risk, reward, and economic decision making in aging. J Gerontol Ser B 67(3):289–298

Romano A, Bortolotti S, Hofmann W, Praxmarer M, Sutter M (2021) Generosity and cooperation across the life span: a lab-in-the-field study. Psychol Aging 36(1):108–118.

Selten R, Ockenfels A (1998) An experimental solidarity game. J Econ Behav Organ 34(4):517–539

Story GW, Vlaev I, Metcalfe RD, Crockett MJ, Kurth-Nelson Z, Darzi A, Dolan RJ (2015) Social redistribution of pain and money. Sci Rep 5:15389

Competing interests
The authors declare no competing interests.

Ethical approval
This project has obtained ethical approval by UCL Research Ethics Committee. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Ethical Committee of our Department approved the study, and the document is available upon request.

Informed consent
We wish to confirm that informed consent was obtained from all participants and/or their legal guardians. The consent includes the consent to publish and will be available upon request.

Additional information
Supplementary information The online version contains supplementary material available at https://doi.org/10.1057/s41599-022-01200-w.

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