INTERGENERATIONAL SUSTAINABILITY DILEMMA AND CAPITALISM IN SOCIETIES: FUTURE AHEAD AND BACK MECHANISM AS A POTENTIAL SOLUTION

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INTERGENERATIONAL SUSTAINABILITY DILEMMA AND CAPITALISM IN SOCIETIES: FUTURE AHEAD AND BACK MECHANISM AS A POTENTIAL SOLUTION

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Maintaining intergenerational sustainability or intergenerational providing of environmental and natural goods is a minimum requirement for the existence of humankind, but it is now becoming one of the biggest challenges for the current human society. Particularly, Intergenerational sustainability tend to be threatened due to its unidirectional nature of the effects from current generations to future generations but not vice versa, which we call intergenerational sustainability dilemma. Therefore, it requires sacrifice/cooperation from the current generation. Cooperation and competition are core issues in various fields, since they are claimed to affect the evolution of human societies and ecological organizations including intergenerational sustainability.

The current developments of human societies have been materialized under democracy and capitalism. Capitalism is contemplated as the best social regime due to its ability to allocating private goods efficiently and generate more innovations through competition. However, capitalism and democracy might not be considered best devices to ensure intergenerational sustainability. In particular, the exclusion of future generation's needs from the economic system and the idea of maximizing individual payoffs through competition endanger intergenerational sustainability and incur a cost for the subsequent generations. Past studies show that social behaviors and preferences are shaped with culture. For instance, due to the maturation of capitalism in societies, people might be more competitive/proself since "competition for survival and success" is

one of the major ideas in capitalism. Consequently, they might endanger intergenerational sustainability in that it requires prosociality from the current generation. Given these states of affairs, new mechanism/social systems could be necessary.

Therefore, our research starts with analyzing the change in human social preference in relation to "ongoing modernization of competitive societies" which we call capitalism. In the second sage, we inspect the association between change in human social preference and human decision for intergenerational sustainability. Finally, we design a new mechanism to maintain intergenerational sustainability and examine its effectiveness to enhance intergenerational sustainability.

The first experiment which is presented in the second chapter of this dissertation examines how human social preference changes with ongoing modernization of competitive societies. To examine this, we implement field experiments of social value orientation and surveys with 1002 respondents for three different areas of Bangladesh: (i) rural, (ii) transitional, and (iii) capitalistic societies. The main result reveals that with the evolution from rural to capitalistic societies, people are likely to be less prosocial and more likely to be competitive. In a transitional society, there is a considerable proportion of "unidentified" people, neither proself nor prosocial, implying the potential existence of unstable states during a transformation period from rural to capitalistic societies. We also find that people become more proself with increasing age, education and number of children. These results suggest that important environmental, climate change or sustainability problems, which require cooperation rather than competition, will pose more danger as societies become capitalistic.

Given this result, in our second experiment, we examine the association between the change in human social preference and their decision for intergenerational sustainability. Third chapter of this dissertation presents this study. We implement an intergenerational sustainability dilemma game (ISDG) with "imaginary future generation" (IFG) as a pol-

icy tool (to prime people for future generations) in two types of Bangladeshi fields: (i) urban (capitalistic) and (ii) rural (less-capitalistic) areas. In such games, a lineup of consecutive generations is organized, and each generation can either maintain intergenerational sustainability (sustainable option) or maximize its own generation's payoff by irreversibly imposing a cost on future generations (unsustainable option). The IFG treatment assigns a member of a generation as the representative of subsequent generations.

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 preference and area-specific effects.

Given the failure of IFG, we design a new mechanism called the future ahead and back mechanism (FAB) and examine its effectiveness to enhance intergenerational sustainability through field experiments consisting of ISDGs. The result of this experiment has been presented in chapter four. In a basic ISDG, generations make the decision through deliberative democracy. In the ISDG with FAB, each generation is first asked to consider the decision of the current generation as if it is in the position of the next generation. Second, the generation makes the actual decision from its original position as the current generation.

The results find that deliberative democracy does not prevent a majority of proself people from choosing unsustainable options, which is the mirror image of the results demonstrated in Hauser et al. (2014), thereby compromising intergenerational sustain-

ability in the basic ISDG. By contrast, FAB is demonstrated to enable proself people to change their individual opinions from unsustainable to sustainable options, inducing more generations to choose sustainable options. We argue that the memories and experiences of what and how people request (or role-playing) as future generations in FAB trigger more logic-based reasoning than norm-based reasoning, thereby enhancing intergenerational sustainability.

BIOGRAPHICAL SKETCH

My name is Shibly Shahrier and I am a citizen of Bangladesh. I am currently a third year Ph.D. student in economics at Kochi University of Technology , Japan. I am going to complete my Ph.D. by March 2018. Before entering Kochi University of Technology, I got my Masters in Public Management from International University of Japan in 2014 and complected my Bachelor degree in Government and Politics in 2009 from Jahangirnagar University, Bangladesh. My academic interest lies in the area of experimental economics, environmental economics, sustainable development and cultural evolution. By pursuing a Bachelor degree in Government and Politics, I gathered knowledge on political thought, decision making theories, public policy analysis and sustainable development. During my Masters, I focused on environmental economics, development economics, econometrics and policy modeling. Currently, my Ph.D. research focuses on analyzing human decision for public and intertemporal problems, such as climate change mitigation and intergenerational sustainability, and finding mechanism to solve these problems. Till date, I have published three papers with Singapore Economic review, PLOS ONE and Sustainability Science, respectively and three of my researches are under review in top quality journals.

This research is dedicated to our ancestors and the future human generations since our ancestors are the major contributors to the current human society and the future generations will make our imaginations come true.

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CHAPTER 1

INTRODUCTION

Current human societies experience how rapid economic development, urbanization and modernization worldwide come up with overexploitation of natural resources and environmental pollution. Natural resource depletion and environmental problems threaten the possibilities of future human generations in the earth, which might even cause the extension of humankind (Milinski et al., 2006, Hauser et al., 2014, Steffen et al., 2015, Maxwell et al., 2016). Therefore, how to strike a balance between coasts and benefits among the generations is a key question (Ostrom, 1990, Milinski et al., 2006, Hauser et al., 2014). Given such state of affairs, sustainability becomes one of the major policy agendas in recent times. In 2016, United Nations introduce sustainable development goals with great emphasis on environmental quality and needs of the future generations. 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).

Since sustainable development is a continuous process that needs longer time than only one generation, it requires cooperation among current and future generations. This means, sustainability should be ensured in an intergenerational setting. However, intergenerational sustainability or intergenerational provision of environmental and natural resources tends to be threatened due to its unidirectional nature, meaning that the amount of natural resources we harvest today or the amount of carbon we emit today affects the subsequent generations but not vice versa. Due to this unidirectional nature of intergenerational sustainability, it needs sacrifice or prosociality from the current generation to the subsequent generations.

The current developments of human societies have been materialized under democracy and capitalism. Capitalism is contemplated as the best social regime due to its ability to allocate private goods efficiently and generate more innovations through competition. However, capitalism and democracy might not be considered best devices to ensure intergenerational sustainability. In particular, the exclusion of future generations' needs from economic system and the idea of maximizing individual payoffs through competition endanger intergenerational sustainability and incur a cost for the subsequent generations. 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.

Many of the past studies in the field of behavioral science demonstrate that cultural change affects human behaviors and decisions (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). For instance, when societies develop under capitalism and democracy, the idea of "competition for survival and success" might transfer from one individual to anther and people might become more competitive/proself since competition is one of the major ideas in capitalism. Consequently, intergenerational sustainability might be threatened due to the increase in the number of proself people with the maturation of capitalism in societies given that it requires sacrifice from the members of the current generation. Our current experience of overexploitation of natural resources and environmental pollution might be a result of such change in human preferences and decisions. Given such state of affairs, new mechanism to maintain intergenerational

sustainability may be urgent.

Several studies have documented how culture affects human behavior of competitiveness, fairness, equity and trust. Henrich et al. (2005, 2010a) show that in indigenous societies, people exhibit higher prosociality and fairness when they are integrated into a market.[1] Leibbrandt et al. (2013) show that fishermen in individualistic lake-based fisheries are more competitive than those in collective sea-based fisheries, suggesting that interactions with other people in the workplace affect human behaviors and preferences. Using a decomposed game of social value orientation (hereafter, SVO), Van Lange et al. (2011) show that economics students are more competitive than psychology students and that "prosocial" individuals volunteer more in practice. Ockenfels and Weimann (1999) and Brosig-Koch et al. (2011) study people's cooperative and solidarity behaviors in Eastern and Western Germany based on their different economic and social histories. They find that subjects from Eastern Germany act more selfishly than those from Western Germany in both public goods and solidarity games. By implementing a value-based study in 20 capitalistic countries, Schwartz (2007) shows that people express stronger preferences for values such as self-assertiveness, mastery of natural and human resources, conformity, power and achievement in more market-driven and competitive societies.

A number of studies examine people's decision for intergenerational sustainability. By implementing a laboratory experiment of externality game, Sherstyuk et al. (2016) reveal that maintaining dynamic externalities is more difficult in intergenerational settings than in a setting with infinitely lived decision makers. Fisher et al. (2004) find that an intergenerational link motivates individuals to sustain intergenerational common pool resources. Conducting an online experiment with an intergenerational goods

[1] Our research differs from that of Henrich et al. (2005, 2010a) in that we study people and their social value orientations in three large-scale societies that are integrated into markets and have different degrees of capitalism, holding features such as language and religion constant.

game, Hauser et al. (2014) reveal that the existence of a few defectors causes over-exploitation of intergenerational goods and, thus, voting or democracy can maintain intergenerational sustainability by resisting the defectors. Kamijo et al. (2017) design and implement an intergenerational sustainability dilemma game (hereafter, ISDG) and show that introducing an imaginary future generation improves intergenerational sustainability. Shahrier et al. (2017) conduct ISDG field experiments in rural and urban areas of Bangladesh, demonstrating that rural people choose much more intergenerationally sustainable options than urban people. Furthermore, contrary to Kamijo et al. (2017), urban people fail to maintain intergenerational sustainability even in the treatment with imaginary future generations. This is because a majority of urban people are proself, and generations of such proself people consistently choose unsustainable options irrespective of the treatments and conditions.[2]

However, none of the past studies analyzes human behavior of competitiveness in relation to the degree of capitalism or ongoing modernization in societies as well as how this change affects their decision for intergenerational sustainability. The literature indicates that societies will be more urbanized and competitive in the future, projecting that, by 2050, 66 % of the global population will reside in cities of developing countries. Specifically, cities in Africa and Asia will account for the 75 % urbanities in the world (American Association for the Advancement of Science, 2016, Wigginton et al., 2016, McDonnell and MacGregor-Fors, 2016). Considering the ongoing modernization and urbanization of competitive societies and the possible increase in the number of proself people, democracy may not be able to maintain intergenerational sustainability, and a new mechanism is necessary. Moreover, all past studies of intergenerational sustain-

[2]Approximately 60 % of student subjects in the ISDG laboratory experiments of Kamijo et al. (2017) are prosocial. The high proportion of prosocial students may be attributed to the location of Kochi University of Technology where Kamijo et al. (2017) conducted ISDG laboratory experiments. Kochi University of Technology is located in Kochi prefecture, which is not urban compared with Tokyo or Dhaka. By contrast, Shahrier et al. (2017) show that only 20 % of subjects are prosocial in the urban areas (Dhaka) of Bangladesh, leading to low intergenerational sustainability.

ability have been demonstrated in developed countries and in laboratories. However, to make our understanding better about human behavior related to and decision for intergenerational sustainability and given the drastic growth of urbanized and modernized societies in the developing world, studies of intergenerational sustainability should be demonstrated in developing countries (Henrich et al., 2005, 2010a,b).

Therefore, in this research, first we analyzing the change in human social preference in relation to "ongoing modernization of competitive societies" which we call capitalism by implementing economic field experiments of social value orientation (SVO) in three areas of a developing country, Bangladesh: (1) rural, (2) transitional and (3) capitalistic societies.. In the second sage, we examine how change in human social preference affects their decision for intergenerational sustainability by means of organizing field experiment of intergenerational sustainability dilemma game (ISDG) in rural (less-capitalistic) and urban (capitalistic) areas of Bangladesh . Finally, we design and examine the effectiveness of two possible mechanisms to maintaining intergenerational sustainability in highly capitalistic societies by organizing field experiments of ISDG.

The later parts of this dissertation have organized as follows: Chapter- 2 entitled "Social value orientation and capitalism in societies" presents the details of the experimentation of human social preference in relation to ongoing modernization of competitive societies; the study of human decision for intergenerational sustainability with respect to the change in human social preference has been presented in chapter- 3 entitled "Intergenerational sustainability dilemma and the degree of capitalism in societies: a field experiment;" chapter- 4 puts forward the examination of a possible mechanism to maintain intergenerational sustainability in highly capitalistic societies, this chapter titles "Intergenerational sustainability dilemma and a potential solution: Future ahead and back mechanism." Finally, chapter- 5 renders the discussion and conclusion.

CHAPTER 2

SOCIAL VALUE ORIENTATION AND CAPITALISM IN SOCIETIES

2.1 Introduction

Competition and cooperation have been important issues in various fields, such as anthropology, biology, economics and sociology, because they are considered determinants of the evolution of human societies and ecological organizations (Wilson et al., 2009, Leibbrandt et al., 2013). In evolutionary dynamics, competition is advantageous in the short run, but for long-run survival, cooperation can also be an effective strategy (Dawkins, 2006, Wilson et al., 2009). In economics, rational self-interest models under competition can efficiently allocate private goods but cannot fully solve some public and intertemporal problems, such as natural resource allocation, public goods provision and resource sustainability for future generations (Milinski et al., 2006, Hauser et al., 2014).

Social behaviors and preferences cannot be fully explained by genetic properties (Henrich, 2004, Henrich et al., 2005, Robinson, 2004, Robinson et al., 2005, Dawkins, 2006, Robinson et al., 2008, Richerson and Boyd, 2008). Alternatively, culture-gene coevolutionary theory argues that human beings learn ideas and culture through a social learning mechanism, and this cultural transmission shapes human behaviors and preferences along with genetical properties (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). With culture-gene coevolutionary theory, the economic environment can be considered part of culture and is expected to affect people's social preferences and behaviors. Given the economic growth of societies, together with concerns about environmental problems and future sustainability, this article addresses the relation between

economic development and social preferences (or social behaviors) that are central to competition and cooperation in societies.

Several studies have documented how culture affects human behavior of competitiveness, fairness, equity and trust. Henrich et al. (2005, 2010a) show that in indigenous societies, people exhibit higher prosociality and fairness when they are integrated into a market.[1] Leibbrandt et al. (2013) show that fishermen in individualistic lake-based fisheries are more competitive than those in collective sea-based fisheries, suggesting that interactions with other people in the workplace affect human behaviors and preferences. Using a decomposed game of social value orientation (hereafter, SVO), Van Lange et al. (2011) show that economics students are more competitive than psychology students and that "prosocial" individuals volunteer more in practice. Ockenfels and Weimann (1999) and Brosig-Koch et al. (2011) study people's cooperative and solidarity behaviors in Eastern and Western Germany based on their different economic and social histories. They find that subjects from Eastern Germany act more selfishly than those from Western Germany in both public goods and solidarity games. By implementing a value-based study in 20 capitalistic countries, Schwartz (2007) shows that people express stronger preferences for values such as self-assertiveness, mastery of natural and human resources, conformity, power and achievement in more market-driven and competitive societies.

None of the past studies focuses on the degree of capitalism in societies to analyze human behaviors and preferences for competition and cooperation despite the growth of capitalism that has taken place around the world. In this paper, we define "ongoing modernization of competitive societies" as capitalism and call highly modernized and

[1] Our research differs from that of Henrich et al. (2005, 2010a) in that we study people and their social value orientations in three large-scale societies that are integrated into markets and have different degrees of capitalism, holding features such as language and religion constant.

competitive societies capitalistic.[2] Most previous studies have been conducted in laboratories with student pools and in developed countries. Nevertheless, to generalize and understand real human behaviors, preferences and their implications, further studies are necessary in developing countries, as argued in Henrich et al. (2010c). This study examines how the degree of capitalism in economic environments brings about an evolution in human behavior and social preferences by conducting field experiments in Bangladesh.

Competition for survival and success is a major idea in capitalism. Individuals in capitalistic societies survive, achieve or gain success by going through competitions where a person's success usually involves having more wealth, status, prestige, among other traits.[3] We also observe that human nature and social behaviors appear to be quiet different based on our first-hand research experiences in rural and urban areas in various parts of Bangladesh. Therefore, we hypothesize that as societies become more capitalistic, the idea of "competition for survival and success" as a cultural trait or meme propagates from brain to brain due to success bias transmission through social learning mechanisms such that people become more competitive.

We have implemented field surveys and experiments in three areas of Bangladesh: (1) rural, (2) transitional, and (3) capitalistic societies. Each possesses the same ethnicity, religion, language and so on, but differs with respect to the degree of capitalism. The capital city, Dhaka, is the most densely populated and is a highly capitalistic society, and there exists a sizable gap between Dhaka and rural areas with respect to the degree of capitalism (Dewan and Corner, 2014). In each area, we have collected socioeconomic information and identified subjects' SVOs as of a (i) competitive, (ii) individualistic, (iii) prosocial or (iv) unidentified type, following Van Lange et al. (1997, 2007). With

[2]There have been many arguments related to capitalism, such as Tonnies' Gemeinschaft/Gesselschaft and Durkheim's mechanical/organic solidarities, since the 19th century. We admit that what we call capitalism, "ongoing modernization of competitive societies," overlaps with these ideas.

[3]Specifically, we consider success to be gaining more wealth, status, or prestige than others. In capitalistic societies, people compete to gain such things.

this data, we characterize SVOs in relation to the degree of capitalism, as well as other socioeconomic factors, through statistical analyses.

2.2 Study region

he field surveys and experiments have been implemented in three regions of Bangladesh: 1. Dhaka, the capital city (capitalistic), 2. several villages in the northern district Bogra (transitional) and 3. Dacope, a southern subdistrict (rural). Dhaka is the most densely populated and capitalistic city. Villages in Bogra have been gradually transforming from rural into capitalistic societies due to economic growth over the past few decades. Dacope is a rural area with the lowest level of capitalism, i.e., it is a highly ecosystem-based society. Bangladesh is ethnically and culturally homogeneous, and these three societies are all integrated into markets. They possess the same ethnic, language, and religious variation. However, they differ from each other regarding the degree of capitalism. The locations are shown in figure 2.1.

Dhaka city is located between 90°18′ and 90°57′ east longitude and 23°55′ and 24°81′ north latitude (figure 2.1). The total land area, population and population density are 1371 km^2, 14.51 million and 10 484 people km^{-2}, respectively (Dewan and Corner, 2014). The population density in this region is almost nine times higher than that of the country average, and it is one of the most densely populated cities in the world (Dewan and Corner, 2014). Dhaka is the center of industrialization, business and service in Bangladesh. Business, service and some labor-intensive jobs are the major occupations in Dhaka. Few farming activities are available in the current Dhaka metropolitan area.

Several villages of the Shahjanpur subdistrict in the northern district of Bogra are located between 89°16′ and 89°29′ east longitude and 24°41′ and 24°50′ north lat-

Figure 2.1: The three regions: Dhaka, Bogra and Dacope

itude (figure 2.1). The total land area and population density are 215.64 km^2 and 1307 people km^{-2}, respectively. The population density is slightly higher than the country average of 1218 people km^{-2} (Bangladesh Bureau of Statistics, 2013). Bogra is known as the gateway to the southern part of Bangladesh and as a modern and industrialized city. All the villages included in our survey and experiments have electricity and good communication with the nearest district city, Bogra. Modernization began with the efforts of several government agencies and NGOs to improve agriculture in that region. The Green Revolution, infrastructure development and suitable location for industrialization in Bogra led to its economic growth. Thus, this study region has been gradually transforming from a rural society into a capitalistic society. For simplicity, we refer to this study region as Bogra for the rest of the paper.

acope is located between 89°24′ and 89°35′ east longitude and 22°24′ and 22°40′ north latitude (figure 2.1). The total land area of the Dacope subdistrict is 991.58 km^2, and the population density is approximately 980 people km^{-2} (Bangladesh Bureau of Statistics, 2013). The population density in Dacope is lower than the country average of 1218 people km^{-2}. The infrastructure in this region is the least developed of the three study areas. The river network is the main channel of transportation. An earthen embankment was built to protect this region from storm surges, and it provides some limited road transportation. Except for some hatcheries and agriculture, there are few industries in this region.

Dacope is adjacent to the world's largest mangrove forest, the Sundarbans. Unlike the other two study regions, business, farming, and fishing are main occupations, which are contingent on the resources and rivers of the Sundarbans. Moreover, most of the households in this region are engaged in natural resource harvesting and agriculture for their self-consumption, apart from their main occupation for income earning. Due to the

proximity of the world's largest mangrove forest, as well as the absence of industries and service sectors, livelihoods in Dacope are dependent on nature and ecosystem services. Moreover, Dacope is located on the coastal belt of Bangladesh, which is one of the most lethal zones in the world due to storm hazards (Ali, 1996, Schiermeier, 2011b,a). In summary, this society's overall dependency on uncertain natural and ecosystem services is higher than that of Bogra and Dhaka.

2.3 Methodology

Social value orientation experiment

To measure people's social preferences for competition and cooperation in three different regions, we employed a decomposed social value orientation (SVO) game developed by Van Lange et al. (1997, 2007). The concept of SVO comes from a game-theoretical approach to interdependence, which represents the effective matrix of outcomes for oneself and for another person (Van Lange et al., 2007). In this game, numbers represent the outcomes for a pair, oneself and the other person, where the other period is unknown to the subject. Following Van Lange et al. (2007), the game is called a triple-dominance decomposed game because each subject is asked to choose from among three options for one question. For example,

Option 1: You receive 500, and the other receives 100.

Option 2: You receive 500, and the other receives 500.

Option 3: You receive 560, and the other receives 300.

Option 1 represents a competitive orientation that maximizes the gap between one-

self and the other (500 − 100 = 400) compared to any other option. Thus, subjects who choose option 1 can be considered competitive, as they seek to maximize their relative gain. Option 2 is a prosocial orientation that maximizes the joint outcome (500+500 = 1000). Finally, option 3 represents an individualistic orientation in that subjects who choose option 3 maximize their own outcome 560 and appear to be indifferent to the outcome of the other. The triple-dominant method of decomposed SVO games developed by Van Lange et al. (1997, 2007) consists of such nine questions, each of which consists of three options as introduced above.[4] Subjects are asked to choose one of three options for each question and to answer nine total questions. The answers are first utilized to identify whether each subject's orientation is competitive, individualistic or prosocial. Specifically, when at least 6 of 9 of the person's choices are consistent with one of the orientations (competitive, individualistic and prosocial), he/she is categorized as that orientation. Otherwise, the subject is categorized as "unidentified."

We implemented our experiments with monetary payments because we needed to attract people to the experimental sites and to encourage them to participate seriously, considering both transportation and opportunity costs. For each session, we collected 20 ∼ 40 subjects at a time in the experimental site. We gave the subjects instructions, and an experimenter (the first author) gave oral presentations to confirm the subjects' understanding. Respondents were informed that the units in this game represented points and that the more points each respondent collected, the more real money he/she would earn from this game. To compute the respondent payoff from this game, we randomly matched respondents into pairs after eliciting their choices.

The experimental earnings from this SVO game were determined by summing the points earned from the 9 selections made for themselves and the 9 selections that their

[4] A major reason for using the triple-dominant method is its simplicity. Many subjects in these Bangladeshi areas are not educated, and we needed a simple game that everyone could understand.

partner made for them, and an exchange rate was applied to determine the real monetary payment for each subject. We also explained the random matching method and payoff calculation using the exchange rate to determine the monetary payment received by the subjects. After eliciting the subjects' answers in the SVO game, we conducted questionnaire surveys and collected each subject's sociodemographic information. Each session took 40 $\sim$ 50 minutes, and the average payment was BDT 300 ($\approx$ USD 3.30), with a show-up fee of BDT 150 ($\approx$ USD 2.00).

Random sampling in the field

We implemented different approaches to random sampling in the three study regions because they possess different sociodemographic and geographical characteristics. In each study region, we administered the field survey and experiments to 334 subjects.[5] The experiments were conducted between December 2014 and March 2015. All subjects are household heads or female subjects that earn income and make financial contributions to the household. In Dhaka, randomization was based on occupations to avoid overrepresentation of some specific groups of people. First, we computed the approximate proportion of each occupational category in the total population by referring to several governmental reports, such as Bangladesh Bureau of Statistics (2011, 2013). Then, we randomly selected a number of organizations or companies for each category. We contacted the organizations, and based on their compliance, we randomly selected individuals from these organizations. However, for low-income occupations and occupations that require frequent movement within the city, such as rickshaw pullers and van drivers, we randomly selected slums and recruited the required number of people from among the residents of those slums. Our experiments were conducted in the classrooms at the Institute of Information Technology of Dhaka University.

[5]The surveys and experiments were administered mainly by the first author.

In Bogra, we conducted household-level randomization. First, we determined the sample size based on the total number of households in each selected union. We conducted our experiments with 145, 99 and 90 subjects from the Aria Bazar, Amrool and Chupinagar unions, respectively, based on the number of households in each union. The number of households were collected from the respective local union offices. We randomly selected the household numbers and recruited income-earning members of households by sending them invitation letters. Finally, we were able to recruit enough subjects with our monetary incentives and invitation letters, and we conducted the experiments in several schools within the study region.

In Dacope, two unions were selected as the study sites, namely, Kamarkhola and Sutarkhali. The total number of households in Kamarkhola and Sutarkhali were 3559 and 7536, respectively (Bangladesh Bureau of Statistics, 2011, 2013). We randomly selected 108 (32 % of the total subjects) and 226 (68 % of the total subjects) subjects from Kamarkhola and Sutarkhali, respectively, based on the proportion of households in these two unions. Because a list of residents was not available from the local government office and people frequently move their shelters based on their daily activities, such as harvesting in the study region, we were unable to implement a typical randomization procedure for this region.

To implement random sampling in Dacope, we follow the procedure used in Himelein et al. (2013, 2014), called geographic cluster sampling. Prior to the experiments, we observed human traffic and the density of households within the study region using GIS technology. Moreover, we visited the study region twice before implementing the experiments. With the help of GIS technology and information obtained through field visits, we divided each of the unions into five subregions and divide each of the subregions into several seemingly equal strata with approximately the same number of

households. Finally, we randomly selected an identical number of subjects from each stratum and invited them to participate in our experiments.

Empirical method

We estimate a multinomial logit model to characterize the determinants of SVOs. Based on the SVO specifications, a subject falls into one of four orientations: (i) competitive, (ii) individualistic, (iii) prosocial, and (iv) unidentified. The multinomial logit model is used to analyze the probability that a subject is assigned to an orientation, and it is specified as:

$$\text{Prob}_n(i) = \text{Prob}(S_{in} \geq S_{In}), \quad \forall I \neq i \tag{2.1}$$

where $\text{Prob}_n(i)$ is the probability that subject n falls into orientation i of the four orientations, I = {competitive, individualistic, prosocial, unidentified}. S_{in} is a function of independent variables that characterize the likelihood that a subject n falls into orientation i. The set of independent variables $\mathbf{X}_n$ includes household income, age, education, number of children under 12 years of age in the household, gender, family structure, occupation dummies, and regional dummies.

Table 3.1 presents the definitions of the variables that are expected to be determinants of people's SVOs. Age is coded as an ordered categorical variable from 0 to 5 following the work of Van Lange et al. (1997) on the prosocial-growth or proself-growth hypothesis. The number of children under 12 and family structure are included since they are claimed to affect people's social value orientations. Occupation dummies are included because the level of involvement in wage-labor occupations and dependence on ecosystem services is thought to affect social preferences (Henrich et al., 2010a, Yang

et al., 2013b,a, Leibbrandt et al., 2013). Specifically, we define the occupations as: (i) ecosystem service occupations (reference group), (ii) wage-labor occupations, and (iii) business and service occupations. Ecosystem service occupations consists of farmers, fishermen, and collectors of wood and honey from the forest. Wage-labor occupations comprise all construction workers, factory workers, van drivers, and rickshaw pullers. Business and service occupations include all businessmen and job holders. Finally, regional dummies are included in the model to capture the effects of capitalism. The multinomial logit regression estimates the change in the probability that people are in a certain social value orientation when one independent variable is altered.[6]

Table 2.1: Description of variables

Variables	Description
SVO categories	Competitive, individualistic, prosocial and unidentified.
Household income	Household income per month in BDT 1000.
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.
Children under 12 years old	Number of children under 12 years of age in the household.
Gender	Dummy variable that takes 1 when the subject is male, otherwise 0.
Family structure	Single-family structures are coded as 1, otherwise (joint family) 0.
Occupation dummy	Ecosystem service occupation is the reference group. Two dummy variables are defined for wage-labor occupation and business and service, respectively.
Regional dummy	Dacope is the reference group. Two dummy variables are defined for Dhaka and Bogra.

[6]One might assume reverse causality between SVOs and regional dummies. A large number of studies have analyzed the objectives and determinants of urban-rural migration. These studies find that economic difficulties such as poverty and unemployment are the main causes for rural-urban migration, and none of these studies suggests that competitive people tend to be attracted to capitalistic societies (see, e.g., Sahn and Stifel, 2003, Dudwick et al., 2011, Young, 2013, Brueckner and Lall, 2015). If reverse causality plays a role in our analysis, more competitive people should migrate to the most capitalistic region, Dhaka. Also, in the context of Bangladesh, it is reported that the majority of migrants to Dhaka are marginalized rural people and remain poor even after migration (Angeles et al., 2009, Rana, 2011, Dewan and Corner, 2014). If these two facts are true at the same time, income would show a correlation with SVOs in our regression analysis. However, we have not found any correlation between value orientation and income, which we will show in the results section.

2.4 Results

Summary statistics

Tables 2.2 and 4.1 provide the summary statistics for the independent variables and SVOs. First, household income is the highest in Dhaka and the lowest in Dacope. This reflects the fact that Dhaka is a highly industrialized and capitalistic region, while Dacope is the least developed region where people's livelihoods depend on ecosystem services. As mentioned in the previous section, Bogra can be considered in between. Thus, the household income data are consistent with our intuition. The gap between the rich and the poor seems to be the highest in Dhaka, since the standard deviation (hereafter, SD) of household income is the highest among the three regions.

The population of Dhaka is relatively younger than that of Bogra and Dacope. Nevertheless, the overall average age of 32.6 years suggests that most people in these three regions are of working age. In addition, people in Dhaka are highly educated, with 16 years of schooling, while most people in Bogra and Dacope have only 5 years of schooling. Moreover, the average number of children under 12 in the three regions is highest in Dacope, and the number of joint family dwellings is significantly higher in Dacope than in Dhaka and Bogra. Furthermore, the summary statistics of occupations show that the sample in Dhaka consists only of wage-labor occupations and business and service occupations. On the other hand, in Bogra and Dacope, ecosystem service, wage-labor, and business and service occupations are well represented, so Bogra and Dacope rely more on ecosystem services than Dhaka.[7] All of these summary statistics are consis-

[7]The ecosystem service occupations consist of only farming in Bogra, while it comprises farming and natural resource harvesting, such as wood and honey collecting, in Dacope. Unlike Bogra, almost 100 % of households in Dacope are engaged in subsistence farming and natural resource harvesting for their self-consumption in addition to their main occupation. Since these activities are not income-generating, we do not consider these their occupations. This dependency on ecosystem services in Dacope has been captured by the regional dummy.

tent with our expectations, including the ordering of the three regions in the degree of capitalism. With the lowest population density, the lowest average household income, the highest number of joint family households, the highest average number of children per household, and the highest dependency on ecosystem services, Dacope is the least capitalistic society followed by Bogra and then Dhaka.

Table 4.1 presents the summary statistics for subjects' SVOs across the three regions. The number of competitive people is the highest in Dhaka (32.34 %), the next-highest in Bogra (23.65 %) and the lowest in Dacope (17.66 %). In addition, individualists are the largest group in Dacope (32.63 %) followed by Dhaka (30.84 %) and Bogra (22.46 %). Moreover, 31.74 %, 19.16 %, and 15.27 % of subjects are classified as having an "unidentified" value orientation in Bogra, Dhaka, and Dacope, respectively. Finally, the number of prosocial subjects is highest in Dacope (34.43 %) and smallest in Dhaka (17.66 %). Overall, the results provide clear evidence that competitive and prosocial people are dominant in Dhaka and Dacope, respectively, whereas the proportion of unidentified people is outstanding in Bogra. This tendency seems to suggest that in a transitional society, such as Bogra, people's SVOs could be unstable, while people in Dhaka and Dacope reflect a tendency toward competitive and prosocial orientations, respectively.

Social value orientation in relation to the degree of capitalism

First, on the basis of table 4.1, we conduct pair-wise chi-squared tests of the categorical variables for the three regions to see whether the distribution of SVOs is independent of a pair regions. Specifically, the null hypothesis is that the distributions of SVOs are identical for any two regions. We confirmed that the results of all possible pairs (Dhaka and Dacope, Dhaka and Bogra, and Dacope and Bogra) reject the null hypothesis at a

Table 2.2: Summary statistics for the independent variables, 1002 observations (each region has 334 observations)

	Regions			Overall
	Dhaka	Bogra	Dacope	
Monthly household income in BDT 1000				
Average (Median)[1]	110 (35.00)	16 (12.00)	13 (10.00)	47 (15.00)
SD[2]	566	21	12	330
Min	3	3	2	2
Max	10000	350	100	10000
Age (ordered categories)[3]				
Average (Median)	0.66 (0.00)	1.58 (1.00)	1.53 (1.00)	1.26 (1.00)
SD	0.85	1.39	1.26	1.26
Min	0	0	0	0
Max	5	5	5	5
Education (years)				
Average (Median)	12.66 (16.00)	6.26 (5.00)	6.56 (5.00)	8.50 (10.00)
SD	5.30	4.96	4.57	5.76
Min	0.00	0.00	0.00	0.00
Max	20.00	17.00	17.00	20.00
Number of children (< 12 year-old)				
Average (Median)	0.84 (1.00)	0.65 (1.00)	1.12 (1.00)	0.86 (1.00)
SD	1.08	0.78	0.90	0.95
Min	0.00	0.00	0.00	0.00
Max	6.00	6.00	4.00	6.00
Gender (Female = 0)				
Average (Median)	0.82 (1.00)	0.95 (1.00)	0.93 (1.00)	0.90 (1.00)
SD	0.39	0.22	0.25	0.30
Min	0	0	0	0
Max	1	1	1	1
Family structure (Joint family = 0)				
Average (Median)	0.62 (1.00)	0.75 (1.00)	0.46 (0.00)	0.61 (1.00)
SD	0.49	0.43	0.50	0.49
Min	0	0	0	0
Max	1	1	1	1
Occupation dummies (Ecosystem service occupation = 0)				
Wage-labor occupation				
Average (Median)	0.22 (0.00)	0.27 (0.00)	0.24 (0.00)	0.43 (0.00)
SD	0.41	0.45	0.43	0.43
Min	0	0	0	0
Max	1	1	1	1
Business and service				
Average (Median)	0.78 (1.00)	0.39 (0.00)	0.53 (1.00)	0.57 (1.00)
SD	0.41	0.49	0.50	0.50
Min	0	0	0	0
Max	1	1	1	1

[1] Median in parentheses.
[2] SD stands for standard deviation.

Table 2.3: Percentage of each social value orientation by study region

	Competitive	Individualistic	Unidentified	Prosocial
Dhaka	32.34	30.84	19.16	17.66
Bogra	23.65	22.46	31.74	22.16
Dacope	17.66	32.63	15.27	34.43
Overall	24.55	28.64	22.06	24.75

1 % level of significance and $\chi^2(3) > 20$, which suggests that the distribution of SVOs is dependent upon the regions. Therefore, the societies wherein people reside might influence their SVOs, controlling for other factors.

To establish our result, we next estimate two different multinomial logit regressions and one logistic regression. Table 2.4 presents the marginal effects for models 1 and 2 from multinomial logit regressions. In model 1, we include all independent variables, along with the regional dummy variables, except for the occupation dummies. To check the robustness of our results, model 2 includes the occupation dummies, with the consideration of the possibility that the degree of individual involvement in wage-labor occupations and dependence on ecosystem services might affect their social value orientations. In addition, table 2.5 presents the marginal effects estimations from the logistic regression (model 3). In this model, we drop all observations of individualistic and unidentified social value orientations to clarify the difference between prosocial and competitive orientations with respect to the regional dummies, controlling for all other independent variables. The results show the marginal probabilities that subjects are in the competitive, individualistic and unidentified orientations relative to being in the reference group of prosocial actors when an independent variable changes.

We first provide a quick overview of our results and then explain the detailed results based on model 1 in table 2.4. Household income and family structure have no

Table 2.4: Models 1 and 2: marginal effects of a multinomial logit regression with prosocial as the reference group (N = 1002)

	Model 1			Model 2		
	Competitive	Individualistic	Unidentified	Competitive	Individualistic	Unidentified
Monthly household income (in BDT 1000)	0.000	0.000	−0.000	0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education (years of schooling)	0.011***	−0.001	−0.010***	0.012***	−0.002	−0.011***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
# of children (< 12 years old)	−0.019	0.027*	0.025*	−0.021	0.026*	0.025*
	(0.017)	(0.016)	(0.015)	(0.017)	(0.016)	(0.015)
Male (base group = female)	0.029	0.069	0.071*	0.031	0.069	0.070*
	(0.043)	(0.047)	(0.040)	(0.045)	(0.047)	(0.040)
Age (categorical variables)	0.022*	−0.004	−0.007	0.025**	0.004	−0.009
	(0.012)	(0.014)	(0.011)	(0.012)	0.014)	0.011)
Single family (base group = joint family)	0.012	−0.038	0.014	0.010	−0.039	0.016
	(0.029)	(0.032)	(0.029)	(0.030)	(0.032)	(0.029)
Regional dummy (base group = Dacope)						
Dhaka	0.096**	−0.022	0.102***	0.085**	−0.021	0.110***
	(0.044)	(0.040)	(0.042)	(0.044)	(0.041)	(0.042)
Bogra	0.053	−0.101***	0.163***	0.053	−0.098***	0.164***
	(0.038)	(0.035)	(0.038)	(0.039)	(0.035)	(0.038)
Occupation dummy (Ecosystem service occupation = 0)						
Wage-labor occupation				0.056	−0.008	−0.038
				(0.051)	(−0.008)	(0.038)
Business and service				0.005	0.024	−0.002
				(0.044)	(0.045)	(0.039)

***significant at the 1 percent level, **significant at the 5 percent level and *significant at the 10 percent level.
The Wald χ^2 statistic is 102.67 and 104.09 for multinomial logit model 1 and model 2, respectively, and significant at the 1 percent level.

explanatory power for SVOs. The coefficient on education is statistically significant for the competitive and unidentified orientations. The number of children under 12 in a household affects the relative likelihood of being in the individualistic and unidentified groups. Relative to being in the prosocial group, gender positively affects the probability of being in the unidentified group, and age positively affects the probability of being in the competitive. Finally, the regional dummies for Dhaka and Bogra are significant predictors of being in the competitive, individualistic, and unidentified groups, compared to being in the prosocial group, taking Dacope as the reference group.

Concerning household income, the insignificant result in table 2.4 is consistent with previous studies, such as Henrich et al. (2005), Wilson et al. (2009), Henrich et al. (2010a) and Leibbrandt et al. (2013), which report that income is not a determinant of behavior associated with competitiveness, fairness, equity or trust. Regarding family structure, some studies, such as Van Lange et al. (1997) and Van Lange et al. (2011), argue that higher interdependence at the family level leads to prosocial orientation. Thus, we initially expected that the joint family structure may induce people to be in the prosocial group, since it is naturally associated with more interactions with relatives and family members. However, our analysis demonstrates that family structure does not affect the probability of being in a specific value orientation. This result is consistent with the argument of Leibbrandt et al. (2013) that interdependence at the social level rather than at the family level is a significant determinant of competitiveness.

The effects of education in model 1 of table 2.4 suggest that an additional year of education increases the likelihood of being in the competitive group by 1.1 % and decreases the likelihood of being in the unidentified group by 1.0 %, relative to being in the prosocial group. It should be noted that one-standard-deviation increase in education (approximately 6 years, i.e., high school plus university) affects the likelihood of being

in the competitive and unidentified groups by 6.37 % and −5.76 %, respectively. Our results suggest that the education system in Bangladesh influences individuals' likelihood of being proself with the number of years of schooling. The current Bangladeshi education system requires young people to engage in cutthroat competition for admission to good high schools and universities. We conjecture that such severe competition in Bangladeshi education is one reason for the increased likelihood of being in the competitive group and the decreased likelihood of being in the unidentified group with longer periods of schooling. Education contains the same cultural trait or meme as capitalism, that is, "competition for survival and success," which could propagate from brain to brain through a social learning mechanism (Henrich and Mcelreath, 2003, Henrich et al., 2005, Dawkins, 2006). As people spend more years in a competitive education system, they become more competitive (Henrich and Mcelreath, 2003, Tomasello et al., 2005, Dawkins, 2006).

The results in model 1 of table 2.4 also show that having one more child under 12 in a household increases the probability of being in the individualistic and unidentified groups by 2.7 % and 2.5 %, respectively, relative to being in the prosocial group. This finding is in contrast with the argument in Van Lange et al. (1997) that people become more prosocial with more interaction and experience with children. However, this difference may reflect the special context of a developing country like Bangladesh, which may be very distinct from that of a developed country. A possible explanation may be that raising a young child in a developing country often comes with more difficulties and hardships than in a developed country. An adult needs to work hard for his/her children and even sacrifices himself/herself to ensure their daily survival. In such a situation, the probability of being in the individualistic or unidentified group is expected to increase with each additional child in a household.

With respect to the significant result related to the gender dummy, the probability of being in the unidentified group is higher for males than for females by 7.1 % relative to being in the prosocial group. Van Lange et al. (1997) find that females are more prosocial than males. However, our finding suggests that females' social preferences are more deterministic than those of males. Furthermore, regarding the age effect, the empirical analysis shows a 2.2 % rise in the probability of being in the competitive group relative to being in the prosocial group when age increases by one 10-year category. This result conflicts with the prosocial-growth hypothesis, which is claimed in Van Lange et al. (1997). Instead, it seems to support the proself-growth hypothesis. The magnitude of the age effect might be considered significant, because individual preferences related to competitiveness and cooperation are known to change very slowly after the early stage of their life (Harbaugh and Krause, 2000, Henrich et al., 2005, Brosig-Koch et al., 2011). Developing countries such as Bangladesh have neither social security systems nor other public support for elderly people. Therefore, elderly people are required to compete for a stable future as they age, which may cause their social preferences to be more competitive.

Now, we closely look at how SVOs differ across regions. Recall that in the rural society (Dacope), the "prosocial" group is dominant. On the other hand, in the capitalistic society (Dhaka), "competitive" people are dominant. In the in-between society (Bogra), the portion of people in the unidentified group becomes larger. As expected, the results related to the regional dummies in model 1 confirm that individuals in Dhaka are more likely to be in the competitive group by 9.6 % than those in Dacope relative to being in the prosocial. Likewise, individuals in Dhaka and Bogra are more likely to be in the unidentified group by 10.2 % and 16.3 %, respectively, than those in Dacope relative to being in the prosocial group. Individuals in Bogra are less likely to be in the individualistic group by 10.1 % than those in Dacope as compared to being in the

prosocial group. We can verify the robustness of our results, since the same qualitative results are observed in model 2 in table 2.4.

As a further robustness check, model 3 in table 2.5 reports the result of the logit regression, focusing on the difference between the prosocial and competitive value orientations across regions. Compared to those in Dacope, individuals in Dhaka and Bogra are 27.9 % and 18.2 % more likely to be in the competitive group, respectively, than in the prosocial group. This result illustrates a clear change from prosocial to competitive value orientations with respect to the degree of capitalism in societies. That is, as societies become more capitalistic, people tend to become less prosocial and more competitive.[8] All three models (models 1, 2, and 3) exhibit the same qualitative results, which suggests that the economic environment, i.e., the degree of capitalism in the society, is a crucial determinant of SVOs.

As mentioned earlier, competition for survival and success is one of the main ideas in capitalism. Individuals in capitalistic societies survive, achieve, or succeed by competing. Hence, we argue that with aging capitalism in societies, the idea of "competition for survival and success" as a cultural trait or meme transfers from brain to brain due to success bias transmission through a social learning mechanism such that people become more competitive. We can provide one simple example of how competition for survival and success as a cultural trait engenders human behaviors: competition for buses in Dhaka. Many people usually wait at bus stops in Dhaka. When a bus approaches the stop, it is usually filled with more passengers than its capacity. Only a few more people can take the bus on each occasion. Therefore, people waiting at the stop compete to get on the bus by pushing and pulling each other. In this case, survival and success means

[8] As part of this robustness check, we estimate a logistic regression between competitive and prosocial orientations with the regional dummy as the only independent variable. We also conducted a contextual/hierarchical analysis using a multilevel multinomial logit regression. Both of these analyses confirm the same qualitative results that have been presented in this paper. For simplicity, we have not included the results in the paper, but they are available upon request.

Table 2.5: Model 3: marginal effects of the logit regression with prosocial as the reference group (N = 494)

	Competitive
Monthly household income (in BDT 1000)	0.00
	(0.00)
Education (years of schooling)	0.012*
	(0.01)
# of children (< 12 years old)	0.007
	(0.031)
Male (base group = female)	0.167
	(0.076)
Age (categorical variables)	0.027
	(0.022)
Single family (base group = joint family)	0.001
	(0.052)
Regional dummy (base group = Dacope)	
Dhaka	0.279***
	(0.072)
Bogra	0.182***
	(0.059)
Occupation dummy (base group = Ecosystem service occupation)	
Wage-labor occupation	0.022
	(0.077)
Business and Service	0.007
	(0.070)

***significant at the 1 percent level, **significant at the 5 percent level and *significant at the 10 percent level.
The Wald χ^2 statistic is 39.83 for the logit regression, significant at the 1 percent level.

that each person goes home as early as possible. There are two ways to survive and achieve success: (1) forming a first-come and first-served queue and (2) competing by pushing and pulling at a bus stop. Unfortunately, in Dhaka, pushing and pulling to get on a bus is a common behavior due to the propagation of competition for survival and success.

Surprisingly, the proportion of people in the "unidentified" group in Dacope (the least capitalistic society) is the lowest among the three regions, while it is the highest in the transitional society of Bogra. This result implies the potential existence of unstable states in people's social preferences. Previous studies of SVOs, such as Van Lange et al. (1997, 2007, 2011), do not pay attention to the existence of such "unidentified" subjects. A gradual change in economic environment is plausibly one reason for the large number of unidentified value orientations in Bogra. In Bogra, cooperation for survival and success was dominant in the past, as is common in rural, agrarian societies. However, as the society gradually becomes capitalistic, the new cultural trait of competition for survival and success appears to conflict with the old pattern. Thus, the conflict seems to bring about instability in people's preferences as "unidentified." This temporary instability may also imply the gradual transformation of an individual's social preference from prosocial to competitive, and it is likely that with the aging of capitalism in this society, people will become more competitive.

It is worth describing some of our observations of the real-life economic practices in Dacope that make people more prosocial. Our survey data confirm that unlike Dhaka and Bogra, almost 100 % of the households in Dacope are engaged in farming and natural resource harvesting for their self-consumption apart from their main occupation for income earning. These activities are unique characteristics of daily life in Dacope and are absent in the other two societies. Hence, in Dacope, economic activities require

cooperation rather than competition to ensure mutual long-term survival under natural uncertainty and hardship. In Dacope, people enter the adjacent forest, the Sundarbans, to collect wood or honey, and they need to cooperate to ensure their safety from wild animals, such as tigers. Moreover, it is common to share the profits or goods equally, regardless of how much wood or honey they collect individually. The same type of sharing practices can be seen among the fishermen who harvest together in adjacent rivers. Due to the existence of such cooperative practices and needs, in the long run, cooperation for survival and success is still dominant. As a consequence, people in this region are more prosocial than those in Dhaka and Bogra, which is consistent with the finding in Leibbrandt et al. (2013).

Finally, we check whether individuals have enough interactions with others in everyday life and whether such experiences of social interactions reflect the individual social preferences identified in our experiments (Erikson, 1980, North, 1990, Van Lange et al., 1997). Specifically, we hypothesize that people's interactions with neighbors in each society have some association with their value orientations, because interactions with neighbors seem to change with the transformation of societies.[9] We collected individual information about the frequency of interactions with neighbors.[10] Table 2.6 presents the summary statistics for the frequency of interacting with neighbors per month in each region. Interestingly, the distribution of the frequency of interactions with neighbors and the SVOs exhibit the same qualitative tendency with respect to the regional dummies. People in Dacope interact with their neighbors most frequently among our three study regions, as captured by both the average and the median. On the other hand, people in

[9]Interactions with friends have been difficult to quantify on the same basis between rural and urban areas because these interactions are heterogeneous based on their different environments and factors such as the availability of the internet. Moreover, interactions with friends are somewhat dependent upon each individual's personality and reflect the fact that friends are chosen endogenously but neighbors are exogenously given in Bangladeshi societies. Therefore, we use "interaction with neighbors" as the main instrument.

[10]To avoid an endogeneity problem between value orientation and social interaction, we have not included the frequency of interactions with neighbors as an independent variable in the regression.

Table 2.6: Frequency of interactions with neighbors per month (N = 1002, 334 observations per region)

Frequency of interactions per month	Regions			Overall
	Dhaka	Bogra	Dacope	
Average	12.7	28.6	30.3	23.9
Median	4	18	30	15
Standard deviation	15.4	31.9	27.8	27.2
Min	0	0	0	0
Max	120	200	150	200

Dhaka have the lowest frequency, based on the average and the median. People in Bogra fall in between. The standard deviations reveal the same tendency, except that Bogra's standard deviation is bit higher than Dacope's. Overall, it appears that economic development changes interactions with neighbors and social preferences. That is, as societies become more capitalistic, people are less likely to interact with their neighbors. This result is also consistent with those of our regression analyses.

To the best of our knowledge, this paper is the first to focus on the degree of capitalism in field experiments and to demonstrate that as societies become more capitalistic, people tend to be less prosocial and more competitive. The literature has already documented the reliability of culture-gene coevolution (Boyd and Richerson, 1985, Henrich et al., 2005, Dawkins, 2006, Richerson and Boyd, 2008, Wilson et al., 2009, Henrich et al., 2010a, O'Brien et al., 2010, Leibbrandt et al., 2013, Moya et al., 2015). Our results can be considered additional evidence of culture-gene coevolution when we consider capitalistic economic development as part of culture. Our results suggest that important environmental, climate change or sustainability problems, wherein cooperation rather than competition is necessary, shall be more pressing as societies become more capitalistic.

2.5 Conclusion

The literature shows that culture can bring about evolutions in human behaviors and preferences. Considering that competition for survival and success is one of the main ideas in capitalism, it is likely that, with economic development and maturation of capitalism in societies, people learn the idea of competition for survival and success and tend to be more competitive. Hence, we have analyzed individual social preferences in relation to the degree of capitalism in societies. Most of the previous studies that address the issue of coevolution between humans and culture have been conducted in laboratories or in developed countries. These field experiments in Bangladesh enable us to study social preferences in relation to the degree of capitalism, since Bangladesh has a wide gap between rural and capitalistic societies.

Our analysis demonstrates that with evolution from rural to capitalistic societies, people are likely to be less prosocial and more likely to be competitive. In a transitional society, there is a considerable proportion of people in the "unidentified" group, which is neither proself nor prosocial, implying the potential existence of unstable states during the transformation period from rural to capitalistic societies. We argue that with maturing capitalism in societies, the cultural trait, i.e., an idea of "competition for survival and success," propagates from one individual to another individual due to success bias transmission through a social learning mechanism, so people become less prosocial and more competitive. We have also found that people become more competitive with increasing age, education and number of children. These results suggest that important problems, such as environment, climate change or sustainability issues, where cooperation rather than competition is necessary, shall be more pressing as societies become more capitalistic.

We note some limitations of our study. We have tried to collect rich data on interactions among people that might be correlated with social value orientations (SVOs). Unfortunately, the economic environment seems to affect the way people interact each other, and some of our initial attempts proved impossible, such as quantifying interactions with friends and the quality of human relationships. In addition, our analyses and results could have been explored in various ways. For instance, we do not analyze SVOs in relation to people's involvement and interactions in distinct frameworks such as traditional solidarity vs. anomic city life. We do not compare our results of the SVO games with other value measures, such as assertiveness, harmony, achievement, conformity and power orientation, used in Schwartz (2007). Since our analysis is based on the SVO games in the field, framing in the experiments may have affected the results as well. Thus, to confirm the robustness of the analysis, it is important to compare our experimental findings with those of different approaches. Future research should be able to account for such issues.

These caveats notwithstanding, it is our belief that this study provides a first step to addressing how the economic environment, specifically, the degree of capitalism in societies, brings about a change (or evolution) in people's social preferences. The more societies develop under capitalism, the more the idea of competition for survival and success seems to propagate as cultural trait. More generally, this study provides an illustration of culture-gene coevolution in relation to capitalism with the idea of competition for survival and success as a cultural trait or meme as suggested by Boyd and Richerson (1985), Henrich and Mcelreath (2003), Dawkins (2006), Richerson and Boyd (2008) and O'Brien et al. (2010).

CHAPTER 3

INTERGENERATIONAL SUSTAINABILITY DILEMMA AND THE DEGREE OF CAPITALISM IN SOCIETIES: A FIELD EXPERIMENT

3.1 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: (i) its ability to ensure the efficient allocation of private goods through competition, (ii) 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., 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 the 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 over-exploitation 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 the 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 preference and behavior 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 behavior 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 are expected to bring about changes in human culture and social norms. For instance, Shahrier et al. (2016) show that as society becomes 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 preference and behavior 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: (i) infinitely-lived decision makers and (ii) 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 behavior and preference 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 in Henrich et al. (2005, 2010a,c). Building upon our previous research (Shahrier et al., 2016), we hypothesize that ongoing modernization of competitive societies, i.e., "capitalism," affects people's behavior and social preference to be more proself, compromising intergenerational sustainability. To examine this hypothesis, we implement an intergenerational sustainability dilemma game (ISDG) with "imaginary future generation" (IFG) as a policy tool in two types of Bangladeshi fields: (i) urban (capitalistic) and (ii) rural (less-capitalistic) areas.

3.2 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 (figure 3.1). 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 (figure 3.1). The Shajhanpur 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 km^{-2} 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 intergenerational sustainability dilemma game (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 in

Figure 3.1: The two study areas: Dhaka and Bogra

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 group choice A and 300 with group choice B as their individual share. Accordingly, each individual payoff becomes 700 and 600 with group choice A and B, respectively. Each generation is allowed to discuss their decision between A and B and how to split the group payoff up to 5 minutes. 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 1st, 2nd, ... 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 "imaginary future generation" (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.

3.2.1 Experimental procedure

To implement random sampling in the rural (less-capitalistic) area, 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) area, we did a randomization based on the population proportion of each occupations in the total population (Bangladesh Bureau of Statistics, 2013). After determining the required

[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.

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 area, we conducted our experiment in three elementary schools, and in the urban area, 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 imaginary future generation (IFG) treatment. On an average, we paid BDT 650 ($\approx$ USD 8.14) to each subject including a fixed show-up fee of BDT 200 ($\approx$ 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 socio-economic information.

3.3 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 3.1 and 3.2. Table 3.2 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 rich and 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 participants 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.

Regarding occupations, wage-labor occupation comprises labor-intensive jobs, such as working in the garments and other industries, rickshaw-pulling, 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

Table 3.1: 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.

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 3.3 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 %)

[2]However, our data reveals 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 3.2: Summary statistics of major socioeconomic characters 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)[1]	50962.30 (35000)	17034.37 (14000)	33998.33 (20000)
SD[2]	53656.33	12067.46	42398.75
Min	5000	4000	4000
Max	325000	115000	325000
Age (ordered categories)[3]			
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

[1] Median in parentheses.
[2] SD stands for standard deviation.
[3] The age variable is defined as an ordered categorical variable (table 3.1).

Table 3.3: The frequency and percentage of group choice *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 3.4: Group choice *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

choose *A*. Utilizing the frequency result summarized in table 3.3, we have run a chi-squared test with the null hypothesis that the distribution over generation choice *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 3.4. 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,

Table 3.5: 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

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 3.5 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 3.5, 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

Table 3.6: Definitions of variables included in the regression

Variable	Definition
Choice *A* or *B*	A dummy variable that takes 1 if the generation choose *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.

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 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 variables and the number of prosocial members in each generation, area dummy, and the IFG dummy as independent variables (See table 4.4 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 4.5 reports the marginal probability of choosing *B* calculated from the results of probit regressions.

Table 3.7: Marginal effects of probit regressions for generation choice *A* and *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 percent level, **significant at the 5 percent level and *significant at the 10 percent level

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 4.5). 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.

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 4.5). 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 3.4, 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 3.5, 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 noncognitive skills be-

tween 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, 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 in 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.

3.4 Conclusion

We experience how ongoing modernization of competitive societies endangers possibilities of future generations by causing over-exploitation 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: (i) urban and (ii) 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 noncognitive 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 preference and behavior may originate from many aspects of human nature, life and so-

cieties. 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.

CHAPTER 4

INTERGENERATIONAL SUSTAINABILITY DILEMMA AND A POTENTIAL SOLUTION: FUTURE AHEAD AND BACK MECHANISM

4.1 Introduction

Intergenerational sustainability is pivotal for survival of human societies. However, maintaining intergenerational sustainability is one of the biggest challenges because of its unidirectional nature in the sense that current generations affects future ones, but the opposite is not true (Ehrlich et al., 2012, Kinzig et al., 2013, Griggs et al., 2013, Costanza et al., 2014, Hauser et al., 2014, Steffen et al., 2015, Maxwell et al., 2016). We have witnessed how environmental problems and overexploitation of natural resources were caused by rapid urbanization and economic growth, threatening the needs of subsequent generations (Milinski et al., 2006, Hauser et al., 2014, Steffen et al., 2015, Maxwell et al., 2016). Therefore, it is a key question of how to take a balance of benefits and costs among different generations (Ostrom, 1990, Milinski et al., 2006, Hauser et al., 2014). The current economic system under capitalism is considered one of the best social regimes because it can efficiently allocates private goods and generates more innovative ideas and technologies through competitions. However, the capitalistic economic systems fail to ensure an efficient allocation of resources such as public goods, natural resources, environmental goods and intergenerational provision of these goods (Krutilla, 1967, Milinski et al., 2006, Hauser et al., 2014). Especially, the exclusion of the needs of future generations in the economic system and maximization of individual payoffs through competition in the current generation seem to compromise intergenerational sustainability and incur an irreversible cost for the next generations (Krutilla, 1967, Fisher et al., 2004, Ehrlich et al., 2012, Griggs et al., 2013, Kinzig et al., 2013,

Costanza et al., 2014, Shahrier et al., 2016, 2017). Section 3 text. The dielectric constant at the air-metal interface determines the resonance shift as absorption or capture occurs.

Human history demonstrates that democracy best fits with capitalism and thus, they have been established as the major collective decision-making process worldwide. However, as is in capitalism, the needs of future generations are not fully considered. Past studies theorize that cultural agents bring changes in human behavior and affects the evolution of human societies (see, e.g., Boyd and Richerson, 1985, Henrich and Mcelreath, 2003, Henrich et al., 2005, Tomasello et al., 2005, Dawkins, 2006, Richerson and Boyd, 2008, Wilson et al., 2009, Moya et al., 2015). Accordingly, empirical studies exhibit how economic environment as a part of culture brings about a change in human behavior. Schwartz (2007) documents that individuals express stronger preference for values such as power and achievement, conformity, self-assertiveness, mastery of nature in more competitive and market-driven societies. Shahrier et al. (2016) show that people become more competitive as societies becomes more capitalistic and urbanized, and highly capitalistic societies consist of a majority of proself people.[1] Therefore, democracy and capitalism might not be effective to maintain intergenerational sustainability, and we need new mechanisms to solve intergenerational sustainability dilemma in highly capitalistic societies.

Several past studies examine people's preference and decision for intergenerational sustainability. Sherstyuk et al. (2016) reveal that maintaining dynamic externalities are more difficult in intergenerational settings than that in an infinitely lived decision makers setting. Fisher et al. (2004) find that an intergenerational link motivates individuals to sustain intergenerational common pool resources. Executing an online experiment of intergenerational goods game, Hauser et al. (2014) reveal that an existence of few

[1] We follow the definition of capitalism stated in Shahrier et al. (2016). They define "ongoing modernization of competitive societies" as capitalism and address highly modernized and competitive societies capitalistic.

defectors causes overexploitation of intergenerational goods and thus, vote or democracy can maintain intergenerational sustainability by resisting the defectors. Kamijo et al. (2017) design and implement an intergenerational sustainability dilemma game (hereafter, ISDG) and show that introducing imaginary future generation improves intergenerational sustainability. Shahrier et al. (2017) conduct ISDG field experiments in rural and urban areas of Bangladesh, demonstrating that rural people choose much more intergenerational sustainable options than urban people. Furthermore, contrary to Kamijo et al. (2017), urban people fail to maintain intergenerational sustainability even under the treatment of imaginary future generations. This is due to the fact that a majority of urban people are proself in Dhaka, Bangladesh, and generations of such proself people consistently choose unsustainable options irrespective of the treatments and conditions.[2]

However, none of the past studies seeks to find a mechanism that can induce proself people to consider future generations or maintain intergenerational sustainability in highly capitalistic societies. Studies demonstrate the rapid growth of modernized and competitive societies, projecting that, by 2050, 66 % of world population will live in cities of developing countries. Especially, cities in Asia and Africa will account for the 75 % urbanities in the world (American Association for the Advancement of Science, 2016, Wigginton et al., 2016, McDonnell and MacGregor-Fors, 2016). Considering ongoing modernization and urbanization of competitive societies together with a possible increase in the number of proself people as demonstrated in Shahrier et al. (2016), democracy may not be able to maintain intergenerational sustainability and a new mechanism is necessary. Moreover, all the past studies of intergenerational sustainability have

[2]About 60 % of student subjects in the ISDG laboratory experiments of Kamijo et al. (2017) are prosocial. The high proportion of prosocial students may be attributed to the location of Kochi University of Technology where Kamijo et al. (2017) conducted ISDG laboratory experiments. Kochi University of Technology is located in Kochi prefecture which is not urbanized compared with Tokyo or Dhaka. On the other hand, Shahrier et al. (2017) show that only 20 % of subjects are prosocial in urban areas (Dhaka) of Bangladesh, leading to low intergenerational sustainability.

been conducted in laboratories and in developed countries. However, to better understand human preferences and behaviors for intergenerational sustainability and given a drastic growth of urbanized and modernized societies in developing countries such as Asia and Africa, studies of intergenerational sustainability should be conducted in such countries (Henrich et al., 2005, 2010a,b).

We design a new mechanism to improve intergenerational sustainability called "future ahead and back mechanism" (FAB) and examine its effectiveness by field experiments of intergenerational sustainability dilemma game (ISDG) in a competitive society of Bangladesh. A lineup of consecutive generations is organized and each generation can either maintain intergenerational sustainability (sustainable option) or maximize her own generation's payoff by irreversibly costing future generations (unsustainable option). In basic ISDG, generations make the decision through deliberative democracy. In ISDG with FAB, each generation is first asked to make a request of the decision to the current generation as if she is in the position of the next generation. Second, she takes the actual decision from its original position of the current generation. The results reveal that intergenerational sustainability is compromised in basic ISDG, implying that deliberative democracy does not prevent a majority of proself people from supporting unsustainable options. On the other hand, the FAB is demonstrated to enable proself people to change their individual opinions from unsustainable to sustainable options and to successfully induce more generations to choose sustainability options. We argue that the memories and records of what and how people request (or role-play) as future generations in FAB influence them to maintain intergenerational sustainability through triggering logic-based reasoning.

4.2 Methods and materials

4.2.1 Study area

Our experiments have been implemented in Dhaka, the capital city of Bangladesh. Dhaka is a highly capitalistic mega city and one of the most competitive societies in the world (Dewan and Corner, 2014). Dhaka city is located in between 23°55′ and 24°81′ north latitude, and 90°18′ and 90°57′ east longitude (Dewan and Corner, 2014) and covers the whole Dhaka metropolitan (figure 4.1). The total land area, population and population density is 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. Dhaka is the most populated city in the world and the center of industrialization, businesses and services in Bangladesh (Dewan and Corner, 2014). Business, service and some labor intensive occupations such as industrial labor work are the major occupations in Dhaka.

4.2.2 Experimental setup

We conduct intergenerational sustainability dilemma game (ISDG), social value orientation (SVO) game and questionnaires (or individual interviews) in the field.

Intergenerational sustainability dilemma game

We implement a three-person intergenerational sustainability game (ISDG), basically following the basic procedures of ISDG laboratory and field experiments employed in Kamijo et al. (2017) and Shahrier et al. (2017), respectively. We conducted three types

Figure 4.1: The study area: Dhaka

of ISDG in the field to find out an effective mechanism for maintaining intergenerational sustainability:

- Basic ISDG: In basic ISDG, three members in each generation are asked to choose between A and B in a deliberative democratic environment and to determine how to split the generation payoff. Each member possesses an equal right to participate in discussion and decision making.
- ISDG with imaginary future generations (hereafter, ISDG with IFG): In ISDG with IFG, we randomly assign one member in each 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 discussion and 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.
- ISDG with future ahead and back mechanism (hereafter, ISDG with FAB): In ISDG with FAB, members in each generation are first asked to think that they are the members in the next generation. As if they are in the next generation, they are asked to make a request to their previous generation about which option they want the previous generation to choose between A and B. In the second step, they get back to their original position and make a decision between A and B from their original (or actual) position in the generation line-up. If the generation's request to the previous generation in the first step and their actual choice in the second step are the same such as A in the first step and A in the second, the choice becomes their final decision. However, if the generation's choices in the first and second steps are different, members in a generation are asked to make anonymous votes for A or B to finalize their generation's decision.

We have also added a new element built upon the previous ISDG experiments only for the treatment of ISDG with FAB. That is to make an individual interview to each subject after they finish the generation decisions. The objective of the individual interviews is to elicit their individual opinions before and after deliberative discussion in FAB and to know whether proself people are successfully induced to change the individual opinions.[3] Having this information of ex-ante and ex-post individual opinions enables us to identify the effect of deliberative democracy or FAB for individual opinion changes and generations' decisions.

4.2.3 Experimental procedure

We were interested to include people from all types and socioeconomic classes subsist in Dhaka metropolitan area. However, we could not implement a household based randomization since getting household numbers from a number of city-offices within the Dhaka metropolitan was not feasible. In addition, we assumed that the response rate could be very low if we invite individuals by sending invitation letter without the help of any organization in such a hectic megacity like Dhaka. Moreover, it was not possible to include lower-class people reside in slums through household based randomization. Therefore, we demonstrated a randomization based on available occupations in Dhaka metropolitan. First, based on the number of people under the available occupations, we proportionally determine necessary number of participants from each of the occupations (Bangladesh Bureau of Statistics, 2013). Once we decided the necessary number of individuals based on the occupation statistics, we randomly picked several organizations associated with each occupation. Hereafter, we arbitrarily chose and invited individu-

[3]Given a failure of maintaining intergenerational sustainability in basic ISDG and ISDG with IFG, we realize a necessity of new mechanisms to enable proself people to change their opinions. To check whether it is successful with a new mechanism of FAB, we determine to conduct individual interviews to elicit how individual opinions change.

als from those organizations upon the approval of the organizations. To include people from less-income occupations with the nature of frequent movement within the city, we randomly picked and invited individuals from several slums.

We administered 22 sessions of ISDG and in total 396 individuals took part in the experiment. Hence, 132 generations were arranged with 396 participants. Out of the 22 sessions, 7, 7 and 8 were assigned to the basic ISDG, ISDG with IFG and ISDG with FAB, respectively. Each session of the ISDG experiment took approximately 3 hours. The maximum and average payment to each of the respondents was 800 BDT ($\approx$ 10 USD) and 670 BDT ($\approx$ 8.53 USD), respectively, including a fixed show-up fee of 350 BDT ($\approx$ 4.46 USD). In the ISDG game, subjects were paid 250 BDT ($\approx$ 3.18 USD) at maximum and 180 BDT ($\approx$ 2.29 USD) on average. Whereas the payment for SVO was 200 BDT ($\approx$ 2.55 USD) at maximum and 140 BDT ($\approx$ 1.78 USD) on average. We conducted the experiments at the Institute of Information Technology, University of Dhaka.

At the beginning of each experimental session, printed experimental instructions were provided to the subjects in their native language. Additionally, the experimenter (the 1st author) demonstrated a verbal presentation and confirmed respondent's understanding about the rules of the game. Hereafter, subjects were assigned to one of the 6 generations. For randomly assigning participants to one of the generations, we asked them to select a card with an ID from a bag where looking at the ID on the card was prohibited for them. We prepared 6 separate rooms for the 6 generations and based on the IDs picked by the participants, we asked them to go and sit in a specific room. Therefore, the members of a generation could only be in touch with her own generation members. Hereafter, we elicited each generation's choice between A or B one by one from 1st generation to 6th generation in a descending order. We let the respondents

know their generation number and the payoff corresponding to A or B. Hence, they could worked out the number of A and B chosen by the previous generations since subjects knew the associated payoff with A and B for the 1st generation and their position in the generation lineup.

Individual interviews were performed after each generation's decision in ISDG with FAB. In the interviews, each subject in the generation was asked about her personal opinions regarding her support for A or B "before and after" the generation's discussion and decision in ISDG with FAB. In the second part of the experiment, we conducted the SVO game. Game instructions were provided in addition with the verbal presentation. After confirming respondents understanding about the game, we elicited their choices in SVO game and collected socioeconomic information.

4.3 Results

Table 4.1 presents the frequencies and percentage of generations' choices for unsustainable option A and intergenerational sustainable option B in basic ISDG, ISDG with IFG and ISDG with FAB. About 30.95 %, 29.57 % and 85.42 % of the generations choose sustainable option B in basic ISDG, ISDG with IFG and ISDG with FAB, respectively. These results suggest that, in both basic ISDG and ISDG with IFG, a majority of the generations choose unsustainable option A. On the other hand, in ISDG with FAB, a majority of the generations choose sustainable option B and only 14.58 % of the generations choose A. To examine whether the distributions of A and B are independent of the treatments, we run pair-wise chi-squared tests. The null hypothesis is the frequency distributions of options A and B are the same for any pair of treatments (Basic vs. IFG, Basic vs. FAB and IFG vs. FAB). Our examination fails to reject the hypothesis for

Table 4.1: Frequency and percentage of generations' choices of options *A* and *B* in Basic ISDG, ISDG with IFG and ISDG with FAB

	A	B	Overall
Basic ISDG	29 (69.05 %)	13 (30.95 %)	42 (100 %)
ISDG with IFG	30 (71.43 %)	12 (29.57 %)	42 (100 %)
ISDG with FAB	7 (14.58 %)	41 (85.42 %)	48 (100 %)

Basic and IFG, however, it rejects the hypothesis for Basic vs. FAB and IFG vs. FAB at 1 % significance level, implying that FAB induces more generations to choose option *B* than any other treatment.

The results in table 4.1 can be interpreted that people choose to maximize their own generation's payoff even when the collective decision is made in a deliberative democratic environment on the basis of results for basic ISDG. Moreover, introducing imaginary future generations (IFG) in the game fails to maintain intergenerational sustainability since the number of *A* even increases in ISDG with IFG than that in the basic ISDG. The results appear to suggest the necessity of a stronger institution to maintain intergenerational sustainability in highly capitalistic societies such as Dhaka. Finally, FAB appears to be successful in maintaining intergenerational sustainability in highly capitalistic societies, Dhaka. About 85.42 % of the generations choose to maintain intergenerational sustainability option *B* in ISDG with FAB (table 4.1).

We characterize the determinants of generations' choices for intergenerational sustainability and how FAB affect generation decisions and individual members. Past studies show that an individual social preference is one of the important determinants for intergenerational sustainability and sustainability of common pool resources (Shahrier et al., 2016, 2017, Timilsina et al., 2017). More specifically, these studies show that an increase in the number of prosocial people in a generation or group comes with

Table 4.2: Distributions in the number of prosocial members per generation

Number of prosocial members in one generation	Number of generations (percentage)			Overall
	Basic	IFG	FAB	
0	26 (61.90 %)	27 (64.29 %)	15 (31.25)	68 (51.79 %)
1	7 (16.67 %)	8 (19.05 %)	25 (52.08)	40 (30.03 %)
2	7 (16.67 %)	5 (11.90 %)	8 (16.67)	20 (15.15 %)
3	2 (4.76 %)	2 (4.76 %)	0 (0.00)	4 (3.03 %)
Subtotal	42 (100 %)	42 (100 %)	48 (100 %)	132 (100 %)

higher probabilities of maintaining intergenerational sustainability and common pool resources. These studies also demonstrate that highly capitalistic societies might have higher tendencies to compromise intergenerational sustainability and common pool resources, since a majority of people are proself members (competitors and individualists).

Distributions of prosocial members categorized by SVO game in each generation for each treatment and for an overall aggregate are summarized in table 4.2. From table 4.2, we see that among the total of 132 generations, 51.79 %, 30.03 %, 15.15 % and 3.03 % of the generations consists of zero prosocial (or three proselfs), one prosocial, two prosocials and three prosocials per generation, respectively. It appears that a majority of the generations consist of only competitors and individualists (proselfs) in a capitalistic city, Dhaka, which is in line with our past works (Shahrier et al., 2016). Table 4.3 presents the percentage of generation choices B with respect to the number of prosocial members per generation (See the "overall" column in 4.3). It shows that when generations consist of only proselfs, 23.53 % of the generations choose B. However, as the number of prosocial members increase in a generation, the percentage of B rises such that 60 %, 100 %, 100 % of the generations choose B when the generations consist of one prosocial, two prosocial and three prosocial members, respectively.

To check whether the distributions of generation choice B are independent of the number of prosocial members in a generation, we run pair wise chi-squired tests.

Table 4.3: Distributions in the number of prosocial members per generation and percentage of choice B under each treatment

# of prosocial members in one generation	Percentage of choice B			Overall
	Basic	IFG	FAB	
0	11.54 % $\left(\approx \frac{3}{26}\right)$	3.85 % $(\approx \frac{1}{27})$	80.00 % $(= \frac{12}{15})$	23.53 % $\left(\approx \frac{16}{68}\right)$
1	14.29 % $\left(\approx \frac{1}{7}\right)$	50.00 % $\left(= \frac{4}{8}\right)$	76.00 % $\left(= \frac{19}{25}\right)$	60.00 % $\left(= \frac{24}{40}\right)$
2	100.00 % $\left(= \frac{7}{7}\right)$	100.00 % $\left(= \frac{5}{5}\right)$	100.00 % $\left(= \frac{8}{8}\right)$	100.00 % $\left(= \frac{20}{20}\right)$
3	100.00 % $\left(= \frac{2}{2}\right)$	100.00 % $\left(= \frac{2}{2}\right)$	-	100.00 % $\left(= \frac{4}{4}\right)$
Subtotal	30.95 % $\left(\approx \frac{13}{42}\right)$	29.57 % $\left(\approx \frac{12}{42}\right)$	85.42 % $\left(\approx \frac{41}{48}\right)$	50.00 % $\left(= \frac{66}{132}\right)$

The null hypothesis is that the distributions of generation choice B are the same for any pair of generations in terms of the number of prosocial members in a generation (Prosocials = 0 vs. Prosocials = 1, Prosocials = 0 vs. Prosocials = 2, Prosocials = 0 vs. Prosocials = 3, Prosocials = 1 vs. Prosocials = 2, Prosocials = 1 vs. Prosocials = 3, Prosocials = 2 vs. Prosocials = 3). The test rejects the null hypothesis for any pair at 1 % significance level, except for the pair of Prosocials = 2 vs. Prosocials = 3, suggesting that generation choices between A and B are dependent on the number of prosocial members in a generation or individual social preferences in a generation.

This result is in line with our past studies, supporting that an individual social preference might be one of the strongest determinants for generations' decisions for intergenerational sustainability (Shahrier et al., 2017). It appears that when generations consist of only proself people in basic ISDG and ISDG with IFG, a majority of them choose unsustainable option A (See the "Basic" and "IFG" columns of table 4.3). When the number of prosocial members in a generation increases, sustainable option B is more likely to be chosen. The findings from basic ISDG and ISDG with IFG suggest that a new mechanism must be developed to induce proself people to change generation choices from A to B, especially when a majority of people in generations consist of proselfs in societies such as Dhaka. Table 4.3 also provides the percentage that gener-

ations choose sustainable option B in FAB when generations consist of zero prosocial, one prosocial, two prosocials and three prosocials. In FAB, 80.00 % and 60.00 % of the generations choose B even when generations consist of zero and one prosocial member, respectively. This is in sharp contrast with the results in basic ISDG and ISDG with IFG, demonstrating that FAB is effective to maintain intergenerational sustainability by affecting proself people in ISDG.

The chi-squared tests and the summay statistics suggest that an individual social preference is one of the key predictors for generations' decisions for intergenerational sustainability, and FAB can be a successful tool to maintain intergenerational sustainability especially when a majority of people in generations consist of proselfs. Hence, to statistically establish our claim here, we run three models of probit regression by taking generation choice B as a dependent variable. In the first model, we include only the data of basic ISDG and use the number of prosocial members in each generation as the only independent variable. The second model comprises the data of basic ISDG and ISDG with IFG along with the number of prosocial members, we include the IFG treatment as another independent variable. Finally, the third model comprises the complete data set of basic ISDG, ISDG with IFG and FAB. In the third model, we also include the interaction term for the number of prosocial members times IFG and the number of prosocial members times FAB as independent variables. We run three regression models in this way to illustrate the robustness of our regression results. We did not include any socio-demographic variable in the regression because they are neither significant nor affect the main results. Finally, the detailed definition of each variable is given in table 4.4.

Table 4.5 reports the marginal effects of independent variables on generation choice B calculated by using probit regressions. Overall, we see that a number of prosocial members per generation in models 1 and 2, FAB dummy and an interaction term of

Table 4.4: Descriptions of variables included in regressions

Variables	Descriptions
Generation choice B	A dummy variable that takes 1 if the generation chooses option B, otherwise 0.
# of prosocials	The number of prosocial members in each generation.
IFG	A dummy variable that takes 1 when IFG treatment is given to one session consisting of 6 generations, otherwise 0.
FAB	A dummy variable that takes 1 when FAB treatment is given to one session consisting of 6 generations, otherwise 0.
IFG $\times$ # of prosocials	An interaction term of IFG and the number of prosocial members in each generation.
FAB $\times$ # of prosocials	An interaction term of FAB and the number of prosocial members in each generation.

FAB dummy and a number of prosocial members in model 3 appear to be economically and statistically significant to affect the likelihood of generation choice B for intergenerational sustainability. On the other hand, IFG dummy in models 2 and 3 and the interaction term of IFG dummy and a number of prosocial members per generation are identified to be insignificant. The overall results of probit regression are quite consistent with the chi-squared tests and summary statistics.

Model 1 in table 4.5 tells that an increase in prosocial members per generation raises the probability of choosing B by 42.9 % relative to the probability of choosing A. In model 2, a number of prosocial members still remains the strong predictor of generation choice between A and B. An increase in prosocials per generation is associated with a 49.2 % rise in the probability of choosing B relative to the probability of choosing A. However, IFG mechanism appears to be ineffective for intergenerational sustainability since IFG dummy is not significant even at 10 % level in model 2. Moreover, the inclusion of IFG dummy in model makes the effect of the number of prosocial members stronger than that in model 1. In other words, an addition of IFG dummy brings about a 6.3 % (= 0.492 − 0.429) rise in the positive association between a number of prosocial members per generation and the likelihood of choosing sustainable option B. In sum-

Table 4.5: Marginal effects of probit regressions for generation choice *B*

Variable	Marginal effect		
	Model 1	Model 2	Model 3
# of prosocial members	0.429***	0.492***	0.504***
	(0.133)	(0.113)	(0.134)
IFG dummy		−0.016	−0.178
		(0.127)	(0.219)
FAB dummy			0.806***
			(0.184)
IFG × # of prosocials			0.267
			(0.249)
FAB × # of prosocials			−0.377**
			(0.189)

***significant at the 1 percent level, **significant at the 5 percent level

mary, IFG mechanism fails to motivate generations to choose sustainability option *B*, while individual social preferences remain as the strongest determinant in both models 1 and 2.

Model 3 in table 4.5 reveals the effects of IFG and FAB treatments and that of a number of prosocials on the probability of choosing sustainable option *B*. In this model, an increase in prosocial members per generation accounts for a 50.4 % higher probability of choosing *B* than choosing *A*, holding all other factors fixed. IFG dummy and the interaction term of IFG and a number of prosocial members remain insignificant even at 10 % level, implying that IFG treatment is unable to maintain intergenerational sustainability. Finally, FAB dummy is identified to be economically and statistically significant, showing that generations under FAB treatment is 80.6 % more likely to choose *B* than choosing *A* compared with those under basic ISDG. In addition, the interaction term of FAB and a number of prosocials is economically and statistically significant with the coefficient of −0.377 such that an increase in prosocials per generation un-

der FAB treatment induce generations to choose sustainable option B only by 12.7 % (= 50.4 % − 37.7 %). This percent increase of 12.7 % under FAB is less than that of 50.4 % under basic ISDG, implying that FAB treatment weakens a positive influence from an increase in prosocials per generations. However, overall, this fact can be interpreted that FAB is a mechanism that enables people to choose sustainable option B without relying on the number of prosocials per generation due to the strong positive impact (80.60 %) of FAB dummy .

In a highly capitalistic areas, a majority of the generations consist of only proself members or only one prosocial. In that case, generations choose to maximize their own payoff by costing subsequent generations in basic ISDG or a deliberative democratic setting. Therefore, to keep up intergenerational sustainability in such a society, we need a mechanism that can enhance intergenerational sustainability. We introduce two mechanisms, IFG and FAB, to improve intergenerational sustainability and examine the effectiveness. The results establish that FAB is an effective mechanism to maintain intergenerational sustainability, especially because of its ability to improve intergenerational sustainability even when the generations consist of proself people. On the other hand, IFG mechanism appears to be ineffective for intergenerational sustainability.

We find that FAB weakens the effect from a number of prosocials per generation on the likelihood of choosing sustainable option B, as compared with the basic ISDG and ISDG with IFG. This can occur only when more generations whose majority consists of proselves decide to choose sustainable option B in ISDG with FAB than basic ISDG and ISDG with IFG. In other words, it can be hypothesized that FAB successfully maintains intergenerational sustainability by changing proself people's decisions from A to B. It might also be the case that a large number of proself individuals switch their opinions from A to B under FAB treatment. To examine this possibility, we have interviewed

Table 4.6: Social value orientations and individual opinion changes by percentage in ISDG with FAB

Social value orientation	Individual opinion change				Subtotal
	BB	*AA*	*AB*	*BA*	
Competitive	0.00 % $\left(\approx \frac{0}{33}\right)$	45.45 % $(\approx \frac{15}{33})$	54.55 % $(\approx \frac{18}{33})$	-	100.00 % $\left(\approx \frac{33}{33}\right)$
Prosocial	82.93 % $\left(\approx \frac{34}{41}\right)$	4.88 % $(\approx \frac{2}{41})$	12.20 % $(\approx \frac{5}{41})$	-	100.00 % $\left(\approx \frac{41}{41}\right)$
Individualistic	5.36 % $\left(\approx \frac{3}{56}\right)$	23.21 % $(\approx \frac{13}{56})$	71.43 % $(\approx \frac{40}{56})$	-	100.00 % $\left(\approx \frac{56}{56}\right)$
Unidentified	7.14 % $\left(\approx \frac{1}{14}\right)$	35.71 % $(\approx \frac{5}{14})$	57.14 % $(\approx \frac{8}{14})$	-	100.00 % $\left(\approx \frac{14}{14}\right)$
Overall	26.39 % $\left(\approx \frac{38}{144}\right)$	24.31 % $\left(\approx \frac{35}{144}\right)$	49.31 % $\left(\approx \frac{71}{144}\right)$	-	100.00 % $\left(\approx \frac{144}{144}\right)$

each subject about which he/she supported between *A* and *B* before and after the FAB treatment. The interviews in FAB enables us to examine how individual opinions change under FAB treatment in relation to individual social value orientations.

There are four possible pairs of individual opinion changes before and after FAB treatment: (i) an subject initially supported *B*, and still supports *B* after FAB treatment (hereafter, *BB*), (ii) an subject initially supported *A* and support *A* after FAB treatment (hereafter, *AA*), (iii) an subject initially supported *A*, but support *B* after FAB treatment (hereafter, *AB*), (iv) an subject initially supported *B*, but support *A* after FAB treatment (hereafter, *BA*). Among these four possible pairs, *BB* and *AA* represent no individual opinion changes, while *AB* and *BA* represent individual opinion changes.

Table 4.6 presents the percentage of these four types of individual opinion changes for each of the value orientation under FAB treatment. About 82.93 % of prosocials follow *BB*, whereas 0.00 %, 5.36 % and 7.14 % of the competitors, individualists and the unidentified individual follow *BB*, respectively. In contrast, *AA* is the lowest for prosocial (4.88 %), followed by individualists (23.21 %) and by competitors (45.45 %). No subjects follows *BA*. Finally, 71.43 %, 57.14 %, 54.55 % and 12.20 % of the individualistic, the unidentified, competitors and prosocials follows *AB*, respectively. It appears

that a considerable portion of the individualists and the competitors change their individual opinions from A to B after FAB treatment. To statistically establish this, we run pair wise chi-squared tests to examine whether the three types of opinion changes are statistically independent of the value orientations. The null hypothesis is that the distributions of opinion changes are the same for any two types of value orientations. The examination rejects the null hypothesis at 1 % level for all the pairs of value orientations, confirming that the three types of opinion changes are dependent on value orientations.

Summary statistics and the chi-squared tests are in line with our expectation, supporting that FAB treatment successfully changes the individualist's, unidentified individual's and competitor's individual opinion from A to B. Therefore, more generations are induced to improve intergenerational sustainability, compared with the basic ISDG and ISDG with IFG. To confirm this finding, we regress types of opinion changes on value orientations and individual socioeconomic variables using a probit regression. We define a dependent variable of opinion change dummy as follows: The variable becomes 1 for AB, otherwise (BB and AA) 0. A set of independent variables includes the SVO dummies (Base group = Prosocial) and socioeconomic variables such as income, education, family structure and so on. Table 4.7 summarizes the detailed definitions of variables included in the regression. Since no opinion changes of BA has been found, this regression simplifies to analyze the probability of the opinion change from A to B relative to the probability of no opinion change under FAB.

Table 4.8 shows the marginal effects of the independent variables on the probability of opinion changes. The marginal effects of the SVO dummies exactly follow the summary statistic of opinion changes for each value orientation. It reveals that compared with the prosocials, individualists, unidentified individuals and competitors are 53.8 %, 45.8 % and 38.1 % more likely to change their opinions from A to B, holding all other

Table 4.7: Descriptions of variables included in regressions for individual opinion change

Variables	Descriptions
Opinion change	A dummy variable that takes 1 if a respondent's opinion changes from *A* to *B*, otherwise 0.
Household income	Household income per month in 1000 BDT.
Gender	A dummy variable that takes 1 when a respondent is a female, otherwise 0.
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, 70 and more, respectively.
Education	Years of schooling.
Family structure	Joint-family structures are coded as 1, otherwise (single family) 0.
SVO dummy variables (Base group = Prosocial)	
Competitive	A dummy variable that takes 1 when a respondent's value orientation is competitive, otherwise 0.
Individualistic	A dummy variable that takes 1 when a respondent's value orientation is individualistic, otherwise 0.
Unidentified	A dummy variable that takes 1 when a respondent's value orientation is unidentified, otherwise 0.

socioeconomic factors fixed. This regression result confirms that FAB can markedly enhances intergenerational sustainability by motivating a large number of the individualistic, the unidentified and the competitive to change individual opinions from *A* to *B*. Consequently, more generations are induced to choose sustainable option *B* under FAB.

Recall that members in a generation need to finalize their decision by anonymous vote for *A* or *B* if they do not have the same request and decision in the first and second steps. Out of 48 generations, 9 generations made their final decision by such anonymous votes. Among these 9 generations, 7 generations vote for *A*. Thus, a voting seems not to solve intergenerational sustainability problems. Moreover, from the data of individual opinion changes under FAB treatment, we find that 106 subjects out of 144 ones initially supported *A* before group discussions. In summary, along with the results of the basic ISDG, the outcomes of voting and opinion changes in FAB treatment provide additional evidence that deliberative democracy fails to maintain intergenerational sustainability

Table 4.8: Marginal effects of probit regressions for *opinion change* and *no opinion change*

Variable	Marginal effect
Household income (in 1000 BDT)	−0.001
	(0.001)
Gender	0.177
	(0.150)
Age	0.032
	(0.044)
Education	0.001
	(0.009)
Family structure	−0.009
	(0.087)
SVO dummy (base group = Prosocial)	
Competitive	0.381***
	(0.093)
Individualistic	0.538***
	(0.064)
Unidentified	0.458***
	(0.119)

***significant at the 1 percent level, **significant at the 5 percent level

when societies consist of a majority of proself people.

This result is a mirror image of that demonstrated in Hauser et al. (2014) showing that voting or democracy is effective to maintain intergenerational provision of goods when a majority of people are prosocial. In their experiments of intergenerational goods games, over-harvesting by a few defectors endangers sustainability of intergenerational goods. Therefore, deciding the harvests by votes improves sustainability since votes or democracy enables a large number of cooperators to prevent a minority of defectors from depleting intergenerational goods. However, in our experiments, a majority of subjects are proselves who prioritize their own payoff. Thus, generations of proself members easily compromise intergenerational sustainability when they make the decisions in a deliberative democratic process such as basic ISDG.

In this research, we suggest two mechanisms of IFG and FAB that can potentially enhance intergenerational sustainability, and FAB is proven to be effective even when a majority of people are proself. Along with our current study, the past researches such as Shahrier et al. (2016), Shahrier et al. (2017) and Timilsina et al. (2017) show that with the maturation of capitalism and further modernization in the society, people become more competitive. In the future, highly capitalistic societies shall be occupied by a majority of proself people. In such a situation, choosing competitive or self-maximizing outcomes including prioritizing own generations seems to emerge as a norm and is deeply inherited in individual belief systems. Therefore, in basic ISDG and ISDG with IFG, proself people choose to maximize their own generations' payoff following the norm, compromising intergenerational sustainability in our highly capitalistic societies (Evans, 2008, Evans and Stanovich, 2013, Howarth et al., 2016, Shahrier et al., 2016).

Researches in brain science demonstrate that an experience of projecting future

events can affect our present decisions (Schultz et al., 1997, Gilbert and Wilson, 2007, Gerlach et al., 2014, Szpunara et al., 2014). Because of the experience of role-playing as a future generation in ISDG with FAB, members of a generation feel the pain of being negatively affected by the previous generations prior to their actual decision in the original position. Moreover, for the actual decision, they need to synchronize their request as a future generation with the actual decision as the current generation through their own logic. The effect of projecting future and the requirement of synchronization in FAB seem to influence individuals to choose intergenerational sustainability through a logic-based decision making process in ISDG with FAB (Evans, 2008, Evans and Stanovich, 2013, Howarth et al., 2016).

Past studies depict the rapid growth of urbanization, especially in Asia and Africa; they project that by 2050, 66 % of the total population will reside in cities and 75 % of the major cities will be in Africa and Asia (American Association for the Advancement of Science, 2016, Wigginton et al., 2016, McDonnell and MacGregor-Fors, 2016). Our results of current and past studies demonstrate that democracy fails to maintain intergenerational sustainability in highly capitalistic societies where a majority of people are proself. Consistently with this result, we have observed several failures of the countries in the world to solve intergenerational problems, such as controlling carbon emission and global warming under democratic institutions (Barrett, 2008, Falkner, 2016).

Given the empirical finding that people become more proself in capitalistic societies together with rapid urbanization, development and implementation of new mechanisms in place of democracy seem to be necessary to maintain intergenerational sustainability. To this end, we design and suggest a new mechanism, namely, future ahead and back mechanism (FAB), by conducting a field experiment in highly capitalistic societies of a developing country, Dhaka, Bangladesh. The examination shows that FAB can main-

tain intergenerational sustainability in field experiments and can be a potential solution for intergenerational problems. To the best of our knowledge, our study is the first to demonstrate that voting or democracy is not effective for intergenerational sustainability when a majority of people are proself and to suggest an effective mechanism for maintaining intergenerational sustainability through field experiments in highly competitive societies of developing countries, Dhaka.

4.4 Conclusion

Maintaining intergenerational sustainability is a necessary condition for the existence of humankind on earth. However, our current economic and political systems are not designed to consider the needs of future generations. Consequently, we experience how faster economic growth under democratic political systems causes overexploitation of natural resources and environmental problems, compromising intergenerational sustainability. Past studies show that economic environment as part of culture affects human preferences and behaviors such that, with the maturation of capitalism and further modernization in societies, people become more proself. Building upon such past literature, this research demonstrates that democracy might fail to maintain intergenerational sustainability in capitalistic societies where a majority of people are proself, suggesting a necessity of new mechanisms.

We design and institute a new mechanism to improve intergenerational sustainability called future ahead and back mechanism (FAB). We compare the outcome under FAB with that under deliberative democratic settings by implementing field experiments of intergenerational sustainability dilemma game (ISDG) in Dhaka, Bangladesh. The results reveal that generations compromise intergenerational sustainability in basic ISDG

since a majority of proself people tend to prioritize their own generation's payoff. On the other hand, FAB mechanism successfully maintains intergenerational sustainability in that a large number of proself individuals are induced to support sustainable option B although such proself subjects initially supported unsustainable option A. We argue that by installing the effect of projecting future events in current decisions and more logic-based reasoning in individual mind, FAB advances intergenerational sustainability. FAB can be an effective device to solve intemporal dilemmas where democracy fails to work out such problems.

Finally, we note some limitation in this research and future possible research. Our study does not analyze the detailed pathways of how FAB affets the process of individual motivations, decisions and group behaviors for intergenerational sustainability in relation to the level of social network, social capital and subjects' brain images. With an additional experimental design, future studies should be able to address these issues. These caveats notwithstanding, it is our belief that this study is the first step to figure out a new mechanism of FAB to solve intergenerational sustainability dilemma in highly capitalistic societies where a majority of people are proself and democracy might fail. The FAB can be used in two ways to solve intergenerational problems. First, FAB can be applied as an alternative institution of democracy in collective decision-making process for intergenerational sustainability. Second, FAB could be applied at individual level rather than collective level as part of education or training to change the individual ways of thinking to be future-oriented (Wilson et al., 2014).

CHAPTER 5

GENERAL DISCUSSION AND CONCLUSION

In recent times, environmental pollution and overexploitation of environmental and natural resources due to urbanization and modernization are the most threatening issues for the existence of humankind in this earth. Studies show that societies in developing countries will be more urbanized and competitive in the future, projecting that by 2050, 66 % of the world population will reside in cities and cities of developing countries in Asia and Africa will account for 75 % of the urbanities in the world. Together with the current environmental pollution and overexploitation of environmental and natural resources, there is a possibility that people might be more competitive as society becomes more modernized and thus intergenerational sustainability will pose more danger. Given these state of affairs, it is important to analyze the human preference and decision for competitiveness and intergenerational sustainability in relation to ongoing modernization of competitive societies and find out potential mechanism to enhance intergenerational sustainability.

Therefore, this research analyzes the change in human social preference in relation to economic environments as a part of culture and how this change affect their decision for intergenerational sustainability. Finally, it seeks to find a potential mechanism to maintain intergenerational sustainability in highly capitalistic society. Our analysis finds that with ongoing modernization of competitive societies, people become more competitive and thus, they endanger intergenerational sustainability. We show that in highly capitalistic societies, people fail to maintain intergenerational sustainability due to the existence of a majority of proself people who prefer to maximize their own generation's payoff. However, the alternative mechanism that we proposed to enhance intergenerational sustainability called 'FAB' is demonstrated to enable proself people to

change their individual opinions from unsustainable to sustainable options, inducing more generations to choose sustainable options even in highly capitalistic societies.

By implementing SVO experiments in less-capitalistic, transitional and capitalistic societies, first we shows that people become more competitive with maturation of capitalism in societies. Our result can be considered as an unique evidence of the effect of culture on human behavior and preference. Competition for survival and success is one of the main ideas in capitalism. Individuals in capitalistic societies survive, achieve, or succeed by competing. Hence, we argue that with aging capitalism in societies, the idea of "competition for survival and success" as a cultural trait or meme transfers from brain to brain due to success bias transmission through a social learning mechanism such that people become more competitive.

In addition, we find a large number of "unidentified" individuals in the transitional society. One reason behind this might be the gradual change in economic environments; as the society gradually becomes capitalistic, the new cultural trait of competition for survival and success appears to conflict with the old pattern of cooperation for survival and success. Thus, the conflict seems to bring about instability in people's preferences as "unidentified." In the less-capitalistic society, people are engaged with farming and natural resource harvesting for their self-consumption. These activities need cooperation rather than competition. For instance, when they go to the forest for collecting honey and wood they need to cooperate to protect themselves from wild animals. Moreover, in this region, it is a common practice among the fishermen, honey-collectors and wood-collectors to share the things/profits equally among themselves. Due to the existence of such cooperative practices and needs, in the long run, cooperation for survival and success is still dominant and more prosocial people are found in less-capitalistic societies.

We find that mainly two channels affect people's decision for intergenerational sustainability, SVO and area specific effect. 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 of less-capitalistic and capitalist captures in our analysis. We argue that the cultural learning pathway 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. In less-capitalistic societies vertical transmission of wealth, and cognitive skills, such as social norms, values, wisdom, family history, non-cognitive skills and farming techniques is a common practice; meaning that younger generation learns such things from the older generation through close interaction between generation. In addition, younger generation receives care from the previous generation. On the other hand, 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. 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 generations payoff without considering intergenerational linkage.

We designed and examined the effectiveness of two mechanisms to maintain intergenerational sustainability in capitalistic areas by demonstrating field experiments of ISDG. 'FAB' turns out to be a effective mechanism to enhance intergenerational sustainability in capitalistic areas by enabling proself people to change their individual decision from unsustainable to sustainable option. We conjecture that FAB induces people to choose more intergenerational sustainability by installing the memory of projecting future and more logic-based reasoning instead of norm-based reasoning in human mind and brain. We propose FAB as a potential alternative of democracy and voting to

take collective-decision regarding intertemporal problems such as environmental pollution, intergenerational providing of environmental and natural goods and more broadly intergenerational sustainability. We also argue that since culture affect human behaviors and decisions, inclusion of FAB in the social system will bring about a change in human behavior towards choosing more intergenerational sustainability and act pro-environmentally instead of selfishly maximizing individual and own-generation's payoff.

Finally, we cite some limitations of this research and suggest potential future researches. We conjecture that the area specific effects on the decision for intergenerational sustainability 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. However, in fact, the specific effects of intergenerational links or the detailed pathways have not been established in this research, the areaspecific effects for intergenerational preferences and behaviors may originate from many aspects of human nature, life and societies. Our study does not analyze the detailed pathways of how and why FAB affects individual motivations, decisions and group behaviors on questions of intergenerational sustainability in relation to subjects social network, social capital and brain images. Future researches should be able to examine these possibilities by employing different experiments and methods.

These caveats notwithstanding, it is our belief that this study is the first step toward identifying a new FAB mechanism to solve the intergenerational sustainability dilemma in highly capitalistic societies in which a majority of people are proself and deliberative democracy fails. As mentioned above, we conjecture that FAB can be used in two ways to solve intergenerational sustainability problems. First, FAB can be applied as an alternative democratic institution in collective decision-making processes on matters

of intergenerational sustainability. Second, FAB could be applied at the individual level rather than the collective level as part of education or training to change individual ways of thinking toward being future-oriented (Wilson et al., 2014)

APPENDIX A

EXPERIMENTAL INSTRUCTIONS FOR THE ISDG GAME WITH FUTURE AHEAD AND BACK MAEHANISM

A.1 Instructions for AB and split game

A.1.1 Initial endowment and total payment from the game

Every subject shall be paid 300 experimental money as an initial endowment only for participation. Additional payment will be made depending on how you perform in the games that follow. In summary, total payment you will receive from the experiments is expressed as follows:

Total payment = Initial endowment of 300 **experimental money + your share of the additional payment.**

Please keep in mind that you will be paid real money in Bnagladeshi currency (BDT) based on your performance in the games. In otherworld, the more experimental money you earn from this game, the more real money you will be paid. To see the payment methods and calculation, refer to the section titled ”How your payment will be determined” at the end of this instruction. At maximum you can earn BDT 250 excluding a showup fee of BDT 350 and transportation allowance.

You will go through the following procedures in this experiment:

- Group assignment: you are assigned to a group of three people.
- Group decisions: Each group is asked to make two decisions.

A.1.2 Group assignment

You shall be part of a group which consists of three people. To determine your group, you are asked to pick one chip out of a bag and the chip indicates your group and ID. Please remember that you are not allowed to look at the chip while you pick up the card from the bag.

Example 1 **(Information on your chip).** The chip you picked indicates the following type of information:

where

- The A3 is your group ID.

- The 2 indicates your subject ID number 2 within group A3.

Experimenters instruct each of the player to move to different places (rooms) to conduct experiments depending on your group ID.

sectionGroup decisions Each group is asked to make decisions in the two games, which are described as follows:

A.1.3 1st game, the *AB* game

- The 1st game is called *AB* game. Each group is first asked to make a decision between *A* and *B*. The additional payoff the group can receive differs between *A* and *B*. The payoff the group can receive by choosing *A* is X, while the payoff by choosing *B* is *X - 300*. For instance, suppose X = 1200. By choosing *A*, your group receives 1200 experimental money as the "additional payoff." By choosing B, your group receives 900 experimental money as the additional payoff.

A.1.4 Decision making procedures for choosing between *A* and *B* in *AB* game

To choose between *A* and *B*, you need to take decisions in three steps following the procedures below:

- In the first step, you need to imagine that your group is the next group. For instance, if you are the member of the first group that is group A1 with IDs, A1-1, A1-2 and A1-3, you need to consider yourselves as members of group A2 or second group and in the same way members of group A3, A4.....according to your group IDs. From this position, you need to make a request to your previous group about the choice between *A* and *B*. In otherworld, you request your previous

group to choose either *A* or *B*. Please feel free to discuss with each other within a group to make the request to your previous group.[1]

- In the second stage, you will take the decision from your actual position. In this stage, you will choose between *A* and *B* according your group IDs. For instance, if your IDs are A1-1, A1-2 and A1-3, you choose between *A* and *B* as members of the first group. Please feel free to discuss with each other in a group to take the decision.

- If your group choices in the first stage and in the second stage are same, than you are done. If you choose *A* in both the stages, your group decision will be *A* or in the same way it is *B* if your group choose *B* in both cases. However, in a situation when your group choose different options in these two stages, such as you request your previous group to choose *A* in the first stage and you choose *B* in the second stage or you request your previous group to choose *B* in the first stage and you choose *A* in the second stage, you need to take final decision between *A* and *B* by voting. Each individual in a group should vote for either *A* or *B* without discussing with each other for the final decision. By majority voting, the final decision will be made.

A.1.5 Second game, the *split game*

- The 2nd game is called "split game." After the "additional payoff" is determined in the 1st decision making, each group is asked to determine how to share the additional payoff among three members. Please feel free to discuss about the divisions within a group. After the two games, your total payoff is calculated to be the sum of an initial endowment and your share of the additional payoff. This is all about the rule concerning how your total payoff is determined. However, this is not the end of a story.

A.2 What your group does would affect other groups

What your group does may affect the payoff for other people. In this experiment, group A1 first plays the *AB* and *split games*. Next, group A2 does the same. Then,

[1] After finishing this step, each of you have to write down your logics and reasons behind your request about the choice between *A* and *B* to the previous group. In other words,please write down why you request to the previous group to choose *A* or *B*. Please use papers and pen that you find in front of you to write down. Your writing will be sent to the next group as a *message from the previous group* which will help to make their request to their previous group.

groups A3; A4; : : : ; ensue sequentially in an ascending order of group IDs. Suppose group A1 made the decision between *A* and *B*. Given the group A1's decision, group A2 shall be asked to play the *AB* game and group A2's payoff is affected in the following way:

- Group A1 chooses *A* and receives *X* experimental money. Then, the additional payoff group A2 can receive by choosing *A* in the *AB* game decreases by *300* experimental money from *X* experimental money. That is, *X - 300* experimental money shall be the additional payoff that group A2 can receive by choosing *A* in the *AB* game.

- Group A1 chooses *B* and receives *X - 300* experimental money. Then, the additional payoff group A2 can receive by choosing *A* in the *AB* game increases by *300* experimental money from *X - 300* experimental money, i.e., *X(= X - 300 + 300)*. That is, *X* experimental money shall be the additional payoff that group A1 can receive by choosing *A* in the *AB* game.

A.2.1 Example-2

Assume as in table-1 that when group A1 chooses *A*, the group receives *X = 1200* experimental money. When group A1 chooses *B*, the group receives *X - 300 (= 1200 - 300) = 900* experimental money.

- When group A1 chooses *A*, the additional payment group A2 can receive by choosing *A* in *AB* game decreases by *300* experimental money from *1200* experimental money, that is, *900* experimental money. If group A2 chooses *B* in the *AB* games, the group receives 600 experimental money *(= 900 - 300)*.

- When group A1 chooses *B*, the additional payment group A2 can receive by choosing *A* in *AB* game increases by *300* experimental money from *900* experimental money, that is, *1200* experimental money. If group A2 chooses *B* in the *AB* games, the group receives *900* experimental money *(= 1200- 300)*.

Table 1: How the decision of group *A1* affects group *A2*

Group *A1*	Group *A2*
A: 1200	A: 900 B: 600
B: 900	A: 1200 B: 900

The same logic applies to a pair of other groups as well, say, between A2 and A3, A4 and A5, : : : etc. To illustrate the logic of the experiment, another example is provided below.

Table 2: How the decision of group *A2* affects group *A3*

Group *A2*	*A3*
A: 900	A: 600 B: 300
B: 600	A: 900 B: 600

A.2.2 Example 3 (You are in group A2)

Suppose group A1 chooses *A*. Then, in this case, group A2 can subsequently receive 900 experimental money or 600 experimental money depending on the choice of *A* or *B* (see table 1). The same logic as described in table 1 applies to the relation between groups A2 and A3. Table 2 summarizes this example.

- When group A2 chooses *A*, the additional payment group A3 can receive by choosing *A* in *AB* game decreases by 300 experimental money from 900 experimental money, that is, 600 experimental money. If group A3 chooses *B* in the *AB* games, the group receives 300 experimental money (= 600 - 300).

- When group A2 chooses *B*, the additional payment group A3 can receive by choosing *A* in *AB* game increases by 300 experimental money from 600 experimental money, that is, 900 experimental money. If group A2 chooses *B* in the *AB* games, the group receives 600 yen (= 900 - 300).

In summary, the choice of *A* or *B* made by one group affects all of other subsequent groups that play the games. In case you do not understand the rule of the experiment, please raise your hands.

A.3 Protocols for *AB* and split games

The *AB* games and split games in a group must be completed within 10 minutes.

A.3.1 *AB* game

Experimenters let each group know the possible payoffs between *A* and *B*. If you are part of groups A2; A3; A4; : : : other than A1, the possible payoffs are determined by how previous groups have made decisions between *A* and *B*. Also, note the possibility that your additional payoff can be negative. When the additional payoff the group receives become negative, members in such a group need to determine how to pay from the initial endowment of 300 experimental money that each member in a group received at the beginning of the experiment.

A.3.2 Split game

Irrespective of whether the additional payoff the group receives is positive or negative, members in a group need to determine how to split or share the payoff or payment among members.

A.3.3 Violation of 10-minute group decision rule

When the decisions in the two games cannot be made within 10 minutes, the following rule shall be applied:

- When the additional payoff the group receives is positive, each member receives an initial endowment of 300 experimental money only.

- When the additional payoff the group receives is negative, say, -*Z*, each member need to equally split -*Z* by three and make the payment of -*Z/3* from an initial endowment of 300 experimental money.

A.4 How your actual earning from this game will be determined

To determine your actual earning in BDT, a exchange rate of 2.80 will be applied. We will divide your total experimental earning from this game (initial endowment + group share/earning from the split game) by 3.5 to convert it into actual payment in BDT. For instance, if your earning from the split game or your group share is 400 experimental money, your total earning is BDT 250 (= (your initial endowment of 300 experimental money + group share of 400 experimental money)/2.80)). You can earn BDT 250 at

maximum from this game. As your group share reduces, your earning also reduces, such as if your group share is 300 experimental money, your actual earning is BDT 214 (= (your initial endowment of 300 experimental money + group share of 300 experimental money)/2.80)). So the more experimental money you earn from the game, the more real money you will get. Please note that your experimental earning from this game might be zero; in these cases, you will only get (i) show up fee of BDT 350 and (ii) transportation allowance.

APPENDIX B
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