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Sustainability Science and Implementing the Sustainable Development Goals

Intergenerational sustainability dilemma and the degree of capitalism in societies: a field experiment

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Abstract Maintaining intergenerational sustainability is a minimum requirement for the existence of humankind, but it is now becoming one of the biggest challenges. Thus, it is necessary to understand what factors determine human preference and behavior for intergenerational sustainability. We hypothesize that ongoing modernization of competitive societies, which we call "capitalism," affects individual social preferences and other factors of human nature, compromising intergenerational sustainability. To examine this hypothesis, we implement an intergenerational sustainability dilemma game with "imaginary future generation" (IFG) as a policy tool (to prime people for future generations) in two types of Bangladeshi fields: (1) urban (capitalistic) and (2) rural (less capitalistic) areas. The analysis reveals that the likelihood of choosing intergenerational sustainable options significantly increases with the number of prosocial people in one generation and a dummy variable of rural areas. Since a considerable portion of people in rural areas are prosocial, rural people are identified to choose intergenerational sustainable options much more frequently than urban people. Moreover, the IFG treatment is not effective for urban people, implying that some stronger devices shall be necessary in capitalistic societies. Overall, our findings demonstrate that as societies become more capitalistic, intergenerational sustainability shall be further compromised through the change in people's social preferences and area-specific effects.

Keywords Intergenerational sustainability · Capitalism · Social preference · Culture and evolution

Abbreviations

IFG	Imaginary future generation
ISDG	Intergenerational sustainability dilemma game
SVO	Social value orientation

Introduction

Capitalism, the driving engine of our current economy, has contributed a lot to the economic development worldwide (Piketty 2014). Capitalism is also considered one of the best social regimes mainly for two reasons: (1) its ability to ensure the efficient allocation of private goods through competition; (2) by means of competition, it generates more innovative ideas and technologies which lead the economy to a faster growth. Hence, capitalism has been selected naturally by almost every country in the world. However, competition cannot ensure the efficient allocation of certain resources in some cases, such as public goods including environmental goods, natural resources and intergenerational provision of these goods (Milinski et al. 2006; Hauser et al. 2014). Intergenerational sustainability of such resources tends to be threatened due to its unidirectional nature of the effects from current generations to future generations but not vice versa (Hauser et al.

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2014). More specifically, the current generation tends to choose actions to their benefit without considering future generations under capitalism and democracy, which we call the "intergenerational sustainability dilemma (ISD)." Henceforth, excess competitions and self-maximization behavior of the current generations under capitalism and democracy may compromise intergenerational sustainability and incur a cost for the future generations.

We experience how economic growth and urbanization come with overexploitation of natural resources and environmental pollution. These effects of economic growth and urbanization threaten the needs of future generations and the existence of mankind in the earth (Ehrlich et al. 2012; Kinzig et al. 2013; Griggs et al. 2013; Costanza et al. 2014; Hauser et al. 2014). Now, a key question is how to take a balance of benefits and costs among different generations for survival of human society (Ostrom 1990; Milinski et al. 2006; Hauser et al. 2014). Given this state of affairs, sustainability or sustainable development has become one of the major policy agendas at many conferences of international organizations in recent years. For instance, in 2016, United Nations introduces sustainable development goal by emphasizing restoration of environmental quality for the planet and needs of future generations (United Nations 2016). The concept of sustainable development comes from the Brundtland report which describes sustainability as development that "meets the needs and aspirations of the present without compromising the ability of future generations to meet their own needs" (WCED 1987). Given this definition of sustainability and to successfully implement the sustainable development goal, this research addresses individual preferences and behaviors for intergenerational sustainability.

Past studies theorize how cultural agents bring evolution in human preference and behavior (see, e.g., Boyd and Richerson 1985; North 1990; Henrich and McElreath 2003; Henrich et al. 2005; Tomasello et al. 2005; Dawkins 2006; Richerson and Boyd 2008; Wilson et al. 2009; O'Brien et al. 2010; Moya et al. 2015). Similarly, several past studies have empirically shown how culture affects people's behaviors of prosociality, trust and fairness (Ockenfels and Weimann 1999; Henrich et al. 2005; Wilson et al. 2009; Henrich et al. 2010a; Brosig-Koch et al. 2011; Leibbrandt et al. 2013; Shahrier et al. 2016). In 2014, 3.9 billion people or 54% of world's population live in cities and it is forecasted that by 2050, the proportion of urban population will be 66% (American Association for the Advancement of Science 2016). The transformation of societies from rural to urban styles is expected to bring about changes in human culture and social norms. For instance, Shahrier et al. (2016) show that as societies become more capitalistic or modernized, individuals tend to be more competitive. Thus, public and intertemporal problems might pose more danger. Considering economic environment in the societies as a part of culture, this paper addresses whether and how intergenerational sustainability is compromised by capitalistic economic environment and people's social preferences.

Several works have examined people's preferences and behaviors over intergenerational sustainability. Sherstyuk et al. (2016) analyze the level of difficulties for maintaining externalities by implementing laboratory experiments of a dynamic game under two types of settings: (1) infinitely lived decision makers and (2) multiple generations. They find that limited inducement to care about the subsequent generations and inconsistency in their behaviors due to the strategic uncertainty make it difficult to retain dynamic externality, and thus individuals make more selfish decisions in an intergenerational setting. Fisher et al. (2004) demonstrate that the existence of intergenerational link motivates people to exploit less in an intergenerational common pool experiment. Executing an intergenerational goods game with the treatment of median voting, Hauser et al. (2014) find that median voting or democracy as an institution promotes intergenerational sustainability. Kamijo et al. (2017) design and implement a laboratory experiment of intergenerational sustainability dilemma game (ISDG) with the treatment of an imaginary future generation (IFG), demonstrating that the IFG improves intergenerational sustainability.

None of these studies addresses what factors cause a change in human behaviors and preferences for intergenerational sustainability, considering the types of societies or economic environment as a part of culture, i.e., the degree of capitalism. Moreover, all the previous studies of intergenerational sustainability have relied on laboratory experiments and have been conducted in the developed countries. However, to generalize and better understand human nature for intergenerational sustainability, field experiments should be conducted in developing countries as suggested by Henrich et al. (2005, 2010a, b). Building upon our previous research (Shahrier et al. 2016), we hypothesize that ongoing modernization of competitive societies, i.e., "capitalism", affects people's behaviors and social preferences to be more proself, compromising intergenerational sustainability. To examine this hypothesis, we implement an intergenerational sustainability dilemma game (ISDG) with "IFG" as a policy tool in two types of Bangladeshi fields: (1) urban (capitalistic) and (2) rural (less capitalistic) areas.

Methods and materials

Study areas

Our experiments have been implemented in two areas of Bangladesh: (i) Dhaka, the capital city and (ii) several

traditional villages of Shajahanpur subdistrict in a northern district Bogra (Fig. 1). Dhaka is a highly capitalistic mega city, while the Shajahanpur subdistrict in Bogra consists of rural agrarian villages. Both areas possess the same culture, language and religious variation since Bangladesh is ethnically and culturally a homogeneous country. These two areas differ from one another in terms of the level of competition or the degree of capitalism in societies. The first study area, Dhaka city, is located between 23°55′ and 24°81′ north latitude, and between 90°18′ and 90°57′ east longitude, covering the whole Dhaka metropolitan (Dewan and Corner 2014). The total land area, population and population density are 1371 km^2, 14.51 million and 10, 484 km^{-2}, respectively (Dewan and Corner 2014). The population density in this region is almost 9 times higher than that of the country average, and it is the most populated city in the world (Dewan and Corner 2014). Dhaka is the center of industrialization, businesses and services in Bangladesh. Business, service and some labor-intensive occupations such as industrial labor work are the major occupations in Dhaka. No farming activity is available in Dhaka metropolitan. For the rest of this paper, we interchangeably refer to Dhaka as urban areas.

The second study area consists of two unions of the Shajahanpur subdistrict in the northern district, Bogra, namely, Amrool and Chopinagar (Fig. 1). The Shajhanpur

Fig. 1 The two study areas: Dhaka and Bogra

subdistrict is located between 24°41′ and 24°50′ north latitudes, and 89°16′ and 89°29′ east longitudes, respectively. The total land area of the Shajhanpur is 54,783 acres; the land area of Amrool, and Chopinagar is 6106 acres and 4048 acres, respectively (Bangladesh Bureau of Statistics 2011). The population density of Amrol and Chopinagar is 951 and 1357 km^{-2}, respectively, whereas the country average is 1218 km^{-2} (Bangladesh Bureau of Statistics 2011). All the villages of these two unions are agrarian societies. Generation by generation, the dwellers in these villages engage in farming. A limited number of agro-based and other small-scale businesses are also available. In the rest of this paper, we refer to this study area as Bogra and interchangeably mention it as rural areas.

Experimental setup

We conduct an ISDG and a social value orientation (SVO) game in the fields.

Intergenerational sustainability dilemma game

We implement a three-person intergenerational sustainability game (ISDG), basically following the basic procedures of ISDG laboratory experiments employed by Kamijo et al. (2017). In this game, a group of three subjects is called a generation and each generation needs to choose between options A and B. By choosing option A, the generation receives a payoff of X, whereas the payoff by choosing option B is $X - 300$. After making the choice between A and B, the generation is asked to split the payoff among the generation members. Each subject's payoff in the ISDG is her generation's share of the group payoff plus the initial experimental endowment of 300. For instance, suppose $X = 1200$. The generation earns 1200 experimental money by choosing A, while the generation earns 900 $(=1200 - 300)$ by choosing B. Consequently, if members of this generation split the payoff equally, each member earns 400 with generation choice A and 300 with generation choice B as their individual share. Accordingly, each individual payoff becomes 700 and 600 with generation choice A and B, respectively. Each generation is allowed to discuss their decision between A and B and how to split the generation payoff up to 5 min. After the generation makes a decision, the members determine how to split the payoff.

Each experimental session consists of a sequence of 6 generations. Each generation is randomly assigned to the $1\text{st}, 2\text{nd}, \ldots$ and 6th generations, respectively, and members of the 6th generation never know that they are the last generation of the session. The current generation's decision affects the subsequent generations such that subsequent generations' payoffs decline uniformly by 300 when the current generation chooses option A, otherwise not. For instance, suppose that $X = 1200$ and the 1st generation chooses A. Then, the 2nd generation will face the game in which she can get 900 and 600 by choosing A and B, respectively. However, if the 1st generation chooses B, the next generation can have the same decision environment as the 1st generation faced. When the 1st generation chooses B, the 2nd generation can have the game in which she can get 1200 and 900 by choosing A and B, respectively. Following the same rule, the game shall continue for the rest of the subsequent generations in each session. Hence, option B can be considered an intergenerational sustainable option, while option A is the choice that compromises intergenerational sustainability.

In each session, the 1st generation starts the ISDG with $X = 1200$, implying that the 5th and 6th generations may face the game in which options A and B are associated with payoffs of zero and -300, respectively.[1] In addition, we include a treatment of "IFG" for the half of total sessions. In that treatment, we randomly assign a member of one generation to be a representative or an agent for subsequent generations as a "ministry of future." The subject with a role of the "ministry of future" is asked to think about not only her own generation but also subsequent generations in decision between options A and B. We introduce this treatment because we are interested in how priming people for the future generations can affect the generations' decision. In this three-person ISDG, subjects were paid BDT 350 (≈USD 4.40) at maximum and BDT 250 (≈USD 3.14) at the average.

Social value orientation games

We have used the social value orientation (SVO) game developed by Van Lange et al. (1997, 2007) to characterize subjects' social preferences. This method categorizes an individual value orientation into competitive, individualistic, prosocial or unidentified types depending upon their choices in the SVO game. In this game, numbers are given to represent the outcome for one self and other where the other is unknown to the subject and there is no possibility to knowingly meet the other in the future. Following Van Lange et al. (2007), one example of the game is given as the choice among the three options: (1) you get 500 and other gets 100, (2) you get 500 and other gets 500, (3) you

[1] When all of the generations from the 1st to the 4th choose option A, then the 5th generation will face the game in which she receives 0 and -300 by choosing A and B, respectively. When the 5th or 6th generations face the games in which options A and B are associated with 0 and/or some negative payoffs, the generation members can refund themselves equally from their initial endowment of 300 to make the individual payoff at least zero.

get 560 and other gets 330. In this example, option (1) represents competitive orientation that maximizes the gap between the point of self and the point of other ($500 - 100 = 400$); option (2) is the prosocial orientation that maximizes the joint outcome ($500 + 500 = 1000$). Finally, option (3) characterizes the individualistic option that maximizes own outcome 560 and indifferent to the outcome of the other.

This SVO game contains 9 selections, each of which consists of three options introduced above with different numbers and orders in each selection. Subjects are asked to choose one among the three options for each of the selections. If at least 6 choices among 9 ones made by one respondent are consistent with one of the orientations (competitive, prosocial and individualistic), he/she is categorized as a person with that orientation. Otherwise, the subject is considered "unidentified." We have implemented our experiment with money incentive. Subjects had been informed that the units represented in this game are points, and the more points one subject gets, the more real money he/she will earn from this game with some exchange rate, which is BDT 250 (≈USD 3.14) at maximum and BDT 150 (≈USD 1.88) on the average. To compute the payoff of the subjects from this game, we randomly match a subject with another subject as a pair. The experimental earning in this SVO game is the summation of points from 9 selections by herself for oneself and 9 selection by the partner for the other. We also explain the way of random matching and payoff calculation for the real money incentive to respondents.

Experimental procedure

To implement random sampling in the rural (less capitalistic) areas, we first collected information of the household numbers from local government offices and randomly choose the required number of households from the two unions based on the respective population. Subsequently, we invited one income-earning member from each of the selected households to participate in our experiments. In the urban (capitalistic) areas, we did a randomization based on the population proportion of each occupation in the total population (Bangladesh Bureau of Statistics 2013). After determining the required number of subjects from each of the occupations, we arbitrarily selected a number of organizations for each of the occupations. Next, we contacted with the organizations and based on their compliance, we randomly selected and invited individuals from these organizations.

For low-income occupations and the occupations that require frequent movement within the city, we arbitrarily pick subjects from the slums or cities, and invited them to participate in the experiments. In the rural areas, we conducted our experiment in three elementary schools, and in the urban areas, we did it at Institute of Information Technology in Dhaka University. In total, we conducted 28 sessions (14 sessions in each of the study areas), and a total of 504 subjects participated in our experiment. Therefore, 252 respondents were grouped into 84 generations in each of the study areas. Half of the sessions in each study area have been assigned to IFG treatment. On an average, we paid BDT 650 (≈ USD 8.14) to each subject including a fixed show-up fee of BDT 200 (≈ USD 2.51). Each session of the experiment took $2.5 \sim 3$ hours approximately.

In each experimental session, we provide a printed experimental instruction to each of the respondents in their native language, Bengali. In addition, we made verbal presentation to explain the rules of the game and double-checked respondents' understanding about the game. After that, we randomly assigned three persons to each generation by asking each subject to pick a card with ID number from a bag. Subjects were not allowed to look at the ID number on the card. To maintain anonymity across generations, we placed the 6 generations in 6 separate rooms by asking each subject to go and sit in a specific room according to their ID. Hence, members of each generation could communicate only with the members of his/her own generation. Thereafter, we elicited each generation's choice between *A* and *B* in an ascending order from the 1st generation to 6th generation. We let members know which generation they belong to and the payoffs associated with the options *A* and *B*. Therefore, each generation is able to calculate how many times *A* and *B* were chosen by the previous generations since subjects know which generation they belong to and an initial game the 1st generation faces. After the ISDG games, we started the SVO game and ensured respondents' understanding about it with printed instructions and oral presentation. Subsequently, we elicited respondents' SVO choices and socioeconomic information.

Results

First, to show the demographic differences between urban and rural areas, we present the descriptions and summary statistics of major socioeconomic factors in urban and rural areas, respectively, in Tables 1 and 2. Table 2 shows that urban people earn three times more income than the rural people on an average. However, in the urban area, a high standard deviation of income implies a huge income gap between the rich and the poor as a usual characteristic of urban areas in developing countries. On an average, urban people are 10 years younger than the rural people since the average age of urban and rural subjects are 23.7 and 33.6 years, respectively. Urban people have 12.60 years of education on an average which is twice as much as the average education of rural people.

Table 1 Description of socioeconomic variables

Variable	Description
Household income	Household income per month in 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
Occupation dummy	Three dummy variables are defined for wage-labor occupation,farming and business and service, respectively

Table 2 Summary statistics of major socioeconomic characteristics at individual level in urban and rural areas, 504 observations (each area has 252 observations)

	Areas		Overall
	Urban	Rural	
Monthly household income in BDT 1000			
Average (median)[a]	50962.30 (35000)	17034.37 (14000)	33998.33 (20000)
SD[b]	53656.33	12067.46	42398.75
Min	5000	4000	4000
Max	325000	115000	325000
Age (ordered categories)[c]			
Average (median)	0.37 (0.00)	1.36 (1.00)	0.86 (0.00)
SD	0.71	1.32	1.17
Min	0	0	0
Max	4	5	5
Education (years)			
Average (median)	12.60 (16.00)	6.48 (5.00)	9.54 (10.00)
SD	4.99	4.04	5.47
Min	0.00	0.00	0.00
Max	19	17.00	19.00
Occupation dummies			
Wage-labor occupation			
Average (median)	0.14 (0.00)	0.35 (0.00)	0.25 (0.00)
SD	0.35	0.48	0.43
Min	0	0	0
Max	1	1	1
Farming			
Average (median)	0.00 (0.00)	0.35 (0.00)	0.17 (0.00)
SD	0.00	0.48	0.38
Min	0	0	0
Max	0	1	1
Business and service			
Average (median)	0.86 (1.00)	0.30 (0.00)	0.58 (1.00)
SD	0.35	0.49	0.50
Min	0	0	0
Max	1	1	1

[a] Median in parentheses

[b] SD stands for standard deviation

[c] The age variable is defined as an ordered categorical variable (Table 1)

Regarding occupations, wage-labor occupation comprises labor-intensive jobs, such as working in the garments and other industries, rickshaw-pulling and daily-paid labor works. Farming includes all kinds of farming activities. Finally, the occupation of business and service contains all kinds of businesses, government and non-government services. It appears that urban areas consist of only individuals with business, service and wage-labor occupations and no farming activities are available in urban areas. On the other hand, we find a seemingly equal mixture of these three occupations in rural areas.[2] In summary, in urban areas, people are relatively young, income and education are high relative to people in rural areas. Life in urban areas comes with a huge income gap among the people where no farming activities exist. The findings depict the usual characteristics of urban areas in developing countries. On the other hand, rural areas consist of an equal mixture of farmers, businessmen and wage-labor occupations with a relatively low income and education.

Table 3 presents the summary statistics of generations' choices for intergenerational unsustainable option *A* and intergenerational sustainable option *B* in ISDG. It shows that 54.76% of the generations choose *B*, whereas 48.24% of the generations choose *A*. However, in urban areas, out of 84 generations, 59 generations (35.12%) choose *A*, and 25 (14.88%) generations choose *B*. On the other hand, in rural areas, out of 84 generations, 67 generations (39.88%) choose *B* and 17 generations (10.11%) choose *A*. Utilizing the frequency result summarized in Table 3, we have run a chi-squared test with the null hypothesis that the distribution over generation choices *A* and *B* between these two areas is the same. The result reject the null hypothesis with a statistical significance of 1% and thus the frequency of generation choices *A* and *B* between urban and rural areas is different from one another. In summary, generations in the less capitalistic rural areas choose more intergenerational sustainable option *B* than the generations in the highly capitalistic urban areas.

The summary statistics of generations' choices between *A* and *B* with and without IFG treatment in urban and rural areas have been presented in Table 4. There are 42 observations in each treatment per study area. In urban areas, there is no difference between the generations with and without IFG in terms of group choices between *A* and *B*. In rural areas, we find a slight increase in generations' choice *B* with IFG, that is, 36 and 31 generations choose option *B* with and without IFG, respectively. The result suggests that in urban areas, the IFG treatment is not effective to affect generations' choices. On the other hand, in rural areas, people may be more induced to choose option *B* with IFG, although the difference between with IFG and without IFG is not so large. Overall, the IFG treatment seems not to improve the intergenerational sustainability, especially, in capitalistic urban areas such as Dhaka.

Table 5 shows the distribution of the number of prosocial members categorized by SVO games in each generation between urban and rural areas. There are 84 generations in each region. As we can see from Table 5, the distribution of the number of prosocial members per generation in urban areas appears to be different from that in rural areas. The 53 generations in urban areas do not have prosocial members, meaning that the generations consist of only individualistic and competitive types of people. On the other hand, only 12 such generations have been found in rural areas. More generations with one or two prosocial members are found in rural areas than in urban areas, while the number of generations with three prosocial members are the same. More specifically, 15 and 12 generations in urban areas have 1 and 2 prosocial members, respectively, whereas 34 and 34 generations in rural areas have one and two prosocial members, respectively. The chi-squared test confirms that the distribution in the number of prosocial members per generation between urban and rural areas is different from one another with statistical significance of 1%. This finding is consistent with Shahrier et al. (2016) and Timilsina et al. (2017) such that due to the propagation

Table 3 The frequency and percentage of generation choices *A* and *B* (percent in parenthesis)

Choice of *A* or *B*	Region		Subtotal
	Urban	Rural	
A	59 (35.12%)	17 (10.11%)	76 (45.24%)
B	25 (14.88%)	67 (39.88%)	92 (54.76%)
Subtotal	84 (50.00%)	84 (50.00%)	168 (100.00%)

Table 4 Generation choices *A* and *B* between the urban and rural areas with and without imaginary future generations (IFG)

	Urban		Rural	
	With IFG	Without IFG	With IFG	Without IFG
A	29	30	6	11
B	13	12	36	31
Subtotal	42	42	42	42

[2] However, our data reveal that in the rural areas, almost 100% of the households engage in subsistence farming for their self-consumption in addition to their main occupations. A significant portion of the wage-labor occupations work in agriculture. Moreover, the occupational category of business and service mainly includes small-scale businesses related to agriculture and only a few service people working in a service sector are found. Overall, people in rural areas are highly dependent on farming and agriculture for their livelihood.

Table 5 Distributions in the number of prosocial members per generation between the urban and rural areas

Number of prosocial members in one generation	Number of generations	
	Urban	Rural
0	53	12
1	15	34
2	12	34
3	4	4
Subtotal	84	84

of the cultural trait of "competition for survival and success", individuals become more competitive and less prosocial as societies become more capitalistic.

The summary statistics and chi-squared tests suggest that the value orientation and the types of societies (capitalistic vs less capitalistic) might have strong predictive power to explain generations' decisions over intergenerational sustainability. Hence, to establish our result, we run a probit regression by taking generation choice between *A* and *B* as a dependent variable and the number of prosocial members in each generation, area dummy, and the IFG dummy as independent variables (see Table 6 for the detailed definition of each variable). In the regression analysis, we initially included income, education, the number of females, the number of household members, occupations and age at generation level. However, we find that such socioeconomic variables do not affect the results. Thus, we decided not to include them in the final analysis. We hypothesize that the number of prosocial members in each generation and area dummy (the degree of capitalism in the society) are statistically and economically significant to explain generations' choices over intergenerational sustainability. Table 7 reports the marginal probability of choosing *B* calculated from the results of probit regressions.

An increase of prosocial members in a generation leads to a 59.2% rise in the probability of choosing *B* relative to the probability of choosing *A*, controlling for the degree of capitalism and IFG (Table 7). It appears that social preference of members is one of the strongest predictors for intergenerational sustainability. Van Lange et al. (2007, 2011) show that, in reality, prosocial people donate and volunteer more than competitive and individualistic people categorized by SVO tests. Their results are consistent with our experimental finding for intergenerational sustainability. In particular, our result suggests that prosocial people care more about the future generations, and the number of prosocial people per generation is a key to enhance intergenerational sustainability.

Table 6 Definitions of variables included in the regression

Variable	Definition
Choice *A* or *B*	A dummy variable that takes 1 if the generation chooses *B*, otherwise 0
# of prosocial members in a generation	The number of prosocial members in each generation
Area dummy	A dummy variable that takes 1 if the generation is from the rural area, otherwise 0
IFG	A dummy variable that takes 1 when IFG treatment is given to one session consisting of 6 generations, otherwise 0

Table 7 Marginal effects of probit regressions for generation choice *B*

Variable	Marginal effects
# of prosocial members	0.592*** (0.079)
Area dummy (Urban = 0)	0.299*** (0.100)
IFG dummy	0.084 (0.105)

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

The area dummy variable in the regression tells us that a generation in rural areas is 29.9% more likely to choose *B* than a generation in urban areas, controlling for social preference and the IFG treatment (Table 7). The coefficient is statistically significant at 1% level and can be considered practically large as well. Hence, the regression result is consistent with the proposition of the chi-squared test demonstrated in Table 4, implying that as societies become more capitalistic, people tend to choose less intergenerational sustainable options due to the region-specific effect. A key question here is now "what does this area dummy really capture?" We will discuss this issue later.

Now, we look at the effect of the IFG on intergenerational sustainability. The outcome of the IFG is positive and economically significant to increase the probability of choosing *B* by 8.4% relative to the probability of choosing *B* without the IFG treatment. However, the effect is not statistically significant even at a 10% level. As is shown in Table 5, the IFG appears not to motivate the generations to choose *B* in both urban and rural areas. However, in rural areas, we have observed a high percentage of generation choice *B* even without the IFG, and this may be the reason why a marginal effect of the IFG is not significant.

In urban areas, the IFG treatment appears not to be effective. Past studies show that human behavior and preference of competitiveness, equity, and fairness do not change constantly over time (Harbaugh and Krause 2000;

Henrich et al. 2005; Brosig-Koch et al. 2011). In highly capitalistic societies, such as Dhaka, people compete to survive and secure their positions from the beginning of their life. Hence, in such societies, people may have formed a consistent preference for choosing competitive outcomes to maximize their own payoff. Therefore, it can be conjectured that simply priming people for the future through the IFG treatment may not change their decisions to sacrifice themselves for the subsequent generations.

Our analysis finds that there are mainly two channels to affect intergenerational sustainability. One channel is social preference of prosociality, and the other is a area-specific channel expressed through the dummy variable in our regression. While it is quite intuitive that more prosocial people in one generation have a strong tendency to choose the intergenerational sustainable option, it is not so clear about what the area dummy captures in the regression. Therefore, we now discuss the possible answers. We argue that the ways of acquiring wealth, cognitive skills and non-cognitive skills between urban and rural areas are different and this difference may be captured by the area dummy (Sticht et al. 1992; Kaplan and Robson 2002; Hikosaka et al. 2013; Kim et al. 2014; Hooper et al. 2015; Jones 2015; Schniter et al. 2015; Morgan 2016). The rural areas in our study are agrarian societies where business, industry and service sectors are not developed and most people engage in agriculture, either as a main income-generating activity or activities for self-consumption. That is, it is likely that most people have been familiar with farming since he/she was born.

In such an agrarian society, transferring wealth and cognitive skills, such as social norms, values, wisdom, family history, non-cognitive skills and farming techniques from one generation to subsequent generations is the usual practice as part of farming activities and daily survival. It is called "vertical transmission" (see, e.g., Cheverud and Cavalli-Sforza 1986; Henrich and McElreath 2003; Hewlett et al. 2011; Labeyrie et al. 2014; Moya et al. 2015; Soldati et al. 2015; Tam 2015; Ross and Atkinson 2016; Kopps et al. 2017). For example, young farmers learn many lessons directly from the members of the previous generations about the techniques ranging from cultivation to harvesting (Sticht et al. 1992; Hewlett et al. 2011; Kim et al. 2014; Hooper et al. 2015; Schniter et al. 2015; Ross and Atkinson 2016). In such situations, old and young generations live intimately with each other in an interactive way that young ones receive care from members of previous generations, such as grandparents and friends of grandparents. Consequently, the younger generations naturally come to know social norms, value, wisdom and family history from the older members of the society (Sticht et al. 1992; Hewlett et al. 2011; Kim et al. 2014; Hooper et al. 2015; Schniter et al. 2015; Ross and Atkinson 2016). Therefore, individuals in rural areas know that wealth, cognitive and non-cognitive skills come from the previous generations and experience such "vertical transmission of knowledge and skills."

On the other hand, in capitalistic areas, such as Dhaka, due to high mobility of occupations, long-working hours, less interaction among the dwellers, nuclear family structure and high density of young people, the vertical transfers of wealth, cognitive and non-cognitive skills from one generation to subsequent generations tend to be weak. Instead, learning of various cognitive and non-cognitive skills in urban societies has been made through the specialized and formalized education systems, such as universities, as societies are developed to be highly specialized, urbanized and mobilized, so-called "horizontal transmission of knowledge and skills" (Labeyrie et al. 2014; Jones 2015; Soldati et al. 2015; Stulp et al. 2016a; Tam 2015; Stulp et al. 2016b). Unlike rural societies, due to formalization and specialization in education, individuals in such a society do not experience "vertical transmission of knowledge and skills" in their learning processes.

Studies show that past memory affects individual decisions about the future (Schultz et al. 1997; Gilbert and Wilson 2007; Gerlach et al. 2014; Szpunara et al. 2014). As a result, unlike rural areas, due to the lack of memory about vertical transmission of knowledge and skills in learning processes, urban people are induced to selfishly maximize their own generation's payoff without considering intergenerational linkage. Overall, it is our belief that the area dummy in our regression analysis captures the differences between rural and urban areas with respect to the degree of interactions among generations and the process of transferring skills from one generations to subsequent generations. That is, intergenerational links for learning and survival in daily life shall be considered a key for intergenerational sustainability.

Past literature has demonstrated theoretically and empirically how culture brings evolution in human preference and behavior. Our analysis can be considered an additional evidence for the effect of culture on human behavior and preference in the context of intergenerational sustainability in relation to the degree of capitalism. At the same time, our findings bring some hope to maintain the intergenerational sustainability using culture as a tool. As mentioned by Dawkins (2006) and Wilson et al. (2009), some policies and institutional changes might be able to effectively direct individuals and societies toward having more intergenerational links. Therefore, with appropriate institutional setups, individuals will be able to learn about how to maintain intergenerational sustainability from each other. That is, the importance of intergenerational sustainability should be propagated from one person to

another person through effective institutional or policy changes.

Conclusions

We experience how ongoing modernization of competitive societies endangers possibilities of future generations by causing overexploitation of natural resources and environmental pollution. Therefore, to ensure the existence and development of human societies, sustainability has become one of the key issues in development agendas. Especially, United Nations' sustainable development goal puts this issue forward. However, to achieve sustainable development goals and to maintain intergenerational sustainability, individual decision for intergenerational sustainability is important. Past studies show how changes in culture, such as ongoing modernization of competitive societies, brings about a change in people's social preferences (Shahrier et al. 2016). Therefore, given the importance of intergenerational sustainability and rapid growth of highly modernized and competitive societies, this paper analyzes human preference and behavior for intergenerational sustainability in relation to the degree of capitalism in the society by implementing experiments in two fields of a developing country, Bangladesh: (1) urban and (2) rural areas.

The analysis reveals that there are two channels to affect intergenerational sustainability, social value orientations and regional-specific effects. The likelihood of choosing intergenerational sustainable options significantly increases with the number of prosocial people in one generation and a dummy variable of rural areas. Since a considerable percentage of prosocial people are found in rural areas, rural people choose intergenerational sustainable options much more frequently than urban people. We also claim that intergenerational links or the transfer of cognitive and non-cognitive skills from one generation to subsequent generations have been lost in urban societies and this may be the reason for the area-specific effects. The IFG treatment (priming people for the future) is not effective for urban people, implying that some stronger devices shall be necessary for intergenerational sustainability in capitalistic societies. Overall, our findings demonstrate that as societies become more capitalistic, intergenerational sustainability shall be further compromised through the changes in people's social preference and area-specific effects.

Human history demonstrates how excess competition in contemporary societies destroys natural environment and sustainability. This research sought to characterize how ongoing modernization of competitive societies affects intergenerational sustainability through field experiments of ISDG and SVO games. As a limitation of our study, the degree of capitalism in societies is assumed to be captured by the area dummy variable in the analysis, and we conjecture that the effects may come from the different level of intergenerational links (vertical or horizontal transmission) in learning processes of cognitive and non-cognitive skills between urban and rural areas (Cheverud and Cavalli-Sforza 1986; Henrich and McElreath 2003; Moya et al. 2015). However, in fact, the specific effects of intergenerational links or the detailed pathways have not been established in this research. It is our belief that the area-specific effects for intergenerational preferences and behaviors may originate from many aspects of human nature, life and societies. Future research should be able to examine such specific factors by employing different types of field experiments for the purpose of suggesting effective policy tools to enhance intergenerational sustainability.

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