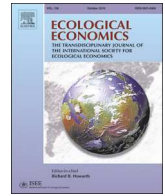




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Analysis

Do market and trust contexts spillover into public goods contributions? Evidence from experimental games in Papua New Guinea

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ABSTRACT

The provision of public goods, such as voluntary enforcement efforts, can be critical to the management of natural resources. However, the degree to which context can influence people's contributions to the public good is poorly understood. Here, we used sequential games in a 'lab in the field' experimental setting with a fishing community in Papua New Guinea to explore whether behavior in two particular contexts—market and trust—spill over public goods' contributions. Behavioral spillovers occur when behavior in one context influences—or is transferred to—behavior in another context. Our results indicate that there is spillover, but surprisingly this occurs from specific roles assumed within the context rather than the broader context itself. The existence of behavioral spillovers into public goods can render conservation initiatives that rely on contributions ineffective, or even damaging if they crowd out intrinsic behavior. Understanding the potential biases different context—e.g. markets created by market-based instruments or trust relied upon by community-based mechanism—can create, is necessary for the implementation of effective and efficient conservation initiatives.

1. Introduction

Many conservation and environmental management initiatives deal with public goods (i.e. those that are non-rivalrous and non-excludable). In some cases, these initiatives may target the provision of public goods directly, such as limiting pollution into the ocean which can diminish the public goods provided by the ocean (recreational opportunities, carbon storage, etc.). While in other cases, these initiatives may depend indirectly on the provision of public goods, such community-managed fishing programs that rely on self-monitoring and enforcement (Cinner et al., 2012a; Cinner et al., 2012b). Although the stock of fish is considered a common good (also known as common pool resource), monitoring and enforcement efforts can be considered a public good for the community. While public goods' contributions, often used as a measure of cooperation, have been a topic of significant theoretical research (Clarke, 1971; Bergstrom et al., 1986; Cornes and Sandler, 1996), and experimental studies (Andreoni, 1990; Fehr and Gächter, 2000; Chaudhuri, 2011; Basurto et al., 2016), little is known about the degree to which people's contributions to public goods are context dependent.

An increasing body of literature suggests preferences not always follow standard choice theory (value maximization) resulting in decisions that overlook the highest value alternative, meaning preferences

can be context dependent (Bowles, 1998; Tversky and Simonson, 1993; Bowles and Polania-Reyes, 2012). Although the number of studies that look at the influence of context in preferences is increasing, they are mostly experimental. Still, no work has looked at the influence contexts might have on public good contributions, either experimentally in the lab or in the field. For conservation initiatives that want to leverage the use of public goods to achieve conservation goals it is of utmost importance to understand if contributions can be context dependent, and how different contexts might influence contributions.

A key way of approaching the issue of context-dependent public goods contributions may be through behavioral spillovers (Thøgersen, 1999). Behavioral spillovers is still considered an emerging field in which some studies have use similar but not identical definitions (Cason et al., 2012; Nash et al., 2017; Galizzi and Whitmarsh, 2019), while others have focused in particular behaviors such as cooperation (Cason and Gangadharan, 2013), rationality (Cherry et al., 2003), or environmental protection (Lanzini and Thøgersen, 2014). Broadly speaking behavioral spillovers refer to behavior in one context influencing—or being transferred to—behavior in another context (Galizzi and Whitmarsh, 2019). In a related body of literature, the idea of context influencing preferences has been attributed to a 'framing effect' akin to the cognitive bias of the same name (Tversky and Kahneman, 1981). Initially framing was researched using positive versus negative

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wording for statements with the same underlying consequences to examine how, for example loss versus gain framing influence people's decisions and behaviors in a range of settings (Tversky and Kahneman, 1981; Hossain and List, 2012). These initial framing studies have recently been expanded by using different contexts with the same underlying decision processes to examine how, for example, a market context can crowd out people's preferences for other-regarding behavior (Falk and Szech, 2013; Bartling et al., 2015b).

Here, we examine the potential for spillover into public goods contributions from two domains of increasing relevance to conservation and environmental management initiatives: market and trust contexts. First, the market context is relevant because more and more conservation initiatives are using market-based mechanisms to address environmental issues (Stavins and Whitehead, 1992; Stavins, 2003; Kroeger and Casey, 2007). Market-based mechanisms encompass instruments (price, quantity) and regulation (market friction and government subsidy reduction) whose primary characteristic is encouraging behavior through market signals (Stavins, 2003). A prominent example is the tradable permits—cap-and-trade¹—program for air pollution in the US, with the type, range, and number of market-based mechanisms constantly increasing around the world (Stavins, 2003; Pagiola, 2008; Vatn, 2010). Second, many conservation initiatives use collective action and community-based approaches for resource management, which rely on trust for cohesion of the community and achievement of the goals (Ostrom, 2010). Trust has been shown to promote cooperation and reduce free-riding behavior in public goods games (De Cremer et al., 2001). These contexts could activate different heuristics related to pro-social behavior; markets, for example, can activate 'economic incentive' heuristic while trust can activate the 'social cognition' heuristic (Declerck and Boone, 2016). We ask "do market and trust contexts 'spill over' into public goods contributions?"

To answer the question of whether context influences spillovers into contributions to public goods we used an economic laboratory experiment in the field (Cardenas and Carpenter, 2008) in the fishing community of Ahus Island, Papua New Guinea. The experiment consisted of a control and two treatments. The control group played a standard public goods game that asked subjects for contributions to a group fund that benefited all members of the group equally (Ledyard, 1994; Dawes and Thaler, 1988). Treatment 1 (market context) also played the public goods game, but this was preceded by a trade/bilateral bargaining game (Smith, 1982). Likewise, treatment 2 (trust context) also played the public goods game, but in this case, it was preceded by a trust game (Berg et al., 1995). Thus, each treatment had two sequential, and independent games. The first game exposed subjects to a context while the second game examined their contributions to public goods. The sequential setting allowed us to determine existence of spillovers (Galizzi and Whitmarsh, 2019) into public goods' contributions, and—if they existed—whether they differ across treatments by comparing them to a control (no context).

To our knowledge, this is the first time that the trust, trade, or public goods games have been played in Papua New Guinea. However, previous experimental economics research in Papua New Guinea has demonstrated some unusual results with regards to perceptions of equity (Henrich et al., 2001; Tracer, 2003; Henrich et al., 2010). For example, players in an ultimatum game (a game in which the first player (sender) offers the second player (receiver) a sum of money, who can then decide to accept or reject the offer, but if rejected, both players receive nothing) in Papua New Guinea tended to not only reject offers

that were too low, but also those that were "too high" (i.e. over 50% of endowment) (Henrich et al., 2001). Importantly, this was behavior in an ultimatum game that had not been observed before (Gintis, 2003). Putting this in a cross-cultural context, these were the highest rejection rates among any country highlighted in a meta-analysis of ultimatum games (Oosterbeek et al., 2004). The authors concluded that the rejection of these "hyper-fair" offers was due to a cultural disposition of not wanting to become engaged in a future reciprocity obligation, which would carry an implicit notion of subservience (Tracer, 2003). Similarly, Henrich et al. (2010) found that the mean allocations in a dictator game (similar to the ultimatum game, but the receiver has no opportunity to refuse) were high in Papua New Guinea, given the level of market integration.

2. Methodology

2.1. Research site

Ahus is a small island (0.25 km²) of approximately 800 inhabitants located ~25 Km off the coast from the Manus provincial capital, Lorengau. The main activity in the island is fishing. Although trade was historically based on bartering fish for vegetables and other supplies (building materials, firewood) (Cinner, 2005), today monetary transactions are the norm as markets and access to imported goods have expanded. On the island, as well as in most of Papua New Guinea, land ownership and fishing grounds are customary and clan-based (Cinner et al., 2005; Cinner and Aswani, 2007). The average age of the population in the island is 30 years old (s.d. 20.5), with ~63% over 18 years old, and 48% female.

2.2. Experimental design

Our experimental design consisted of a control, whereby only a public goods game was played, and two treatments. Treatment 1 (market context) consisted of a public goods game that was preceded by a trade game, while treatment 2 (trust context) consisted of a public goods game preceded by a trust game. We conducted 25 sessions with six participants each. Treatments and controls were assigned randomly to each session.

2.3. Subjects

Only adults (18 years old or older) were allowed to participate in the experiment, with subjects self-selecting to participate (in a first-come first-serve fashion) while maintaining general representativeness of the four main clans in the island, as each clan was asked for a fixed number of participants based on the island population. Subjects participated at random in either the control or either of the two treatments. The trade and trust games were played six rounds plus a practice round at the beginning.

2.4. Payment

Subjects received payment for the public goods game and the preceding game (for the treatments). In the treatments, only one of the rounds in the first game was paid. The round was selected at random using a six-sided dice rolled in front of all participants at the end of the first game. In the control, only the public goods game was played, thus subjects were given the expected average earnings (across treatments) from the first game as a show up fee to account for payment biases. Across treatments and control, the public goods game remained the same and was played only once (one shot game).

2.5. Setting

To conduct the sessions an open area was subdivided into cubicles

¹ Consider carbon dioxide emission for example, the country sets a total level (cap) of carbon dioxide emissions and permits are given to companies to emit certain amount of carbon dioxide to comply with the country's cap. If a company emits less than the permits they hold they can sell the rest, if they need to emit more, they can buy permits from other companies that are below their individual quota.

to maintain anonymity between participants' decisions. Subjects were given printed local currency (PGK) coins (two types: 1 Kina coins and 20 Toea coins— 100 Toea equals one Kina) to make their decisions. For both treatments and the control, instructions were read out loud (in Papua New Guinea's most used official language, Tok-Pisin) before starting any games, communications was not allowed between subjects, and questions were addressed individually.

2.6. Market context

Illustrated by a trade game in which subjects were randomly paired and assigned a role (buyer/seller). The roles were the same across rounds but the pairs were randomized in each round. Sellers were endowed with a box they had to sell to their counterpart, while buyers were endowed with money to purchase the box (14 Kina). Both buyer and seller were asked to submit offers (bids) to exchange a box, the range of the bids was from zero to 14 Kina—in increments of 20 Toea (0.2 Kina). Offers to buy and sell were taken to their counterparts where the subject had to make an initial offer first. If the offers were the same, or if the offer to buy was higher than the offer to sell (the ask price determined the actual price), the trade was completed; sellers earned the price agreed and buyers earned 14 Kina minus the price. If the offers were not the same, subjects were asked if they accepted the other person's offer, if they rejected the other person's offer but wanted to submit a counter offer, or if they rejected it and wanted to maintain their previous offer (no counter offer). If both, buyer and seller, rejected their counterparts' offers three consecutive times, no trade was made and both subjects earned zero in that round (this result occurred only once in the experiment). To make their offer, buyers had to make a bid using the printed coins and put them in front of them, while sellers had to take from the printed coins in front of them to indicate their ask. Subjects had no time limit to make their offers.

2.7. Trust context

In the trust game subjects were randomly paired and assigned a role (sender/receiver). The roles were the same across rounds but the pairs were randomized in each round. Both roles were endowed with five Kina each. Senders had to decide how much, if any, of their endowment they wanted to send to the recipient, then the money sent was tripled before it was delivered to the recipient. After receiving the money from the senders, receivers had to decide how much, if any, of their money (including their initial endowment) they wanted to send back to the sender. Receivers were allowed to use their initial endowment to allow comparison with previous studies. Receivers were in no obligation to send money back. To make their decisions subjects had to use the printed coins and put them in front of them. Inspired by the findings by [Henrich et al. \(2001\)](#) that hyper-fair (> 50% of the sender's endowment) offers were rejected in the ultimatum game likely due to a desire to avoid potential reciprocal obligations in the future, we conducted a supplemental analysis to examine whether analogous behavior was observed in our trust game. Specifically, we hypothesized that if this were the case in our study, we would find: 1) very few instances of receivers not sending money back, and that 2) giving > 50% back to the sender would be more common when initial offers were hyper-fair as a means of diffusing potential future obligations. Although, receivers sending money back to the initial sender is often referred to as reciprocity ([Berg et al., 1995](#); [Cárdenas et al., 2009](#)), this term could be inaccurate if the motivations behind doing so are not solely reciprocity (e.g. self-image, social pressure, generosity). Thus, we refer to the action of sending money back to the initial sender as 'trustworthiness' since it indicates that the trust (from the initial sender) was worth it.

2.8. Public goods game

The public goods game consisted of groups of three subjects

(randomly selected) that received the same endowment (6 Kina) and had to decide how much of their endowment they wanted to contribute to a group fund. Contributions were added, doubled, and divided equally among the members of a group (marginal per capita return: 0.66). As in a standard public good game ([Ledyard, 1994](#)), higher contributions resulted in higher individual income if the other members did the same, but by withholding contributions a subject could reach even higher income if the other members of the group contributed to the fund. This game creates incentives for cooperation and free riding depending on the expectations subject have on other members' contributions. All decisions were simultaneous and independent. To make their contribution, subjects placed the amount they wanted to contribute in front of them using the printed coins. Subjects knew their earning from the previous game before they had to make their contribution decision.

2.9. Roles

Since the market and trust context have in themselves particular roles (e.g. buyer and seller, or sender and receiver, respectively) that could be associated to different context in people's minds and influence contributions in various ways, we treat role as a covariate in our analysis. This is possible since subjects maintain their role for the entirety of the study after they are randomly assigned. Using roles for our analysis allow us to understand if contributions to public goods suffer from spillovers from previous games that are particular to the roles in the different contexts. The roles were fixed in the treatments to reduce complexity, and confusion.

2.10. Analysis

The decisions in the trade game (bids, asks, prices), trust game (money sent, money sent back), and public good game (contributions) are examined using descriptive statistics as well as non-parametric tests (Mann-Whitney-Wilcoxon) and Fisher's exact test when appropriate. For the public goods game we also used Cohen's D to examine the magnitude of differences in contributions between the different roles (buyer, seller, sender, receiver, and control) and gender. Further, to understand the influence a context might have on contributions to public goods we developed two statistical models using least squared linear regressions. The first model attempted to explain contributions to public goods based on 1) context; 2) earnings in the first game; 3) age, and 4) gender of the subject. The second model replaced context with roles (the other variables remained the same). There were no problems of heteroscedasticity or multicollinearity in the models. To check for robustness, we also considered models with average earnings in the first game (instead of actual earnings), different interactions between the variables, as well as specifications with truncation (Tobit model). The different specifications did not provide different qualitative results and the marginal change in fitness (or significance) did not justify the added complexity (only the least squared models will be presented, other models can be found in the Appendix and Supplemental Material sections).

3. Results

Total average earning across treatments was 15.8 PGK for the control, 15.6 PGK for the market treatment, and 15.9 PGK for the trust treatment ([Table 1](#)).² The average age of the participants in the control was 35 years old, 29 years old in the market treatment, and 32 years old in the trust treatment. 54% of the participants were self-identified female in the control, 42% in the market treatment, and 54% in the trust treatment.

² The minimum wage in rural fishing communities in Papua New Guinea (like Ahus Island) is approximately 15 PGK a day (1 USD = 3.37 PGK).

Table 1
Summary of variables and earnings.

			N	Mean	SD
Earnings First Game	<i>Earning from the First Game</i>	Buyers*	24	7.8	3.0
		Sellers*	24	5.6	2.8
		Receivers	24	8.3	4.4
		Senders	24	6.4	3.2
		Control	54	7.0	0.0
Contribution to Public Good	<i>Contributions made to the group fund</i>	Buyers	24	2.5	1.4
		Sellers	24	3.2	1.4
		Receivers	24	2.0	1.7
		Senders	24	3.1	1.6
		Control	54	2.8	1.7
Age	<i>Age of the subject</i>	All	150	32	12
Gender	<i>Gender of the subject</i>	Female	75	-	-
		Male	75	-	-
Total Earnings	<i>Total payoffs in the experiment</i>	Buyers	24	17.0	3.4
		Sellers	24	14.2	3.4
		Receivers	24	17.2	5.2
		Senders	24	14.5	3.8
		Control	54	15.8	1.7

Note: Mean and standard deviations (SD) are expressed in Kina (1 USD ≈ 3.37 PGK). *One pair did not reach a price agreement and earn zero in one round making average earnings in the trade game less than the equal distribution (7 PGK).

3.1. Market game

Prices in the trade game were on average 20% lower than the expected equilibrium price assuming equal bargaining power (7 PGK) resulting in earning being 11% higher than the equal distribution for buyers (the trade price was equal to the seller's offer if the buyer's offers was lower than the seller's offer). The overall equilibrium price (5.8 PGK) in the trade game is below the expected equal distribution (7 PGK) under equal bargaining power and tends to stay under it throughout the rounds (Fig. 1). Equilibrium prices over rounds presented minimum changes, consistent with randomized pairing. Most trades (88%) were concluded by the second offer and the initial offer was, in average, 7.2 PGK for sellers and 5.4 PGK for buyers. Initial offers from buyers (bids) and sellers (asks) were close to the equal distribution throughout the rounds, 50% of initial offers were ± 30% of theoretical equal distribution price, while 60% of offers were 7 ± 1 PGK by the second bid (Fig. 1 and Appendix 1).

3.2. Trust game

Trust (money sent by senders) and the money sent back from

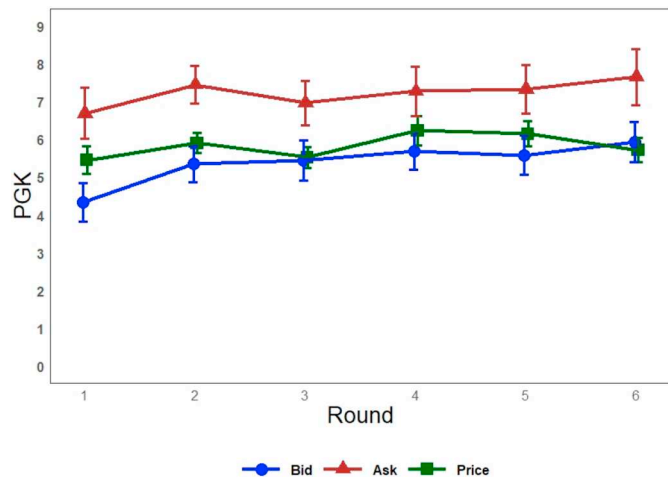


Fig. 1. Average initial Bid, initial ask, and trade price per round. Vertical lines indicate standard errors. PGK = Papua New Guinea Kina.

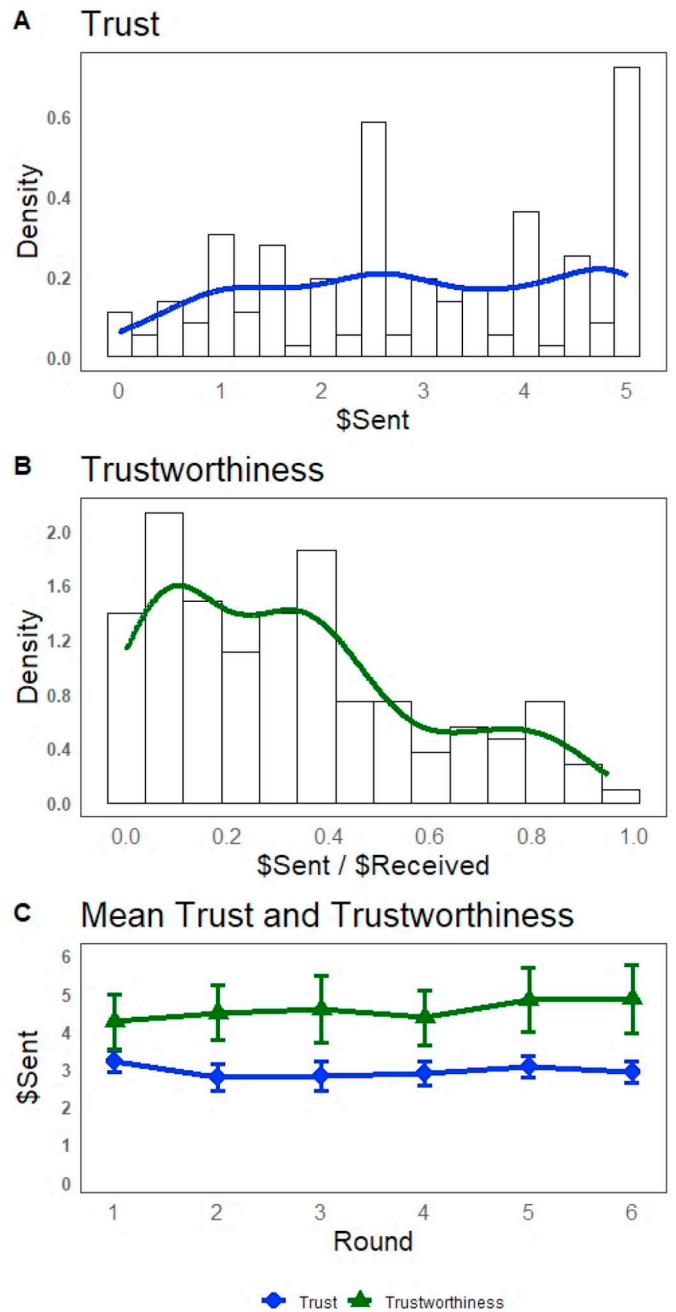


Fig. 2. A. Frequency and density line of money (PGK) sent by senders (Trust). B. Frequency and density line of the ratio of money (PGK) sent back by receivers (Trustworthiness) over money received. C. Mean trust and trustworthiness by rounds, vertical lines indicate standard errors.

receivers (trustworthiness, as defined in the methodology) stayed relatively constant, on average, throughout the rounds (Fig. 2C). Senders initiated trust relationships (sent positive amounts) 97% of the time and sent on average 58% of their endowment (Fig. 2A-C and Appendix 1). Fig. 3 illustrates the relationship between senders and receivers decisions. Of the instances in which subjects received money, 92% of them sent money back, while in two occasions receivers who were sent nothing sent money back from their endowment (Fig. 3). The average amount sent back was 53% of the money received (Fig. 2B-2C and Appendix 1). In 34% of the instances, receivers sent back less than the original amount sent to them (before it was multiplied), while in ~49% of cases the money sent back was 50% or more (equal split) of the money received; in 22% of instances receivers sent back 100% or more

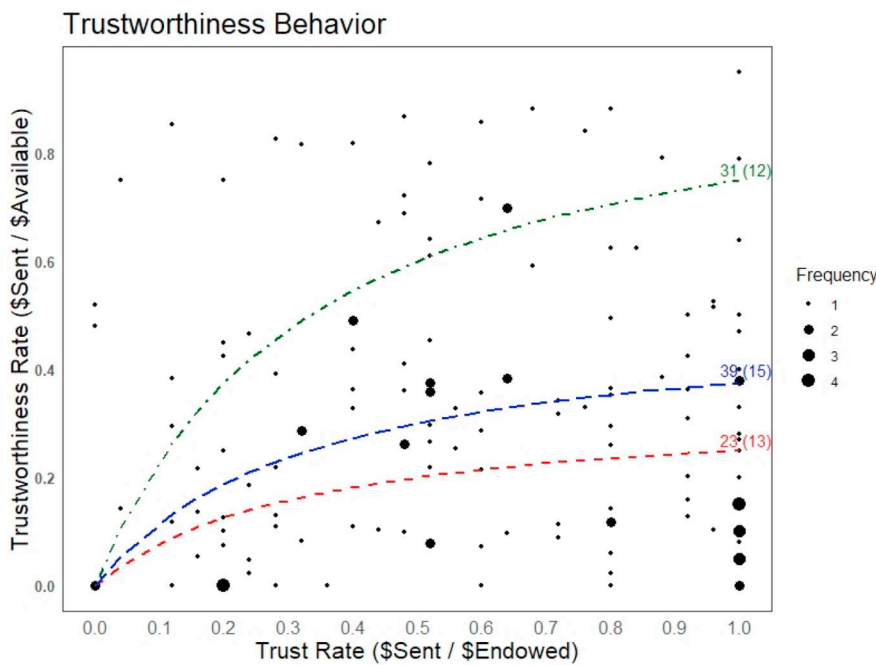


Fig. 3. Relationship between rates of trust and trustworthiness. The dashed line (red) indicate the threshold for recipients that returned the money originally sent to them (before being multiplied). The long dashed line (blue) indicates recipient that returned half (50%) of the money received (after being multiplied). The dot-dashed line (green) indicates recipients that returned all (100%) of the money received (after being multiplied). The numbers above the curves represent the observations equal or greater than the curve (not including the two observations at the origin), the number of individuals exhibiting the behavior are in parenthesis. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

(using their endowment) of the money received (Fig. 3). Assuming two levels for the money sent back (high $\geq 50\%$ of the money received, low $< 50\%$ of the money received) and trust (high $\geq 50\%$ of the endowment, low $< 50\%$ of the endowment), the level of money sent back was independent of the level of trust (p -value 0.39 using Fisher's exact test). Independence can be rejected when comparing the proportion of instances in which subjects sent back $> 100\%$ of the money received (p -value 0.02 using Fisher's exact test), with a higher proportion occurring with low levels of trust.

3.3. Public goods game

Contributions in the public good game were, on average, 2.8 PGK for the control, 2.9 PGK for the market treatment, and 2.5 PGK for the trust treatment, with contributions in the market and trust treatments not being statistically different to the control (p -value 0.87 and 0.27 respectively using Mann-Whitney-Wilcoxon test). Looking closer at the treatments we find within treatment differences in contributions to the public good. Relative to control group contributions to the public good game, sellers and senders contributed more (14% and 11% respectively), while buyer and receivers contributed less (11% and 29% respectively) (Table 1, Fig. 4). Effect size tests (Cohen's D) within treatments shows medium differences (Cohen's D = 0.51, and 0.66) between roles (Table 2). Although, these within treatment differences seem to cancel out, such that the average public good contribution per treatment is indistinguishable from the control.

The least square models (Appendix 2) confirm our previous results while allowing us to control for the effect of the other potential relationships such as the initial payment effect (money received in the first game), age, and gender. Model selection criteria (AIC) favours the model using roles instead of context, revealing that both the receiver role and gender to be related to public goods contributions (Fig. 5, $n = 150, p = 0.016$). Earnings in the first game (initial payment effect) and age do not seem to be related to contributions while gender has a statistically significant relationship—males contributed $\sim 20\%$ less to the public good when compared to females in the control. The average contribution for a 32 years old female that earned 7 PGK in the first game is $\sim 52\%$ (3.1 PGK) of her endowment.

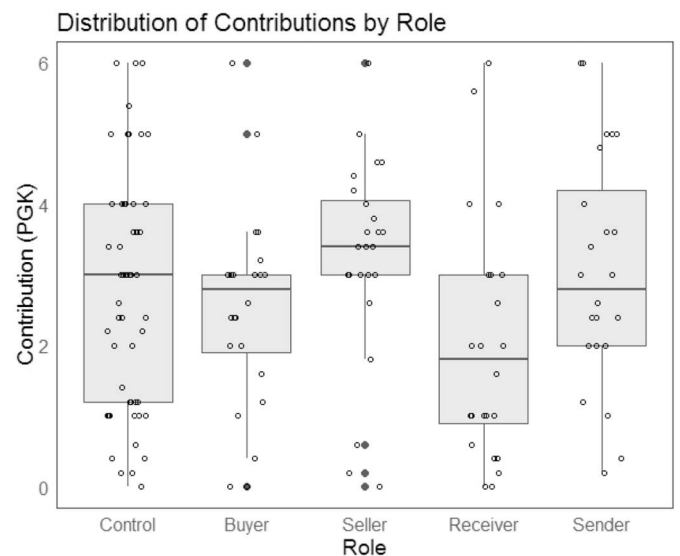


Fig. 4. Distribution of contributions by roles. Hollow circles represent data points (dispersion added for visual purpose).

Table 2

Effect size of contributions to public good by groups.

Comparison	Cohen's D	Classification*
Control - Buyer	0.20	Small
Control - Seller	-0.25	Small
Control - Sender	-0.13	Negligible
Control - Receiver	0.51	Medium
Buyer - Seller	-0.51	Medium
Buyer - Sender	-0.36	Small
Buyer - Receiver	0.35	Small
Seller - Sender	0.12	Negligible
Seller - Receiver	0.81	Large
Sender - Receiver	0.66	Medium
Female - Male	0.34	Small

* Classification suggested in Cohen, J. (1988) Statistical power analysis for the behavioral sciences (2nd ed.) Academic Press, New York.

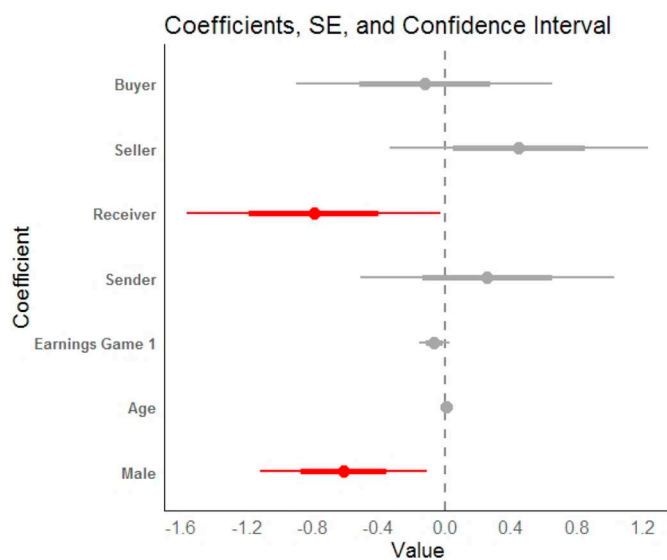


Fig. 5. Coefficient plot of how contributions to public goods games are related to role in previous game (buyer, seller, receiver, sender), gender, age, and earnings in the previous game. Estimates are relative to the control group, where no previous game was played. Thick lines represent stand errors (SE) while thin lines are 95% confidence intervals. Red indicated that the 95% confidence intervals do not cross zero. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

4. Discussion

Before addressing the relationship that different roles might have with contributions, it is important to understand if the behavior found in the trade, trust, and public goods games conforms to previous findings or not. We found that our trade game equilibrium price was continually below the expected distribution under equal bargaining power, and tended to stay under it throughout the rounds, this could be explained by an anchoring effect (Tversky and Kahneman, 1974) from low bids which allowed bargaining to move the equilibrium price below the equal distribution (Galinsky et al., 2009). Another explanation for sub-equal equilibrium could be that buyers held more bargaining power than sellers in the game, this could perhaps be explained by players' own market experience primarily selling fish to the mainland (Cinner et al., 2005; Lau et al., 2019), or by a perception that buyers would reject higher prices. The level of bargaining (number of offers) during the trade game was low. Instead of starting at opposite ends and moving towards an equilibrium price after multiple counteroffers (Smith, 1982), we saw subjects making initial offers close to the expected equilibrium price under equal bargaining power and being willing to accept them often (Hoffman et al., 1994), this suggests a perceived diminishing value in the bargaining process or perceived asymmetries in bargaining power.

The level of trust (58% of endowment sent) and money sent back (52% of the money received by receivers) found in the trust game are consistent with average findings reported in a meta-analysis of experimental studies using trust games (Johnson and Mislin, 2011). Although according to Johnson and Mislin (2011), trust and the money returned (sent back by receivers) should be lower than average when participants are not students, receivers have an endowment, and random payments are used (our settings). When compared to studies conducted in the field, trust and trustworthiness (money sent back) in our study also seem high. For example, participants in our study trusted almost twice as much (proportionally) as the Maasai communities in Kenya (Cronk, 2007), and trusted (~15%) and sent back (~8%) more than participants from Latin-American countries (Cárdenas et al., 2009)—although payment was not random in the first study and

interaction was not anonymous in the second. In addition, our trust game allowed us to build on previous applications of the ultimatum game in Papua New Guinea (Henrich et al., 2001; Tracer, 2003) by providing an opportunity for receivers to send money back to the senders. Henrich et al. (2001) suggested that hyper-fair offers (> 50% of the sender's endowment) were rejected in the ultimatum game likely due to a desire to avoid potential reciprocal obligations in the future. If reciprocal obligations were in fact the reason, we would rarely find receivers sending nothing back if they were trusted, while returning > 50% to the sender should be common when initial offers were hyper-fair (as a means of diffusing potential future obligations). Instead, we found the opposite, multiple instances of receivers sending nothing back (or sending less than what it was originally sent), and receivers returning > 50% of what they received being independent of hyper-fairness.

In public goods, the level of cooperation (contributions to the public good) ranges from the social optimal full contribution (Pareto-efficient) to the free-riding zero contribution, with most experimental evidence pointing to cooperation in a range between 40% and 60% of available endowment (Ledyard, 1994; Chaudhuri, 2011), but this tends to decrease during repeated rounds of play (Fehr and Schmidt, 1999). Cooperation found in our study is at the lower end of the expected range (46% overall), despite using a small group size and a large expected benefit from a unit contribution (for each unit contributed a person received 66% of it)—both settings often associated with higher cooperation (Gunthorsdottir et al., 2007; Ledyard, 1994). The relative low contributions might be associated to differences between lab experiments in college campuses and the field, in particular rural low-income areas where people are more reliant on daily earnings. Also, cooperation could be reflecting the context in which the experiment was carried out. At Ahus Island, fishery resources were historically managed through customary practices such as fishing restrictions and protected areas, which had demonstrable benefits to fish stocks (Cinner et al., 2005). However, over the last 16 years, these collective action systems have broken down (Lau et al. 2018), and fish stocks in Ahus were the most depleted in a global assessment of coral reef fisheries (MacNeil et al. 2015). Thus, the breakdown in real cooperation regarding actual fisheries management may be reflected in the game.

As the results from the trade, trust, and public good game are within the range of previous findings we can now look at the behavioral spillovers from trust and trade games on cooperation in a public goods game. Previous research has examined how markets might affect behavior in economic games by comparing game outcomes along a gradient of market integration (Henrich et al. 2011). For example, previous research in Papua New Guinea has found that more market integrated communities contributed less to an ultimatum game (Tracer, 2003). Our investigation attempted to build on this work by examining whether a market or a trust context might spillover into cooperative behavior. Regarding an overall 'context effect' or framing, we did not find an unambiguous relationship with trade or trust, perhaps suggesting that, unlike the area of markets and externalities (Falk and Szech, 2013; Bartling et al., 2015b), context influence in public goods might be more nuanced. A specific nuance is that, although general context was not related to public goods contributions, individual roles were, suggesting the existence of spillovers from specific rather than more general contexts into public good contributions. In particular, roles within treatments seemed to have opposite effects (e.g., contributions by senders were high and by receivers low), and the role 'receiver' was significantly lower than the control group. Since the roles within the context had an opposite relationships with cooperation in the public good, the overall relationship with context was ambiguous.

Our findings are in line with previous studies as the evidence of behavioral spillovers is mixed at best. For example regarding cooperation, and using a lab experiment, Cason and Gangadharan (2013) found that sellers successfully coordinated to fund a research project but did not extend that collaboration into lower competition (higher

collusion) in the market, suggesting no spillovers in cooperation. A related study using minimum and median effort coordination games found spillovers only from the medium effort game into the minimum effort game (Cason et al., 2012). Studies testing the influence of market context found that exposure to market games increased preferences' stability in non-market settings (Cherry et al., 2003; Cherry and Shogren, 2007). Also using a market context, other studies found that exposure to trade decreased other regarding behavior when decisions generated externalities (Falk and Szech, 2013; Bartling et al., 2015a); although another study using similar games found no spillover (Kirchler et al., 2015). In the area of pro-environmental behavior the evidence is also mixed, finding in one case that encouraging 'green' purchases increased recycling (Lanzini and Thøgersen, 2014), while in another recycling decreased support for pro-environmental policy (Truelove et al., 2016). Unlike previous studies, our results suggest it is necessary to look within contexts and not only to the overall influence a context might have, as behavior specific to particular roles within a context might be generating spillovers into other behaviors.

Finally, gender was related to contributions to public goods and mediates spillovers from the trade and trust games into cooperation, with male subjects being less cooperative than their female counterparts after participating in trade and trust games. This finding is broadly consistent with Tracer (2003), who found that females in Papua New Guinea proposed larger offers in an ultimatum game than males (though this relationship was not statistically significant), and with Croson and Buchanan (1999) who found that women returned more on average than men in an international comparison of trust games.

Our study is an important first step in examining whether there are behavioral spillovers from different contexts into public goods games, but it is limited in understanding framing in public goods. Future studies should consider an alternative design aimed to understand framing effects, instead for behavioral spillovers, in public goods. Our design has other shortcomings that could be addressed in future studies. First, we only focus on the existence of behavioral spillovers from two particular contexts into contributions to public goods. Second, our study is correlational, not causal and does not identify a mechanism through

which our observed role spillover operates. Third, the control lacks a task preceding the public good games, making the comparison between treatment and control (but not between treatments) less precise. Fourth, alternating roles in the different context could smooth differences between the roles.

5. Conclusions

People's preferences can be context dependent and contributions to public goods are not an exception. Our results do not support an overall unambiguous effect of the market or trust context spilling over into contributions to public goods, since the different roles (seller/buyer, sender/receiver) within a context have opposite effects on contributions. However, we do find that roles within the contexts are important and can generate behavioral spillovers over public goods contributions. As conservation initiatives increase their, direct or indirect, reliance on public goods to achieve their goals, the existence of behavioral spillover into contributions can render conservation programs ineffective (if the spillover decreases contribution) or inefficient (if the spillover increases contribution). The successful implementation of conservation programs that rely on public goods require an understanding of the potential spillovers different contexts (e.g. markets created by market-based mechanisms or trust relied upon by community-based mechanism) and the roles within them (i.e. buyers/sellers, trustors/trustees) can have.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. Tables

Trust Game: Trust and trustworthiness by rounds

	Round	1	2	3	4	5	6	Total
Trust	Mean	3.2	2.8	2.8	2.9	3.1	2.9	2.9
	SD	1.4	1.7	1.9	1.5	1.4	1.5	1.6
Trustworthiness	Mean	4.2	4.5	4.6	4.4	4.8	4.8	4.6
	SD	3.6	3.6	4.4	3.6	4.2	4.4	4.0

Trade Game: Price by rounds

	Round	1	2	3	4	5	6	Total
Price	Mean	5.4	5.9	5.5	6.2	6.1	5.7	5.8
	SD	2.5	1.8	1.9	2.7	2.3	2.2	2.3

Trade Game: Offer Table (Buyers)

Bid	N		1	2	3	4	5	6	Total
1	144	Mean	4.3	5.3	5.4	5.7	5.6	5.9	5.4
		SD	2.5	2.3	2.6	2.4	2.5	2.6	2.5
2	118	Mean	5.2	5.5	5.1	5.9	6.0	5.1	5.4
		SD	2.6	2.5	1.7	3.0	2.3	2.2	2.4
3	18	Mean	5.7	6.3	6.0	4.9	7.6	5.9	6.1
		SD	1.3	0.6	0.5	2.4	-	0.9	1.1

4	7	Mean	4.0	5.0	5.0	8.0	5.7	5.5
		SD	-		1.4	-	1.0	1.2
5	4	Mean	5.0		4.4		6.0	5.1
		SD	-		-		-	-
6	3	Mean	5.4		5.0		7.0	5.8
		SD	-		-		-	-
7	2	Mean	5.6				7.8	6.7
		SD	-				-	-
8	1	Mean					7.8	7.8
		SD					-	-
9	1	Mean					7.8	7.8
		SD					-	-
10	1	Mean					7.8	7.8
		SD					-	-

Trade Game: Offer Table (Sellers)

Ask	N		1	2	3	4	5	6	Total
1	144	Mean	6.7	7.4	7.0	7.3	7.3	7.7	7.2
		SD	3.3	2.4	2.8	3.2	3.1	3.6	3.1
2	78	Mean	7.0	9.6	6.4	6.6	7.3	7.3	7.4
		SD	2.1	14.9	1.6	1.8	2.9	2.9	4.4
3	16	Mean	10.1	6.2	6.4	6.0	9.0	7.8	7.6
		SD	3.0	0.3	0.3	0.0	2.8	3.0	1.6
4	7	Mean	5.6		5.0	5.0	10.6	9.0	7.0
		SD	0.6			-	-	4.2	2.4
5	4	Mean	6.0			5.0	8.0	11.8	7.7
		SD	-			-	-	-	-
6	2	Mean	5.6					10.4	8.0
		SD	-					-	-
7	1	Mean						10.0	10.0
		SD						-	-
8	1	Mean						9.8	9.8
		SD						-	-
9	1	Mean						8.8	8.8
		SD						-	-
10	1	Mean						7.8	7.8
		SD						-	-

Appendix 2. Models

Model using Context

Linear regression for contributions to group fund in the public good game.	
Constant	3.08*** (0.25)
Market Context	0.13 (0.33)
Trust Context	-0.27 (0.32)
Earning first game	-0.1** (0.05)
Age	0.01 (0.01)
Male	-0.58** (0.26)
Observation	150
p-Value	0.053

Note: Earnings in first game and age are centered at the mean. Standard errors in parenthesis.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

Model using Roles

Linear regression for contributions to group fund in public good game.	
Constant	3.09*** (0.25)
Role: Buyer	-0.12 (0.40)
Role: Seller	0.45 (0.40)
Role: Receiver	-0.80** (0.39)
Role: Sender	0.26 (0.39)
Earning first game	-0.06 (0.05)
Age	0.01 (0.01)
Male	-0.61** (0.26)
Observation	150
p-value	0.016

Note: Earnings in first game and age are centered at the mean. Standard errors in parenthesis.

*** Significant at the 1% level.

** Significant at the 5% level.

* Significant at the 10% level.

Appendix 3. Data and supplementary material

Data used in this article are openly available on James Cook University's Tropical Research Hub [<https://doi.org/10.25903/5e8548786bbf4>]. Supplementary material to this article can be found online at <https://doi.org/10.1016/j.ecolecon.2020.106661>.

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