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Essays on the Non-monetary Aspects of Cooperative Behaviours

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The undersigned Martin Daniel SIYARANAMUAL, in his quality of doctoral candidate for a Ph.D. degree in Economics granted by the Università Ca' Foscari Venezia attests that the research exposed in this dissertation is original and that it has not been and it will not be used to pursue or attain any other academic degree of any level at any other academic institution, be it foreign or Italian.

Preface

Understanding cooperative behaviours in social dilemmas is one of the key issues in modern societies as plenty of our daily life situations share this feature. Much of today's economic analysis describe that it is rational for an economic actor to free-ride in the social dilemma situation although cooperation would be optimal from a social perspective. Examples of such situation range from effort decisions in work or sports teams, the private provision of local public goods, the extraction of common pool resources, voter participation in elections to up-to-date international problems like climate protection, debt discipline or the regulation of financial markets. In all these examples a rational and selfish individual according to the notion of Nash equilibrium, will choose an action that is beneficial for herself but not for the society as a whole.

The phenomena surrounding the social dilemma problem have for a long time been recognised in economics. However, in the past two decades the discipline developed a powerful instrument to study its importance in greater detail: behavioural and experimental economics arose. Thus, a very exciting research area evolved in economics focusing on observed behaviour and behavioural theories that try to explain why individuals are willing to cooperate in social dilemmas. There are three non monetary aspects that potentially can explain why individuals are willing to cooperate in social dilemmas, namely, social interaction, cognitive ability, and social image concern. These aspects are discussed in each chapter of the current dissertation.

In Chapter 1 I analyse the effect of social interaction on the decision to contribute to public good. To capture this phenomenon, I use the contingent valuation method (CVM) to elicit the respondents' willingness to pay (WTP) for the improvement of municipal solid waste management. The CVM is a method to construct consumers' preferences toward public or quasi-public goods/services, by asking people to directly report their WTP (or WTA) to obtain a specified good rather than inferring them from observed behaviours in regular market places. In other words, CVM circumvents

the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good in question. Although CVM is widely used to construct preferences toward public good, nonetheless since CVM relies on hypothetical behaviours in hypothetical marketplaces, hence it is possible to have the gap between hypothetical and actual behaviours. One way to minimise this gap is by considering the dimension of individual social interaction in the decision process. While this dimension has been acknowledged to play an important role in the construction of private good preferences, however, in the context of public good, the role of social interaction has not been adequately examined. To examine the effect of social interaction, I construct a sampling design where respondents are divided into three different groups, namely treated, untreated, and control groups. The respondents in the treated and untreated groups were allowed to interact/discuss with each other, within and across groups, prior to the WTP elicitation question. I find that treated and untreated respondents with social interactions have higher and significant likelihood to purchase the public good relatively to control respondents. While those who did not have interaction have a lower WTP for the improvement of waste management.

In Chapter 2, which is a join study with Luis Aranda, we investigate how cognitive abilities correlate with civic engagement of older Europeans (aged 50+), using waves two and three of the SHARE dataset. An instrumental variable approach is employed in an attempt to disentangle possible endogeneity issues arising between cognitive abilities and civic engagement. Cognitive abilities are instrumented with the number of books in the respondent's place of residence during childhood. The results advocate for the existence of a causal relationship running from cognition in old age to community engagement. While contradicting game theoretic predictions, this empirical finding is in line with mainline experimental results showing how par-

ticipants with higher cognitive abilities tend to be less risk averse, and thus more willing to choose a risk-dominant action in a stag hunt game context more often.

In the last chapter, I compare whether the results from having an observer and an exemplar in a public good game are similar. To make this comparison, I employ a four-players finitely repeated public goods experiment on two directed star networks, observer and exemplar networks. In the observer network, the central player can observe peripheral players' contributions or earnings. While in the exemplar network, the central player's contribution or earning can be observed by the peripheral players. In the experiments, a player's consumption of public good depends on her own contribution, and on others' contributions. I find evidence that the behaviours of peripheral players are statistically indistinguishable across network structures. However, the peripheral players who belong to the observer network are more willing to conform with the group behaviours, meaning that they will increase (reduce) the contributions if theirs are below (above) their groups average. Furthermore, I also find evidence that the contributing behaviours are more stable in the observer networks than in the exemplar network.

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To my loving parents.

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Chapter 1

Social Interaction and Public Goods Provision

1.1 Introduction

The present article aims to investigate the role of social interaction on respondents' willingness to pay (WTP) for a proposed improvement in urban solid waste management (SWM).[1] The empirical study was conducted in Bandung, Indonesia. To elicit respondents' WTP, I used a contingent valuation method (CVM), a method that is widely used to construct consumers' preferences toward public or quasi-public goods/services, by asking people to directly report their willingness to pay (WTP) to obtain a specified good, or willingness to accept (WTA) to give up a good, rather than inferring them from observed behaviours in regular market places.[2] In other words, CVM circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good

[1]This research was supported by EEPSEA (Economy and Environment Program for Southeast Asia) Doctoral Fieldwork. The opinions expressed in this article are solely those of the author.

[2]Beside CVM, there is a relatively new valuation method for non-market benefits, known as choice experiment (CE). Unlike CVM, the choice experiment method allows the identification of the trade-offs that each individual makes between attributes of a specific public good or service.

in question. Although CVM is widely used to construct preferences toward public good, nonetheless since CVM relies on hypothetical behaviours in hypothetical marketplaces, many economists regard the preferences from CV studies with scepticisms, for example Diamond and Hausman [1994] conclude that CVM does not measure the preferences they attempt to measure because of the non-existence of people preferences for the public good in question and from the failure of respondents to consider the effect of their budget constraints.

By integrating the role of social interaction in WTP responses, my study brings a novel routine to minimise the gap between actual and hypothetical behaviours. This seems entirely plausible that to make informed choices, people often consult with their social ties for information gathering or conforming what they think with social norms, especially when they are not familiar with the condition they are confronted. And since one is not often asked a WTP elicitation question in everyday life, hence a standard assumption of CV studies that says respondents can provide a rapid answer to this type of question may create the gap between actual and hypothetical behaviours. The routine that I propose here is based on routine that has been employed in the CV studies, namely, time to think feature. Using this feature, the respondents are divided into treatment and control group. For the control group, the respondents follow a standard CV survey, meaning that the respondents answer directly the WTP elicitation question. While for the respondents in the treatment group, they are given time to think (usually over a night) about the answer that they will give for the WTP elicitation question. Some recent studies that employ this feature are Cook et al. [2007], Lucas et al. [2007], Islam et al. [2008], and Whittington et al. [2009].

Unlike those recent studies, the respondents in my study were divided into three different groups, namely treated, untreated and control respondents (I provide a detail explanation in the methodological section). The respondents who were categorised as the treated respondents were asked to think about the current condition of SWM in

Bandung and the hypothetical solution that I proposed, and the possible amount of money that they are willing to pay as their contribution for the hypothetical solution. There are two aspects that are significantly different from the time to think feature. First, while the normal time to think is usually one night, here, the treated respondents had 4-6 days time to think. Second, instead of thinking about the answer for the WTP elicitation question, I was asking them to think about the problem, the hypothetical solution and the possible amount of money as contribution. Moreover, I was telling them that they are allowed to discuss this matter with their family members or friends. The respondents who were categorised as untreated respondents were following a standard CV survey, however, these respondents had one distinguished feature compared to the control respondents, they were neighbours of treated respondents. By allowing the treated and untreated respondents to be neighbours, I was expecting that there will be social interactions among themselves that in the end will shape their preferences toward public good provision. My expectation is a fair expectation since Bandung has already experienced the negative impacts of ill-managed municipal SMW (the detail explanation is provided in the Section 3). The last category, the control respondents, they followed a standard CV survey similar to the recent studies from the previous paragraph. The way I split my respondents is inspired by the study of Duflo and Saez [2003, 2004].

Recently, there has been a growth of field experimental literature that tries to measure the effect of social interaction. Examples in this literature include Miguel and Kremer [2003]. They analyse an experimental design to evaluate own and external effects of a medical treatment against intestinal worms for children in schools in Kenya, and obtain evidence of spillover effects. They show that children in treated schools who did not get the medicine were positively affected. However, in their case, variation in treatment status within a school was not randomised but occurred because some children were not present on treatment day. Katz et al. [2001] use random

assignment to a housing voucher program for households living in high poverty public housing projects in the Boston area and find improvement of treated families in safety, health, and exposure to crime. Sacerdote [2001] uses random assignment of first-year students in Dartmouth college dorms and finds peer effects strongly influence levels of academic effort as well as decisions to join social groups. Duflo and Saez [2003, 2004] randomised the members of the departments who receive encouragement invitation to join pension and welfare presentations. They find that those who received encouragement have higher probability to join pension and welfare plan (treated sample) relatively to those who did not receive the encouragement. Moreover, those who did not receive the encouragement but belong to the same department as those who received the encouragement (untreated sample) have a higher probability to join the pension and welfare plans relatively to those who belong to the department when none of them received the encouragement invitation (control sample). The Katz et al. [2001] and Sacerdote [2001] studies on social interactions differ from Duflo and Saez [2003, 2004] and mine as well, mainly because they study the effect of assigning individuals to different peer groups, whereas in our studies, peer groups are fixed, and we analyse how individual decisions are affected by an exogenous change on the information set of some members of the peer group.

Beside proposing a novel routine to minimise the gap between actual and hypothetical behaviours, my study also has an implication on public policy regarding urban SWM in the developing countries, particularly in Bandung. Understanding and evaluating the attitudes and opinions of Bandung residents toward the issues surrounding the SWM and the economic valuation of the perceived benefits of improvements in SWM are crucial in determining the desirability and the feasibility of adopting the proposed program. In urban areas, especially in the rapidly urbanizing cities of the developing world, problems and issues of SWM are of immediate importance. Most municipal governments have acknowledged the importance of solid waste

issue, however rapid population growth overwhelms the capacity of most municipal authorities to provide even the most basic services. Moreover, most of SWM are often under-priced or non-priced due to public good characteristics that are inhibited in the SWM, therefore it is difficult to infer the economic benefits of improving SWM, even though the generation of solid waste could pose serious threats to environment and public health.

The valuation studies on solid waste services could be categorised into two groups based on where the study took place. In the first group are studies that were conducted in developed countries where solid waste management is relatively well established, hence these studies focus more on the benefits of introducing new SWM approaches, such as kerbside/drop-off recycling, composting and incineration, which aim to reduce landfill. While the other group is the studies that were conducted in the developing countries where the adequate solid waste management has been relatively neglected, thus these studies focus more on the benefits of providing/improving the basic or traditional solid waste disposal methods such as collection, transportation and landfills with better pollution control measures.

From the previous SWM valuation studies, generally, people in developing countries are willing to pay for SWM programs, and the requirements for improvement in SWM services are very often placed ahead of other major social concerns such as improvements in water and sewer services, housing, indoor air pollution and insect pests, etc. [Altaf and Deshazo, 1996, Othman, 2002, Osumanu, 2008]. Moreover, Altaf and Deshazo [1996] also found that the WTP value increases in general with income and education level. Beside income and education level, there are some other factors that also influence significantly on the WTP decision. Huang and Ho [2005], Ichoku et al. [2009] report that awareness about the seriousness of solid waste related problems has positive impact on the demand to improved SWM. Beside that, Afroz et al. [2009], past positive experience in receiving the SWM services and trust in the

proposed project also influence positively on respondents' WTP. This suggests that SWM service is a normal economic good. Female respondents have a general tendency to be willing to pay more than the male respondents [Fonta et al., 2008, Ichoku et al., 2009].

Although people from developing countries rank improper solid waste disposal as the top environmental problem, the user fee that they are willing to pay can only partially cover the cost of the service. Bluffstone and Deshazo [2003] concluded that the WTP for upgraded landfills covers only about 80-90% of the cost for a project in Lithuania to upgrade their SWM system to European level. Naz and Naz [2008] found the ratio of WTP over the total cost to be only 22-35% in the Philippines. Palatnik et al. [2005] also mentioned the necessity of subsidy to achieve an efficient level of recycling for the case of Israel. A general impression is that the WTP for the improvements in SWM do not occupy an important share in household income, since it only counts 0.1-0.9% of household income.

The essay is organized as follows. The next section, I discuss my research methodology, in which I start form the discussion on my CV questionnaire, followed by the sampling strategy, then completed by the discussion on the estimation method. In Section 3, I provide a brief explanation about the current condition of SWM in Bandung. Section 4 is the result section of my study and started with the descriptive statistics of the respondents, which includes socio-economics characteristics, attitudes and awareness toward SWM issues. Then followed by household demand estimation for improved SWM. The final section concludes.

Theoretical background. The main objective of a CV study is typically to obtain an accurate estimate of the benefits of a change in the level of provision of a public good. And depending on the nature of the public good being discussed, the new level can be interpreted as quality or quantity. Then the estimated benefits obtained

can be used in a benefit-cost analysis. In order to obtain meaningful estimated benefits, the CV study must meet not only its methodological imperatives, but also the requirements of economic theory. Based on microeconomic theory, consumer benefits can be measured by Marshallian consumer surplus or Hicksian consumer surplus. For the CV studies, the benefits are measured by the Hicksian consumer surplus, since the Marshallian consumer surplus varies as price or quantity changes.[3]

Let $V(Y, \mathbf{P}, \mathbf{X}, g)$ be a representative household's indirect utility function, with Y as the income, $\mathbf{P}$ is a price vector of other goods, $\mathbf{X}$ denotes the vector of socio-economic characteristics that might influence the household's ability to pay or constrain its behaviour, and g as the characteristic of the commodity of the interest, or in this case the improvement of the SWM. The household's WTP for the improvement of the SWM is defined as the following:

$$V(Y_0 - WTP, \mathbf{P}_0, \mathbf{X}_0, g_1) = V(Y_0, \mathbf{P}_0, \mathbf{X}_0, g_0) \tag{1.1}$$

Where the subscript 0 and 1 indicate the old and new conditions respectively. The equation above implies that WTP will be a function of the proposed change in g as well as the other factors hypothesised to influence a household's value for a change in g,

$$WTP = f(g_1, g_0, Y_0, \mathbf{P}_0, \mathbf{X}_0) \tag{1.2}$$

Clearly that WTP Calculation uses estimated parameters depends on the covariates chosen, and is also a function of the random component assumed for preferences. In general, willingness to pay is the amount of money that makes the respondent indifferent between the status quo and the proposed CV scenario.

[3]The microeconomics textbook by Mas-Colell et al. [1995] provides a detailed explanation on measuring consumer benefits using Marshallian and Hicksian consumer surplus

Based on the main objective of this essay, the respondents in my study are categorised into five different groups. The first two groups are the treated and untreated respondents with social interaction. The second two groups are the treated and untreated respondents without social interaction. And the last group is the control group.[4] Therefore, if there is no statistical difference of the independent variables, used in the equation above, across groups, then the variation of households' WTP must be explained by the sampling strategy. Hence I can define the WTP based on the sampling strategy like the following,

$$\begin{aligned} WTP^{SI}_{treated} &= f(g_1, g_0, Y_0, \mathbf{P}_0, \mathbf{X}_0, t, \iota) \\ WTP_{treated} &= f(g_1, g_0, Y_0, \mathbf{P}_0, \mathbf{X}_0, t) \\ WTP^{SI}_{untreated} &= f(g_1, g_0, Y_0, \mathbf{P}_0, \mathbf{X}_0, n, \iota) \\ WTP_{untreated} &= f(g_1, g_0, Y_0, \mathbf{P}_0, \mathbf{X}_0, n) \\ WTP_{control} &= f(g_1, g_0, Y_0, \mathbf{P}_0, \mathbf{X}_0) \end{aligned} \tag{1.3}$$

The superscript SI indicates that the household had social interaction prior the WTP elicitation question and ι denotes the social interaction.

1.2 The Research Methodology

Prior to the survey, I conducted several activities that provided important inputs in the formulation of the CV questionnaire. The First activity was meeting with stakeholders. From government agencies, there were PD. Kebersihan, a municipal-owned company that responsible on waste management in Bandung and BAPPEDAL, the government body which in charge on environmental issues on the city level. Beside

[4] A detailed explanation about my sampling strategy can be found in the methodology section

government agencies, there were two environmental non-governmental organizations (NGOs) that joined the meetings, Greeneration Indonesia and WALHI. This meeting was conducted on June 3rd 2011. Following the meeting was a focus group discussion (FGD) on June 10th 2011. Then, using the information that I obtained from the meeting and the FGD, I conducted a pre-test survey, using 100 samples (conducted between June 20th - 23rd 2011).

The actual survey was conducted from July 1st to September 30th, 2011 with 3 weeks break from July 24th to August 15th, 2011 due to the Moslem fasting period and the celebration following it. During the break period, I found that there was no major event that might change the respondents interviewed after the break period. Moreover, the break was started after I had finished interview all respondent within one neighbourhood, in order to avoid the information spillover from one household to another. For the pre-test and actual surveys, I employed 20 enumerators. These enumerators were final year undergraduate students from Department of Economics, Padjadjaran University, who received a short training on how to conduct this CV survey. The training was conducted on June 17th and 30th 2011.

1.2.1 CV Questionnaire

The contingent valuation method uses survey questions to elicit individuals' preferences for non-market goods. The essential task of a contingent valuation exercise is to design a questionnaire which elicits respondents' preference for the good being valued. In this study, the questionnaire consists of four parts:

1. Questions about respondents socio-economic characteristics and other factors that might influence their preferences toward the improvement of SWM.

2. A detailed description of SWM in Bandung and the hypothetical circumstance under which it is made available to the respondent.

3. Questions that elicit the respondents' WTP for improving the quality of SWM.

4. Questions about respondent's social interaction.

The first three parts are following the construction that Mitchell and Carson [1989] propose. To be precise, in the first part, socio-economic and others interested information questions are placed, such as sex, marital status, occupation, level of education, community involvement, household size, and household monthly income. The second part begins with the purpose of this research and an explanation of the task and statement that respondents' opinions will be used as inputs for policy determination. Afterwards, respondents are provided with a brief outline of the solid waste problem in Bandung and the consequences thereof. A solution to this problem, MaSUK RT program, will be then described. A justification for collecting funds through a referendum will also be provided, with neighbourhood contribution as a payment vehicle. To provide balance to the information provided earlier, the respondents will also be given reasons why they might not want to donate and will be reminded of their budget constraint. After the respondents have understood about the second part, then the enumerators elicit the respondents' WTP. For the elicitation question format, I use the dichotomous choice as presented in the Box 1.[5]

[5]Note that the respondents already explained about respondents' selection process, confidentiality of responses and time commitment to finalise the questionnaire, before the interview was started.

Box 1: Dichotomous Elicitation Question Used in The Questionnaire

13. Proposal: Bandung Municipality residents will contribute Rp. X for the improvement of municipal solid waste management under MaSUK RT program. This contribution will be levied on monthly neighbourhood association solid waste retribution.

- ☐ I would vote YES to the MaSUK RT program with a fee of Rp. X would be added on my monthly neighbourhood association solid waste retribution.
- ☐ I support the MaSUK RT program and the use of a fee on my monthly neighbourhood association solid waste retribution but it is not worth Rp. X to me and thus I would vote NO.
- ☐ I support the MaSUK RT program and the use of a fee that would be added on my monthly neighbourhood association solid waste retribution but I cannot afford Rp. X and thus would vote NO.
- ☐ I support the MaSUK RT program with a fee of Rp. X that would be added on my monthly neighbourhood association solid waste retribution, but I would vote NO for the following reason:
  - ☐ The money is unlikely to be used as stated.
  - ☐ Not enough money will be mobilized.
  - ☐ I think it should be Bandung Municipality government that should finance the improvements of municipal solid waste management.
  - ☐ I do not trust that the government body who will administer the fund.
  - ☐ Others, please specify _____
- ☐ I would vote NO to the MaSUK RT program even if there were no cost to my monthly household since its existence does not have any impact to my household.

In the dichotomous choice elicitation format, respondents are provided two alternatives with one alternative typically being the status quo, and asked to choose one of them. The dichotomous choice question has several advantages and is now the most commonly used elicitation format since it was popularized by Bishop and Heberlein [1979]. In particular, the take-it-or-leave-it question simplifies the respondents' task by asking respondents to decide whether to vote for or against the proposal at the fixed price provided. More importantly, the dichotomous choice question circumvents the potential for strategic voting behaviour and is incentive compatible. Indeed, one of the core theoretical results in mechanism design, derived independently by Gibbard [1973] and Satterthwaite [1975], is that no response method involving more than two choices can be incentive compatible without restrictions on the agents' preferences.

Beside dichotomous choice format, there are other elicitation formats that widely used. The earliest elicitation question used is an open-ended question where respondents are asked directly to state their WTP for a given public good. While straightforward, respondents may find it difficult to answer an open-ended question for an environmental change they are not familiar with, and they may skip the valuation question or give unreliable answers. Therefore, the open-ended question often leads to a large number of non-responses and outliers [Desvousges et al. [1983] as found in the Mitchell and Carson [1989]]. Another alternative is the payment card format. In this elicitation format, respondents are provided a list of monetary amounts and are asked to choose the level of payment that most closely approximates their WTP [Mitchell and Carson, 1981, 1984]. This method reduces the number of non-responses and outliers. However, the payment card question is sensitive to biases relating to the range of the numbers listed on the payment card [Mitchell and Carson, 1989]. In addition to the potential biases embedded in the open-ended and payment card formats, a fundamental issue about respondents' strategic behaviour exists in both elicitation formats Mitchell and Carson [1989].

Beside the three common parts, I also add social interaction part. In this part, I asked respondents to name 5 of their friends, with whom they usually spend their spare time together. The variable social interaction is drew from this part. I assume that the treated respondents have social interaction if, at least, one of her friends mentioned in this part belongs to the same neighbourhood like herself and had a discussion about solid waste management prior to the WTP elicitation question and must be as either treated or untreated respondent. Similarly to the untreated respondents, they are assumed to have social interaction if they can fulfil all the three requirements, with the exception on the third requirement, her friend must be a treated respondent only. Obviously, using this assumption, I cannot capture the friends-of-friends type of social interaction. The detail questions in this part is presented in Box 2.

Box 2: Social Interaction Questions Used in The Questionnaire

	Name 1:	Name 2:	Name 3:	Name 4:	Name 5:
a. Does he/she live within 1 kilometres from your house?	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes
b. How long have been known each other?	0 ☐ < 1 year 1 ☐ 1-2 years 2 ☐ > 2 years	0 ☐ < 1 year 1 ☐ 1-2 years 2 ☐ > 2 years	0 ☐ < 1 year 1 ☐ 1-2 years 2 ☐ > 2 years	0 ☐ < 1 year 1 ☐ 1-2 years 2 ☐ > 2 years	0 ☐ < 1 year 1 ☐ 1-2 years 2 ☐ > 2 years
c. What subject(s) you normally discuss?	0 ☐ Jobs 1 ☐ Neighbourhood matters 2 ☐ Sosial and political issues	0 ☐ Jobs 1 ☐ Neighbourhood matters 2 ☐ Sosial and political issues	0 ☐ Jobs 1 ☐ Neighbourhood matters 2 ☐ Sosial and political issues	0 ☐ Jobs 1 ☐ Neighbourhood matters 2 ☐ Sosial and political issues	0 ☐ Jobs 1 ☐ Neighbourhood matters 2 ☐ Sosial and political issues
d. For the last 4-6 days, did you discuss the solid waste problem with he/she?	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes
e. In a week, how many hours you usually spent to talk?	0 ☐ < 3 hours 1 ☐ 3-5 hours 2 ☐ > 5 hours	0 ☐ < 3 hours 1 ☐ 3-5 hours 2 ☐ > 5 hours	0 ☐ < 3 hours 1 ☐ 3-5 hours 2 ☐ > 5 hours	0 ☐ < 3 hours 1 ☐ 3-5 hours 2 ☐ > 5 hours	0 ☐ < 3 hours 1 ☐ 3-5 hours 2 ☐ > 5 hours
f. Do you usually talk to each other in a group or individually?	0 ☐ Individually 1 ☐ In a group	0 ☐ Individually 1 ☐ In a group	0 ☐ Individually 1 ☐ In a group	0 ☐ Individually 1 ☐ In a group	0 ☐ Individually 1 ☐ In a group
g. Does he/she has a keen interest on environmental issues?	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes
h. Is he/she a member of environmental NGO	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes	0 ☐ No 1 ☐ Yes
i. Is he/she actively involved in the neighbourhood activities?	0 ☐ Not active 1 ☐ Rarely 2 ☐ Often 3 ☐ Active	0 ☐ Not active 1 ☐ Rarely 2 ☐ Often 3 ☐ Active	0 ☐ Not active 1 ☐ Rarely 2 ☐ Often 3 ☐ Active	0 ☐ Not active 1 ☐ Rarely 2 ☐ Often 3 ☐ Active	0 ☐ Not active 1 ☐ Rarely 2 ☐ Often 3 ☐ Active
j. If he/she were asked the willingness to pay question, do you think that he/she will give the same answer like yours?	0 ☐ No 1 ☐ I do not know 2 ☐ yes	0 ☐ No 1 ☐ I do not know 2 ☐ yes	0 ☐ No 1 ☐ I do not know 2 ☐ yes	0 ☐ No 1 ☐ I do not know 2 ☐ yes	0 ☐ No 1 ☐ I do not know 2 ☐ yes

1.2.2 Sampling Strategy

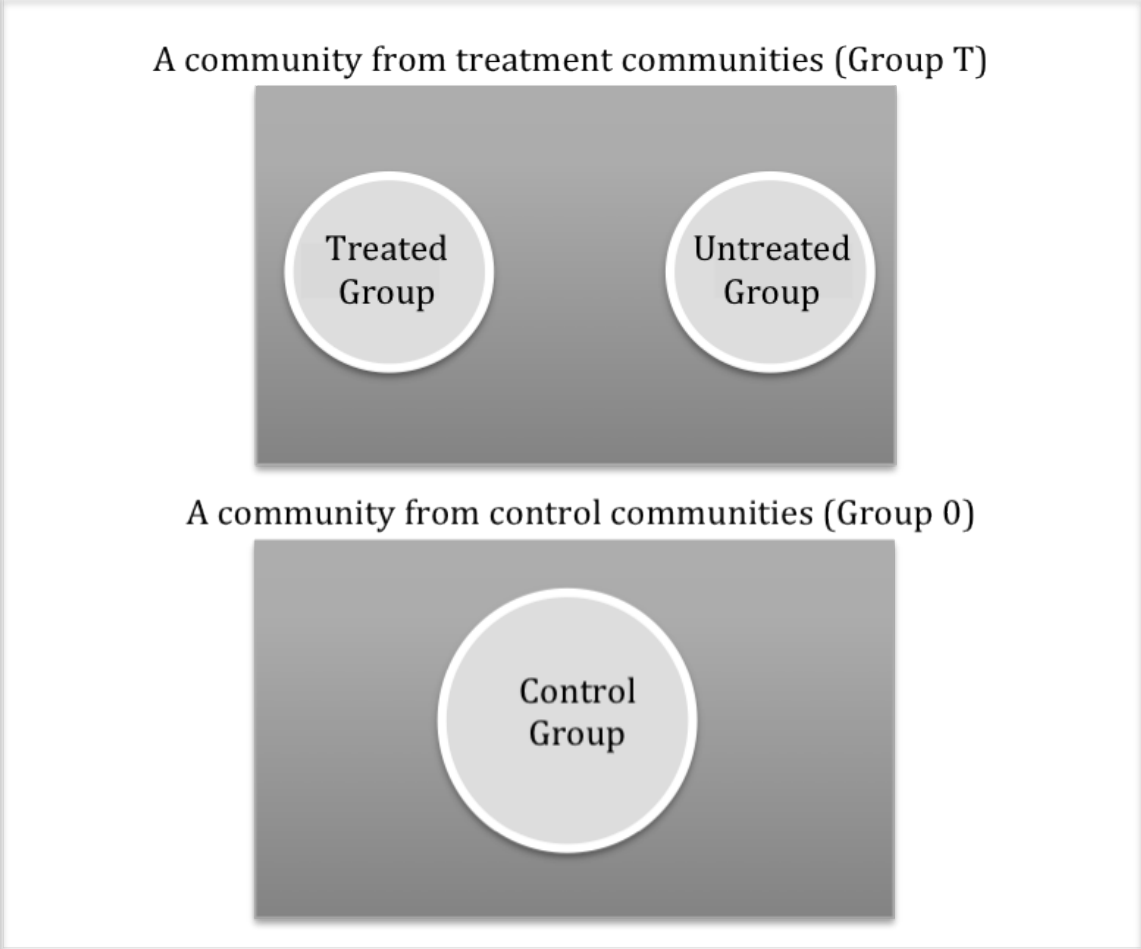
I split my respondents into two different groups, treatment and control groups, whom were belong to different neighbourhoods. To collect the sample of neighbourhoods, I used a simple random sampling strategy, in which the area is based on the administrative jurisdiction area, not by imposing virtual grid on the area of Bandung. There are 151 sub-districts, from which I randomly collected 5 sub-districts. Then I randomly selected two neighbourhoods from each sub-district sample, thus, there were 10 neighbourhoods that belong to my sample set. Finally, these neighbourhoods were equally distributed to each group, treatment and control groups.

On average, each neighbourhood in Bandung consists of 300 households. I then randomly selected 60 households from each neighbourhood that belong to the control group. Therefore, in total there were 300 respondents that belong to the control group, and these respondents were called as control respondents. While for each neighbourhood that belong to the treatment group, I randomly collected 120 households, from which 40 households were assigned into the treated respondents and 80 households were assigned into the untreated respondents. Therefore, the total respondents in the treatment group were 600 respondents, of whom 200 of them were treated respondents and 400 respondents were untreated respondents.

The control respondents followed a standard CV survey, where they answered all questions in one interview session. While the treated respondents were interviewed in two sessions. In the first session, these respondents were answering the first and the second parts of the CV questionnaire. Before the first session ended, the enumerator had explained the current condition of SWM in Bandung and the hypothetical solution to improve its quality, and these respondents had been asked to think about this issue for about 4-6 days. They had been told that they were allowed to discuss or share the information that they received from the enumerator with the other members of their family or with their neighbours. After 4-6 days, the same enumerator

came back and finished the interview. For the untreated respondents, they followed standard CV survey like the control respondents, with one exception, they finished the interview on the same day that the treated respondents finished their second interview.

Figure 1.1: Sampling Design



Using this sampling strategy, I can measure two direct treatment effects, which are the time to think and being neighbour effects. And in order to achieve the main objective, which is measuring the social interaction effect, I combine this sampling strategy with the information obtained from the Part 4 of the questionnaire, the social interaction part. As I explained before, from the social interaction part, I can determine

whether the treatment respondents discussed or not prior their elicitation question. Therefore, by comparing the behaviours of between the treated respondents who discussed or shared their information with other treated or untreated respondents, and those who did not share nor discuss the information, I can measure the effect of social interaction on the likelihood to purchase public good. Moreover, the social interaction effect can also be measured from the untreated respondents side. We can regard this as sender-receiver relationship between the treated and treated respondents.

It is worth to emphasize that in the information given to the treated respondents, there was no information regarding the proposed price of the hypothetical solution. This is significantly different from the standard CV studies that use time to think feature. In these studies, the respondents were asked to think about the proposed price of the hypothetical public good, while in mine, the respondents we asked to think about the problem and the hypothetical solution. I did not provide the proposed price as a part of information given, in order to avoid respondents' protest due to the fact that they might comparing different price level.

1.2.3 Estimation Method

The subsequent presentation follows Haab and McConnell [2002]. For the households' WTP estimation, I use a linear logit model, which is among the most common parametric models employed in the CV literature with dichotomous choice.[6] This specification assumes that

$$\Pr(\text{yes}) = \Pr(\epsilon_j < \boldsymbol{\alpha}_i \mathbf{z}_j - \beta t_j) \tag{1.4}$$

where $\mathbf{z}_j$ is an m-dimensional vector of variables related to individual j, and $\boldsymbol{\alpha}_i$ denotes an m-dimensional vector of parameters, such that $\boldsymbol{\alpha}_i \mathbf{z}_j = \sum_{k=1}^{m} \alpha_{ik} z_{jk}$ and

[6] Crooker and Herriges [2004] provide a comparison of several methods that generally used to derive WTP estimation.

$\epsilon_j \sim \text{logistic}(0, \frac{\pi^2\sigma_L^2}{3})$. And the corresponding maximum likelihood function is given by:

$$L(\alpha, \beta|y, z, t) = \prod_{j=1}^{T} \left[\left[1 + exp\left(- \frac{\boldsymbol{\alpha}\mathbf{z}_j - \beta t_j}{\sigma_l}\right)\right]^{-1}\right]^{I_j} \cdot \left[\left[1 + exp\left(- \frac{\boldsymbol{\alpha}\mathbf{z}_j - \beta t_j}{\sigma_l}\right)\right]^{-1}\right]^{1-I_j} \tag{1.5}$$

An important attribute of the linear logit model in the CV study is that, unlike most logit applications, the dispersion of WTP in the population (captured by σ_L) can be separately identified [Cameron, 1988]. This is accomplished by varying the price offered, which is the t_j, across observations. In particular, if $\hat{\sigma}_{Lk}$ denotes the kth element of the maximum likelihood estimate of σ_L, then $\hat{\sigma}_L = \hat{\sigma}_{L0}^{-1}$. The original parameter vector can likewise be recovered using $\hat{\beta}_{Lk} = \frac{\hat{\sigma}_{Lk}}{\hat{\sigma}_{L0}}$. Finally, in the logit framework both the conditional mean WTP ($E_\epsilon(\text{WTP}|\boldsymbol{\alpha}, \beta, \mathbf{z}_j)$) and the conditional median WTP ($\text{median}_\epsilon(\text{WTP}|\boldsymbol{\alpha}, \beta, \mathbf{z}_j)$) are given by

$$E_\epsilon = \text{median}_\epsilon = \frac{\boldsymbol{\alpha}\mathbf{z}_j}{\beta} \tag{1.6}$$

and the conditional dispersion of WTP in the population is given by

$$d_{\text{WTP}} = Std.Dev.(\text{WTP}|\boldsymbol{\alpha}, \beta, \mathbf{z}_j) = \sigma_L \tag{1.7}$$

1.3 Overview Of The Study Area

The study was conducted in Bandung, the capital of West Java province, located about 180 km south-east Jakarta, is the fourth largest city in Indonesia. With over 2.9 million populations in 2007, it's one of the most densely populated cities in Asia

and It is also rated as one of the fastest-growing major cities/metropolitan in Southeast Asia. Beside that, Bandung acts as the capital of West Java Province and the core for Greater Bandung Metropolitan Area, which is rated as one of the fastest-growing major cities/metropolitan regions in Southeast Asia.

SWM in Bandung falls under the jurisdiction of the municipal-owned company called PD. Kebersihan. Its main responsibilities consist collection, street cleansing, and disposal. However, PD. Kebersihan cannot cover most of the collection service for the residential area due to its financial and manpower constraints. The manpower is become an issue because many urban residential area in Bandung, and in any other Indonesian cities, are located in a narrow alley, hence the only means to collect the waste is using a handcart. And to overcome this issue, many residential areas organise their own informal collection service, which is funded by monthly communal contribution or directly levied on the household. Beside the coverage problem in the residential area, one to two thirds of the solid waste generated do not leave temporary disposal sites; sites that located close to the poor residential area or traditional markets. As a result, the uncollected waste spills indiscriminately in the streets and in drains, so contributing to flooding, breeding of insect and rodent vectors and the spread of diseases. Another waste related issue is the ill-managed final disposal site. The composting and recycling process of the collected waste that can be transported to the final disposal site is running least optimal due to the fact that the organic and inorganic wastes are not properly separated.

Because of this ill-managed SWM, Bandung already experienced two disasters. First, on February 21st, 2005, there was a landslide at Leuwigajah final disposal site.[7] After 3 days of heavy rain, 2.7 million cubic meters of waste started sliding down the valley. The waste covered a 200-250 m wide stripe on a length of 900 m

[7]Leuwigjah final disposal site was the biggest site for Bandung solid waste; it was located in the peri-urban of Bandung urban area and about 1500 tons municipal solid waste per day was delivered to the site.

causing 143 victims and hundreds injured. According to Kölsch et al. [2005], the landslide were due to acute drainage problem coming along with pore water pressure in soft soils or high water tables inside landfills. Second, on December 15th 2010, due to the unpaid compensation problem, neighbourhoods who live surrounding the Sarimukti final disposal site[8] created a road blockage at the site entrance for about three days. As the result, Bandung was inundated by its own solid waste, about 3000 tons of solid waste was piling-up at the temporary/collecting sites around the urban area and trickling-out to the streets.

Based on the current condition of Bandung SWM, especially for the residential area, this study proposed a hypothetical program called MaSUK RT (*Manajemen Sampah Untuk Kawasan Rumah Tangga* or solid waste management for residential area). Under this program, municipal government provides garbage bins and daily waste collection service. Each garbage bin consists three different compartments; green (for organic waste), yellow (for non-organic waste) and red (for glass and metal). The residents needs to pay for these services, levied on their monthly electricity bill. The MaSUK RT program is solving two most important problem, the financial constraint and low awareness level about the importance to separate between organic and non-organic waste. This awareness is importance because, when solid waste is properly separated, then it is easier to recycle the non-organic waste and to compost the organic one. Hence, if final disposal able to recycle and to compose properly, there will be no pile of waste, which at the end we can prevent these two disaster to happen again in the future.

[8]Before the Leuwigajah disaster, Bandung had four disposal sites, however due to the disaster all those site were closed and Bandung relocated final disposal site to the Sarimukti site.

1.4 Results

This section is divided into two parts. First is the discussion about socio-economics profile of the respondents and second is the household demand estimation for SWM improvements.

1.4.1 Survey Results

As I mentioned before, the actual survey was conducted from the beginning of July to the end September 2011, with three weeks break in between. In total there were 900 respondents interviewed, however, there were 20 observations eliminated for missing values in the relevant questions, therefore the response rate was 98%.

Table 1 summarises the descriptive statistics of respondents characteristics that are relevant for the parametric estimation of household WTP. The majority of the respondents from each group are female respondents, in total there were 431 female respondents from three different groups. Although male-female ratio in Bandung according Indonesia 2010 census is 1.03, nonetheless because most of the interviewed conducted in the day time, then it is reasonable if the majority of the respondents was female, since most of Indonesian women work as housewives or the owner of small family business. Moreover, from each group, more than 80% of respondents are married couple who live in a household consists of 5 members on average, where two of the household members are working members. The average of respondents' years of schooling is about 11 years and the minimum age from treated and control groups is 19 years old, while from the untreated group is 20 years old.

The average monthly income from the pooled respondents in the treatment group is IDR 3,622,044/month (equivalent to USD 585.07) while the average monthly income from the control group is IDR 3,622,396/month (equivalent to USD 585.13).[9] The mean income of the respondents in treated group which is IDR 3,894,670 is signif-

[9]USD 1 = IDR 6,190.77 (PPP)

icantly higher than the mean income of the control samples. The difference can partly be attributable to the additional screening in the sampling procedures for treated and untreated respondents. Beside that, the statistically difference also appears between treatment (combining treated and untreated) and control groups for communal contribution. This difference is justifiable since the communal contribution is determined through communal discussion and amount of contribution can be difference from one household to another.

Table 1.1: Descriptive Statistics, by groups

Variable	**Description**	**Treatment Group**			**Control Group**
		All	**Treated**	**Untreated**	
response	= 1 if agree to purchase = 0 otherwise	0.519 (0.5)	0.487 (0.501)	0.534 (0.499)	0.441 (0.497)
price	The offered price	13853.040 (6355.675)	14022.840 (5966.380)	13768.350 (6546.893)	14750 (6144.599)
sex	= 1 if male = 0 otherwise	0.446 (0.497)	0.462 (0.499)	0.438 (0.498)	0.434 (0.496)
age		46.505 (12.054)	47.904 (12.891)	45.808 (11.569)	43.785 (12.272)
marital	= 2 if divorce = 1 if married = 0 if single	1.015 (0.331)	1.02 (0.364)	1.013 (0.314)	0.976 (0.317)
education	Years of schooling	11.654 (3.453)	11.594 (3.846)	11.683 (3.244)	11.42 (3.312)

Continued on next page

Table 1.1 – continued from previous page

Variable	Description	Treatment Group			Control Group
		All	Treated	Untreated	
size	Household size	4.743 (1.739)	4.949 (1.87)	4.641 (1.662)	4.712 (2.116)
fee	Monthly fee for community informal waste collection service	1539.696 (3799.06)	1748.731 (3544.406)	1435.443 (3920.078)	2822.917 (5243.037)
income	Monthly income	3622044 (3065485)	3894670 (3515818)	3486076 (2809090)	3622396 (3261537)
knowledge	SWM knowledge and awareness	8.618 (1.972)	8.508 (1.963)	8.673 (1.976)	8.313 (2.17)
experience	= 1 if having negative experience(s) = 0 otherwise	0.272 (0.445)	0.244 (0.43)	0.286 (0.452)	0.295 (0.498)
perception on municipal government	= 1 if positive perception = 0 otherwise	0.753 (0.431)	0.695 (0.461)	0.782 (0.413)	0.778 (0.416)
N	Total respondents	592	197	395	288

Std. Dev. in parentheses

Respondents' knowledge and the awareness about municipal SWM problems are roughly similar across groups, where 8 out of 12 test questions can be answered correctly. Table 6 provides a clear picture about the distribution of the correct answer

for each question. More than 40% of the control respondents are having negative experiences due to the ill-managed solid waste, while for treated and untreated groups, the number of respondents who have negative experiences is less than 30%. However, only 69.54% of treated respondents believe that the proposed program can be well-implemented by the municipal government, while for untreated and control respondents, more than 70% believe that municipal government can implement the proposed program.

From 197 respondents who went to the treated respondents, 83.76% (165 respondents) were actually discussing the information that they received in their first interview sessions prior the second interview sessions, either with another treated or with untreated respondents. While for untreated respondents, 309 out of 395 respondents were discussing with treated respondents about solid waste problems prior their interview sessions.

As expected, issues related to the environmental condition are less important, relatively to economic issues. 51.02% of respondents consider that economic issues are the most urgent issues that need to be solved first by the municipal government. Nonetheless, there are 34.66% of respondents believe that the most urgent problem need to be solved in Bandung is the environmental issues. The reverse situation can be found in responses for the second urgent problem that need to be solved. 38.3% of respondents answered that environmental issues are the second urgent problem and 18.64% answered that economic issues are the second urgent problem.

Table 1.2: Two Most Urgent Problems (Pooled Data)

First issue that need to be tackled		
List of Problems	Freq.	Percent
Economic issues	449	51.02
Environmental issues	305	34.66
Security issues	23	2.61
Public transportation	16	1.82
Public education	38	4.32
City infrastructures	44	5
Others	5	0.57
Total	880	100

Second issue that need to be tackled		
List of Problems	Freq.	Percent
Economic issues	164	18.64
Environmental issues	337	38.3
Security issues	83	9.43
Public transportation	52	5.91
Public education	114	12.95
City infrastructures	114	12.95
Others	16	1.82
Total	880	100

Among environmental issues, inadequate municipal solid waste management is ranked as the first most pressing environmental problem by the largest proportion of respondents (66.71%), followed by water/river pollution (20.91%), air pollution (5.91%) and green open space deterioration (5.11%). For the second most pressing environmental problem, 30.23% of respondent rank water/river pollution as the first, followed by solid waste management problem (21.7%). These results are in accordance with the fact that some of the respondents have been experienced the negative impacts of the inadequate of the solid waste management and the respondents' perception about the seriousness of solid waste management problem.

Table 1.3: Two most urgent environmental problems (Pooled Data)

First Environmental Problem		
List of Problems	Freq.	Percent
Water/river pollution	184	20.91
Solid waste management	587	66.71
Air pollution	52	5.91
Green open space deterioration	45	5.11
Don't know/not sure	9	1.02
Others	3	0.34
Total	880	100

Second Environmental Problem		
List of Problems	Freq.	Percent
Water/river pollution	266	30.23
Solid waste management	191	21.7
Air pollution	171	19.43
Green open space deterioration	164	18.64
Don't know/not sure	68	7.73
Others	20	2.27
Total	880	100

As I mentioned before, some of the respondents actually have negative experiences because of the improper and inadequate municipal solid waste management. However, the first municipal problem that directly gives a negative impact to the households' well being is the lack of access to clean water (28.63%), followed by the low quality of drainage system that cause a flood (17.5%), and the solid waste collection problem (15.8%), and then the water quality (14.89%). For the second municipal problem that has direct negative impact on households' well being, 17.05% of respondents choose that it is the solid waste collection problem, followed by the low quality of drainage system that can cause a flood (15.45%), inadequate public services (11.82%) on the third place. These negative experiences have an implication on how respondents consider the seriousness of solid waste management problem. 54.66% of respondents agree that municipal solid waste problem is a serious problem.

Table 1.4: Problems that directly impact on household well being (Pooled Data)

First Experienced Municipal Problem		
List of Problems	Freq.	Percent
Access to clean water	252	28.63
Quality of water	131	14.89
Low quality drainage system	154	17.5
Access for motor vehicle	43	4.89
Inadequate public services	61	6.92
Solid waste collection issue	139	15.8
Low quality of public health	35	3.98
None	65	7.39
Total	880	100

Second Experienced Municipal Problem		
List of Problems	Freq.	Percent
Access to clean water	68	7.73
Quality of water	98	11.14
Low quality drainage system	136	15.45
Access for motor vehicle	75	8.52
Inadequate public services	104	11.82
Solid waste collection issue	150	17.05
Low quality of public health	85	9.65
None	164	18.64
Total	880	100

Table 1.5: The Seriousness of Solid Waste Management Problem (Pooled Data)

According to you how serious is the problem of solid waste management in Bandung?		
	Freq.	Percent
Highly serious	481	54.66
Serious	329	37.39
Not serious	38	4.31
Don't know/not sure	32	3.64
Total	880	100

There are 12 questions used to capture the level of knowledge and awareness. Survey results show that respondents adequate knowledge about solid waste. About 47.5% of respondents know that the remaining vegetables and fruits can be categorised as organic solid waste, while wrapping plastic is categorised as non-organic solid waste, and about 92.5% of respondents know the solid waste can be categorised as degradable and non degradable solid waste. Moreover for the awareness questions, 60.11% of respondent can answered correctly on the question about the management of municipal solid waste is under the control of state-owned enterprise or municipal government. While for the question about daily production of solid waste in Bandung Muncipality, 61.48% of respondents gave a correct answer. Moreover, the respondents are also well aware that Bandung was inundated with solid waste for three days because of the ill-managed solid waste. However, only 2.16% of respondents are aware that the current dumping site will be closed at the end of year 2012. It is an alarming situation since Bandung residents might not realise that Bandung is at the edge of a catastrophic problem due to the inadequate solid waste management.

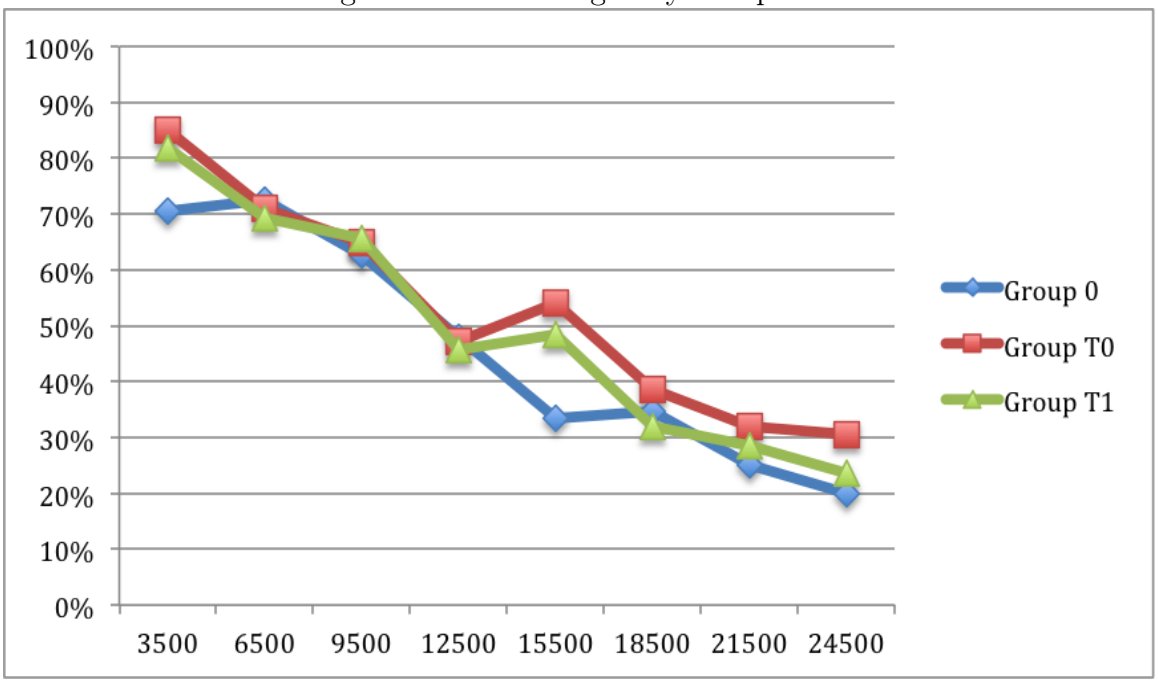
Table 1.6: Knowledge and Awareness (Pooled Data)

No.	Question or Statement	Correct answer (%)
1	The remaining vegetables and fruits can be categorised as organic solid waste, while wrapping plastic is categorised as non organic solid waste.	47.5
2	Solid waste can be categorised into two types: degradable and non degradable.	92.5
3	Organic solid waste is the degradable solid waste.	87.27
4	Compost is made from organic solid waste.	89.2
5	Organic and non organic solid waste should be properly separate in order to make a composting process goes efficiently.	94.77
6	Most of the non organic solid waste is recyclable.	89.09
7	Currently, the final dumpsite for Bandung solid waste is no longer at Leuwigajah.	76.02
8	In Bandung, solid waste and its related issues are under the management of municipal owned enterprise or municipal government.	60.11
9	Bandung produces 1000 tonnes solid waste per day.	61.48
10	In the end of year 2010, Bandung was inundated by the solid waste because of the blockade in the access to the Sarimukti final dumpsite.	91.7
11	Currently, Bandung has only one final dumpsite, Sarimukti dumpsite. Do you know when is the termination date for this site?	2.16
12	Have you heard about Leuwigajah tragedy (February 25, 2005)?	60

1.4.2 Household Willingness to Pay Estimation

Figure 2 shows the percentage of yes responses for a given price across groups. As one would expect, in the CV study with a single price component, the percentage of respondents who are willing to purchase the improvement SWM decreases as the price offered increases.

Figure 1.2: Percentage of yes responses



Moreover, the two-sample Wilcoxon Mann-Whitney test shows that there is no significant difference of yes responses across groups, which means, neither having time to think (treated) nor being a neighbour of treated respondents (untreated) have a significant impact on the likelihood to purchase the public good. The insignificant difference between treated and control respondents is in line with the result of Whittington et al. [1993], but contradicting with the study of Lauria et al. [1999]. In Whittington et al. [1993], they find that giving time to think to Ghanian households does not significantly influence their WTP on the improvement of sanitation services.

While Lauria et al. [1999] find that giving respondents time to think will actually reduced the likelihood to purchase the improved sanitation services in Philippines.

Table 1.7: Wilcoxon Mann-Whitney test of yes response

	Two samples of yes response		
	control vs. treated	control vs. untreated	treated vs. untreated
z-value	-1.005	-2.404	-1.074
p-value	0.3151	0.0162	0.2826

To analyse further on the respondents behaviours, I employ three linear logit models with the yes response as the dependent variable, and the results are presented in the following table.

Table 1.8: Multivariate Results

Variable	**Model 1**	**Model 2**	**Model 3**
	y	y	y
price	-1.56e-04***	-1.50e-04***	-1.47e-04***
	(1.44e-05)	(1.63e-05)	(1.61e-05)
income	1.94e-07***	1.32e-07***	1.35e-07***
	(3.39e-08)	(3.62e-08)	(3.57e-08)
education	0.0995***	0.0976***	0.0907***
	(0.0284)	(0.0321)	(0.0300)
knowledge	0.121***	0.109**	0.105**
	(0.0410)	(0.0465)	(0.0463)
experience	0.339*	0.405**	0.422**

Continued on next page

Variable	Model 1	Model 2	Model 3
	y	y	y
	(0.176)	(0.201)	(0.201)
perception	0.962***	0.823***	0.840***
	(0.193)	(0.221)	(0.220)
sex	-0.219	-0.173	
	(0.177)	(0.205)	
age	0.00359	-0.00361	
	(0.00756)	(0.00863)	
marital	-0.0929	0.00365	
	(0.276)	(0.320)	
size	0.0459	0.0349	
	(0.0439)	(0.0488)	
treated group	0.146		
	(0.217)		
untreated group	0.275		
	(0.182)		
D1		1.318***	1.296***
		(0.275)	(0.271)
D2		-2.443***	-2.453***
		(0.522)	(0.522)
D3		1.565***	1.559***
		(0.234)	(0.233)
D4		-1.572***	-1.569***
		(0.284)	(0.283)

Continued on next page

Variable	Model 1	Model 2	Model 3
	y	y	y
Constant	-1.887***	-1.292*	-1.302**
	(0.634)	(0.720)	(0.513)
Observations	880	880	880
LR χ^2	256.7	459.7	457.9
Prob $< \chi^2$	0	0	0

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In the first model, I use two dummy variables to capture the treatment effect, namely treated and untreated. These two dummy variables shows that the purchasing behaviours of treated, untreated and control groups are statistically indistinguishable and this result corresponds with the Figure 2. In the second and the third models, I use dummy variables to differentiate the treated and untreated respondents who had social interactions prior elicitation question, D1 and D3 respectively, with treated and untreated respondent who did not have, D2 and D4 respectively. The main difference between Model 2 and Model 3 lies on the explanatory variables used. I drop four variables that seem do not have significant effect on the decision to purchase public good. Moreover, even though the number of the explanatory variables is different, I find that the result does not change significantly.

From the result table, we can see that there are six variables, namely price, income, education, knowledge, negative experience and perception that constantly give a significant influence on the decision to purchase the public good. Moreover, the sign

of these variables are consistent with the theoretical prediction, where price has price has a negative impact on the likelihood to purchase public good and the rest gives positive effects. Beside that, the corresponding marginal effect on variable price, presented in Table 9[10] also imply that, a Rp.1000 increase in the price offered decreases the probability of giving a yes response by -1.88E-05, -2.02E-05 and -2.31E-05 at price equal to Rp.3000, Rp.24500, and at the mean price respectively, which means that respondents are more responsive to the increasing in price when they already pay a higher price. Furthermore, I also find that income, education and perception have positive influences on the decision to support the project proposed at 1% of significance level, while knowledge and experience have significance level at $p < 0.05$, and variable fee at $p < 0.1$.

Table 1.9: The Marginal Effects of Explanatory Variables

	Household demand at different price level		
Change in variable	Rp. 3000	Rp. 24500	Rp. 14146.59
price	-1.88e-05***	-2.02e-05***	-2.3e-05***
	(1.49e-06)	(1.44e-06)	(2.45e-06)
income	1.73e-08***	1.86e-08***	2.11e-08***
	(4.58e-09)	(4.66e-09)	(5.50e-09)
education	0.0116***	0.0124***	0.0142***
	(0.0038)	(0.0040)	(0.0046)
knowledge	0.0134**	0.0143**	0.0163**
	(0.0059)	(0.0063)	(0.0071)
experience	0.0540**	0.0578**	0.0659**

Continued on next page

[10]Here, I only present 5 explanatory variables, however the results are coming using all explanatory variables in Model 3

	Household demand at different price level		
Change in variable	Rp. 3000	Rp. 24500	Rp. 14146.59
	(0.0255)	(0.0274)	(0.0311)
perception	0.1075***	0.1152***	0.1312***
	(0.0279)	(0.0301)	(0.0333)
D1	0.1659***	0.1778***	0.2024***
	(0.0359)	(0.0370)	(0.0398)
D2	-0.3140***	-0.3366***	-0.3831***
	(0.0587)	(0.0734)	(0.0789)
D3	0.1996***	0.2140***	0.2436***
	(0.0320)	(0.0305)	(0.0321)
D4	-0.2008***	-0.2153***	-0.2451***
	(0.0328)	(0.0404)	(0.0413)

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The interesting part of my result lies on the treatment parameters. In the first model, neither belong to the treated nor to the untreated respondents has any significant on the decision to purchase the local public good. However, when I control for the social interactions effect (Model 2 and Model 3), with 1% significance level, treated and untreated respondents with social interactions have higher probability to respond "yes" with respect to the control respondents. And with the same significance level, those who do not have social interactions will less likely to respond "yes". Using the third model, the marginal treatments effects also show that being a treated or untreated respondent who had social interaction prior WTP elicitation

question will improve the likelihood to support the proposed program to improve the municipal waste management in all three different prices, namely Rp. 3000, Rp. 24500 and the average price. There one possible reason why my result differs from the previous CV studies that employed time-to-think feature. The positive effect of social interaction in influencing the likelihood to purchase public good can be regarded as the positive effect of communication in sustaining cooperative behaviours found in the experimental economics literature.

The large experimental literature has found that there are significant contribution levels in early periods, but contributions decline both over time and with the experience level of experiment participants, however Isaac and Walker [1988] seminal paper shows that this declining trend can be averted if experiment participants have the opportunity for face-to-face communication before making their (private) individual contribution decisions. Even with experienced participants. Moreover, their result also shows that communication not only improves cooperation in the round immediately following it, but its effect carries over to a number of subsequent iterations. The positive effect of communication on cooperative behaviours also prevails in many different experimental contexts, for example, Cason and Khan [1999] find that improved contribution monitoring does not increase contributions without face-to-face verbal communication, and that communication (even with imperfect monitoring) dramatically improves subjects' ability to efficiently provide the public good. Communication also helps to overcome free-riding in common-pool resource experiments under conditions of heterogeneity in resource endowment and payoffs [Hackett et al., 1994, Ostrom et al., 1994]. The one-way communication from treated respondents who endowed with information and communicate it to untreated respondents has been analysed by Koukoumelis et al. [2012a,b]. The results of those two papers show that cooperative behaviours are sustained even under one-way communication.

After we analysed the respondents' behaviours across groups, the next step of CV study is to calculate the mean willingness to pay (MWTP) for the proposed public good. The Calculation of MWTP uses estimated parameters depends on the covariates chosen, and is also a function of the random component assumed for preferences. In this case, the MWTP calculation is based on the third model, and the method to derive the MWTP is following equation (7):

$$WTP_j = \frac{\boldsymbol{\alpha z_j}}{\beta} + \frac{\epsilon_j}{\beta}$$

where, $\boldsymbol{\alpha}$ is the vector of coefficients other than price offered coefficient, including constant, and β is the price offered coefficient. $\boldsymbol{\alpha z_j}$ is the mean value of the corresponding variable, with the mean value of the constant is equal to one and ϵ is the error term. With respect to the uncertainty of ϵ_j, the mean willingness to pay is:

$$E_\epsilon(WTP_j \mid \boldsymbol{\alpha z_j}\beta) = \frac{\boldsymbol{\alpha z_j}}{\beta}$$

MWTPs across groups for the improvements of SWM are presented in the following table

Table 1.10: Estimates of Mean Willingness to Pay

	Mean WTP (Rp.)
Control Respondents	12808.75
Treated Respondents without Social Interactions	11349.86
Untreated Respondents without Social Interactions	10821.45
Treated Respondents with Social Interactions	14010.04
Untreated Respondents with Social Interactions	15591.45

Paralleling with the results from Table 8 and Table 9, the MWTP of treated respondents with social interaction is 9% higher than the control respondents, while those without social interaction, their MWTP is reduced by 11% relatively to the control respondents. And the difference between treated respondents with and without social interactions is about Rp. 2618.80 equivalently we can say that MWTP of the former group is 23% higher than the latter one. The effect of social interaction on MWTP to the untreated group is slightly higher than for the treated group. The untreated respondents with social interaction have 22% higher MWTP compared to the MWTP of the control respondents, while those respondents without social interaction, their MWTP is 16% less than the control MWTP. While MWTP difference within untreated respondents is 44%.

1.5 Conclusion

After conducting this study, there are several important facts related to the municipal waste management, especially in Bandung. First of all this study reveals that waste collection service is a normal good, meaning that demand is negatively influenced by price and positively influenced by income. Although, there already exists a communal collection service, nonetheless Bandung residents are willing to pay more to have a better collection service, Moreover, the priority of waste management problem, according to Bandung residents, is higher than any other environmental issues, such as water pollution or the deterioration of green open space. And regarding to the separation between organic and non-organic waste, this study reveals that Bandung residents do understand about the importance and the benefit of having organic and non-organic waste is properly separated, nonetheless, their knowledge does not reflect the current situation found in the final dumping site.

Alongside with common explanatory variables found in CV study, the results of present contingent valuation study indicate a substantial effect of social interactions in the decision of willingness to pay to improve a solid waste management services in Bandung. Similar to the results found in Whittington et al. [1993], when respondents were given time to think and information (treated respondents), the probability of them respond "yes" is not significantly different with those who did not have time to think. Interestingly, the effect of social interaction also appear to untreated respondents, whom are respondents who reside in the same community like treated respondents. One possible reason that can be used to explain the social interaction effect is communication effect. In this study, similar to experimental economics literature, there is a positive effect of communicating the information that treated respondents endowed, although it is a one-way communication, but similar to Koukoumelis et al. [2012a,b] studies, the effect of communication influences the behaviours of sender and receiver simultaneously.

The positive effect of social interaction examined in my study suggests that development projects requiring collective action should stress social interaction between participants to improve cooperation and attain socially desirable outcomes. The result indicates that social interaction is very powerful in increasing voluntary public goods contribution levels. Drawing policy implications of my findings beyond the specific institutional setting studied should be done with caution. With that caveat in mind, the policy recommendation suggested by this study is that development programs which feature an important role for collective action should emphasize social interaction for group cohesion-building.

The experience of several specific development programs also supports this policy recommendation. For example, the highly successful Grameen Bank in Bangladesh, which provides no-collateral loans at market interest rates to the poorest Bangladeshis, relies on small group social interaction to ensure repayment. I

do not argue, however, that social interaction will always solve collective action problems, and neither do I argue that Grameen Bank type credit programs can be replicated in all environments. Instead of implementing costly monitoring programs or educating all citizens, more might be gained at a lower cost by emphasizing the role of social interactions among themselves. My result and the experience of the Grameen Bank indicate that social interaction is often an effective tool in eliciting socially desirable outcomes in projects requiring a great deal of collective action from beneficiaries.

Chapter 2

Are Smarter People Better Samaritans? Effect of Cognitive Abilities on Pro-Social Behaviours

2.1 Introduction

Why are people willing to engage in pro-social activities? Much of today's economic analysis is based on the assumptions that people are both rational (in the Nash equilibrium notion) and selfish. For example, in the context of the prisoner's dilemma, stag hunt games, or in the private provision of public goods, people are assumed to be clever enough to figure out that defection and free riding are the risk-dominant strategies. However, empirical and experimental evidence seems to reject the traditional conjecture of defective behaviour under the social dilemma condition. In general, two arguments have been used to justify people's positive preferences toward pro-social activities. First, individuals are not purely selfish, but instead place a significant value on social goods, which means they do not only value their own consumption but the consumption of others as well (they have other-regarding preferences). Sec-

ond, people actively engage in pro-social activities because of what has been referred to in the literature as the "warm-glow" effect. The warm-glow effect refers to the idea that individuals might engage in pro-social activities for the sole reason that it makes them feel good, either because they care about what others think of them or because they feel better about themselves, but not necessarily because they care about the public benefit *per se* [Andreoni, 1990, Bernheim and Rangel, 2005].

Currently, there is a growing literature that tries to improve the understanding of a wide range of behaviours by conceptualising choice as originating from cognitive functions which are not only heterogeneous across subjects but also influenced by external factors. For instance, in the experimental and psychological economics literature cognitive hierarchy is included in the model of decision making [Nagel, 1995, Costa-Gomes et al., 2001, Camerer et al., 2004]. In addition, among other things the relationship between cognition and outcomes in experimental settings [Brandstätter and Güth, 2002, Ben-Ner et al., 2004] and between cognitive ability and financial decisions [Christelis et al., 2010] have been documented.

Nonetheless, detailed analyses on the relationship between cognitive ability and pro-social behaviours (considering in particular volunteering and civic engagement) are for the most part lacking or inconclusive. Potentially, however, this relationship may represent a significant factor from both theoretical and practical perspectives. For researchers, for instance, understanding the relationship between cognitive ability and pro-social behaviours may shed light on the underlying mechanisms of co-operation among individuals. Additionally, it may help policy makers better devise inclusive policies which enhance participation and community engagement for the improvement of society.

Civic engagement has become a particularly relevant issue when considering the well-being of older individuals, either on or approaching retirement. Post-retirement engagement and socialization have been consistently shown to reduce both physi-

cal and mental decline in old age [Fratiglioni et al., 2004a,b, Berkman et al., 2000, Zunzunegui et al., 2003, Everard et al., 2000], providing for a more socially and economically active society. However, to our knowledge empirical evidence showing a link from cognition to civic participation is still lacking. The aim and novelty of this essay is thus exploring the causal link that cognitive abilities have on pro-social engagement in old age from an empirical perspective.

Our results, using data from the Survey of Health, Aging and Retirement in Europe (SHARE), indicate higher cognitive abilities as causal determinants of pro-social behaviours. In particular, retrospective information on the number of books at home when the respondent was ten years old is used to instrument cognition in older age (50+) and exogenously estimate its impact on civic engagement. As a result, individuals with higher cognitive ability in this age group are found to be significantly more willing to engage in pro-social activities.

This essay is structured as follows. The next section reviews traditional economic findings which predict uncooperative behaviour as the optimal strategy in public goods games and sets the theoretical bases that justify the present work. Section 2.3 gives an overview of the data, variables and empirical methodology, while the results are presented in Section 2.4. Section 2.5 concludes.

2.2 Theoretical Background

The present study builds upon two strands of economic literature. First, the literature relating uncooperative behaviours in a social dilemma situation to a higher degree of risk aversion. Second, the theoretical studies linking risk aversion to cognitive ability.

Investing one's own resources in civic activities without knowing whether other community members are willing to participate can be viewed as a risky decision. In this sense, risk aversion might influence people's behaviours toward the production of

public goods. In the book *A Discourse on Inequality*, Jean-Jacques Rosseau illustrated this situation in his influential stag hunt parable, which serves as the theoretical starting point of the present essay.

Assume that two hunters have to choose simultaneously between two hunting strategies: stag or hare. If one hunts a hare, he is sure to catch it regardless of the action of the other hunter, but in order to kill a stag both hunters have to join efforts. If one hunter chases after a stag alone, he comes back empty-handed. The dilemma comes from the fact that, on the one hand, half a deer is better than one hare. On the other hand, hunting a hare involves no risk while the success of a stag hunt depends on the fact that both hunters must be willing to cooperate.

Rousseau's parable is represented in game-theoretical terms in Table 2.1 below, where $\pi_1 > \pi_2 > \pi_3 > \pi_4$. The stag hunt game has two pure strategy equilibria: "all stag" and "all hare." The "all stag" equilibrium payoff-dominates the "all hare" one, but the latter risk-dominates the former [Harsanyi and Selten, 1988]. Nevertheless, it is not clear which of the two equilibria should be expected, as many other aspects –such as the number of hunters– must be considered in order to determine the plausibility of each equilibrium. For instance, when only two hunters are present, hunting a stag is preferred to hunting a hare provided that the second player also hunts stag with probability $\frac{1}{2}$ or higher. However, when n hunters participate a stag is the optimal strategy only if there is a probability of at least $\frac{1}{2}$ that all other hunters hunt the stag. If each one hunts stag with an independent probability p, then this requires $p^{n-1} > \frac{1}{2}$. To illustrate, nine out of ten players must each hunt the stag with probability $p \gtrsim 0.93$ in order to make it worthy for the tenth hunter to join their efforts. As we can see, chasing after the stag is far from being the optimal strategy in a world with an increasingly large number of hunters.

The stag hunt game makes it clear that more risk-averse individuals, even if maintaining unselfish preferences, might choose to engage less in civic activities to protect

Table 2.1: Stag Hunt Game

	Stag	Hare
Stag	π_2 π_2	π_4 π_1
Hare	π_1 π_4	π_3 π_3

themselves from the risk of others' defection. It is worth noting that though the stag hunt game is static in nature, it is nonetheless able of mimic real world interactions where risk-dominant strategies are expected to prevail. The argument goes as follows: in a public good context, cooperating in its provision gives a higher payoff than defecting only if everyone cooperates. Otherwise, not cooperating is clearly advantageous, given that by definition an individual cannot be excluded from the public good. Since in the real world the probability that absolutely everyone contributes their share to the public good is very small (if not equal to zero), the theory predicts rational individuals to be risk-averse and thus restrain from participating. Paradoxically, cooperative behaviours are commonly observed in reality, which possibly indicates a lesser degree of risk aversion than predicted or the prevalence of myopic behaviours which may lead an individual to making foolish choices.

The link between participation and risk attitudes has been documented in several recent works. Most existing studies relating risk and contributions to public goods use a measure of natural risk, such as participation in the stock market. In line with the notion that perceived risk affects contributions to a public good, Charness and Villeval [2009], find that subjects who invest more in risky assets contribute more to public goods. A similar result based on a multi-period prisoner's dilemma has been reported by Sabater-Grande and Georgantzis [2002].

The second strand of literature upon which the present essay is built regards the relationship between risk aversion and cognitive ability. Kahneman and Tversky [1981, 1984, 1986] and Read et al. [2000] proposed a theory which foresees a strong

relationship between risk aversion and cognitive ability. The theory embodies the trouble presented by a fraction of the population in bracketing choices in a broad manner, i.e., recognising how risky decisions integrate with other assets like lifetime wealth, or conceptualizing and integrating future considerations with current goals. Narrow bracketing increases risk aversion as it impedes people from relating risky decisions with wealth, and increases myopic behaviours by augmenting people's difficulty in incorporating considerations about the future. However, there is empirical evidence that narrow bracketing is reduced when cognitive costs are lowered. For instance, Frederick [2005], Brañas-Garza et al. [2008], and Oechssler et al. [2009] find that, in general, individuals with low cognitive abilities tend to be more impatient and more unwilling to gamble, even in the domain of gains. This link between cognition and narrow bracketing provides for a mechanism directly relating risk aversion and cognitive ability.

Based on the two literature strands discussed above, it is fair to say that on one side risk aversion hinders the attainment of payoff-dominant equilibria by preventing cooperative behaviour. On the other side, a positive link exists between risk aversion and cognitive ability. Put together, the theory implies that individuals with higher cognitive ability will have a lower degree of risk aversion, therefore engaging more in cooperative behaviours. The present essay aims at testing this claim empirically.

Literature Review

Studying the relationship between cognitive ability and pro-social behaviours is not new to economic, sociological, and psychological literature. Brandstätter and Güth [2002] report a negative relationship between giving in a dictator game and performance in cognitive tests. Similarly, Ben-Ner et al. [2004] find a negative relationship between giving in a dictator game and performance on the Wonderlic test of intelligence. This relationship is stronger for women than for men. Benjamin et al.

[forthcoming] find a weak positive relationship between cognitive ability and selfishness in the dictator game. These studies suggest that selfishness increases with higher degrees of cognitive ability.

Moreover, a variety of works suggest the existence of a link between educational attainment and charitable giving. Higher educational attainment has been consistently associated with a higher probability and larger amount of charitable giving [Brown and Lankford, 1992, Bekkers and Wiepking, 2011, James, 2011]. However, it is possible that this association is driven by the individual's underlying cognitive ability rather than by educational attainment itself. This question is explored in a cross-sectional analysis of giving using the Netherlands Panels Study 2003 [Wiepking and Maas, 2009]. Their cognitive measurement was a 12-item vocabulary test with a mean score of 67% correct. Following previous results, higher education was initially shown to predict greater charitable giving. However, the authors found that this relationship could be explained by the larger financial resources and stronger verbal abilities of those displaying higher educational attainment.

Bekkers [2006] examination of charitable giving using the Family Survey of the Dutch Population also included a measurement of verbal proficiency. Respondents were measured on their ability to select the correct synonym from a list of five alternatives. In a two-stage Heckman regression, he finds that verbal proficiency was a positive significant predictor of both the presence of charitable giving among all respondents and the level of charitable giving among donors. This held true even when controlling for a variety of possible mediating pathways such as income, wealth, education, subjective health, and personality.

Cognitive ability has also been associated with both volunteering and civic engagement. In an examination using the General Social Survey, Hauser [2000] finds that verbal ability, measured by a 10-word vocabulary test, was associated with the number of organizations with which a respondent reported involvement (excluding

labour unions). This relationship held even after controlling for the individuals' level of education. Verbal ability was also found to predict participation in the previous presidential election. Similarly, Hillygus [2005] employs a longitudinal study of college graduates to show that verbal SAT scores are associated with future political participation.

Denny [2003] found that a measurement of functional literacy (measured across multiple dimensions to estimate the respondents' abilities in extracting and using information from various texts) was positively associated with volunteering (given by participation in community or voluntary activities) after controlling for educational attainment. Such positive association between functional literacy and volunteering was constant across a variety of countries including Canada, Switzerland, Belgium, Chile, Czech Republic, Denmark, Finland, Germany, Great Britain, Hungary, Ireland, Italy, the Netherlands, New Zealand, Northern Ireland, Norway, Poland, Slovenia, Sweden, and the United States. In addition, studies of volunteering behaviour limited to older adults have also found that volunteers score higher on tests of cognitive abilities [Glei et al., 2005, Hao, 2008].

2.3 Data, Variables and Methodology

2.3.1 Data

We use data from the second (2006) and third (2008) waves of the Survey on Health, Aging and Retirement in Europe (SHARE)[1], which surveys people aged 50 and over

[1]This article uses data from SHARE 2006 and 2008, Wave 2 and 3, release 2.5.0 and 1, respectively. The SHARE data collection has been primarily funded by the European Commission through the 5th Framework Programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th Framework Programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5- CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th Framework Programme (SHARE-PREP, N^o 211909, SHARE-LEAP, N^o 227822 and SHARE M4, N^o 261982). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11 and OGHA 04-064)

Table 2.2: Summary Statistics

Variable	Sum	Mean	Med.	Std. Dev.	Min	Max	N
Civic	1598	0.26231	0	0.5458	0	3	6092
Imm. Recall	30620	5.0263	5	1.7156	0	10	6092
Del. Recall	21501	3.5294	4	1.9714	0	10	6092
Numeracy	21008	3.4485	3	1.0957	1	5	6092
Books (10)	13353	2.1919	2	1.2300	1	5	6092
Married	3803	0.62426	1	0.4843	0	1	6092
Age	380699	62.492	61	10.0340	40	98	6092
Female	3387	0.55598	1	0.4969	0	1	6092
Fin. Distress	2855	0.46865	0	0.4990	0	1	6092
Chronic cond.	2863	0.46996	0	0.4991	0	1	6092
Education	13818	2.2682	2	0.8272	1	5	6092
ADLs	1076	0.17663	0	0.6613	0	6	6092
Unemployed	188	0.03086	0	0.1729	0	1	6092
Retired	2955	0.48506	0	0.4998	0	1	6092

in 14 European countries: Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Ireland, Italy, the Netherlands, Poland, Spain, Sweden, and Switzerland. SHARE is a multidisciplinary and cross-national database which provides detailed information on physical and mental health, socio-economic status, and social and family networks of respondents and their households. International comparisons are allowed by the inter-country standardization of all questions.

The third wave of SHARE, referred to as "SHARELIFE," provides retrospective information focusing on respondents' life histories. It links individual micro data over the respondent's entire life with institutional macro data on the welfare state.

The current sample is made up of 6,092 persons (56% females) with complete information on cognitive abilities and civic engagement. The mean age is 64 for men and 63 for women. The summary statistics of the most relevant variables in our study are presented in Table 2.2.

and the German Ministry of Education and Research as well as from various national sources is gratefully acknowledged (see `www.share-project.org` for a full list of funding institutions).

2.3.2 Variables

Measuring cognitive abilities

The purpose of this essay is to analyse the association between cognitive abilities and volunteering in old age. SHARE provides detailed information on several indicators of cognition, such as mathematical and recall ability. In this section we describe the nature and construction of such indicators of cognitive abilities.

Mathematical ability, also referred to as numeracy, measures the respondent's capacity to perform basic numerical operations. It is an index composed of four questions which ask the respondent to calculate (1) 10% of a number; (2) one-half of a number; (3) the number for which another given number represents a fraction of two-thirds; and (4) the total amount in a two-year period given an initial amount and an annual interest rate of 10%. Using these four questions, a numeracy indicator ranging from one to five can be constructed [Dewey and Prince, 2005].

The indicator for recall ability, or memory, is in turn split up into two categories: immediate and delayed recall. Respondents are given a list of ten words and are asked to memorize them. After about a minute, the interviewer prompts the respondent to list the words she can remember. The immediate recall indicator is thus constructed based on the number of words recalled correctly, and ranges from 0 (respondent could not recall a single word from the list) to 10 (all words were correctly recalled by respondent). Unexpectedly for the respondent and after some more unrelated questions have been answered, the interviewer returns to the word listing and asks the respondent to again name the words she can recall. This makes for a second indicator upon which the delayed recall score is constructed.[2] The sample distributions of immediate and delayed recall, as well as numeracy score, are shown in Figure 2.4.

Measuring civic engagement

[2]All observations where the interviewer indicated that contextual factors may have impaired the respondent's cognitive performance during the interview were dropped from our study.

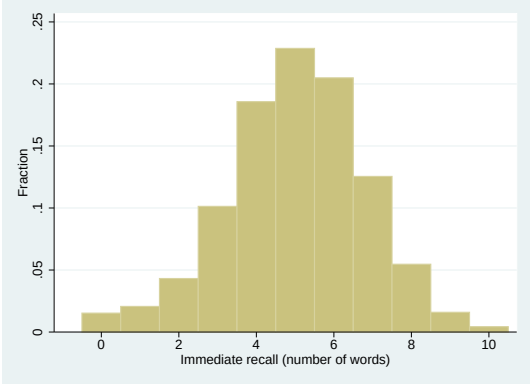


Figure 2.1: Immediate recall

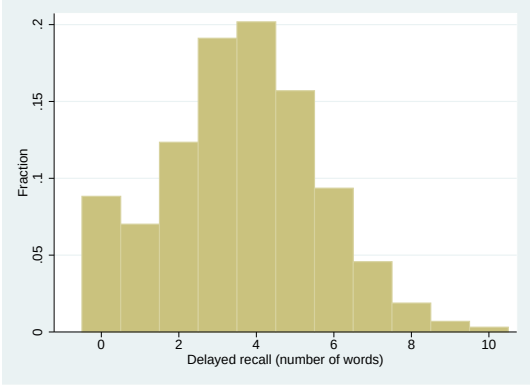


Figure 2.2: Delayed recall

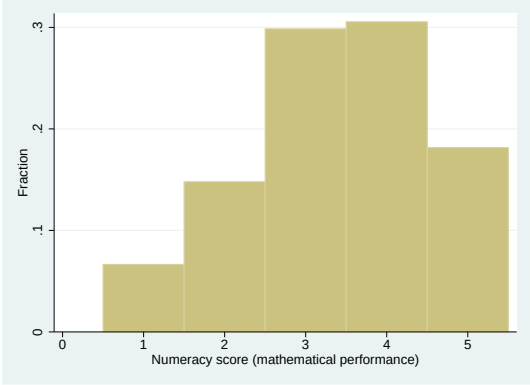


Figure 2.3: Numeracy score

Figure 2.4: Distribution of cognitive indicators.

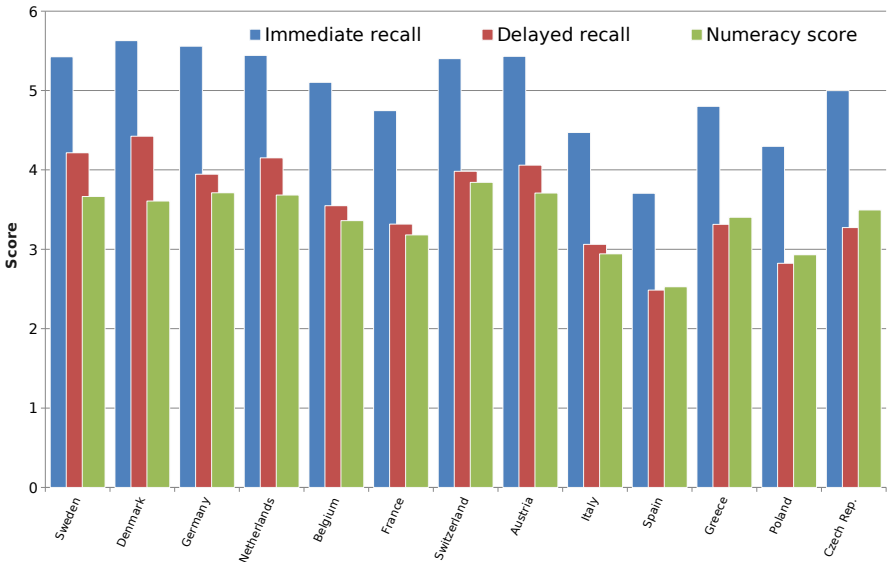


Figure 2.5: Average cognition score by country and cognitive indicator.

A measure of civic engagement is constructed from a set of questions indicating the different social activities performed by the respondent in the month prior to the interview. Due to the gratuitous character commonly attributed to the concept of civic engagement and voluntary activities, we leave out of our study those activities with strong consumption aspects attached to them, such as attending an education or training course and participating in a sport, social, or other kind of club. We therefore consider only three indicators of participation in society: a) done voluntary or charity work; b) taking part in activities of a religious organization; and c) taking part in political or community-related organization.From these three categories of participation, we construct a civic engagement index ranging from 0 (no participation) to 3 (involvement in all three categories). Cognitive abilities are unequally distributed across European countries, forming a pseudo north-south gradient (Figure 2.5). On the other hand, Figure 2.6 displays the average civic engagement score by each of the three cognitive indicators; a clear positive association between civic participation and cognition can be perceived.

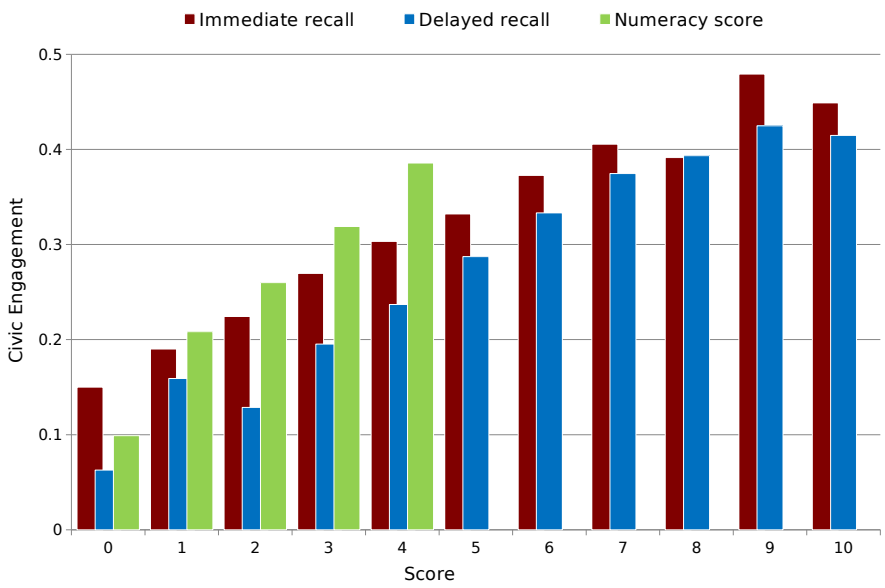


Figure 2.6: Average civic engagement by cognitive indicator for the pooled sample.

2.3.3 Methodology

Empirical specification

We start by estimating the association between cognitive abilities and civic engagement by running a linear regression with a full set of controls, which include, among others, indicators of the respondent's socio-economic and health status. Our econometric specification is:

$$y_i = \boldsymbol{x}_i'\boldsymbol{\beta} + \delta_i \text{cognition}_i + v_i \tag{2.1}$$

where y_i represents the number of activies to which the respondent participates and $\boldsymbol{x}_i$ is a vector of socioeconomic and demographic characteristics which we discuss in detail below. The variable of interest, cognition_i, denotes the respondent's score for each of the three measures of cognitive abilities.

Table 2.3 shows the results of the OLS regression of civic engagement on each of the three indicators for cognition. Such results evidence a positive association between cognition and civic participation in old age, with the largest effects given by

the numeracy indicator of cognitive abilities. Throughout this study, we control for the following characteristics of the respondent: marital status (dummy, equals one if respondent is married and zero otherwise); age; gender (dummy, equals one for females and zero otherwise); years of education; the number of chronic conditions (dummy, equals one if more than two chronic conditions, and zero otherwise); an additional health indicator which measures the hardship met in performing activities of daily living (ADLs); employment status (dummy, equals one if respondent is unemployed, and zero otherwise); a retirement dummy (equals one if respondent is retired, and zero otherwise); financial distress (measures the ability of households to "make ends meet" at the end of the month); and household income (split into quantiles). Furthermore, all regressions are estimated using calibrated weights and, although not explicitly shown in equation 2.1, country dummies were included in all estimations to account for cultural differences between countries.[3]

However, the OLS estimation aforementioned does not take into account the fact that cognition and civic engagement can be endogenous, which, if not addressed properly, impedes any possible statement of causality between the two. For instance, reverse causality might exist, as people who engage more in society might be more likely to expose themselves to mentally stimulating situations and activities and will thus perform better in cognitive tests. Omitted variables and confounding factors for both cognitive abilities and civic engagement, such as culture and genetics, might also arise and cast doubt on our linear regression estimates, not to mention non-random selection mechanisms which might have made more likely for people with a certain cognition level to participate in the survey. In order to account for such issues and obtain consistent estimates for our structural parameters, an instrumental variable approach is adopted in this study.

[3]Survey weights are provided in SHARE with the aim of removing bias from the survey sample and thus making the resulting statistics more representative of the population as a whole.

Table 2.3: OLS regressions of civic engagement on the three cognitive indicators

Variable	**Model 1** Civic Eng.	**Model 2** Civic Eng.	**Model 3** Civic Eng.
Immediate recall	0.022***		
	(0.004)		
Delayed recall		0.015***	
		(0.003)	
Numeracy score			0.031***
			(0.006)
Married	-0.003	-0.001	-0.003
	(0.013)	(0.013)	(0.013)
Age	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Female	0.003	0.004	0.016
	(0.012)	(0.013)	(0.012)
Financial distress	-0.044***	-0.046***	-0.041***
	(0.014)	(0.014)	(0.014)
Chronic disease	0.011	0.010	0.01
	(0.013)	(0.013)	(0.013)
Education	0.058***	0.060***	0.056***
	(0.008)	(0.008)	(0.009)
ADL	-0.024***	-0.026***	-0.023***
	(0.008)	(0.008)	(0.008)
Unemployed	-0.026	-0.024	-0.025
	(0.035)	(0.035)	(0.035)
Retired	0.010	0.013	0.011
	(0.016)	(0.016)	(0.016)
Income	-0.007	-0.006	-0.006
	(0.004)	(0.004)	(0.004)
Constant	-0.061	0.090	-0.022
	(0.099)	(0.071)	(0.098)

Notes:

Standard errors in parentheses

***p <0.01, **p <0.05, *p <0.1

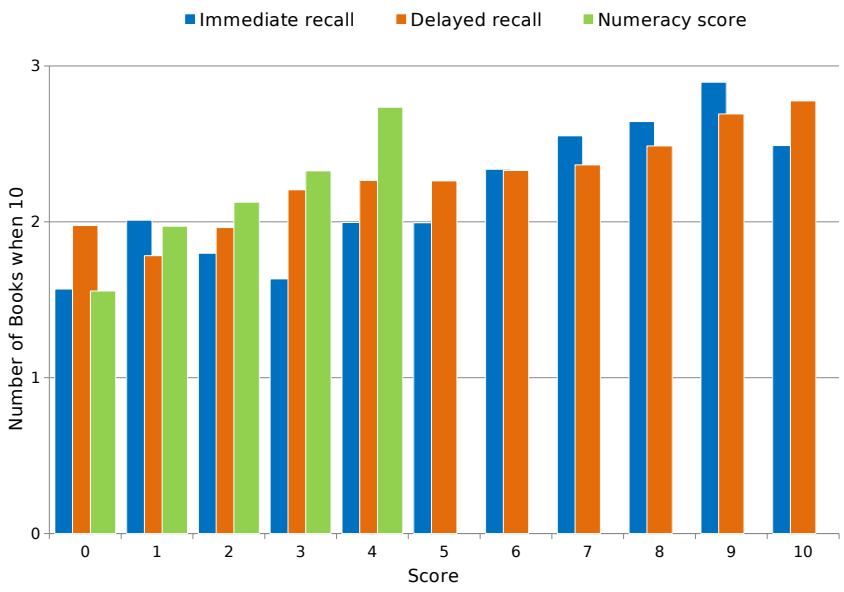


Figure 2.7: Average number of books when aged 10 by cognition level.

We use retrospective information on the respondent's life collected in SHARELIFE to instrument our indicators of cognitive ability. In particular, we make use of the information about the number of books[4] in the place of residence when the respondent was ten years old. The justification for using this as our instrument rests upon the assumption that the number of books present at the respondent's home during childhood affects civic participation in later adulthood only through its potential effect on cognitive abilities. Put differently, in order for it to be a valid instrument, it must be directly related to cognitive abilities (relevance) and influence civic participation only through its effects on cognition (exogeneity). As shown in Figure 2.7, there is clear positive relationship between cognitive levels in old age and the number of books at home during childhood.

We address the endogeneity issues in our data by resorting to a two-step Generalized Method of Moments (GMM) instrumental variables estimation with robust standard errors [Hansen, 1982]. As opposed to the more commonly-used two-stage least squares (2SLS), GMM allows for an efficient estimation in the presence of het-

[4]Magazines, newspapers, and school books are explicitly excluded from the question.

eroskedasticity of unknown form. In using survey data, such as SHARE, we have enough reasons to presume the non-homoskedasticity of our residuals.[5] Accordingly, the *robust* option of the *ivreg2* command in STATA is employed in order to obtain standard errors and statistics which are robust to the presence of arbitrary heteroskedasticity.

2.4 Results

2.4.1 First stage results

Table 2.4 shows the estimated coefficients from the first stage regression of civic engagement on the instrument and other exogenous variables in our model. The results confirm the relevance of the chosen instrument for all indicators of cognition (namely immediate recall, delayed recall, and numeracy). In particular, having more books at home during childhood is shown to be a strong predictor of higher mathematical ability and better memory levels in old age.

2.4.2 Second stage results

Table 2.5 shows the results of the second stage GMM procedure. Here, civic engagement is regressed on the estimated level of cognition obtained from the first stage regression in the previous section. Given that the instrument is valid, such cognition estimates should now be free from most endogeneity issues.

All three cognition indicators seem to exert a strong, positive, significant, and causal effect on the degree of civic engagement of individuals. The higher an individual's mathematical and memory levels, the more likely it is that she will reach out to her community, with long-lasting memory and numeracy as the indicators with the strongest effects on engagement.

[5] See, for instance, Wooldridge [2001] and Wooldridge [2002, p. 193].

Table 2.4: First stage regressions

Variable	**Model 1** Immediate recall	**Model 2** Delayed recall	**Model 3** Numeracy score
Number of books	0.117***	0.105***	0.109***
	(0.020)	(0.023)	(0.012)
Married	0.155***	0.144**	0.137***
	(0.045)	(0.052)	(0.029)
Age	-0.053***	-0.060***	-0.017***
	(0.003)	(0.003)	(0.002)
Female	0.321***	0.422***	-0.255***
	(0.042)	(0.050)	(0.028)
Financial distress	-0.109*	-0.001	-0.141***
	(0.048)	(0.057)	(0.031)
Chronic diseases	-0.128**	-0.131**	-0.061*
	(0.043)	(0.050)	(0.029)
Education	0.344***	0.397***	0.296***
	(0.032)	(0.037)	(0.019)
ADLs	-0.143***	-0.158***	-0.133***
	(0.039)	(0.039)	(0.022)
Unemployed	0.003	-0.119	-0.053
	(0.125)	(0.140)	(0.075)
Retired	0.194***	0.164*	0.118***
	(0.056)	(0.066)	(0.036)
Income	0.048**	0.035*	0.041***
	(0.015)	(0.017)	(0.010)
Constant	6.941***	5.438***	3.610***
	(0.223)	(0.257)	(0.145)
Observation	5119	5120	5120
F-value	92.06	91.4	109.65
$Prob > F$	0	0	0
R^2	0.289	0.273	0.299

Notes:

Standard errors in parentheses

***p <0.01, **p <0.05, *p <0.1

Interestingly enough, older people in the lower income quantiles are more likely to get involved in their society. This appears as an arguably counter-intuitive result which would need further exploration before definite conclusions are drawn from it.

IV tests

For all three measures of cognitive abilities, the hypothesis that cognition can be treated as exogenous in the main regression is always rejected at traditional significance levels (p-value<0.01). This serves as supporting evidence in favour of our chosen empirical methods and procedures. cannot reject its null that cognition may be treated as exogenous. i.e. the IV approach is necessary because cognition cannot be treated as exogenous in the regression

Our instrument, number of books when the respondent was ten, appears to be relevant to cognition as confirmed by our first stage estimates. Moreover, the Stock-Yogo (2005) weak identification test is passed in all cases, as all F-statistics from our first stage regressions are well above the critical values. Nevertheless, given that the model is exactly identified, we are unable to provide statistical evidence for the excludability of our instrument from the main equation. In what follows we review different attempts to tackle this issue.

Robustness

The robustness of the positive effect of cognition on civic engagement is made evident by its persistence on both our first stage OLS and second stage GMM results, regardless of the different indicators used to denote cognition.

Nevertheless, in order to overidentify the model and thus be able to run a Sargan-Hansen test of overidentifying restrictions, an additional instrument would be required. This will allow us to provide a clearer and more convincing statistical proof of the validity of our model. The natural candidates in our case would be the re-

Table 2.5: Second stage regressions

Variable	**Model 1** Civic Eng.	**Model 2** Civic Eng.	**Model 3** Civic Eng.
Immediate recall	0.295***		
	(0.083)		
Delayed recall		0.328***	
		(0.103)	
Numeracy score			0.324***
			(0.082)
Married	-0.044*	-0.045*	-0.042**
	(0.024)	(0.026)	(0.021)
Age	0.017***	0.021***	0.007***
	(0.005)	(0.006)	(0.002)
Female	-0.096***	-0.140***	0.080***
	(0.034)	(0.050)	(0.027)
Financial distress	-0.009	-0.041*	0.004
	(0.023)	(0.024)	(0.023)
Chronic diseases	0.042*	0.047*	0.023
	(0.022)	(0.026)	(0.019)
Education	-0.057	-0.086*	-0.051*
	(0.036)	(0.048)	(0.031)
ADLs	0.006	0.015	0.006
	(0.017)	(0.020)	(0.014)
Unemployed	-0.028	0.012	-0.010
	(0.054)	(0.062)	(0.048)
Retired	-0.050*	-0.046	-0.030
	(0.029)	(0.033)	(0.024)
Income	-0.022***	-0.020**	-0.021***
	(0.008)	(0.009)	(0.007)
Constant	-2.162***	-1.899***	-1.287***
	(0.601)	(0.591)	(0.327)
Observation	5119	5120	5120
Adjusted-R^2	-0.434	-0.828	-0.174

Notes:

Standard errors in parentheses

***p <0.01, **p <0.05, *p <0.1

spondent's relative mathematical and language position to others when she was ten years old –information readily available in SHARELIFE. After including them in our study, however, we conclude that their validity as potential instruments is dubious at most, for their inclusion causes the model not to reject the exogeneity of cognition assumption at the 5% level.Furthermore, their association to cognition in the first stage OLS regression seems to run in the opposite direction to what would otherwise be commonly believed (i.e. better mathematical and language position relative to others in childhood is negatively related to all three cognition indicators in later adulthood). Both individually and when combined with the number of books instrument, mathematical and language ranking in childhood fall short from instrumental validity. Thus, we find no statistical grounds whatsoever for including these variables as additional instruments in our model, which remains hence exactly identified.

Our instrumental variables model of the effects of cognition on civic engagement appears thus robust to different checks and specifications. This favours the claim that smarter individuals will also be better citizens, for which we turn to the next section.

2.5 Conclusions

Using data on the elder European population from the SHARE database, we are able to examine the relation between cognitive abilities (as measured by three different indicators) and the degree to which an individual engages in society (an index made up of voluntary and charity activities and participation in religions and/or political organizations). We find evidence for a strong causal link from cognition to participation: the higher the cognitive state of an individual, the more likely she will be involved in her community. In other words, smarter individuals do seem to behave as better Samaritans.

It would be interesting to assess if the effect found in our study holds true for the population as a whole, and not just for individuals aged 50 and over. Also, in an ideal world, a valid second instrument will greatly facilitate our task of showing concrete evidence of the excludability of our instruments. To our knowledge, however, this constitutes the first serious attempt to study the relationship between cognition and civic engagement through a non-experimental approach.

The impact of these results is manifold. For policy makers, for instance, it is an appeal not to underestimate the importance of keeping a mentally active society even in advanced age, which will potentially result in better and more participatory citizens and thus in the construction of a stronger democracy. However, improving cognitive abilities is a lifelong endeavour, as it heavily relies on the available educational and personal development opportunities in a given society. Our findings are in line with those of Jones [2006], in that improving a population's cognition levelsn (*e.g.*, through better nutrition, health and school systems, particularly in the poorest countries), will increase the cognitive abilities of its inhabitants and thus pave the road for a more cooperative world.

Chapter 3

Are Results from Having an Observer and an Exemplar in a Voluntary Contribution Similar?

3.1 Introduction

How to promote contributions, is an area of growing interest in economics since contributions are an important source of financing for many organizations and public goods worldwide. Nowadays, most of the literature in this area recognises that the motivations for cooperative behaviours go far beyond a narrow definition of the demand for material payoffs. Therefore it is important to study and understand what non-material factors that drive individuals to behave more cooperatively, and how decisions by a policy maker can affect that factors for such behaviours. Two potentially important factors that can promote cooperative behaviours are social image concern and availability of salient example. Social image concern refers to a tendency that an individual's behaviour is partly motivated by others' opinions about herself [Ariely et al., 2009]. This implies that players tend to act less altruistically if no one

observes their actions. While salient example refers to the Schelling's conjecture that says that people are often remarkably good at coordinating their decisions, even when communication is impossible, because people base their decisions on the salience of the available options or the focal points [Schelling, 1980]. Although Schelling's conjecture refers to the coordination problem, nonetheless, the provision of public goods can also regarded as a coordination problem, with players are willing to contribute if others also contribute [Sugden, 1984]. Therefore players behave more unselfishly if they observe an example who act unselfishly.

In this essay, I compare the effects of social image concern and salient example in the context of repeated public goods game. The experiments are played in two directed star networks, observer and exemplar networks, in which there are four players in each network. The observer network is a network where the central player has the ability to observe the behaviours of peripheral players. And in the exemplar network, the central player's behaviour is observed by the peripheral players. The observer and exemplar networks try to capture the effect of social image concern and salient example on the peripheral players' behaviours, respectively. Each player's consumption of the public good depends on his own contribution, and others contributions in the group. Furthermore, I differentiate the feedback sent (received) by the peripheral players in the observer (exemplar) network into contribution and earning feedbacks. This differentiation allows me to assess the phenomenon where players behave more cooperatively when they are presented with the contribution feedback but behave more selfish when they are confronted with the earning feedback.

The main hypothesis that I analyse throughout this study is that the results of having an observer and an exemplar in the context of repeated public goods game are statistically distinguishable. In particular, I compare the contributing behaviours of peripheral players under observer and exemplar networks.

There are two main findings from my experiments. First, the results confirm that the contributing behaviours of peripheral players in the observer network do not differ significantly from the contributing behaviours in the exemplar network. This implies that social image concern and salient example have equal effects in influencing cooperative behaviours. However, the results also reveal that the contributions under exemplar network decay faster than the one in the observer network, which implies that the social image concern is more effective in sustaining cooperative behaviours.

Second, depending whether her contribution in the previous round was above or below the group average, it seems fair to say that players respond differently to the effects of intra-group interaction. I find that, if a player's contribution is above the group average, she will reduce her contribution significantly and vice versa regardless whether she belongs to the observer or exemplar networks. However, if she belongs to exemplar network, she is more willing to reduce the contribution if it is higher than the average relatively if she belongs to observer network. Furthermore, the reverse appears in the case where her contribution is below the average, then a player from observer network are more willing to conform with the average than those who belongs to the exemplar network.

In the next section, I summarize the related literature and note where my approach departs from existing work. In Section 3, I describe the experimental design. Section 4 presents the main findings from the data, and Section 5 concludes this study.

3.2 Related Literature

In network public goods games, players choose how much of their endowment to contribute towards the public good. Payoffs are derived from what is left of their endowment and from consumption of the public good, which depends on the contributions in their neighbourhood and the marginal return to contributions. If agents

are payoff-maximizers in the sense of Nash equilibrium, then every player's dominant strategy is to free ride in the one shot game and in every round of the finitely repeated game, with the assumption that the marginal return to contributions is within a range that generates the social dilemma in which individual interests conflict with social efficiency. However, several public goods experiments have shown that players make positive contributions, which tend to decay with repetition (e.g Fehr and Schmidt [1999], Fehr and Gächter [2000], Carpenter [2007], and Egas and Riedl [2008]) Average contributions typically start at 50-60% of the endowment, and fall to 15-20% of the endowment by the last round.

In this essay, I test the relative importance of social image concern and salient example in promoting cooperative behaviours. Several papers have investigated on the effect of social image concern on cooperative behaviours. For example Rege and Telle [2004]. In this study, they considered a standard public good game with ten subjects in each group. In one sub-sample the subjects had to reveal their contribution to the whole group after making the contribution decision. The average contribution almost doubled with public observability. Andreoni and Petrie [2004] find that giving information about both the identity and the contribution of others increases contributions significantly in a public good experiment. Interestingly, a treatment where subjects had the option to remain anonymous resulted in the highest level of contributions. List et al. [2004] analysed charitable contributions to a Center for Environmental Policy Analysis at the University of Central Florida. They used three different information treatments: (i) completely anonymous responses, (ii) the experimenter knows the response, and (iii) the whole group knows the response. The largest share of yes responses was obtained when the whole group was informed of the response, followed by the case when only the experimenter knew the response.

There exists several field experiment studies investigating the role of social image concern in promoting the cooperative behaviours, for example Soetevent [2005]'s

investigation in Dutch churches using closed and open collection bags. The use of open baskets, where close neighbours in the church could identify a donor's contribution, increased overall contributions by about 10% in the second offering of the services. Alpízar and Martinsson [2013] show that the traveller's donation for conserving Cahuita National Park in Costa Rica is higher if the third party is present when she makes her donation relatively when the donation is made in solitude. Alpízar and Martinsson's result supports the results of List et al. [2004], and Alpizar et al. [2008].

Compared to the social image concern, the salient example receives more attentions, for example the current theoretical papers by Ball et al. [2001] and Kumru and Vesterlund [2008]. In those papers, they argue that the present of commonly observed example can solve the coordination problem and thus it is more likely to be mimicked or deferred to. Bala and Goyal [1998] model is closely related with the idea of the exemplar role in this study. In their model, the commonly observed agent, which they denote as the "royal family" can help the population to choose a better outcome by only acting as the exemplar.

I am aware of four field experiments that analyse the effect of salient example in promoting cooperation. Frey and Meier [2004] analysed the behaviour of students in Zurich who had the opportunity to contribute to two social funds every semester. The contributions were higher when they were informed that many other students were contributing, although the effect was not statistically significant. Shang and Croson [2006] investigated how information about a typical contribution to a radio station affects subject contributions. They found that the highest reference amount ($300) gives a significantly higher contribution than giving no information at all. The direction for smaller amounts ($75 and $180) was the same, although not statistically significant. Heldt [2005] found that Swedish cross-country skiers were more likely to contribute to the track maintenance if many others contributed. Martin and Randal [2008] found that visitors to a museum put more money into a transparent box,

thereby donating money to the museum, when there was money in the box compared to when the box was empty.

In each condition the information of behaviours is differentiated into contribution feedback and earning feedback. A few recent works compared the consequences of providing contribution and earning feedback on the cooperative behaviours. For instance in the dictator game, Duffy and Kornienko [2010] conclude that the proposers exhibit more other-regarding behaviours when they can compare their proposed allocation among themselves, even though this comparison is irrelevant to their payoffs. While in the earning tournament, they find that the proposers tend to be more self-regarding individual.[1] In the Cournot oligopoly, Huck et al. [1999, 2000], Offerman et al. [2002] argued that the firms will behave more competitive when the individual information about their rivals' actions and profits is provided, relatively to the case where only average information is provided. Moreover, they also found that firms tend to imitate their rivals' actions depends on the type of information they receive. If the information consists of the quantities and profits of other firms yields more imitation, which implies more competitive behaviours.

The story of players that behave more self-regarding individual when they confronted with the payoffs of other players happens also in the context of gift exchange game.[2] Gächter et al. [2012] investigates how employees' reciprocity toward an employer is affected by the feedback that they confront. When the employees are confronted with pay comparison information, they tend not to reciprocate by exerting more effort in response a high wage if they observe others doing so. While when they are confronted with effort comparison information, they reciprocate by giving more effort if they observe that they receive higher wage and others are exerting more

[1]Servátka [2009] argues that the underlying motive of proposers' other-regarding behaviours, when they are placed in the generosity tournament, is coming from the reputation motive, and this motive is stronger than social influence motive, which is supporting the result from Cason and Mui [1998] that says social information has insignificant effect on proposers' behaviours.

[2]The gift exchange game is normally used to illustrate the employer-employee relationship.

effort. This study is supporting the results from Clark et al. [2010] and Gächter and Thöni [2010], in which they conclude that wage comparison is significantly influence employees' effort.

In the context of public good game, by far, Nikiforakis [2010] is the only study that compare the effect of action and earning feedbacks on the effectiveness of punishment in sustaining cooperation. He finds that under earning feedback condition, punishment loses its effectiveness in sustaining the cooperative behaviours. Beside the diminishing of punishment effectiveness, he also finds that earnings feedback has a negative effect on contribution levels, while contribution feedback has a positive effect.

I employ two directed star network structures (Figure 1). In one network, observer network (N1), there is a central player who observes the peripheral players. In the other network, exemplar network (N2), it is the reverse condition; there is a central player who is observed by the peripheral players. The directed star networks I use here are different with the star network structure found in the paper by Fatas et al. [2010], or Eckel et al. [2010], or in Rosenkranz and Weitzel [2012]. Thus, by able to observe or being observed, the central player inherently has high status. She is the "royal family" in the sense of Bala and Goyal [1998] or the "focal point" in the sense of Schelling [1960, 1980].

There are several studies have been conducted to analyse the effect of network structures on cooperative behaviours, for example the study of Fatas et al. [2010], and Rosenkranz and Weitzel [2012]. Both studies discuss the effect of network structures on players' behaviours in the context of public good game. The main difference between these studies lie on the payoff functions. In the former study, the payoff function is irrelevant with the number of links that a given player has, while in the later study, players payoff functions are influenced by the number of links that they have. In this study, the payoff function follows the work of Fatas et al. [2010].

Although there is a difference in their payoff function structures, nonetheless, they end up with similar conclusion that the contributions under the star network are not statistically different with the ones from complete network structure. Moreover, the contributions from the star network are higher relatively to the contributions from other structures. From organisation point of view, these studies suggest that having a high status individual in the group can efficiently improve team production. Relating to the studies of Fatas et al. [2010], and Rosenkranz and Weitzel [2012], in this study, I basically try to distinguish whether the ability of star network to promote cooperative behaviours can be coined from the ability of central player to observe the peripheral players or it is because the central player who is being observed by the peripheral players.

The most related study with the current one is the study by Eckel et al. [2010]. In their study, they have 4-person groups repeatedly play a standard VCM in the undirected star network à la Fatas et al. [2010] (there is a central player who can observe and be an example by everybody else) to analyse the role of status in promoting cooperative behaviours. Unlike Fatas et al. [2010], where players are randomly placed in the network, they allocate the central position to those who obtained the highest or the lowest score in the trivia quiz. They find that the central position matters in influencing contributions if the central player has high status.

Several papers have investigated whether cooperation differs across alternative interaction structures in prisoners dilemmas. For instance, **?** argues that local interaction can protect the emergence of cooperation from defectors through an evolutionary process in prisoners dilemmas. Eshel et al. [1998] also demonstrate that cooperation in the prisoners' dilemma game can survive if players interact locally, and if we assume that they imitate successful behaviour. Cassar [2007] finds some differences in the cooperation levels under different interaction structures in an experimental setting.

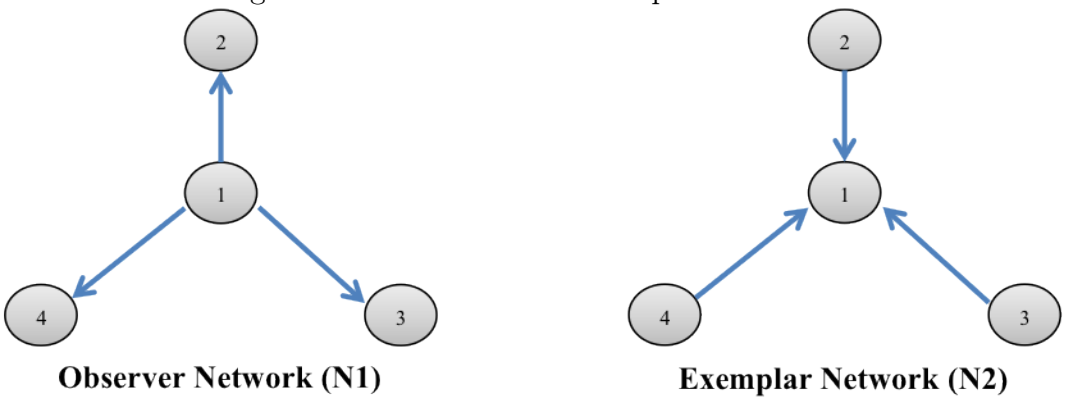
In a public goods environment, Suri and Watts [2011] find that varying the underlying network structure does not have a significant effect on average contributions, at least at the aggregate level. They conclude that either players are not conditional cooperators, or that cooperation does not vary with the network structure of interactions. My essay differs from theirs in that I study the neighbourhood structure on a fixed network, while they vary the underlying network structure. In this study, I show that the specific interaction structure within a network matters for the way players learn and contribute in the finitely repeated game. My findings support the hypothesis of conditional cooperation and identify learning as an important channel through which the neighbourhood structure and monitoring technology affect cooperative behaviour when individual and social incentives conflict.

3.3 Experimental Design and Hypothesis

The aim of my experimental design is to provide a quantitative support on the differences between social image concern and salient example in promoting cooperative behaviours. The experiments are conducted in four-person groups in two directed star networks, which are observer and exemplar networks. In the observer network, the central player can observe the behaviours of three peripheral players. While in the exemplar network, the central player behaviour is observed by others. The observer and exemplar networks impose a social structure on the game, and give the central player a higher position in the social hierarchy, simply by virtue of being able to observe or to be commonly observed. Therefore, in order to obtain the main objective, I will compare the contribution behaviours of peripheral players across two network structures. There is no guarantee or restriction that the central player who acts as either the observer or exemplar will lead a group to higher levels of contributions. In the observer network, the peripheral players who are observed may ignore the observation

of central player and in the exemplar network, the peripheral players may ignore the example of the central player. Beside that the central player may not choose a strategy that, if copied, would lead to higher contributions. Consequently, I hypothesise that there is no statistical difference of contribution behaviours of peripheral players across networks.

Figure 3.1: Observer and Exemplar Networks



The information feedback in both network is differentiated into two types, contribution and earning feedbacks. Hence in total, I have four treatments: observer network with contribution feedback (N1-C); observer network with earning feedback (N1-E); exemplar network with contribution feedback (N2-C); and exemplar network with earning feedback (N2-E). Information about player j's is only transmitted to player i if and only if there is a directed link that goes from player i to player j. Hence in the observer network (N1), the central player is the only player that can observe contribution or earning from other players. And in the second network, the exemplar network (N2), the peripheral players are the players that can observe the contribution or earning of the central player.

In all treatments, the groups repeatedly play two VCM games lasting for ten rounds each. The second game is known as a restart game, proposed by Andreoni [1988], to capture the effect of learning. The subjects also know the structure of the network and their own position before they start the game. At any given round,

each subject i is endowed with $W = 10$ tokens (the currency units used during the experiment), and then they simultaneously make a contribution c_i to the group account. Each token that is contributed to the group account, $(c_i + \sum_{j=1}^{N} c_j)$, yields a payoff of $\alpha = 0.5$ tokens to each member of the group. Each token that is not contributed by a subject is credited to that subject's private account. Thus, at a particular round, subject i's earnings (in tokens) are given by

$$\pi_i\left(c_i, \sum_{j=1}^{N} c_j\right) = W - c_i + \alpha\left(c_i + \sum_{j=1}^{N} c_j\right) \tag{3.1}$$

Before making a contribution in the subsequent round, subjects will be informed about the amount they contributed to the project, the payoff they receive, and the group total contributions. In addition, under the observe network (N1), the star receive information either about peripheral players' actions or payoffs. While under the observed network (N2), the peripheral players receive information either about star player's action or payoff. At the end of the session, data on some socio characteristics was collected from the subjects.

The experiment was conducted at the Ca' Foscari University of Venice using the software z-Tree [Fischbacher, 2007]. Participating subjects came from the subject pool that mainly recruits students of Ca' Foscari University of Venice from all faculties. Eight sessions, two sessions for each treatment, were conducted with a total of 120 participants. For N1-Contribution (N1-C) and N1-Earning (N1-E) treatments, I had four sessions with 16 participants in each session. While for N2-Contribution (N2-C) and N2-Earning (N2-E) treatments, I had two sessions with 12 participants, and two session with 16 participants. The average age was 22 years and 65 percent were female. No subject took part in more than one session.

Upon arrival, the subjects were welcomed and randomly seated at visually separated computer terminals. The subjects were given 15 minutes to read through the instructions, and then the experimenter read aloud the instruction. The instruction

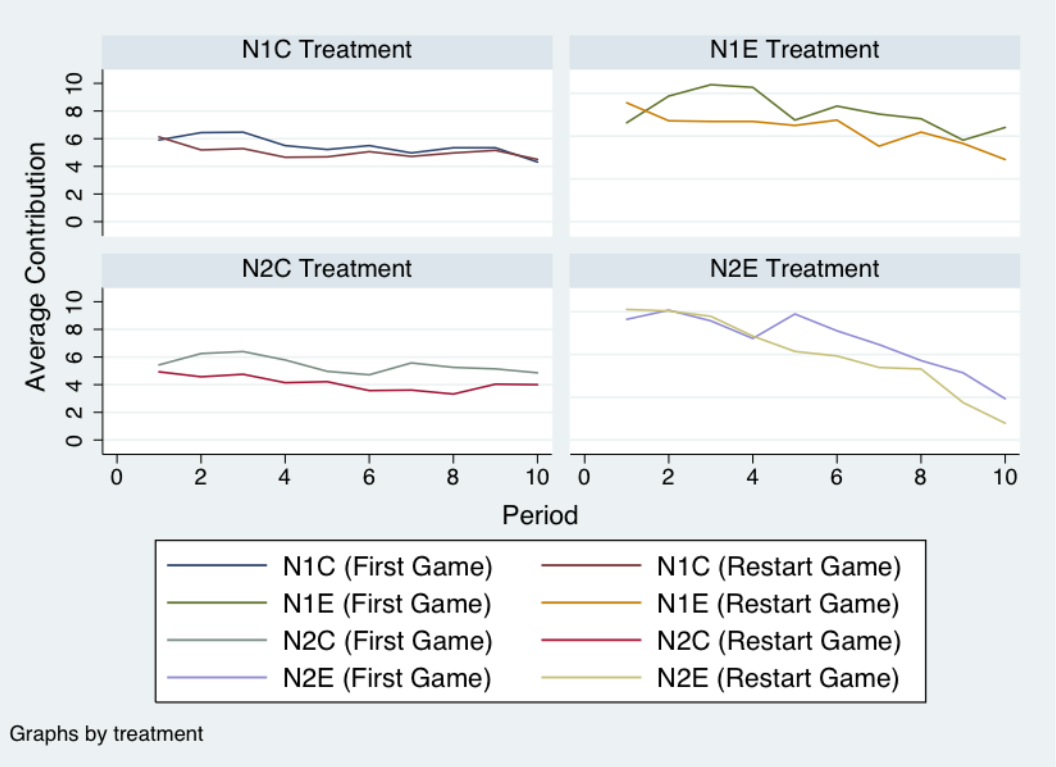
is presented in the appendix section. The subjects were then randomly assigned to a group and a role. All decisions were made anonymously, and neither during nor after the experiment were subjects informed about the identity of the other members of their group. Moreover, since there was unexpected restart game, subjects were initially told they would play a game of ten rounds and at the end of this game, they were told, unexpectedly, that they will play another ten rounds. They were also told that their earning from the previous ten rounds will be carried out in the restart game.

On average, the experimental sessions lasted about one hour, including the reading of the instruction and the completion of post-experimental questionnaires. All subjects received 3 Euro as the show up fee, which was added to earning from the experiment. At the end of the session, the accumulated earnings from all periods were converted into Euro at a rate of 100 tokens = 1.50 Euro, subjects were paid in private and in cash at the end of each session. The subject earnings ranged from 6.30 Euro to 8.50 Euro, averaging 7.40 Euro (approximately US$ 9.69 at the time of the experiment).

3.4 Experimental Results

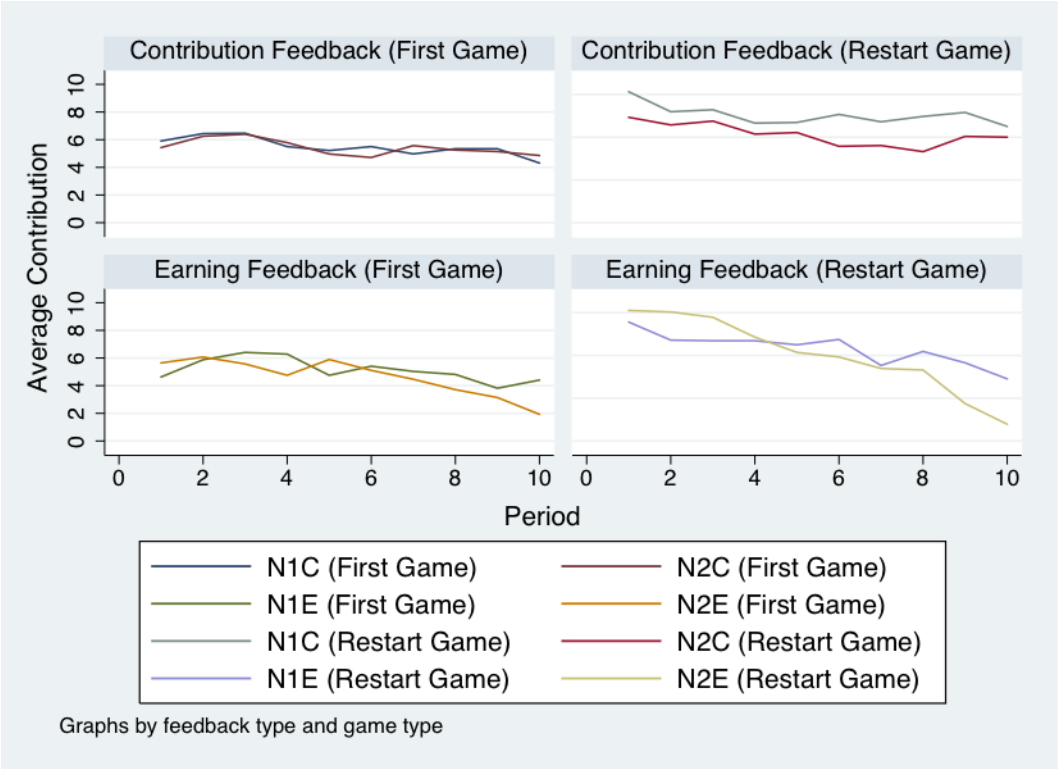
Let us begin with the aggregate data, which paints a picture consistent with previous experimental findings. As Figure 2 shows, the average contributions level in the initial period, regardless whether it is from the first or the restart games, are significantly different from zero and it decreases subsequently. Over all periods, average contributions in the first and restart game are statistically distinguishable, except for the N1-C treatment. For N1-E and N2-C treatments, the differences in average contributions of first and restart games are at 1% significance level, while for the N2-E treatment the differences come at 5% significance level.

Figure 3.2: Average Contributions of First and Restart Games by Treatments



Next, I compare the average contributions between two network structures, observer (N1) and exempler (N2) networks under different feedback regimes.

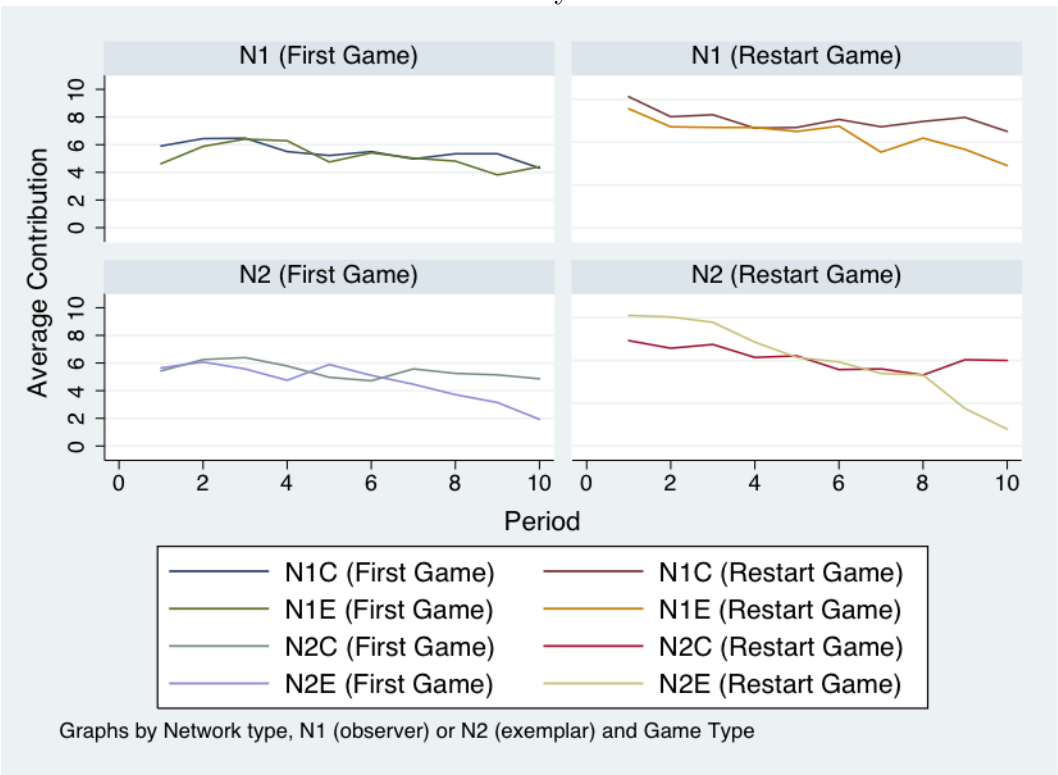
Figure 3.3: Observer versus Exemplar Average Contributions Across Feedback Regimes



According to Mann-Whitney test, over all periods, the average contributions of N1-C treatment are not statistically different from the average contributions of N2-C treatment in the first game, while in the restart game, the average contributions between N1-C and N2-C are different at 1% significance level. In the earning feedback regime, over all periods of the first game, the average contributions between N1-E and N2-E treatments are different at 10% significance level. And in the restart game, over all periods, this difference disappears.

We can also compare the effects of feedback on the contributing behaviours within each network structure.

Figure 3.4: Contribution Feedback versus Payoff Feedback Across Network Structures



According to Mann-Whitney test, over all periods, the average contributions of N1-C treatment are not statistically different from the average contributions of N1-E treatment in the first game, while in the restart game, the average contributions between N1-C and N1-E are different at 5% significance level. In the exemplar network structure, over all periods of the first game, the average contributions between N2-C and N2-E treatments are different at 1% significance level. And in the restart game, over all periods, this difference disappears.

Network structure and peripheral contributions. As I mentioned before, the comparison of social image concern and salient example to promote cooperative behaviours is based on the behaviours of peripheral players therefore, the analysis of this subsection is based on the peripheral behaviours only. Table 1 summarises and highlights the considerable heterogeneity of the average contributions among peripheral and central players across treatments. As we can infer that in the observer

network (N1), the average contributions of central players are higher than the average contributions of peripheral players across information feedbacks, while the opposite picture appears in the exemplar network (N2).

Table 3.1: Average Contributions by Treatment and Position

Treatment		Number of Players	Average Contributions	
			First Game	Restart Game
N1-C	Central	8	5.3625	4.825
			(3.7862)	(3.8837)
	Peripheral	24	5.5458	5.1042
			(3.5189)	(3.6064)
	All players	32	5.500	5.0344
			(3.5824)	(3.6734)
N1-E	Central	8	4.350	3.3125
			(3.3265)	(3.0999)
	Peripheral	24	5.4042	4.6542
			(3.4712)	(3.3124)
	All players	32	5.1406	4.3188
			(3.4608)	(3.3074)
N2-C	Central	7	6.0857	5.4429
			(2.6306)	(3.0390)
	Peripheral	21	5.2190	3.6714

Continued on next page

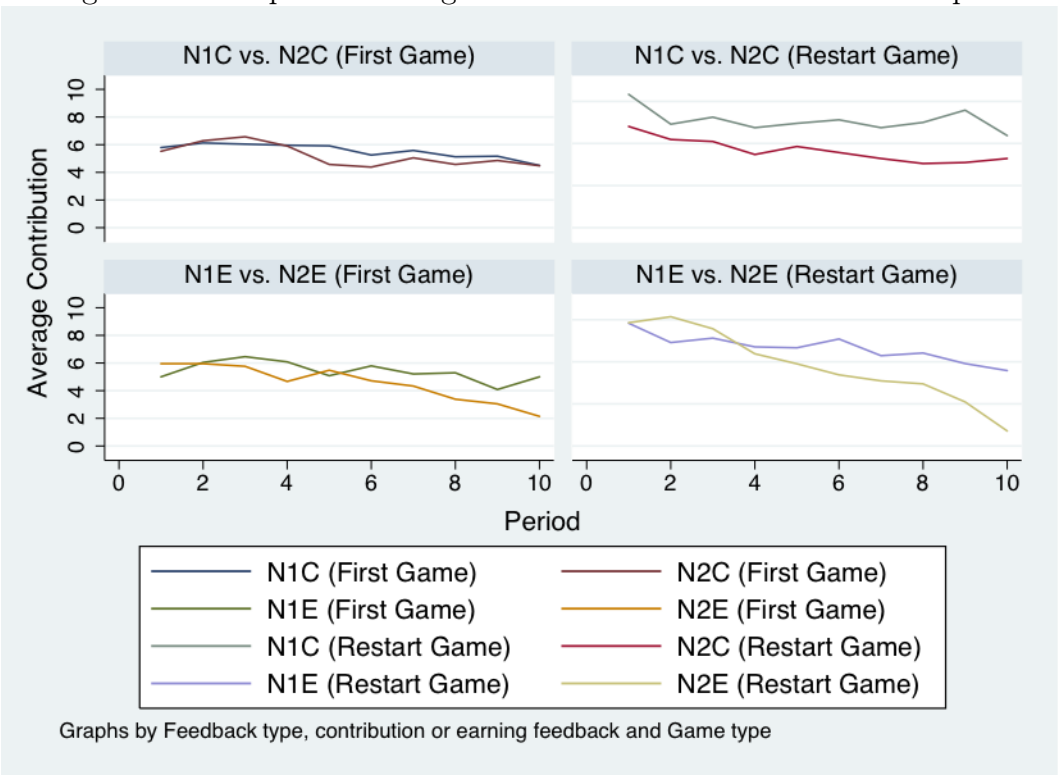
Table 3.1 – continued from previous page

Treatment		Number of Players	Average Contributions	
			First Game	Restart Game
			(3.1758)	(3.0359)
	All players	28	5.4357	4.1143
			(3.0673)	(3.1271)
N2-E	Central	7	4.8857	4.6143
			(3.4454)	(3.7582)
	Peripheral	21	4.5429	3.8095
			(3.0687)	(3.2535)
	All players	28	4.6286	4.0107
			(3.1442)	(3.3977)

Std. Dev. in parentheses

Of the main objective is the difference in contributions of peripheral players across two network structures. The following figure reports the comparison between observer and exemplar networks under contribution and earning feedbacks.

Figure 3.5: Peripheral Average Contributions: Observer vs. Exemplar



In the first game, the average contributions of peripheral players across network structures under contribution feedback are statistically indistinguishable overall periods. However, the variance of contributions of peripheral players in the observer network is significantly bigger than the variance from the exemplar network. As we can see from Figure 5, in the restart game, overall, average contributions of peripheral players in the observer network are higher than in the exemplar network. Beside the average contribution, the variance of contributions in the observer network is also bigger than the variance of the exemplar network.

While under earning feedback regime, the average contribution of peripheral players and its variance in the observer network are significantly higher than the counterparts from exemplar network, both at 10% significant level. While in the restart game, the difference in contributing behaviours is still continuing at 10% significance level but their variances are statistically indistinguishable overall periods.

To have a robust results whether or not the contributing behaviours of peripheral players are different across treatments, I employ two different regression techniques, namely ordinary least square (OLS) and censored panel data with fixed effects.

There are two reasons behind the use of regression techniques in analysing my experimental data set. First, the nature of the data makes it is reasonable to expect that the individual allocation decisions typically exhibit very strong serial correlation, and are significantly related to previous allocation decisions and others decisions. Second, the regression techniques is used to minimise the session effects, an effect where observations across subjects of a given session might exhibit more correlation than observations across subjects in different sessions [Fréchette, 2012]. Particularly on the censored panel data regression technique, I use this technique since the data is censored: from below by the fact that an individual's contribution to the group good is constrained to be non-negative, and from above by the fact that an individual's contribution to the public good cannot exceed her endowment in a given period.

For the OLS and fixed effects techniques, the dependent variable is the peripheral player contribution per period, g_{it}. While for the censored panel data regression, the dependent variable is the censored peripheral player contribution per period $g_{it}^{censored}$. Across all techniques, the independent variables consist of: the interactions of treatment dummy variables, N1-C and N2-C, with linear trend in the first, First Game$_t$, and restart games, Restart Game$_t$, respectively; the interactions of treatment dummy variables, N1-C and N2-C, with the lagged contribution variable, g_{it-1}; and the interactions of treatment dummy variables, N1-C and N2-C, with the lagged positive and negative deviations from the average group contribution, $(g_{it} - \bar{G}_{it-1}) > 0$ and $(g_{it} - \bar{G}_{it-1}) < 0$ respectively. The positive and negative deviation variables capture how players respond differently depending whether her contribution in the previous round was above or below the group average. A positive coefficient on these variables

indicates adjustment away from the group average, while a negative coefficient means that the player is adjusting his contribution toward the group average.

Table 2, Table 3 and Table 4 report the regression results for the peripheral players behaviours under contribution feedback, earning feedback and pooled data set, respectively. Across these tables, we can infer that the direction of all explanatory variables using two different techniques do not change, however, failing to account for panel structure and censoring would reduce the magnitude as well as the significant level of the explanatory variables in influencing the contributing behaviours of peripheral players. This inference is similar to what we can find in the study of Ashley et al. [2003].

Now, let us begin with Table 2. First, although the direction of trend variables under OLS and censored panel data regression are identical, nonetheless the magnitude of trend variables using the censored panel data regression are twice as large as what we can get using the OLS technique. Moreover, OLS result shows that the coefficient of trend variables are statistically not different from zero except for the restart game in N2-C treatment. This result implies that contributing behaviours are stable across two treatments. However, when I control for panel data structure and censoring, it clears that there are negative trends in contributing behaviours across two treatments. In first game, the negative trend coefficients between N1-C and N2-C do not differ so much, while in the restart game, the trend for N2-C treatment is twice larger than in the N1-C. This inference implies that in the restart game, the peripherals contributions from the exemplar network under contribution feedback is decaying faster than the contributions from observer network.

Second, across all regression techniques, the coefficients on lagged contributions are positive and significant, which indicate a substantial correlation in contributions from one period to the subsequent one.

Third, OLS result indicates that only coefficient of positive deviation for N1-C treatment is statistically different from zero, which implies that if a peripheral player belong to N1-C treatment, the she will reduce the contribution if her contribution is higher than the average contribution in her group. However if her contribution is lower, there is no corresponding increase. For N2-C treatment, it seems that a peripheral player keep the same contributing behaviour regardless whether her contribution is higher or less that the average contribution in her group. Using censored panel data regression technique, we can infer that a peripheral player, regardless whether she belongs to N1-C or N2-C treatment, will adjust her contributing behaviour toward group behaviour, nonetheless she is more willing to reduce her contribution than to increase it.

Fourth, the coefficients for the network structure dummy variables are insignificance in all regression techniques, which indicate that the contributing behaviours in the N1-C and N2-C treatments are not statistically different.

Table 3.2: Peripheral Behaviours Under Contribution Feedback

Variables	OLS	Censored
First Game$_t$ × N1-C	-.0575637	-.1654992*
	(.0699318)	(.0940408)
Restart Game$_t$ × N1-C	-.0324028	-.0683711*
	(.030247)	(.0409024)
First Game$_t$ × N2-C	-.0861309	-.1746221*
	(.0762464)	(.1024514)
Restart Game$_t$ × N2-C	-.0663286**	-.1344521***
	(.0337867)	(.0456515)
g_{it-1} × N1-C	.7544521***	.8476884***
	(.0633504)	(.116318)
g_{it-1} × N2-C	.6905729***	.8849198***
	(.0819487)	(.1319288)
$(g_{it} - \bar{G}_{it-1})_+$ × N1-C	-.6626856***	-.7835206***
	(.1111681)	(.1775858)
$(g_{it} - \bar{G}_{it-1})_-$ × N1-C	-.161694	-.466252**
	(.1228761)	(.1910585)
$(g_{it} - \bar{G}_{it-1})_+$ × N2-C	-.2013773	-.7404445***
	(.1642947)	(.2559706)
$(g_{it} - \bar{G}_{it-1})_-$ × N2-C	-.1252611	-.3387503*
	(.1234315)	(.2025698)
N1-C	.1101152	.0708564
	(.9618507)	(1.568157)
Constant	2.061516***	2.020989*

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Variables	OLS	Censored
	(.6993946)	(1.130332)
σ_μ		2.097348
σ_ϵ		3.529935
Observation	810	810
Number of subject		45
Adj R-squared	0.3477	
Wald χ^2		172.24

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Moving to the next table, Table 3. In general the results from earning feedback data set are similar from the contribution feedback data set. There are negative trends in contributions across N1-E and N2-E treatments and the trend coefficients from censored panel data regression are doubled relative to the corresponding coefficients when I do not control the panel structure and censoring. Moreover, results from Table 3 also indicate that there is a strong indication of serial correlation in both treatments, different responses depending whether a player contribution in the previous round was above or below the group average, and there is no indication that N1-E treatment is statistically different from N2-E treatment.

Nonetheless, compared to the results from Table 2, it is clear that the results from each regression technique are more similar using the earning feedback data set, especially for the four contribution deviation variables. The OLS result indicates that a player whom belongs to the N1-E treatment tend to conform with the average contribution in her group, meaning that she increases (reduces) the contribution if her contribution is below (above) the average contribution. Moreover, the coefficients of

positive and negative deviations are quite similar, which indicates that players in the N1-E treatment respond similarly when their contributions in the previous round were above or below the group average. A different result appears for the N2-E treatment. Here, if a player's contribution is above the group average, the estimated coefficients indicate that she will reduce her contribution. However, if her contribution is below the group average, there is no corresponding increase.

Table 3.3: Peripheral Behaviours Under Earning Feedback

Variables	OLS	Censored
First Game$_t$ × N1-E	-.061993	-.1227659*
	(.058216)	(.0745854)
Restart Game$_t$ × N1-E	-.0392302	-.0863856***
	(.0253854)	(.0329964)
First Game$_t$ × N2-E	-.1958757***	-.2802988***
	(.0657172)	(.0828691)
Restart Game$_t$ × N2-E	-.0898942***	-.1436585***
	(.0287494)	(.0361659)
g_{it-1} × N1-E	.8861814***	.7631117***
	(.0534621)	(.1096842)
g_{it-1} × N2-E	.8402793***	.9657227***
	(.0548288)	(.0824451)
$(g_{it} - \bar{G}_{it-1})_+$ × N1-E	-.4503764***	-.5565016***
	(.1019281)	(.1534121)
$(g_{it} - \bar{G}_{it-1})_-$ × N1-E	-.3360859***	-.3071634*
	(.1191686)	(.169952)
$(g_{it} - \bar{G}_{it-1})_+$ × N2-E	-.9162977***	-1.196887***

Continued on next page

Variables	OLS	Censored
	(.1234395)	(.1618398)
$(g_{it} - \bar{G}_{it-1})_- \times$ N2-E	-.023447	-.0010209
	(.1078289)	(.1590568)
N1-E	-1.00234	.6558922
	(.7956301)	(1.273372)
Constant	2.174391***	2.116626**
	(.589847)	(.8718443)
σ_μ		1.595731
σ_ϵ		2.702853
Observation	810	810
Number of subject		45
Adj R-squared	0.5247	
Wald χ^2		381.02

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Moving to Table 4. The results that we can find in Table 4 are not so much different from what we have seen in Table 2 and Table 3 before. Using the pooled data set, all the trend coefficients confirm that there is a decay in contributions that goes with the period. However, the coefficients value from OLS technique are half of the values using the censored panel data regression, which indicate that failing to control the panel structure and censoring in contributions leads to a smaller magnitude of how contribution decays over time. Although players in both network structures are willing to conform with the group behaviours, nonetheless, they are more willing to reduce the contributions than to increase it.

Table 3.4: Peripheral Behaviours Across Networks

Variables	OLS	Censored
First Game$_t$ × N1	-.0613422	-.138681**
	(.0457461)	(.0596843)
Restart Game$_t$ × N1	-.0351646*	-.0766252***
	(.0198356)	(.026104)
First Game$_t$ × N2	-.129773**	-.2143475***
	(.0503959)	(.0653365)
Restart Game$_t$ × N2	-.0743792***	-.1351639***
	(.0223299)	(.0290373)
g_{it-1} × N1	.8265002***	.8044302***
	(.0412482)	(.0785979)
g_{it-1} × N2	.8061198***	.9632725***
	(.0468792)	(.0728021)
$(g_{it} - \bar{G}_{it-1})_+$ × N1	-.5632578***	-.6828814***
	(.0758852)	(.1173075)
$(g_{it} - \bar{G}_{it-1})_-$ × N1	-.2603858***	-.3878708***
	(.0842969)	(.1268076)
$(g_{it} - \bar{G}_{it-1})_+$ × N2	-.5810959***	-1.01317***
	(.100554)	(.1435177)
$(g_{it} - \bar{G}_{it-1})_-$ × N2	-.1391578*	-.2342826*
	(.0802896)	(.1243634)
N1	-.2227597	.663213
	(.620227)	(.9926386)
Constant	1.834963***	1.797748**

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Variables	OLS	Censored
	(.4543)	(.7022593)
σ_μ		1.861903
σ_ϵ		3.131082
Observation	1620	1620
Number of subject		90
Adj R-squared	0.4279	
Wald χ^2		500.36

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Across all the regression results, there are four general inferences that we make. First, across all models, there are negative trends in contributions across network structures under two feedback regimes. Beside confirming that there is a decay in contribution, the trend coefficients also reveal that contributing behaviours in observer network are more stable than the ones that we can find in the exemplar networks. Second, the coefficient on lagged contributions are positive and significant, which indicate a substantial correlation in contributions from one period to the next one across all treatments.

Third, depending whether her contribution in the previous round was above or below the group average, it seems fair to say that players respond differently to the effects of intra-group interaction. In all regression results, if a player's contribution is above the group average, the estimated coefficients indicate that she will reduce her contribution significantly and vice versa. Interestingly, the estimated coefficients also indicate that, on average, players who belong to exemplar network are more willing to reduce the contributions if it is higher than the average compared to the players

from observer network. However, if their contributions are below the average, then the players from observer network are more willing to conform with the average than those who belong to the exemplar network.

Fourth, the coefficients for the network structure dummy variables are insignificance in all regression results, which indicate that the contributing behaviours in the observer and exemplar networks are not statistically different. Correspond with the main objective of this study, this result suggests that the behaviours of players remain the same, regardless whether there is an observer or an exemplar. Nonetheless, the first and the third general inferences suggest that having the observer is relatively better than having the exemplar in sustaining the cooperative behaviours.

3.5 Conclusions

Are the results of social image concern and salient example in the context of repeated public goods game similar? To answer this question, I perform the series of laboratory experiments, in which I impose two directed star networks as the social network structure among players in a four-person group, namely observer and exemplar networks. I randomly assign one person to be a central player and the rest act as the peripheral players. In the observer network, the central player can observe, either the contributions or the earnings of peripheral players, while in the exemplar network, the contribution or the earning of the central player is observed by the peripheral players. I find that the contributing behaviours of peripheral players are remain the same either when the central player act as an observer or as an exemplar, or in other words, the contributions of peripheral players are not different across network structures. However my findings also point out that the contributing behaviours of peripheral players are more stable in the observer network compared to the ones from exemplar

network, which implies that having an observer around is more effective to sustain the cooperative behaviours than having an exemplar.

Moreover, across all network structures, there is evidence that the peripheral players tend to conform with the group behaviours, meaning that a player will reduce (increase) her contribution if it is above (below) the average contribution. Interestingly, in the case of positive deviation from the average contribution in the group, the peripheral players who belong to exemplar networks are willing to reduce the contributions more, compared to the ones belong to the observer network, but in the case of negative deviation, the peripheral players from exemplar network are more reluctant to increase their contributions, compared to those who belong to the observer network.

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Estratto per riassunto della tesi di dottorato

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Titlo della tesi: Essays on the Non-monetary Aspects of Cooperative Behaviours

Abstract: This dissertation consists of three independent essays that explore the non-monetary aspects on the cooperative behaviours. In the first essay, I analyse the effect of social interaction on the decision to contribute to public good. To examine the effect of social interaction, I construct a sampling design where respondents are divided into three different groups, namely treated, untreated, and control groups. The respondents in the treated and untreated groups were allowed to interact/discuss with each other, within and across groups, prior to the WTP elicitation question. I find that treated and untreated respondents with social interactions have higher and significant likelihood to purchase the public good relatively to control respondents. While those who did not have interaction have a lower WTP for the improvement of waste management. In the second essay, which is a join work with Luis Aranda, we investigate how cognitive abilities correlate with civic engagement of older Europeans (aged 50+), using waves two and three of the SHARE dataset. The results advocate for the existence of a causal relationship running from cognition in old age to community engagement. In the last essay, I compare whether the results from having an observer and an exemplar in a public good game are similar. To make this comparison, I employ a four-players finitely repeated public goods experiment on two directed star networks, observer and exemplar networks. I find evidence that the behaviours of players are statistically indistinguishable across network structures. However, the players who belong to the observer network are more willing to conform with the group behaviours, meaning that they will increase (reduce) the contributions if theirs are below (above) their groups average. Furthermore, I also find evidence that the contributing behaviours are more stable in the observer networks than in the exemplar network.

Estratto: Questa tesi si compone di tre saggi indipendenti che esplorano aspetti non monetari di comportamenti cooperativi. Nel primo saggio, analizzo gli effetti dell' interazione sociale sulla decisione di contribuire ad un bene pubblico. Per esaminare l'effetto dell'interazione sociale, si utilizza un piano di campionamento in cui gli intervistati sono divisi in tre gruppi e sottoposti ad un trattamento sperimentale. Gli intervistati nei gruppi trattati e non trattati sono stati autorizzati per interagire/discutere tra loro, sia all'interno del gruppo che tra gruppi, prima della domanda sperimentale riguardante alla *willingness to pay* (WTP). Si trova che che gli intervistati trattati e non trattati con le interazioni sociali hanno probabilità più alta per l'acquisto del bene pubblico rispetto al gruppo di controllo. Mentre coloro che non possono interagire hanno una WTP inferiore riguardo al miglioramento della

gestione dei rifiuti. Nel secondo saggio, di cui Luis Aranda è co-autore, si indaga la correlazione delle abilità cognitive con l'impegno civico dei cittadini europei di età superiore a 50 anni. Si utilizzano le *waves* due e tre del set di dati SHARE. I risultati sostengono l'esistenza di una relazione causale che lega la cognizione ed l'impegno sociale all'interno della comunità. Nell'ultimo saggio, studio se i risultati di avere un osservatore e un esemplare in un *public good game* sono simili. Come metodologia vengono impiegati quattro giocatori in un esperimento ripetuto di un *public good game*. I giocatori occupano posizioni su due network diretti con configurazione di tipo *star*, *observer* ed *exemplar*. I risultati dimostrano che i comportamenti dei giocatori non differiscono al variare delle strutture di rete. Tuttavia, i giocatori che fanno parte della rete di tipo *observer* sono più disposti a conformarsi con i comportamenti del gruppo, il che significa che tendono ad aumentere (ridurre) il loro contributo se il loro contributio è inferiore (superiore) al contributo medio del gruppo. Inoltre, si dimostra che i comportamenti che contribuiscono al bene pubblico sono più stabili nelle reti *observer* che nelle reti di tipo *exemplar*.