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The diffusion of mobile money

Evidence from a lab experiment in the field

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The diffusion of mobile money: Evidence from a lab experiment in the field

Project Report for the International Growth Centre

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This report summarizes the initial findings and policy implications of a lab experiment in the field where it is examined how we can measure individuals' willingness to share valuable information with strangers in an accurate manner, and how they price this information sharing. We also examine how this measurement depends on whether the characteristics of strangers are known or not. The initial results from this experiment point towards there being more valuable exchanges among anonymous individuals, and to game participants negatively responding to increases in the cost of transmitting information. These are relevant lessons for policymakers wanting to use SMS technology for cost-effective development interventions in general, and specifically to reap the development benefits of increased adoption of new technologies such as mobile money, particularly in areas that are more isolated and deprived – and could potentially benefit the most with large adoption of these services.

1. Introduction

Until recently, most empirical evidence from developing countries suggested that assistance and favors are primarily exchanged within small, geographically-defined communities (Udry 1994, Fafchamps and Gubert 2007, de Weerdt and Fafchamps, 2010). In recent years, however, the new widespread availability of mobile phones (together with mobile money and mobile data services) brought the opportunity of potentially enlarging networks to large geographic distances. For instance, Mbiti and Weil (2013), and Jack and Suri (2014) document the mobile money revolution in Kenya, whereas Batista and Vicente (2016) present experimental results of the randomized introduction of mobile money in Mozambique. All of these works present evidence that mobile money contributed to consumption smoothing of rural households, achieved mainly through transfers from their network based in rural areas.

The spread of mobile phone coverage over the past decade has significantly reduced the costs of obtaining information, thereby enabling consumers, traders, and producers to send and receive information more quickly and cheaply (Aker and Mbiti, 2010). A related and growing body of research is concerned with understanding the economic impact of information disseminated through mobile phones and other information technologies in developing economies. Work in this area examines impacts on agricultural markets (Muto and Yamano 2009, Svensson and Yanagizawa 2009, Aker 2010, Goyal 2010, Aker and Fafchamps 2011, Fafchamps and Minten 2012), fishing markets (Jensen, 2007), electoral participation (Aker, Collier and Vicente, 2016) or migrant remittances (Batista and Narciso, 2016).

A different strand of the economics literature focuses on the determinants of giving behavior. Starting with the seminal Becker's (1974) model of altruistic transfers within the household, the more recently literature has used experimental methods to examine motivations behind giving. Studies have explored the existence and nature of altruistic motives for giving, such as Andreoni and Vesterlund (2001), Andreoni and Miller (2002), Camerer and Fehr (2004), and DellaVigna et al (2012). Other work, such as Leider et al (2009) and Ligon and Schechter (2010), has highlighted that transfers may

reflect selfish or "exchange" motives – desires on the part of givers to reward recipients for past behavior or to influence future behavior – in addition to altruism. More recently, Batista, Silverman and Yang (2015) have found, for the case of Mozambique, that giving behavior seems to be strongly affected by a paternalistic desire to control gift usage by recipients.

Our experimental work can be placed at the intersection of these strands of the economics literature: we aim at using the opportunity provided by the wide availability and usage of mobile phones in Mozambique to conduct a lab-in-the-field experiment examining the determinants of sharing valuable information in randomly formed networks – similarly to Centola (2010), but most originally in the economics literature where the endogenous formation of networks has typically complicated econometric identification of causal effects of behavior in the context of social networks.

By documenting the determinants of valuable information exchanges among exogenously formed social networks users of mobile phones, we hope to be able to inform policymakers wanting to use SMS technology for cost-effective development interventions in general, and specifically to reap the development benefits of increased adoption of new technologies such as mobile money. As documented in the literature on the economic impact of providing information in developing countries, this type of interventions can be expected to be particularly effective and strongly inductive of change, particularly in rural areas that are more isolated and deprived.

2. Experimental design

The actions of players in the experiment take place within rounds in a game. In the following description of the experimental design the rounds will be discussed first, followed by the six treatments and then a description of assignment of treatments into games on squares. Subjects play on squares. The concept of squares will also be defined in this experimental design description.

1.1. Base game

Each game is divided into rounds. There are two types of rounds: one seeding round; and

several transfer rounds.

There are two treatments of the base game: anonymous; and informed. In the fully anonymous treatment, no information is provided regarding the identity or type of the other players. In the informed treatment, information is provided about a vector of characteristics z (e.g., gender, clan). The timeline for the experiment is as follows:

Seeding round:

1. At the beginning of round $t = 1$, a message m_{it} is transmitted to a randomly selected player i. In this message, i is told that by forwarding the SMS to a specific phone number, he/she will receive an amount τ_{it} in his/her mobile money account. This phone number is our switchboard.

2. Having received the message, player i either sends it to our switchboard or not, i.e., takes action $a_{it} = \{1, 0\}$. The value of τ_{it}, which may vary over time and individuals, is set so that forwarding the SMS is always profitable, i.e., it is larger than the cost of sending an SMS. It is a one-time unconditional transfer.

3. The message also specifies that player i may forward the message to several unidentified individuals j within a 24 hour time window. In the informed version of the game, i is told the characteristics z_j of each individual j. If the message is forwarded to j, that individual receives the same message as i, and is thus able to receive the same treasure. This does not subtract from the treasure received by i. The only cost to i is the cost of forwarding an SMS.

In practice this SMS goes to our switchboard, which then forwards the message to the selected individual j. Player i does not know the actual identity of j. Player i may send the message whether or not he/she has taken the treasure, and the decision to forward is distinct for each recipient j. We denote the action of player i to transfer the message to recipient j in round t as $d_{ijt} = \{1; 0\}$.

Transfer rounds:

1. At the beginning of round $t = 2$, player j may receive a message m_{jt} from player i. In this message, j is told that by forwarding the SMS to our switchboard phone number, he/she will receive an amount τ_{jt+1} in his/her mobile money account. Player j is also told that the message originates from an anonymous individual i (anonymous version) or an individual with characteristics z_i (informed version).

2. Having received the message, player j either secures the treasure or not, i.e., takes action $a_{jt+1} = \{1; 0\}$. The value of τ_{jt+1} is the same as τ_{it}.

3. The message also specifies that j may choose to forward the message to several individuals k within a 24 hour time window. In the informed version of the game, j is told the characteristics z_k of each k individual. If the message is forwarded to k, that individual receives the same message as j, and is able to receive the same treasure. All else is the same as in a seeding round.

1.2. Squares

We form groups of 16 individuals $S_{t\,c}$ arranged in a square as follows:

$t = 1$	S_{11}	S_{12}	S_{13}	S_{14}
$t = 2$	S_{21}	S_{22}	S_{23}	S_{24}
$t = 3$	S_{31}	S_{32}	S_{33}	S_{34}
$t = 4$	S_{41}	S_{42}	S_{43}	S_{44}

Each square is assigned to a specific treatment over a four-day period – an additional explanation about the treatments will be provided below.

On the first day $t = 1$ we send treatment messages to all subjects in the first row. Day 1 is the seeding round and these are the 'seeded' individuals. Subjects in row $t = 1$ can pass the message to each of the individuals in row $t = 2$. They have one day (24 hours) to do so from the moment they

receive the original message. This is to ensure that people who work, have a flat mobile phone, etc, get a chance to participate – guaranteeing in this way that this type of selection mechanism does not affect the players' responses . After those 24 hours, they can still pass on the message (we cannot stop an incoming SMS to our switchboard), but we no longer transmit it to the next row. Individuals in row t = 2 who receive the message can, in turn, pass it to those in row t = 3. And individuals in row t = 3 can, in turn, pass it to those in row t = 4. After four rounds, the game stops.

Since we did not know beforehand what proportion of subjects would pass the message about the treasure to the next row, we started with all four subjects being able to send the message to all four subjects on the next row. In other words, each S_{1c} (where c = 1, 2, 3, or 4) could send it to all or none of S_{21}, S_{22}, S_{23} and S_{24}. And so on for the other rows.

1.3. Treatments

There are two groups of three treatments, so six treatment games in total, which may be summarized as follows.

Treatment 1 – *'Share or Hide'*. In this treatment, i is given the choice to either transmit the original message m_{it} or send nothing. Subject i must pay a cost w_{ijt} for transmitting the information to j, with $0 \leq w_{ijt} \leq \tau_{it}$. The base treatment explained in the above experimental design description is when $w_{ijt} = 0$. We vary w_{ijt} across different j within the same subject i. By varying w_{ijt}, we are able to examine how much people are willing to pay for sending information. This is a measure of effort in sharing valuable information with others.

Treatment 2 – *'Truth or Lie'*. In this treatment, i is given the choice to either transmit the original message m_{it} or transmit a falsified message that looks very much like m_{it} but has the wrong secret code. Subject i must pay a price w_{it} for transmitting the correct information, with $0 \leq w_{ijt} \leq \tau_{it}$. Let $d_{ijt} = 1$ if i sends the correct message to j and -1 otherwise. If j receives the incorrect message, he/she will not receive the treasure and will not be able to share the treasure with others as well.

Treatment 3 – *'Lie or Shut Up'*. In this treatment, i is given three choices: either transmit the original message m_{it} and pay price w_{it} as in treatment 2; transmit a falsified message that looks very much like m_{it} but has the wrong secret code; or not transmit any message. Let $d_{ijt} = 1$ if i sends the correct message to j, -1 sends the wrong message, and 0 otherwise. If j receives the incorrect message, he/she will not receive the treasure and will not be able to share the treasure with others as well.

Treatment 4 – *'Grab the Loot'*. The sender of information can stipulate a portion $p_{ijt} \leq \tau_{jt}$ that is deducted from j's treasure when i sends the message to j. Player j cannot refuse the message. This is basically a dictator game over the value of the information.

Treatment 5 – *'Price for Information'*. The sender of information can stipulate a price $p_{ijt} \leq \tau_{jt}$ that j must pay to i in order to receive the message about the treasure. If j refuses to pay, j does not receive the message and i does not receive the payment. This is basically an ultimatum game, couched in an information sharing frame. It also mimics a market for information in which the seller sets a take-it-or-leave-it price.

Treatment 6 – *'Pay What You Want'*. The recipient of information can stipulate a price $p_{jit} \leq \tau_{jt}$ that j returns to i in order to receive the message about the treasure. We use this notation to facilitate analysis later: p_{ijt} is, by construction, the part of the value of the treasure that accrues to i, the rest going to j. Player j can decide to return nothing. This is basically a reverse dictator game, couched in an information sharing frame. It also mimics a 'pay what you want' market model as practiced by certain websites.

Treatments 4-5-6 are all aimed at measuring how to price information. We implement them on the same subjects, so we can achieve identification within subjects. Similarly, treatments 1-2-3 are all about how willing people are to share valuable information with strangers in an accurate manner, and how much they are willing to pay for this, and how much they are willing to falsify the information they transmit. For this reason, we also implement these treatments on the same subjects.

1.4. Sequencing of games

Each square plays four games. The first game is the base game 0 described in the Rounds Section above. The other three games are either the information treatments 1-2-3 or the price treatments 4-5-6.

We have 12 squares that are randomly divided into two groups of six: those playing games 1-2-3 and those playing games 4-5-6. Each group of six is further divided into two groups of three: the first three always play anonymous games; the second group of three always plays informed games.

Finally, within each group of three squares, the order of the games is varied systematically as follows:

	A			B			C		
price treatments	4	5	6	6	4	5	5	6	4
information treatments	1	2	3	3	1	2	2	3	1

To summarize, the assignment structure of games to squares is as follows:

	Game 1	Game 2	Game 3	Game 4
Square *a*	*0A*	*1A*	*2A*	*3A*
Square *b*	*0I*	*1I*	*2I*	*3I*
Square *c*	*0A*	*3A*	*1A*	*2A*
Square *d*	*0I*	*3I*	*1I*	*2I*
Square *e*	*0A*	*2A*	*3A*	*1A*
Square *f*	*0I*	*2I*	*3I*	*1I*
Square *g*	*0A*	*4A*	*5A*	*6A*
Square *h*	*0I*	*4I*	*5I*	*6I*
Square *k*	*0A*	*6A*	*4A*	*5A*
Square *m*	*0I*	*6I*	*4I*	*5I*
Square *n*	*0A*	*5A*	*6A*	*4A*
Square *p*	*0I*	*5I*	*6I*	*4I*

3. Preliminary Results

Participants in the Mozambique Treasure Hunt Experiment were selected from the treatment group of the randomized control trial conducted by Batista and Vicente (2015). This study examined the impact of randomly introducing mobile money for the first time in a representative sample of rural areas of the Southern provinces of Mozambique where mobile money services could be launched. The intervention and baseline survey took place in 2012, and were followed by additional surveys in 2013 and 2014.

All participants in the Mozambique Treasure Hunt Experiment were registered users of the mobile money service mKesh, following the intervention studied by Batista and Vicente (2015), and agreed to participate in this experiment. Information about the characteristics of the players in the experiment is available from Batista and Vicente (2015)'s baseline and endline surveys.

The experiment was conducted within a sample of 192 individuals. The participants were randomly selected among *mKesh* service users in Gaza (61%), Inhambane (23%) and Maputo Province (14%). The participants were compensated in the experiment through mobile money transfers directly to players' *mKesh* accounts. Our sample had 59% females, with ages between 17 and 79 years old. The average age of the participants was 40 years old. On average, the participants had 6 years of schooling - only 12 participants had not completed any schooling. Prior to starting the experiment, our team tested and confirmed that all the participants were able to respond to SMS messages. About half of the individuals in our sample had a monthly income between 0 and 660 Mozambican Meticais (MZN). The demographic characteristics of the participants are summarized in Table 1 below.

Table 1. Sample summary statistics.

	Obs	Mean	Std. Dev.	Min	Max
Gender	192	1.59	.49339	1	2
Education	191	6.48	3.4302	0	14
Income	183	2.41	1.6744	1	7
Age	189	39.97	13.7908	17	79

As described in the previous section, each experimental subject played four games in the experiment. Each game had four rounds. In each round of a game, the participants received proposals to send or receive treasures to or from up to 4 people. At the beginning of each new round a message was

sent to all participants notifying them about the messages they would receive and cost of responding to a SMS message during the game. This introductory message did not contain information pertaining to any of the treatments. The objective of the introductory message was to prevent lack of participation due to confusion regarding the participation cost and for easy identification of messages sent for this experiment.

Table 2 summarizes the results of game 1. Forty-eight individuals (the four individuals in the first row of each square) were selected to participate in the first round of game 1. Out of these 48 players, 24 participants had the informed version of the game. Information provided to the participants included the name, age, education and monthly income of the individuals who would receive the treasure. The other 24 participants had the anonymous version.

Seeding was done by offering all the participants the opportunity to receive a treasure of 35 meticais (MZN) in their mobile money accounts. The participants had to respond by sending an SMS message to our switchboard accepting this treasure. A total of 13 participants accepted the bonus.

Table 2. Game 1- Main Participant Responses

	Round 1		Round 2		Round 3		Round 4	
	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous
Participants Offered Treasure	24	24	16	16	12	11	10	6
Participants Who Accepted Treasure	5	8	2	9	2	4	3	3
Shared Treasures	20	29	12	14	11	9	-	-

After seeding, the participants were given the possibility of sharing the possibility of earning a treasure of 35 MZN (to be received in mKesh, mobile money value) to up to 4 other people. There was no cost associated with this transmission other than the cost of sending an SMS (this would be 2MZN or 1 SMS depending on the mobile phone package of the individual). Among valid responses, the mKesh treasure was transmitted in 29 instances by participants with the anonymous version, and in 20 instances by participants with the informed version.

In round 2 of game 1, participants in the second row of each square were notified about the bonuses that were transmitted by the participants of the previous round. The participants received up to 4 notifications, and they had to send a message accepting to receive the bonus that was sent to get it. Certain characteristics of the individuals sending the bonus were revealed to the recipients in 20 instances (informed version). In 29 instances, participants were notified that an unidentified individual had sent them the bonus (anonymous sender). The participants accepted to receive the treasure on 11 occasions, being that in 9 out of these 11 responses the participants agreed to receive the treasure from an anonymous sender.

After transmitting the bonuses from the first round, 32 participants of the second round were offered the possibility of sending a message that would give 4 others the opportunity to earn a 35 MZN bonus. In this round 16 participants were given the informed version and the other 16 participants received the anonymous version. There were 26 SMS responses where the participants agreed to transmit the bonus, 12 in the informed setting and 14 in the anonymous setting .

Round 3 was similar to round 2. The round was completed in two phases. The first phase was the transfer of mobile money bonus shared by participants of the previous round. And the second was sharing or not, of bonuses from participants of the current round to other individuals. There were 4 participants of round 3 playing the anonymous version who accepted the treasures they were offered, while there were 2 participants playing the informed version who accepted the treasures. The second

phase of round 3 had 23 participants who were asked to transmit a bonus to 4 individuals. We received 20 responses where the participants decided to transmit the bonus.

Round 4 of game 1 entailed only the transfer of bonuses from round 3 to those players who accepted to receive them. Of the 20 bonuses transmitted from round 3 to 4, 6 were accepted by participants in round 4 – where 3 of these accepted bonuses were received from an anonymous individual.

Table 3 displays the results of the rounds played in game 2. At the beginning of the first round of game 2 (overall round 5), we gave 32 participants the possibility to win treasures of 35 MZN and 7 participants accepted the offer. At this stage, there were 6 treatments in the game, as explained in the design section, and each treatment was played by a group of 8 individuals. Each variation of the game had an anonymous and an informed version played by 4 participants each within each treatment. As in the previous rounds, treatment 1 gave participants the opportunity to transmit 35 MZN treasures at the cost of sending an SMS. In the second treatment, transmission of the bonus had an associated cost between 0 to 15 MZN. In the third and fourth treatments, the participants could also send a wrong code, or send nothing by not replying to our message, or explicitly refusing to share the treasure. In the fifth treatment, participants were asked to choose the proportion of 35 MZN that they wanted to transmit - the participants who played the fifth treatment kept the money remaining from the 35 MZN that they transmitted. In treatment 6, participants were also asked to transmit a proportion of the 35 MZN treasure, but in this case the recipients had to accept the amount transmitted for the senders to receive their share of 35 MZN.

When participants were simply asked if they wanted to share the treasure with other people, the treasure was transmitted to 11 individuals in the anonymous version of the game and to 2 individuals in the informed version of the game. When we associated the transmission with a cost, two participants agreed to pay from 5 to 15 MZN to share treasures with anonymous individuals on 6 instances. Only one participant chose to transmit the bonus at zero cost in the informed version. From those with two

alternatives, transmitting the bonus or sending a wrong code, 1 person truthfully transmitted the bonus to 4 individuals and 7 sent a wrong code. Among participants who were asked to share a proportion of the 35 MZN treasure, two participants proposed amounts between 0 and 10 MZN.

In overall round 6 (round 2 of game 2), 30 mKesh treasures were transmitted from the previous round and 7 were accepted by the participants of this round. Twenty participants were requested to transmit 35 MZN or a proportion of that amount to 4 other individuals each, totaling 80 possible transmissions of bonuses. The treatments were similar to the ones described in round 5. In round 6, mKesh bonuses were transmitted in 17 messages sent by the participants. Among participants who could propose a proportion of 35 MZN to transmit, participants shared treasures with others that varied between 5 to 10 MZN.

In the transfer of treasures from overall rounds 6 to 7, a wrong code was sent in 10 instances and bonuses shared in 16 instances. In two transfers, the recipients from round 7 were asked if they wanted to reward the senders by transmitting back a proportion of bonus that they could receive. There were two valid responses from the recipients of the transfers. In both valid responses the players accepted the bonuses. One participant accepted 10 MZN from an identified person and the other accepted 35 MZN sent by an anonymous individual. On the second phase of the 7^{th} round, there were 4 versions of the game in which 14 individuals who played were given the opportunity to transmit bonuses. Six participants were asked to share treasures at no cost (2 anonymous and 4 informed), 4 were asked to transmit bonuses at costs varying from 0 to 15 MZN and 4 participants were asked to transmit a proportion of 35 MZN (all informed). One participants who had the costless informed version of the game accepted to transmit the 35 MZN bonus to 1 individual.

Game 2 finished with round 8. During this round, 4 participants received a wrong code, while 2 participants were notified that other individuals wanted to transmit 35 MZN to them. No participants accepted to receive a bonus in this round. The main results of game 2 are shown in Table 3.

Table 3. Game 2 – Main Participant Responses.

	Round 1		Round 2		Round 3		Round 4	
	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous
Shared treasures in treatment 1	2	11	4	2	1	0	-	-
Shared treasures in treatment 2	2	6	0	0	0	0	-	-
Shared treasures in treatment 3	0	0	0	0	0	0	-	-
Shared treasures in treatment 4	0	4	0	6	0	0	-	-
Shared treasures in treatment 5	0	1	0	0	0	0	-	-
Shared treasures in treatment 6	1	0	5	0	0	0	-	-
Received bonuses	-	-	4	3	1	1	0	0

Note: Treatment 1- base game, participants simply asked to transmit the bonus. Treatment 2- participants asked to transmit bonus at varying costs (0 to 15 MZN). Treatment 3- participants asked to transmit bonus, send wrong code or send nothing. Treatment 4- participants asked to transmit bonus or send a wrong code. Treatment 5- dictator, participant can propose the amount to give other individual. Treatment 6- participant can choose amount to give but receiver has to agree so both people receive the bonus.

The main results from game 3 are described in Table 4. Game 3 started in overall round 9. At the beginning of this round, 32 participants were offered 35 MZN and 6 participants accepted the offer. The 6 treatments of the game, already described in round 5, were played in 9. Each treatment was played by 8 participants. Bonus was transmitted in an informed setting on 7 instances, in contrast with 11 instances in the anonymous setting. A bonus of 20 MZN was transmitted twice by a participant in the dictator game.

In round 10, 3 participants accepted to receive the bonus that was transmitted from the participants in round 9. Two of the participants of round 10 who received the bonus from the previous round rewarded the senders by transmitting back 34 and 35 MZN. Round 10 had 14 participants who were asked to transmit up to 35 MZN through various treatments of the game. Among 4 participants who had the basic treatment of the game (3 informed and 1 anonymous), only 1 (anonymous) transmitted the bonus. Among 2 participants who were proposed to choose between transmitting the bonus, sending a wrong code or not send anything, 1 participant transmitted the bonus to 2 individuals.

In round 11, only one participant accepted to receive the bonus from an anonymous sender. In this round, 2 participants were asked to transmit 35 MZN at no cost (basic treatment), while the other 2 participants were also given the option of sending a wrong code or not sending anything. One participant in the informed setting of the game transmitted the bonus.

Game 3 was completed in round 12. In this round, one participant was notified about the possibility of receiving a bonus of 35 MZN. No responses were received in this round. Some of the main results for game 3 are summarized in Table 4.

Table 4. Game 3 – Main Participant Responses.

	Round 1		Round 2		Round 3		Round 4	
	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous
Shared treasures in treatment 1	6	1	0	1	1	0	-	-
Shared treasures in treatment 2	0	2	0	0	0	0	-	-
Shared treasures in treatment 3	0	3	0	2	0	0	-	-
Shared treasures in treatment 4	0	0	0	0	0	0	-	-
Shared treasures in treatment 5	0	2	0	0	0	0	-	-
Shared treasures in treatment 6	1	3	0	0	0	0	-	-
Received bonuses	-	-	0	3	0	1	0	0

Note: Treatment 1- base game, participants simply asked to transmit the bonus. Treatment 2- participants asked to transmit bonus at varying costs (0 to 15 MZN). Treatment 3- participants asked to transmit bonus, send wrong code or send nothing. Treatment 4- participants asked to transmit bonus or send a wrong code. Treatment 5- dictator, participant can propose the amount to give other individual. Treatment 6- participant can choose amount to give but receiver has to agree so both people receive the bonus.

The main results for game 4 are summarized in Table 5. Game 4 took place from rounds 13 to 16. In round 13, 32 participants were seeded with an offer of 35 MZN and 6 accepted the offer. Subsequently, 48 participants, divided according to the treatments of the game they were playing, as described in round 5, received proposals to transmit bonuses. The bonus of 35 MZN was transmitted on 18 instances. The participants who could choose to transmit amounts below 35 MZN, Shared treasures between 0 to 10 MZN.

At the beginning of round 14, 27 participants were notified that someone might have transmitted a bonus to them. Eight of the participants notified, were given the possibility of sending back a proportion of the treasure they received. Sixteen of the notified participants were told that they had to send a message to our switchboard to get access to the treasure, while 3 participants did not have to send any response to receive the treasure. Among the participants notified, a wrong code was transmitted on 26 occasions. Two participants who were offered the treasure responded to our switchboard and received it. So in this round, the bonus transmitted from the previous round was received in 5 occasions in total. Seventeen participants of round 14 were subsequently given the option of transmitting up to 35 MZN. There were 4 treatments of the game in this round: 8 participants were asked to transmit a bonus at cost 0, 4 were proposed to transmit a bonus at varying costs (0 to 15 MZN), 2 had the alternative of sending a wrong code and 3 could send any amount from 0 to 35 MZN. Participants decided to transmit the bonus on 16 occasions. No participant transmitted amounts below 35 MZN.

On round 15, participants there were no valid responses from participants who could potentially receive bonuses transmitted from the previous round. There were 10 participants in the transmission phase of the 15^{th} round. Six participants could transmit the bonus without any costs (2 informed and 4 anonymous), while 4 participants would transmit the bonus at varying costs (all anonymous). There were 5 valid responses. Among the valid responses, the participants agreed to transmit 35 MZN bonus on 3 occasions.

The last round of game 4, round 16, had 3 participants. All the participants received 35 MZN and were given the opportunity to send back a proportion of that amount. No participant returned any amount to the sender. Table 5 summarizes the results of game 4.

Table 5. Game 4 – Main Participant Responses.

	Round 1		Round 2		Round 3		Round 4	
	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous	Informed	Anonymous
Shared treasures in treatment 1	5	7	2	7	0	3	-	-
Shared treasures in treatment 2	2	4	0	7	0	0	-	-
Shared treasures in treatment 3	0	0	0	0	0	0	-	-
Shared treasures in treatment 4	0	0	0	0	0	0	-	-
Shared treasures in treatment 5	3	0	0	0	0	0	-	-
Shared treasures in treatment 6	0	0	0	0	0	0	-	-
Received bonuses	-	-	0	5	0	0	0	0

Note: Treatment 1- base game, participants simply asked to transmit the bonus. Treatment 2- participants asked to transmit bonus at varying costs (0 to 15 MZN). Treatment 3- participants asked to transmit bonus, send wrong code or send nothing. Treatment 4- participants asked to transmit bonus or send a wrong code. Treatment 5- dictator, participant can propose the amount to give other individual. Treatment 6- participant can choose amount to give but receiver has to agree so both people receive the bonus.

4. Concluding remarks and policy implications

The wide availability of mobile phones has enabled a number of cost-effective development policy interventions mainly related to the provision of information to be enacted in a variety of different fields – e.g. agricultural training, access to product markets, voter education, or the promotion of health immunizations. We believe that our research conveys important input into the design of these important and potentially far-reaching interventions.

In our work, we found that experimental subjects were more likely to share the possibility of earning treasures in the simplest "share or hide" treatment, where they were faced with a binary choice of transmitting the message or not. In more complex treatments, where there was the possibility of sharing a wrong code instead of the actual possibility of earning a treasure, the simplest treatment also elicited a higher response rate of participants – in this case, this result may be observed in a higher likelihood of a wrong code to be shared by players in the 'truth or lie' treatment than in the 'lie or shut up' treatment. In this sense, it seems that simplifying procedures when using SMS communication may be an effective way of increasing subject engagement.

Our work also suggests that the cost of sharing information affected the willingness of experimental subjects to do so. Among players who had to pay a cost to send the treasure, the treasure was transmitted only once at cost of 15 MZN. All the other transfers were at costs below 15 MZN. An important takeaway from this experiment is therefore that individuals will respond to changes in the cost of transmitting information. The participants were only willing to pay up to a limit to transmit or receive the information, although there was heterogeneity in this threshold across individuals. This result suggests that programs that try to disseminate information via SMS should consider the cost each individual will need to incur to share such information.

One main lesson learned from our analysis so far is that there were more treasure exchanges among anonymous individuals. In all the treatments, the participants were more likely to send or receive treasures sent from anonymous individuals than from identified individuals. One possible explanation

for this finding is that people trust less an individual whom they can picture sending the treasure, but who is not personally known to them, than they trust an anonymous system implicitly linked to the mobile money provider transmitting the message. This is valuable information in the sense that it reveals trust in the mobile money system, which can support important policy interventions using thus system.

As mobile phone networks become increasingly more accessible in rural areas and people become more familiarized with using mobile phones, the use of mobile money services may offer new opportunities to facilitate trade of various goods and services at long distance, as well as money transfers from urban to rural areas – in line with the results by Batista and Vicente (2015) for Mozambique, Mbiti and Weil (2012) and Jack and Suri (2012) for Kenya, or Blumenstock, Eagle and Fafchamps (2016) for Rwanda. Together with this evidence, our findings that interventions using SMS aimed at information dissemination should be simple, inexpensive and sent institutionally, may be useful to design cost-effective development interventions in a variety of sub-Saharan contexts.

Furthermore, we believe that our experimental results may be generalizable to the use of other information technologies, such as internet based exchanges of valuable information using social networks. Even though our experiment makes use of the wide availability and usage of cell phones, SMS technology is comparable to similar messaging instruments using the internet. The popularity of data services using mobile phones is increasingly growing in the African continent, such that it is likely that these services and internet-based social media will soon become as widespread and at least as effective as the use of SMS-based interventions. This is likely to substantially widen the potential reach of our results.

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