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Abstract

Climate change has become a major threat to existence of humankind on earth. Studies demonstrate that climate change gets exacerbated and people become nonprosocial with urbanization (Ehrlich et al., 2012, Wigginton et al., 2016, Shahrier et al., 2016, 2017, Jingchao et al., 2021). It is hypothesized that people's cooperation on climate change declines as they become nonprosocial with urbanization. To examine the hypothesis, we implement a survey experiment consisting of climate donation (CD) and social value orientation (SVO) games in three areas of a developing country, Bangladesh: (i) rural, (ii) semiurban and (iii) urban ones. In CD game, a respondent splits a fixed endowment between herself and a donation to climate change countermeasures. The analysis reveals that the number of nonprosocials is higher in the semiurban and urban areas than in the rural area, and nonprosocials donate less than do prosocials. It also shows that education, belief in human-induced climate change and natural disasters' experiences increase the donations. However, the magnitudes of the increases are less than the magnitudes of the decline in donations associated with urbanization and SVO from prosocials to nonprosocials. Overall, this research suggests that cooperation on climate change shall be compromised along with further urbanization, and a new paradigm, such as vision and/or core values for society development and education, will be necessary to counter such a trend.

Key Words: Cooperation on climate change; urbanization; prosociality; culture and evolution

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Contents

Nomenclature

BDT Bangladeshi currency, Taka

CD Climate donation

SVO Social value orientation

USD US dollar

1 Introduction

Climate change has become a major threat to existence of humankind on earth, and stabilizing the earth's climate is a significant challenge for human society (Ehrlich et al., 2012, Kinzig et al., 2013, Griggs et al., 2013, Costanza et al., 2014, Hauser et al., 2014, Steffen et al., 2015, Amesbury et al., 2017). Studies project the rapid growth of urbanization worldwide and demonstrate that climate change gets exacerbated as societies become urbanized (American Association for the Advancement of Science, 2016, Ehrlich et al., 2012, Wigginton et al., 2016). It is argued that the climate change problem is prone to the "tragedy of commons," and people's cooperation & prosociality are necessary to counter the problem (Milinski et al., 2006, Aitken et al., 2011, Karkowitz and Shariff, 2012, Bernauer and McGratg, 2016, Anderson et al., 2017). Cultural agents are claimed to be very important, bringing changes in human behaviors and facilitating prosociality, trust and fairness among people (see, e.g., Dawkins, 2006, Richerson and Boyd, 2008, Henrich et al., 2010a, Brosig-Koch et al., 2011, Leibbrandt et al., 2013, Moya et al., 2015). Shahrier et al. (2016, 2017) find that with ongoing urbanization of societies as part of a cultural change, individuals tend to be nonprosocial, posing dangers on intragenerational and intergenerational problems. This paper addresses how cooperation on climate change is associated with ongoing urbanization and people's prosociality.

It is found that prosocials tend to care more about environmental protections, show more proenvironmental behaviors and contribute more to the provision of environmental goods than do nonprosocials (Cameron et al., 1998, Joireman et al., 2001, Schultz, 2001, Aitken et al., 2011, Neaman et al., 2018, Asma et al., 2021). Cameron et al. (1998) conduct a classroom experiment, demonstrating that prosocials are more likely to support a program to reduce transportation pollution than do nonprosocials (proselves). Joireman et al. (2001) show that prosocials are proenvironmental and have a belief in social consequences of environmental problems relative to nonprosocials. The survey experiment of Schultz (2001) demonstrates that nonprosocials score high in egoistic environmental concern (concern for self) in comparison to prosocials. Aitken et al. (2011) find that people with a strong perception of commons dilemma are less willing to mitigate environmental problems than others. Neaman et al. (2018) implement a questionnaire survey in Chile and show that prosocial and proenvironmental be-

haviors are positively associated with each other. Asma et al. (2021) administer a field experiment in Bangladesh, demonstrating that prosocials donate more than nonprosocials for salinity risk reduction. Overall, the literature indicates that people's degree of prosociality may be an important determinant of their level of cooperation on climate change.

Several studies suggest that people become nonprosocial (proself) with urbanization, affecting their generativity and decisions regarding sustainability of common-pool resources and intergenerational sustainability (Timilsina et al., 2017, 2019, 2021, Shahrier et al., 2017). Timilsina et al. (2019) find that people become less generative with a change in social value orientation from prosocial to nonprosocial as societies become urbanized. Timilsina et al. (2017) administer an experiment of a dynamic common pool resource game in Nepal. They reveal that the sustainability of common pool resources declines as the number of nonprosocial people increases with urbanization. Shahrier et al. (2017) implement a field experiment of intergenerational sustainability dilemma game (ISDG) in urban and rural areas of Bangladesh. They find that the number of prosocial people is higher in the rural area than in the urban area and the probability of choosing intergenerational sustainable options rises with the increase in the number of prosocial people per generation. Therefore, generations in the rural area choose more intergenerational sustainable options than those in the urban area. Timilsina et al. (2021) show that urban society consists of a number of people with stable preferences over maximizing their own generation's payoffs, influencing others to follow them. Thus, generations in urban society endanger intergenerational sustainability, unlike those in rural society. All in all, the literature suggests that the degree of prosociality and urbanization may be two decisive factors that affect people's cooperation on climate change.

It is found that climate change gets exacerbated as societies become urbanized (American Association for the Advancement of Science, 2016, Ehrlich et al., 2012, Wigginton et al., 2016). Studies also suggest that with the ongoing urbanization of societies, the number of nonprosocial people increases, who cooperate less than prosocials on environmental and sustainability issues (Shahrier et al., 2016, 2017, Timilsina et al., 2017, 2019, 2021, Jingchao et al., 2021, Asma et al., 2021). Therefore, we hypothesize that people's cooperation on climate change decline as they become nonprosocial with urbanization. It is projected that the proportion of the urban population will be $66\,\%$ and $75\,\%$ of the

world urbanites will be in developing countries of Africa and Asia by 2050 (American Association for the Advancement of Science, 2016, Wigginton et al., 2016). Considering rapid urbanization in societies and the possible increase in the number of nonprosocials with urbanization, examining our hypothesis is important to address environmental and climate change related issues. Moreover, a majority of the studies of cooperation on climate change have been demonstrated in developed countries. However, to generalize the findings and understand human cooperation on climate change better, more of such studies should be administered in developing countries (Henrich et al., 2005, 2010a,b). In this study, we analyze cooperation on climate changes concerning ongoing urbanization and human prosociality by conducting a survey experiment of climate donation (CD) and social value orientation (SVO) games in three types of fields of a developing country, Bangladesh: (i) rural, (ii) semiurban and (iii) urban ones.

2 Study areas

We demonstrated our survey experiment in three different areas of Bangladesh: (i) Dhaka, the capital city (urban), (ii) several semi-urban areas of Shajahanpur and Sherpur subdistrict in a northern district Bogura (semiurban) and (iii) several remote villages of Palashbari subdistrict in a northern district Gaibandha (rural). Since Bangladesh is mostly homogeneous in terms of culture and ethnicity, these three study areas exhibit the same religious, cultural and linguistic variations. They vary from one another in terms of the level of urbanization in society. The first study area, Dhaka consists of all the areas in Dhaka metropolitan. This area is located between $90°18'$ and $90°57'$ east longitude and between $23°55'$ and $24°81'$ north latitude. The total population and land area of this area are 14.51 million and $1371\,\mathrm{km}^2$, respectively (Dewan and Corner, 2014). The density of population is $10\,484\,\mathrm{km}^{-2}$ which is approximately 9 times higher than the country average of $1218\,\mathrm{km}^{-2}$ and it is the most densely populated city in the world (Dewan and Corner, 2014). Dhaka is known as the headquarter of businesses, industries and services in Bangladesh. Due to the heavy industrialization and lack of arable land, farming activities are almost absent in the Dhaka metropolitan. Thus, its economic activities depend less on ecosystem services and nature. Business, service and some labor intensive occupations such as in-

dustrial wage labor, rickshaw-pulling are the major occupations in Dhaka metropolitan. This area is representative of the urbanized society in our study. It is interchangeably addressed as Dhaka or the urban area for the rest of the paper.

The second study area comprises several semiurban areas of Shajahanpur and Sherpur subdistricts in the northern district, Bogura. Shajahanpur subdistrict is located between $89°16'$ and $89°29'$ east longitudes and between $24°41'$ and $24°50'$ north latitudes. Sherpur subdistrict is located between $89°20'$ and $89°32'$ east longitudes and between $24°32'$ and $24°44'$ north latitudes. The total population, land area and population density of Shajahanpur (Sherpur) are $289\,804$ ($332\,825$) and $54\,783$ acres ($73\,128$ acres) and $1307\,\mathrm{km}^{-2}$ ($1125\,\mathrm{km}^{-2}$), respectively (Bangladesh Bureau of Statistics, 2011). The population densities of Sherpur and Shajahanpur are slightly lower and higher respectively than the country average (Bangladesh Bureau of Statistics, 2011). Bogura district is known as the gateway to the northern part of Bangladesh. The city of Bogura is one of the modernized and industrialized cities in Bangladesh. The study area is located adjacent to the Dhaka-Bogura highway and has well by road communication with the city of Bogura. This area is undergoing a process of urbanization. Urbanization starts with the agricultural revolution lead by some government agencies and NGOs. The increase in agricultural production, infrastructure development and suitable location for industrialization lead to its economic growth. Thus, this area has been experiencing a transition from a rural society into an urbanized society. Economic activities in this area include a mix of farming, small and medium scale businesses, services and labor-intensive occupations, such as industrial labor jobs and rickshaw-pulling. This area stands for the semiurban society and will be addressed interchangeably as Bogura or the semiurban area for the remaining parts of the paper.

Several agrarian villages of Palashbari subdistrict in the northern district Gaibandha are included in the third study area. Palashbari is located between $25°11'$ and $25°19'$ north latitude and $89°16'$ and $89°32'$ east longitude. The total population, land area and population density of Palashbari are $244\,792$, $45\,774$ acres and $1321\,\mathrm{km}^{-2}$, respectively (Bangladesh Bureau of Statistics, 2011). This area consists of traditional agrarian villages and it is one of the least developed areas in Bangladesh. Industry and service sectors are less developed and only some small agro-industries are available in this area. Almost all the dwellers are engaged with farming either as their main income generating activity or for

their self-consumption.[1] Besides farming, economic activities include some small and medium scale businesses and labor intensive occupations such as van-pulling and rickshaw-pulling. Since farming is the major income generating activity in this area, its economy heavily depends on nature and the ecosystem. In summary, with less developed industry and service sector and dependency on agriculture, this study area is the least urbanized among the three study areas. We interchangeably address this study area as Palsahbari or the rural area for the remainder of this paper.

[Figure 1 about here.]

3 Methods and materials

3.1 Experimental setup

We demonstrated a climate donation (CD) game, a social value orientation (SVO) game and questionnaire surveys in the fields.

The climate donation (CD) game

To measure a respondent's level of cooperation on climate change, we implemented a climate donation (CD henceforth) game. The structure of CD game is the same as the experiment administered in Asma et al. (2021). CD game is a special variant of a standard dictator game. In a dictator game, a respondent divides a fixed endowment between herself and an unknown other (the receiver) (Bolton et al., 1998, Engel, 2011). In CD game, a respondent is asked to divide an initial endowment of 250 BDT into two accounts: (i) an individual account for herself and (ii) a donation to climate change countermeasures. They are free to choose any division of the endowment including a zero donation to climate change countermeasures. We inform the respondents that the total donation collected from this game would be finally donated to the organization named the "Adaptation Fund," and it would spend the money for taking countermeasures against the adverse effects of climate change. They are also informed that the amount of money they keep in the individual account for themselves is their actual earning from the game.

[1] Our data confirms that more than $90\,\%$ of the people are engaged with farming in this study area.

CD game is different from the standard dictator game in that in CD game, a respondent knows who is the receiver (the Adaptation Fund), unlike that in the standard dictator game. Since the dictator game is an established method to measure an individual's cooperation with an unknown other, the donation in CD game should be considered as a proxy of a respondent's level of cooperation on climate change. We conduct CD game for its simplicity and to confirm the same environment for every respondent (Engel, 2011). A number of respondents who participate in the survey experiment are less-educated. CD game is suitable for obtaining individual donations for climate change countermeasures, in which even less-educated respondents would express their donation effectively. Besides, in CD game, every respondent has the same initial endowment, and therefore, it measures their level of cooperation on climate change given the same environment to everyone. For the remainder of the paper, we address the climate donation game as CD game and the donation for climate change countermeasures in CD game as the climate donation.

Social value orientation (SVO) game

To figure out individual social value orientations or social preferences, we demonstrated a triple dominance method social value orientation (SVO) game advanced by Van Lange et al. (1997, 2007). This game characterizes a respondent's social value orientation either as competitive, prosocial, individualistic or unidentified, based on the respondent's choices in the game. In such a game, a respondent is randomly paired with another respondent and asked to choose among three options, where the another respondent (referred as "the other") is unknown to the respondent. Each of the options in the game represents two numbers as the outcome for ownself and the other. One example of such a triple dominance decomposed SVO game is the selection problem among the following three options: (i) you get 500 and the other gets 100, (ii) you get 500 and the other gets 500, (iii) you get 560 and the other gets 330. Option (i) in the example represents competitive value orientation. An individual with this preference is called a competitor who wants to maximize the gap between her ownself and the other ($500 - 100 = 400$). Option (ii) corresponds to prosocial value orientation, which maximizes the joint outcome for ownself and the other ($500 + 500 = 1000$). A person with this orientation is regarded as a prosocial. Finally, option (iii) is representative of individualistic orientation. An individual with this

orientation is called an individualist who prefers to maximize her outcome 560 and indifferent to the outcome of the other.

SVO game consists of 9 selection problems, each selection contains the three options of competitive, prosocial and individualistic orientation described above with different ordering and numbers. A respondent needs to choose one option from each of the selections. If at least 6 choices in the 9 selections of a respondent match with one of the orientations (competitive, prosocial or individualistic), we categorize her as a person with that orientation; otherwise, she is characterized as an individual with "unidentified" orientation. After the respondents complete the game, we randomly pair a respondent's choices with another respondent's choices to compute their total points. A respondent's total points are the sum of her points from the 9 choices she made for herself and points she receive from the 9 choices the other respondent in the pair made for "the other." To calculate the actual earning (cash in BDT), we apply an exchange rate of 63.4, i.e., every 63.4 points received by a respondent deserves to be 1 BDT, such that a respondent would earn 150 BDT (≈ 1.76 USD) at maximum. The respondents are informed that the units represented in this game are points and the more point they get, the more money they would earn. We also explain the procedures of the random matching and calculation of the total points and actual earning to the respondents.

3.2 Random sampling in the field

To include respondents from all the socioeconomic classes, we took different approaches for random sampling in the three study areas. We did so considering the feasibility of the approaches given the different sociodemographic characteristics of the study areas. In the urban area, we carried out randomization based on occupations, since household based randomization was not feasible there. In rural and semiurban areas, we implemented household based randomization. All the respondents in our survey experiment have individual income and financial contributions to their households. The total number of respondents from urban, Dhaka, semiurban, Bogura and rural, Palashbari are 184, 134 and 125, respectively.

The urban area, Dhaka is an unorganized megacity with the highest density of population in the world (Dewan and Corner, 2014). Collecting information about the household numbers from the city

offices was not feasible in this area. Besides, we assumed that the response rate would be very low if we invite respondents by sending invitation letters, following household based randomization. Therefore, we implemented random sampling based on occupational categories and included respondents through the channels of different organizations. First, following the occupation statistics, we selected a required number of respondents from each of the occupations and randomly picked several organizations to collect respondents (Bangladesh Bureau of Statistics, 2015). Upon the consent of the organizations, we distributed invitation letters and flyers among the employees. Invitation letters included our contact information, so that interested respondents would contact us directly.[2] Additionally, we invited respondents by creating an event onto Facebook. Hereafter, following the occupational statistics, respondents were randomly chosen from those who contacted us and expressed their interest to participate in the survey experiment. Contacting respondents through the organizations and Facebook event thus increased the credibility of our survey experiment and motivated respondents to participate in it. To include respondents with informal occupations, low-income and frequent movements within the city such as rickshaw-pullers, we selected several slums and hired respondents from those slums using human connections. The show-up rate among those invited was approximately $80\,\%$ in this area.

In the case of the semiurban, Bogura and rural, Palashbari, we conducted household based randomization. First, we arbitrarily selected several unions and wards for including respondents.[3] Hereafter, we collected household identification numbers from the local union and ward offices. Based on the number of households in each union and ward, we randomly selected the required number of households and invited one earning member from each of the households via invitation letters or local human connections. In the semiurban area, we administered our survey experiment with 134 respondents in two subdistricts of Bogura, namely Shajahanpur and Sherpur. From each of the subdistricts, we included 67 respondents. Out of the 4 unions of the Shajahanpur subdistrict, which are adjacent to the Dhaka-Bogura highway, we selected 2 unions. The two unions were Aria Bazar and Majhira. The total number of households in these two unions was $14\,831$. The number of households in Aria Bazar and Majhira were 9664 and 5161, respectively (Bangladesh Bureau of Statistics, 2011). Therefore, the number of respondents from Aria Bazar and Majhira were respectively 44 and 23 in our study, follow-

[2]The first author and research assistants distributed invitation letters.

[3]Union and ward are the smallest administrative units of rural and urban administration in Bangladesh, respectively.

ing the household proportion of these two unions. From the Sherpur subdistrict, we chose 3 wards out of a total of 9 wards, they were ward no 1, 2 and 6. The total number of households in these three wards was 1869. The number of households in Ward no 1, 2 and 6 were 549, 473 and 847, respectively. We invited 20, 17 and 30 respondents respectively from ward no 1, 2 and 6 based on the proportion of households of these wards in the total number of households. The show-up rate among those invited was approximately 85 % in this area. In the rural area, first, we randomly selected 3 unions out of the total 9 unions of Palashbari subdistrict, they were Harinathpur, Hossainpur and Monoharpur. The total number of households of these three unions was 15 045. The number of households in Harinathpur, Hossainpur and Monoharpur were 4317, 6089 and 5045, respectively (Bangladesh Bureau of Statistics, 2011). Based on the household proportion of the three unions, we invited 35, 49 and 41 respondents respectively from Harinathpur, Hossainpur and Monoharpur. The show-up rate among those invited was approximately 85 % in this area.

3.3 Experimental procedure

The survey experiment was conducted between June 2016 and August 2016. In the rural and semi-urban areas, we administered the experiment in several elementary schools within the study areas. In the urban area, the experiment had been demonstrated at the Institute of Information Technology, University of Dhaka. In urban, semiurban and rural areas, we respectively administered 16, 11 and 11 sessions of our experiment. Each session included $10 \sim 16$ respondents and took $1.5 \sim 2$ hours. Respondents were paid 550 BDT ($\approx$ 6.44 USD) at maximum with a fixed showup fee of 150 BDT ($\approx$ 1.76 USD). The maximum payments from CD and SVO games were 250 BDT ($\approx$ 2.94 USD) and 150 BDT ($\approx$ 1.76 USD), respectively. On average we paid 429 BDT ($\approx$ 5.05 USD) to the respondents, where average payments from CD and SVO games were respectively 179 BDT ($\approx$ 2.11 USD) and 100 BDT ($\approx$ 1.18 USD). Average household income per day in Bangladesh was 532.93 BDT ($\approx$ 6.27 USD) in 2016 (Bangladesh Bureau of Statistics, 2019). The average payment in our survey experiment was 0.80 times of the average household income per day.

In a session of the experiment, respondents were gathered in an experimental hall. First, we conducted the SVO game. We confirmd the respondent's understanding of the SVO game using printed

instructions, verbal presentations and quizzes. Subsequently, we elicited respondent's choices in the SVO game. After the completion of SVO game, we provided printed experimental instructions of CD game to respondents in their native language, Bengali. Besides, we made verbal presentations to explain the rules of the game and double-checked their understanding of them employing quizzes.[4] We gave each of the respondents two envelopes: (i) an envelope containing the initial endowment of 250 BDT and (ii) an empty envelope entitled "account for ownself." Hereafter, they were instructed to enter a counter in the experimental hall one by one. Each of them was asked to put the donation for climate change countermeasures in a non-transparent box affixed there and kept the rest of the money in the envelope entitled "account for ownself." Respondents were not allowed to discuss and share information about their donations with one another. Hereafter, we demonstrated a questionnaire survey to collect information about their science literacy, critical thinking disposition, climate change perception, environmental concern and sociodemographic information. Finally, respondents received their payment from the games including the showup fee and left the experimental hall.

3.4 Empirical method

The climate donation in CD game is bounded by 0 BDT and 250 BDT, such that a respondent can donate 0 BDT, a zero donation, or 250 BDT, a donation of the total stake of money or any other amount between 0 BDT and 250 BDT. OLS may provide biased estimations for identifying the determinants of climate donation as it contains several zero donations and donations of the total stake of money. Therefore, to characterize climate donation, we estimate two-limit Tobit regressions (McMillen and McDonald, 1990, Zuehlke, 2020). A two-limit Tobit model to deal with zero donations and donations of the total stake of money in CD game takes the following form:

$$y_i^* = \mathbf{X}_i \boldsymbol{\beta}_j + \epsilon_i \tag{1}$$

where y_i^* is a contentious latent variable. If observed climate donation by respondent i is denoted by y_i, then $y_i = y_i^*$ if $0 < y_i^* < 250$, $y_i = 0$ if $y_i^* \leq 0$ and $y_i = 250$ if $y_i^* \geq 250$. Therefore, the dependent

[4]The first author administered the experiment.

variable in this model is a censored dependent variable when observations at the limits are present. If there is no observation at the limits, the model is considered as truncated.[5] $\mathbf{X}_i$ for $i = 1, ..., 9$ is a vector of independent variables that are expected to affect climate donation. $\boldsymbol{\beta}_j$ for $j = 0, ..., 9$ is a vector of parameters associated with the intercept and $\mathbf{X}_i$. And ϵ_i represents the random error term. To characterize y_i, the parameters are estimated through maximum likelihood estimation in two-limit Tobit regressions that allows us to compute the marginal effects of the independent variables on climate donations (McMillen and McDonald, 1990, Zuehlke, 2020).

Table 1 presents the description of the dependent variable and a set of independent variables. The dependent variable is the climate donation (donations in CD game). Sociodemographic controls include income (household income), age, education, gender and family structure. Building upon the past studies, we include the individual belief in whether climate change is human-induced or nature-induced and the number of disaster experiences as independent variables (Kahneman et al., 1993, Walker et al., 1999, Brown et al., 2002, Bulte et al., 2005, Aitken et al., 2011, Spence et al., 2011, Myers et al., 2013, Yu et al., 2013, Walters et al., 2014). To elicit a respondent's belief in whether climate change is human-induced or nature-induced, we ask her to read two statements along with associated figures. The first statement with a figure describes how human activities change the climate and cause harm to the environment. We incorporate the statement from Milinski et al. (2006). The second statement with a figure depicts the scenario opposite to that in the first statement and illustrates the possibilities of nature-induced climate change. This statement is taken from Hulme et al. (1999). Upon reading these two statements, a respondent chooses one option among the following four options: (i) I agree with statement 1, (ii) I agree with statement 2, (iii) both statements are persuasive and I cannot answer and (iv) I do not understand the statements and cannot answer. The variable "Human-induced" captures the individual belief in whether climate change is human-induced. It takes a value of 1 when a respondent

[5] Out of the total 443 respondents in our survey experiment, 21 and 15 respondents respectively express a zero donation and a donation of the total stake of money. A Tobit model assumes the same data-generating process to characterize the decision of whether to donate or not as well as the amount of donations through specifying the latent variable (Yen and Huang, 1996, Forbes and Zampelli, 2013). On the other hand, several other models assume different data-generating processes for the decision of whether to donate or not and the amount of donations, such as two-step hurdle models (James III and Sharpe, 2007, Forbes and Zampelli, 2013). Since our data contains only a small proportion of zero donations, we decide to employ a two-limit Tobit model as suggested by McMillen and McDonald (1990), Brehanu and Fufa (2008), Zuehlke (2020). In fact, we apply some models with the assumptions of "different data-generating processes," and have difficulty obtaining the estimation results because the likelihood functions never converge in optimization due to a small percentage of zero donations in CD game.

believes that climate change is human-induced (chooses option i), otherwise (if a respondent chooses one among options ii, iii and iv) it is coded as 0. The variable, "Disaster experiences" presents the number of disaster experiences, such as the experiences of cyclones, floods and earthquakes in a respondent's lifetime, which causes damages to her physical and/or mental health, livelihood and wealth. The area dummy captures the effect of ongoing urbanization of societies where the rural, Palashbari is the base group. Finally, the dummy variable, "Nonprosocial" represents whether a respondent is nonprosocial or prosocial. It takes a value of 1 if a respondent is characterized as nonprosocial (competitive/individualistic/unidentified) in the SVO game, otherwise (prosocial), it is coded as 0.[6]

[Table 1 about here.]

4 Results

Table 2 presents the area-wise and overall summary statistics of the dependent variable, climate donation and independent variables. It appears that the average climate donation in the rural area is higher than that of the urban and semiurban areas. Mean (median) climate donations from the respondents in the rural, semiurban and urban areas are respectively 91.71 BDT (100 BDT), 55.34 BDT (50 BDT) and 67.45 BDT (50 BDT). Figure 2 illustrates the area-wise percentage distribution of climate donation. In this figure, the horizontal and vertical axes respectively denote the amounts of climate donation in BDT and the percentage of respondents who donate those amounts. The rural area has two major moods of climate donation at $50 \sim 60$ BDT and $120 \sim 130$ BDT as approximately $30\,\%$ and $31\,\%$ of the respondents respectively donate these two amounts. In the semiurban area, approximately, $19\,\%$ and $43\,\%$ of the respondents climate donations are $20 \sim 30$ BDT and $50 \sim 60$ BDT respectively which are the two major moods of climate donation in this area. In the case of the urban area, we find two major moods of climate donations such that approximately $35\,\%$ and $22\,\%$ of the respondents donate $50 \sim 60$ BDT and $100 \sim 110$ BDT, respectively. In all the areas we find two major moods of climate donation. However, in the rural area, the highest spike occurs at $120 \sim 130$ BDT. It is higher than those in the urban and

[6] In the primary analyses, we include respondent's science literacy, critical thinking disposition, climate change perception and environmental concern as additional independent variables. Since they neither appear as significant predictors of climate donation nor do affect the qualitative effects of other independent variables, we exclude them from the final analyses presented in the paper.

semiurban areas. In summary, figure 2 demonstrates that the climate donation from the respondents in the rural area is higher than the respondents in the urban and semiurban areas which is in line with the summary statistics of climate donation in table 2.

[Figure 2 about here.]

Now we look at summary statistics of the independent variables. Households from the rural area earn $10\,060$ BDT (≈ 125.75 USD) per month on average which is approximately 1.8 and 5 times lower than that of the households from the semiurban and urban areas, respectively. The standard deviation of income in the urban area is $59\,000$ BDT (≈ 745 USD) which is very high relative to those in the other two areas. This demonstrates a huge income gap between rich and poor in the urban area as the usual characteristic of urbanized cities in developing countries. On average, respondents from the rural area are relatively older than those from the semiurban and urban areas. Regarding education, respondents from the rural, semiurban and urban areas have 7.02 (median= 5), 9.4 (median= 10) and 12 (median= 16) years of schooling on average, indicating that respondents from the rural area are less educated than those from the urban area. Respondents in these three areas are not so different from each other in believing that climate change is human-induced. However, a respondent from the rural area experiences 3.78 natural disasters on average and it is 3 times higher than that of a respondent from the other two areas. Finally, the summary statistics of the nonprosocial dummy show that the number of nonprosocials is higher in the semiurban and urban areas than in the rural area in that $62\,\%$ $88\,\%$ and $89\,\%$ of the respondents are nonprosocial respectively in the rural, semiurban and urban areas. This finding is consistent with Shahrier et al. (2016, 2017), Timilsina et al. (2019, 2021) and Jingchao et al. (2021), demonstrating that the number of nonprosocials (prosocials) increases (declines) with the maturation of urbanization in societies. In summary, all the sociodemographic characteristics are compatible with our expectations about the ordering of the three areas in terms of the degree of urbanization. On average, respondents from the rural area have the lowest household income and years of schooling and the highest average age among the respondents from the three areas, indicating that it is the least urbanized area followed by the semiurban and urban areas.

[Table 2 about here.]

Figure 2 and table 2 show that climate donation from the respondents in the rural area is higher than those in the urban and semiurban areas. The summary statistics in table 2 also suggest that the number of nonprosocials rises as society becomes urbanized. These two findings indicate the possibility that people's cooperation on climate change may decline as they become nonprosocial with urbanization. To examine how ongoing urbanization, respondent's level of prosociality (SVO) and other independent variables affect climate donation, we estimate two models of two-limit Tobit regressions. Table 3 presents the coefficients and marginal effects of independent variables on climate donation in two-limit Tobit regressions. In model 1, we include all the independent variables except for the nonprosocial dummy. In model 2, we include the nonprosocial dummy as an additional independent variable. Model 1 first observes the relationship between climate donation and ongoing urbanization controlling for all other independent variables except for respondent's level of prosociality or SVO. Model 2 then examines the relationship between respondent's climate donation and their level of prosociality and how the impact of the degree of urbanization on climate donation change because of adding the nonprosocial dummy in the analysis. Model 2 thus enables us to examine whether people's cooperation on climate change tends to decline as they become nonprosocial with urbanization. Columns 2 and 3 of table 3 respectively report the coefficients and marginal effects of independent variables on climate donation in model 1. Education, human-induced, disaster experience and the area dummies of urban and rural appear as significant predictors of climate donation, statistically and economically.

In model 1, education positively affects cooperation on climate change in that an additional year of education is associated with a 2.05 BDT increase in climate donation. This effect can be considered rather small, however, one-standard-deviation increase in education (≈ 4.92 years) raises climate donation by 10.09 BDT. Past studies find a mixed effect of education on cooperation on climate change. Sun et al. (2016) and Diederich and Goeschl (2014) find a positive impact of education on WTPs for smog mitigation and voluntary climate actions. Adaman et al. (2011) show that people with primary and secondary education are willing to pay more than illiterate people do for CO_2 emission control. However, WTPs of university degree holders and illiterate people are not different from one another for the same purpose. Brick and Lewis (2014) demonstrate that education is unrelated to proenvironmental behavior. Unlike developed countries, there exists a huge gap in people's educational attainment in

developing countries such as Bangladesh, and people with high education have good knowledge about climate change and its impacts. As a result, highly educated respondents cooperate more than the less educated respondents on climate change.

Climate donation from those who believe climate change is human-induced is 17.11 BDT higher than the others. Past studies show that because of the "moral responsibility effect," people with the belief that climate change is human-induced cooperate on environmental and climate change-related issues (Kahneman et al., 1993, Walker et al., 1999, Brown et al., 2002, Bulte et al., 2005, Aitken et al., 2011, Yu et al., 2013). Our result concerning whether climate change is human or nature-induced is consistent with these studies and suggesting that the "moral responsibility effect" may be a universal predictor of cooperation on climate change. Regarding the impact of disaster experiences, an additional experience of disaster in a respondent's lifetime is associated with a 3.12 BDT rise in climate donation. It should be noted that climate donation increases by 9.58 BDT in relation to a one-standard-deviation (≈ 3.07 times) rise in disaster experiences. This finding is in line with the past studies demonstrating that the experience of natural disasters induces people to cooperate on climate change (Spence et al., 2011, Myers et al., 2013, Walters et al., 2014).

Finally, we examine how the ongoing urbanization of societies affects cooperation for climate change in model 1 by looking at the effect of area dummies on climate donation. Holding all other factors fixed except for the level of prosociality or SVO, Respondents in the semiurban and urban areas respectively donate 37.98 BDT and 26.96 BDT less than those in the rural area on average. This result is in line with the summary statistics and percentage distribution of climate donation respectively in table 2 and figure 2, suggesting that climate donation declines with ongoing urbanization. Shahrier et al. (2017) and Timilsina et al. (2017) show that as society becomes urbanized and modernized, people care less about intergenerational sustainability and common-pool resource sustainability. Our result is in line with their findings and demonstrates that cooperation on climate change gets exacerbated with the ongoing urbanization of societies.

[Table 3 about here.]

Now we look at the results in model 2 of the regression analyses. Specifically, we observe the outcomes of the nonprosocial and area dummies in model 2 to answer why cooperation on climate

change declines with ongoing urbanization. The nonprosocial dummy appears as the strongest predictor of climate donation among all the independent variables in model 2. Besides, the impacts of area dummies on climate donation change remarkably in comparison to those in model 1. The qualitative effects of the other independent variable in models 2 remain as same as those in model 1. Holding all other factors fixed, a nonprosocial respondent's climate donation is 87.40 BDT less than a prosocial respondent. Past studies show that nonprosocials (proselves) care less about intergenerational and resource sustainability, behave less proenvironmentally and donate and volunteer less for humanitarian activities than prosocials (Joireman et al., 2001, Van Lange et al., 2007, 2011, Shahrier et al., 2017, Timilsina et al., 2017). Consistent with these studies, our result demonstrates that nonprosocials also cooperate less on climate change than prosocials.

The urban dummy becomes insignificant and the semiurban dummy becomes weaker, statistically and economically because of the inclusion of the nonprosocial dummy in the analysis. This means, holding all other factors fixed, the urban-rural difference in climate donation is entirely driven by the change in SVO from prosocial to nonprosocial (competitive, individualistic and unidentified) with the urbanization of societies. The semiurban dummy remains significant but the statistical and economic significance of it decline notably relative to those in model 1. The marginal effect of the semiurban dummy in model 2 is -15.01 BDT, which is significant at the $5\,\%$ level (it is -37.89 BDT at the $1\,\%$ level in model 1). This means there might be other area-specific changes in addition to the change in SVO that explain the rural-semiurban difference in climate donation. Overall, the summary statistics and regression analyses reveal that the number of nonprosocials is higher in semiurban and urban areas than in the rural area and nonprosocial's climate donation is significantly lower than prosocials on average. As a result, climate donation declines as society becomes urbanized. These findings confirm the hypothesis posed in this study and demonstrate that people's cooperation on climate change decline as they become nonprosocial with urbanization.

Results suggest that education, disaster experiences and the belief in human-induced climate change positively impact climate donation. On the other hand, urbanization and the SVO change from prosocial to nonprosocial are negatively associated with donations. In model 2, one standard deviation increase in education and disaster experiences are respectively associated with a 7.04 BDT and 5.95 BDT rise in

the climate donation, and those who believe that climate change is human-induced, donate 13.53 BDT more than others. Each of the magnitudes of increase concerning education, disaster experiences and belief in human-induced climate change are less than the magnitudes of decline in climate donation with respect to the transformation of the society from rural to semiurban (15.01 BDT) and an SVO change from prosocial to nonprosocial (87.40 BDT). Therefore, even an increase in education, natural disaster experiences and belief in human-induced climate change might not be sufficient to maintain cooperation on climate change as societies become urbanized and individuals become nonprosocial. It implies that cooperation on climate change will be compromised along with further urbanization.

Shahrier et al. (2016) argue that successful individuals in the urbanized societies compete to survive and achieve success through competition. Therefore, with the urbanization of societies, a cultural trait called "competition for survival and success" transfers from one individual to another through a cultural learning system of success bias transmission. This process of transmission makes people nonprosocial (proself), inducing them to maximize their own payoffs rather than cooperating (Shahrier et al., 2016, 2017). Thus, the majority of the nonprosocial people in the urbanized areas maximize their payoffs rather donating significantly for the climate change countermeasures. The semiurban dummy remains significant even after adding the nonprosocial dummy in the analysis. While the change in SVO and its impact on climate donation are discussed, it is not clear what is encapsulated in the semiurban dummy. The semiurban area in our study is experiencing a gradual transformation from rural to urban settings. Individuals in the semiurban area may be inclined to give up environmental quality for achieving economic growth during the transformation from rural to urbanized society, which might be captured by the semiurban dummy. Past studies show that changes in culture affect human behaviors and decisions (Henrich et al., 2010a, Brosig-Koch et al., 2011, Leibbrandt et al., 2013, Shahrier et al., 2016, 2017). Our finding is consistent with these studies, demonstrating that the process of urbanization as part of cultural change brings a change in people's SVO from prosocial to nonprosocial, which affects their decision to cooperate on climate change.

5 Conclusion

Climate change has become a major threat to existence of humankind on earth, and stabilizing the earth's climate is a significant challenge for human society. It is argued that the climate change problem is prone to the "tragedy of commons," and cooperation & prosociality from the individuals are necessary to counter the problem. Studies project the rapid growth of urbanization, especially in developing countries, and demonstrate that climate change gets exacerbated as societies become urbanized (American Association for the Advancement of Science, 2016, Ehrlich et al., 2012, Wigginton et al., 2016). Shahrier et al. (2016, 2017) show that because of changes in culture, the number of nonprosocials (prosocials) increases (declines) with ongoing urbanization. Given that climate change gets exacerbated and people become nonprosocial with urbanization, we hypothesize that people's cooperation on climate change decline as they become nonprosocial with urbanization. Considering rapid urbanization in societies and the possible increase in the number of nonprosocials with urbanization, examining our hypothesis is important to address environmental and climate change related issues.

We analyze cooperation on climate changes concerning ongoing urbanization and human prosociality by conducting a survey experiment consists of climate donation (CD) and social value orientation (SVO) games in three areas of a developing country, Bangladesh: (i) rural, (ii) semiurban and (iii) urban ones. In CD game, a respondent splits a fixed endowment between herself and a donation to climate change countermeasures. The analysis reveals that the number of nonprosocials is higher in the semiurban and urban areas than in the rural area, and nonprosocials donate less than do prosocials. It also shows that education, belief in human-induced climate change and natural disasters' experiences increase the donations. However, the magnitudes of the increases are less than the magnitudes of the decline in donations associated with urbanization and SVO from prosocials to nonprosocials. Overall, this research suggests that cooperation on climate change shall be compromised along with further urbanization, and a new paradigm, such as vision and/or core values for society development and education, will be necessary to counter such a trend. It is found that creating an asking situation and social pressure increase voluntary contributions for humanitarian activities (DellaVigna et al., 2012, Andreoni et al., 2017, Meer, 2017). Our study shows that the moral responsibility effect, i.e., the be-

lief in human-induced climate change induces people to donate for climate change countermeasures. Therefore, formalized ways of organizing programs for initiating cooperation on climate change should be placed in developing countries, which would create an asking situation and social pressure by emphasizing human-induced climate changes. Besides, utilizing education and cultural learning systems, moral responsibilities can be promoted for an intentional behavioral change towards cooperating on climate change as suggested by Wilson et al. (2009).

To this end, we mention some limitations of our study. Our study does not measure the effect of asking situations, social pressure, social capital, social interaction, market exposure and social learning mechanism on people's cooperation on climate change. Future studies will be able to address these issues by designing and demonstrating surveys and experiments. Besides, our findings should be tested in other developing countries to be generalized. These caveats notwithstanding, this study provides the first evidence that people's donations for climate change countermeasures declines as they become nonprosocial with urbanization, implying that cooperation on climate change shall be compromised along with further urbanization. Therefore, new paradigm, vision and/or core values for development and education will be necessary to maintain people's cooperation on climate change as societies become urbanized. We suggest that formalized ways of organizing programs for initiating cooperation on climate change should be placed in developing countries, which would create an asking situation and social pressure by emphasizing human-induced climate changes.

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List of Figures

Figure 1: Study areas: Dhaka (urban), Bogura (semiurban) and Palashbari (rural)

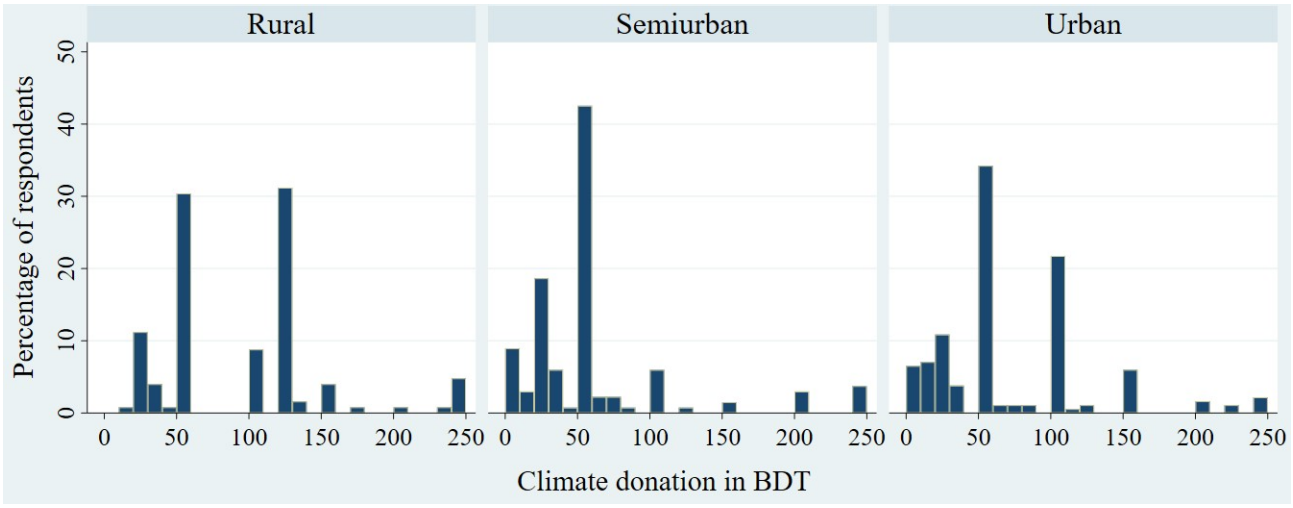

Figure 2: The percentage distribution of climate donation by study areas.

List of Tables

Table 1: Description of dependent and independent variables

Variables	Description
Climate donation	The donations by a respondent for climate change countermeasures in CD game.
Income	Household income per month in 1000 BDT.
Age	Categorical variable of $\{0, 1, 2, 3, 4, 5\}$ where ages between 20 and 29, 30 and 39, 40 and 49, 50 and 59, 60 and 69, and 70 and over are coded as $0, 1, 2, 3, 4$ and 5, respectively.
Education	Years of schooling.
Gender	Dummy variable that takes 1 when the a respondent is a female, otherwise 0.
Family structure	Joint family structures are coded as 1, otherwise (single family) 0.
Human-induced	Dummy variable that takes 1 when a respondent believe that climate change is human-induced, otherwise 0.
Disaster experiences	The Number of disasters (such as cyclone, flood and earthquake) experience in a respondent's lifetime.
Area dummies	Two dummy variables are defined for semiurban, Bogra and urban, Dhaka, rural, Palashbari is the reference group.
Nonprosocial dummy	Dummy variable that takes 1 if a respondent is nonprosocial (competitive/individualistic/unidentified), otherwise (prosocial) 0.

Table 2: Summary statistics for the dependent and independent variables

	Areas			Overall ($N = 443$)
	Rural ($N = 125$)	Semiurban ($N = 134$)	Urban ($N = 184$)	
Climate donation				
Average (Median)[1]	91.71 (100.00)	55.34 (50)	67.45 (50)	70.73 (50.00)
SD	58.07	54.59	53.74	56.92
Min	10	3	0	0
Max	250	250	250	250
Income				
Average (Median)	10.06 (7.00)	18.49 (15.00)	51.42 (33.00)	29.79 (15.00)
SD	10.84	12.24	59.17	43.26
Min	0.50	4	3	0.50
Max	75	80	600	600
Age (ordered categories)[3]				
Average (Median)	1.19 (1.00)	1.23 (1.00)	0.82 (1.00)	1.05 (1.00)
SD	3.35	1.25	0.99	1.18
Min	0	0	0	0
Max	5	5	4	5
Education (years)				
Average (Median)	7.02 (5.00)	9.47 (10.00)	12.61 (16.00)	10.08 (10.00)
SD	3.35	4.01	5.11	4.92
Min	0.00	0.00	0.00	0.00
Max	16.00	17.00	17.00	17.00
Gender (Male $= 0$)				
Average (Median)	0.07 (0.00)	0.00 (0.00)	0.17 (0.00)	0.09 (0.00)
SD	0.26	0.00	0.38	0.29
Min	0	0	0	0
Max	1	0	1	1
Family structure (Single family $= 0$)				
Average (Median)	0.26 (0.00)	0.35 (0.00)	0.35 (0.00)	0.33 (0.00)
SD	0.44	0.48	0.48	0.47
Min	0	0	0	0
Max	1	1	1	1
Human-induced (Nature-induced $= 0$)				
Average (Median)	0.84 (1.00)	0.95 (1.00)	0.78 (1.00)	0.85 (1.00)
SD	0.37	0.22	0.42	0.36
Min	0	0	0	0
Max	1	1	1	1
Disaster experience				
Average (Median)	3.78 (3.00)	1.25 (0.50)	1.12 (0.00)	1.90 (1.00)
SD	4.62	1.73	1.67	3.07
Min	0.00	0.00	0.00	0.00
Max	35.00	10.00	10.00	35.00
Nonprosocial dummy (prosocial $= 0$)				
Average (Median)	0.62 (1.00)	0.88 (1.00)	0.89 (1.00)	0.81(1.00)
SD	0.49	0.33	0.31	0.39
Min	0.00	0.00	0.00	0.00
Max	1.00	1.00	1.00	1.00

[1] Median in parentheses.
[2] SD stands for standard deviation.
[3] The age variable is defined as an ordered categorical variable (table 1).

Table 3: Models 1 and 2: Coefficients and marginal effects of independent variables on climate donation in two-limit Tobit regressions

	Model 1 ($N = 443$)		Model 2 ($N = 443$)	
	Coefficient	Marginal effect	Coefficient	Marginal effect
Income	-0.00	-0.03	-0.07	-0.09
	(0.15)	(0.13)	(0.13)	(0.11)
Income squared	-0.00	-	-0.00	-
	(0.00)	-	(0.00)	-
Age	-2.78	-2.78	-2.88	-2.88
	(2.45)	(2.45)	(2.00)	(2.00)
Education	2.05^{***}	2.05^{***}	1.43^{***}	1.43^{***}
	(0.70)	(0.70)	(0.57)	(0.57)
Gender	-0.91	-0.91	-7.05	-7.05
	(10.01)	(10.01)	(8.18)	(8.18)
Family structure	-2.97	-2.97	-6.24	-6.24
	(6.07)	(6.07)	(4.96)	(4.96)
Human-induced	17.11^{**}	17.11^{**}	13.53^{**}	13.53^{**}
	(7.93)	(7.93)	(6.47)	(6.47)
Disaster experience	3.13^{***}	3.13^{***}	1.94^{**}	1.94^{**}
	(0.98)	(0.98)	(0.80)	(0.80)
Area dummies (base group = semiurban)				
Semiurban	-37.98^{***}	-37.98^{***}	-15.01^{**}	-15.01^{**}
	(7.89)	(7.89)	(6.62)	(6.62)
Urban	-26.96^{***}	-26.96^{***}	0.52	0.52
	(8.45)	(8.45)	(7.15)	(7.15)
Nonprosocial dummy (base group = prosocial)	-	-	-87.40^{***}	-87.40^{***}
	-	-	(6.09)	(6.09)
Constant	56.28^{***}	-	36.54^{***}	-
	(11.00)	-	(9.08)	-
Log Likelihood	-2272.28	-	-2187.64	-

***significant at the 1 percent level, **significant at the 5 percent level and ***significant at 10 percent level.