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Mobile money and its impact on improving living conditions in Niger

A replication study

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Mobile money and its impact on improving living conditions in Niger: a replication study

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Summary

Around the world, there has been an exponential growth in cash-based programs, especially unconditional cash transfer programs. By 2013, these public policies had been placed in at least 119 countries, including 37 in Africa. This context presents an unprecedented opportunity to increase financial inclusion using a new payment channel that can decrease the operating costs, improve the security and increase the outreach. Replacing cash transfers with other payment mechanisms, such as mobile money, could have additional benefits and advantages for recipients.

A 2016 study by Aker and colleagues, *Payment mechanisms and antipoverty programs: evidence from a mobile money cash transfer experiment in Niger*, suggests that the use of mobile money might change intra-household socio-economic dynamics. Our replication study evaluates the original paper's findings. The pure replication – our independent reproduction of findings – confirms that our results are comparable to the original authors' results.

Our measurement and estimation analysis includes analysis of heterogeneity and a robustness test. The heterogeneity evaluation suggests that the Zap mobile money transfer intervention had a different impact on older beneficiaries than younger ones. The robustness analysis, which considers multiple imputation and Lee bounds analysis, confirms that the original results are robust to the evaluation of these methods. In the theory of change analysis, we describe stunting and wasting status, as well as their severity in children under 5 years using anthropometric measures available in the data set. We are able to find a protective effect, via Zap, for the reduction of wasting in children 25–60 months old.

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Abbreviations and acronyms

CI	Confidence interval
FDR	False discovery rate
m-transfer	Mobile money transfer
OLS	Ordinary least squares
SD	Standard deviation
SE	Standard error

1. Introduction

This report independently assesses the findings in Aker and colleagues (2016) study, *Payment mechanisms and antipoverty programs: evidence from a mobile money cash transfer experiment in Niger*. The study evaluated the impact of three cash transference mechanisms in a low-income country, Niger. The first was cash; this mechanism provided the cash transfer manually, distributed in individual envelopes. The second mechanism, mobile, included a manual cash transfer, a mobile phone with mobile money transfer (m-transfer) enabled, training on how to use it and an account. The third mechanism, Zap, included an m-transfer–enabled, training on how to use it and an account; the transfer was performed via the mobile phone and the beneficiaries had to take the mobile phone to a m-transfer agent to obtain the transfer.

Aker and colleagues (2016) used a randomized controlled trial with a sample size of 96 villages[1] that had been previously classified by the government of Niger as having produced less than 50 percent of their consumption needs during the 2009 harvest. These villages were stratified by administrative division and randomly assigned to the cash, mobile or Zap interventions. Randomization seeks to balance any characteristics of the population who received the treatment – Zap, mobile or cash.

Aker and colleagues (2016) provide evidence that the Zap intervention had a greater impact than cash or mobile. This finding suggests that mobile money could be a simple and low-cost way to deliver cash transfers, once the necessary infrastructure is in place. Zap households bought more types of food items and increased their diet diversity. Furthermore, differences were primarily due to the m-transfer intervention and not to the mobile phone. On the other hand, Zap recipients did not significantly improve their use of mobile money to receive remittances or to save, which are both important for financial inclusion.

According to Klapper and Singer (2014), advancements in technology and electronic platform–based business models have allowed many governments to increase the efficiency and scope of their electronic-payments infrastructure. In this way, governments may benefit from making payments more efficiently by lowering the cost of disbursing and receiving payments. In South Africa, for example, the cost of disbursing social grants in 2011 by smart card was a third of manual cash disbursement (CGAP 2011). Additionally, in recent years, payment products have emerged as one of the most promising tools for financial inclusion, serving as an on-ramp to other formal financial products and services through social benefits or wage payments (Holloway et al. 2017).

However, there are others benefits, such as increased incentives to save and improved women's economic participation and empowerment. In this sense, Aker and colleagues (2016) provide new evidence about the benefits and opportunities of digital payment services such as mobile money.

Using electronic payments as delivery channels for transfers can further improve the efficiency of government social programs. We reassessed the study independently from

[1] According to the National Institute of Statistics of Niger (2014), these 96 communities belong to the Department of Tahoua, capital of Tahoua region, one of the country's seven regions.

the results published by the original authors in order to review and confirm the findings from the original article. The report proceeds as follows: Section 2 describes the findings of pure replication and compares the results with those from the published version. Section 3 discusses the measurement and estimation analysis, which includes a heterogeneous impact evaluation and robustness checks. Section 4 describes the theory of change, specifically on nutrition. Section 5 concludes.

2. The pure replication

In this section, we describe our independent reproduction of findings in order to test consistency in the original published results by Aker and colleagues (2016). We reconstructed the original article using cleaned data, kindly shared by the original authors, which consisted of four data sets.[2] On the one hand, analyzing cleaned data might be an advantage, because it allows for managing the data set used to estimate the published results, thereby avoiding the development of a new cleaning process. On the other hand, the data cleaning depends on research team's decisions, as well as difficulties encountered in the field; therefore, not reviewing this information could be a disadvantage.

To understand the impact of the intervention, we estimated the two regression models found in the original publication:

$$Y_{iv} = \beta_0 + \beta_1 Zap_v + \beta_2 Mobile_v + \beta_3 seed_v + \theta_C + \varepsilon_{iv} \quad (1)$$

$$Y_{iv} = \tau_0 + \tau_1 Zap_v + \tau_2 Cash_v + \tau_3 seed_v + \theta_C + \mu_{iv} \quad (2)$$

Y_{iv} represents the relevant outcomes of individual or household *i* in village *v*. Furthermore, similar to the original regression model, the variables do not have subscripts of time. This is because the outcomes were evaluated comparing treatment arms post-intervention. $Cash_v$ is an indicator for villages assigned to the cash group. Zap_v is an indicator for villages assigned to the Zap group. $Mobile_v$ is an indicator for villages assigned to the mobile group.

The coefficients that captured the impact of the mechanism are β_1, β_2 and τ_1, which are described in our tables. On the other hand, $seed_v$ is an indicator for the presence of a seed distribution program at the village level. Lastly, θ_C is geographic fixed effects at the commune level, which control potential differences at commune level.[3] Finally, ε_{iv} and μ_{iv} are the error terms.

2.1 The data

The files received consist of four data sets. The first data set "zapanthro," includes anthropometric data for 1,223 children. This data set reports weight and height of children included in the original study. The second data set, "zapchilddiet," contains information about the children's diet and the consumption of grains, beans, fats, meats,

[2] See https://sites.tufts.edu/jennyaker/research-2/ for the data sets.

[3] The communes – Affala, Bambeye, Barmou, Kalfou, Takanamat and Tebaram – are representative of the communes of the Department of Tahoua. In Appendix G, we present additional information on Niger's demographics.

condiments, fruit and others for 964 children. The "zapanthro" and "zapchilddiet" data sets were collected at the same time and using the same questionnaires, which were applied in 929 households from 49 villages. However, the number of children included in each data set is different as a consequence of missing data for some of the variables.

The third data set, "zapprices," presents weekly price information for six products (oil, rice and others) in 43 markets between May 2010 and September 2010. The fourth data set, "zaphousehold," is composed of the surveys conducted in May 2010 (baseline), December 2010 (midterm) and May 2011 (final); each period can be identified by the variable *time*. The data set has information for about 1,156 households, arranged in sections of household demographics, food security, agricultural production and sales, mobile phone usage, asset ownership, and shocks. In other words, this data set has proxies of well-being, such as asset accumulation and food security, which are key variables for impact evaluation.

To clearly identify the different treatment arms in the process of analysis, we renamed the different interventions according to the published version of the article: variable *ittmobile* was renamed *ittZap*; variable *ittplacebo* was renamed *ittMobile*; and variable *ittcash* was renamed *ittCash*.

For our replication process, we recognized that interventions were randomly assigned in order to avoid selection biases. After reviewing literature and previous experiences in impact evaluation, we decided that ordinary least squares (OLS) would get a consistent estimate of the program effect (Khandker et al. 2010).

In addition, as part of the original .do file execution, Excel documents were generated with coefficients and standard errors, which facilitated data management. To improve data management, we added means and standard deviations to already presenting coefficients and standard errors in a single data set (.dta).

2.2 Tables

The tables created by our replication study mirror those of the original paper, including mean estimations of each variable for the cash group and regressions to compare this group to the mobile and Zap groups. Additionally, we include the number of observations of each mean estimation and regression with standard deviations and standard errors.

To replicate the tables, we used two regressions for each outcome. The first regression allowed us to reproduce the Zap–cash coefficient, while the second described the Zap–mobile coefficient. The mobile–cash coefficient was estimated by both regressions with a different sign. We included geographic fixed effects at the community level using dummy variables. Following Aker and colleagues (2016), we also controlled for the presence of a seed distribution program. Finally, we clustered the error term at the village level to account for the program design and correct for heteroscedasticity.

To facilitate comparison between the original authors' results and our pure replication findings, we joined the results of the published version with the erratum and the corrigendum in new tables, named "Current Tables" (Appendix A). Differences found between coefficients of current tables and pure replication tables are underlined in the

tables. Our results are very similar to the published findings by the original authors, with no statistically significant differences.

2.2.1 Timeline of the intervention: Table 1

To clearly identify the steps of the study, we recalled the milestones of the evaluation design between January 2010 and May 2011. Table 1 shows the timeline of intervention progress: village selection in January 2010, the baseline survey in May 2010, the intermediate survey in December 2010 and the final survey in May 2011. This table is presented to give a general overview of the original intervention process.

Table 1: Timeline of data collection and implementation

Year	Jan	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	Village selection	Identification and selection of program recipients	Program preparation	Baseline household and village-level survey in 93 villages	Hungry season and planting season monthly cash transfers in 116 villages				Harvest period		Midterm household and village-level survey in 96 treatment villages
					Price data collected in 45 markets in all communes						
2011				Final household and village-level survey in 96 villages; nutrition survey in 30 villages	Hungry season and planting season				Harvest period		

2.2.2 Balance between treatment and comparison groups: tables 2–3

The objective of tables 2 and 3 is to show that the groups cash, mobile and Zap were similar at the baseline survey. Table 2 presents a comparison about socio-demographics, household income sources and assets, mobile phone ownership, experience with previous shocks, such as drought, and other village's covariates. As part of the table, there are 20 variables evaluated to decide whether the three treatment arms were comparable in the baseline evaluation.

In Table 2, we find that the three intervention arms under study have similar characteristics in all variables except *age of respondent*. There is a statistically significant difference between the mean age of group Zap and group mobile – the same finding as the original authors. On the other hand, we find only one minor difference in a standard error of the variable *household experienced crickets in past year;* we calculate 0.04, whereas the Current Tables calculated 0.05. Our Table 2 coefficients are the same as the coefficients published by original authors.

Table 2: Baseline individual and household covariates (by treatment status)

Variable	Observations (Cash)	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Sociodemographic characteristic						
Age of respondent	370	33.22 (11.05)	1099	1.90 (1.21)	–0.90 (1.24)	2.79** (1.24)
Polygamous household	372	0.28 (0.45)	1105	0.04 (0.04)	0.02 (0.04)	0.01 (0.04)
Respondent is member of Hausa ethnic group	372	0.81 (0.39)	1105	–0.05 (0.08)	0.08 (0.06)	–0.13 (0.08)
Number of household members	372	9.31 (4.95)	1105	–0.40 (0.63)	–0.21 (0.52)	–0.18 (0.50)
Number of household members under 15 years	372	5.65 (3.42)	1105	–0.35 (0.38)	–0.11 (0.34)	–0.24 (0.34)
Percentage of household members with some education	372	0.58 (0.32)	1104	–0.01 (0.03)	0.04 (0.03)	–0.04 (0.03)
B. Household income sources and asset						
Agriculture is an income source	372	0.98 (0.15)	1103	–0.01 (0.01)	–0.01 (0.01)	–0.00 (0.01)
Livestock is an income source	372	0.61 (0.49)	1103	0.06 (0.06)	–0.03 (0.06)	0.09* (0.05)
Remittances are an income source	372	0.34 (0.47)	1103	–0.01 (0.04)	–0.05 (0.04)	0.04 (0.04)
Number of asset categories owned (out of 12)	372	3.62 (1.60)	1105	0.07 (0.18)	–0.15 (0.16)	0.22 (0.14)
C. Mobile phone ownership and usage						
Household owns mobile phone	372	0.29 (0.45)	1104	0.04 (0.05)	–0.03 (0.04)	0.06 (0.04)
Respondent has used mobile phone since last harvest	371	0.61 (0.49)	1100	0.06 (0.05)	0.00 (0.05)	0.05 (0.04)
Respondent made or received call since last harvest	371	0.61 (0.49)	1100	0.06 (0.05)	0.00 (0.05)	0.05 (0.04)
Respondent sent or received m-money transfer since last harvest	371	0.00 (0.00)	1100	0.00 (0.00)	0.00 (0.00)	–0.00 (0.00)
D. Shock						
Household experienced drought in past year	372	0.98 (0.15)	1106	–0.00 (0.01)	0.01 (0.01)	–0.01 (0.01)
Household experienced crickets in past year	372	0.81 (0.39)	1106	–0.02 (0.04)	–0.04 (0.05)	0.01 (*0.04*)
E. Village-level covariate						
Market located within the village	31	0.35 (0.49)	93	–0.04 (0.13)	0.01 (0.13)	–0.04 (0.12)
School located within village	31	0.97 (0.18)	93	0.01 (0.04)	–0.04 (0.05)	0.05 (0.05)
Presence of a seed distribution program	31	0.26 (0.44)	93	0.04 (0.08)	-0.04 (0.08)	0.08 (0.09)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

In the original paper, Table 2 indicates that 1,106 observations were used for the analysis of sociodemographic characteristic, household income sources and assets, and mobile phone ownership and usage. We found a different number for each group of variables and estimation based on the table. For means estimation, we used a range of observations, between 370 and 372; for regressions, the total observations used for each variable were in the range between 1,104 and 1,090.

After data collapse from individual observations to village level, our replication results show 31 observations of the cash group, used to calculate the mean for each variable. Additionally, 93 observations were included to calculate regressions.

In Table 3, as in the previous table, we followed the original authors' analysis to see differences between groups. This third table describes baseline characteristics about food security, migration, remittances and agricultural production. Some of these variables were used to measure the interventions' impact.

Whereas the original Table 3 shows 1,105 observations included in the analysis for the entire table, our Table 3 shows a range of observations, between 371 and 372, that were used in the mean of the cash group. The regressions also used a range of observations, between 1,102 and 1,105. We found a minor difference in the *produce cowpeas* variable; in our pure replication process, the standard error was 0.04, compared to 0.03 in the original study.

In general, tables 2 and 3 show that the three groups – cash, mobile and Zap – are similar in the baseline evaluation, considering all the characteristics observable by the original authors. No variables show statistically significant differences between intervention arms.

Table 3: Baseline individual and household outcomes (by treatment status)

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Food security outcomes and coping strategies						
Number of months of household food provisioning (scale of 6)	372	1.93 (1.56)	1105	0.19 (0.15)	0.14 (0.14)	0.06 (0.14)
Household diet diversity index (scale of 12)	371	3.10 (2.03)	1103	0.04 (0.19)	–0.08 (0.18)	0.12 (0.16)
B. Migration and remittances						
One household member migrated since the last harvest	372	0.47 (0.50)	1104	0.03 (0.05)	0.02 (0.05)	0.01 (0.05)
Number of remittances received since the past harvest	372	0.71 (1.89)	1102	0.24 (0.20)	0.08 (0.17)	0.16 (0.19)
Received remittance via m-money transfer (Zap)	372	0.02 (0.13)	1102	0.00 (0.01)	0.01 (0.01)	–0.00 (0.01)
C. Agricultural production and livestock						
Cultivate land	372	0.98 (0.13)	1105	–0.02 (0.01)	–0.01 (0.01)	–0.01 (0.01)
Produce millet	372	0.97 (0.17)	1105	–0.01 (0.01)	0.01 (0.01)	–0.01 (0.01)
Quantity of millet produced (kg)	372	267.35 (362.65)	1105	19.97 (52.86)	–16.25 (43.77)	36.22 (40.03)
Produce cow peas	372	0.87 (0.34)	1105	–0.03 (*0.04*)	–0.07* (0.04)	0.05 (0.04)
Quantity of cow peas produced (kg)	372	9.06 (29.52)	1105	2.34 (2.44)	0.98 (2.73)	1.36 (2.49)
Produce vouandzou or okra	372	0.54 (0.50)	1105	0.00 (0.06)	–0.02 (0.05)	0.02 (0.05)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01.

2.2.3 The core of the impact evaluation: tables 4–5

The impact of the introduction of mobile money in the unconditional cash transfer is measured in tables 4 and 5. Table 4 shows changes in the use of the cash transfer to buy food and nonfood items, and Table 5 shows the impact on food security, nutritional status and nondurable goods.

The impact was assessed using dummy variables that reflected the influence of each cash transfer mechanism – cash, mobile or Zap. These were included in each regression, with the same method we used to evaluate the balance of characteristics between interventions groups reviewed in tables 2 and 3. As shown in tables 4 and 5, our pure replication validated the principal results with minor differences.

Table 4 shows information from the study's midterm survey in December 2010. The results presented here show the same coefficients, standard deviation and standard errors found by the original authors. We found a difference of rounding in one of the standard errors for the variable *transfer used to buy staple grains (millet, sorghum)*. The original value of the standard error is 0.01 for the mobile–cash coefficient, whereas in the pure replication it is 0.00. We chose to show the number of observations for each estimate linked to the outcomes evaluated.

This table is particularly important, because it shows the potential effects that could have an impact on well-being, such as the amount of money invested for education and how it varied depending on the cash transfer mechanism.

Table 4: Uses of cash transfer

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Uses of cash transfer for food items						
Number of food and nonfood items purchased with cash transfer	352	4.32 (2.46)	1047	0.78*** (0.24)	–0.07 (0.24)	0.85*** (0.25)
Transfer used to buy staple grains (millet, sorghum)	347	1.00 (0.05)	1035	–0.01 (0.01)	0.00 (*0.00*)	–0.01 (0.01)
Transfer used to buy other grains (corn, rice)	347	0.56 (0.50)	1035	0.18*** (0.05)	–0.02 (0.05)	0.2*** (0.06)
Transfer used to buy cowpeas	347	0.4 (0.49)	1035	0.09* (0.05)	–0.01 (0.05)	0.10** (0.05)
Transfer used to buy condiments	347	0.68 (0.47)	1035	0.11** (0.05)	–0.02 (0.04)	0.12*** (0.04)
Transfer used to buy oil	347	0.68 (0.47)	1035	0.13*** (0.05)	–0.01 (0.05)	0.15*** (0.05)
Transfer used to buy meat	347	0.38 (0.49)	1035	0.16*** (0.04)	–0.02 (0.04)	0.18*** (0.04)
B. Uses of cash transfer for nonfood items						
Transfer used to pay school fees	347	0.07 (0.26)	1035	–0.02 (0.02)	–0.01 (0.02)	–0.01 (0.02)
Transfer used to pay health expenses	347	0.30 (0.46)	1035	–0.01 (0.03)	–0.03 (0.04)	0.03 (0.03)
Transfer used to buy clothes	347	0.04 (0.20)	1035	0.01 (0.02)	0.00 (0.03)	0.00 (0.02)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01. Table 4 shows information from the study's midterm survey in December 2010

The coefficients calculated are the same as those of the original authors. These results confirm that Zap households, on a scale of zero to eight, bought 0.78 more types of food and nonfood items than the cash group, and 0.85 more itemsthan the mobile category. The Zap group bought more grains (corn and rice), oil and meat, with a significance level of 1 percent. In the case of other foods, such as cowpeas, there were more purchases in the Zap group than the mobile and cash group, with a significance of 5 percent and 10 percent, respectively.

One difference we found is in the number of total observations used. The Current Tables report 1,047 observations for the entire table. Our replication shows different numbers. For mean evaluations, the observations used on *number of food and nonfood items purchased with cash transfer* were 352, and 347 for other cash transfer uses. Similarly, in the case of regression, there were 1,047 total observations for that first characteristic and 1,035 for all other characteristics.

In Table 5, the analysis focuses on consumption. Specifically, the first variable evaluated gives us information about the difference in the dietary diversity score between groups. For the measurement of dietary diversity, the original authors considered a recognized indicator in the literature – the household dietary diversity score.[4] This score has been validated for several age and sex groups as a proxy measure for macro- and/or micronutrient adequacy in the diet (Kennedy et al. 2011). The household dietary diversity score has been positively correlated with adequate micronutrient density of complementary foods for infants and young children (FANTA 2006). We reviewed and used the score already constructed in the data set and confirmed the results; Zap scores 0.51 higher than mobile, with statistical significance of 1 percent, and 0.28 higher than cash, with a significance of 10 percent.

Similarly, we confirmed that consumption of beans, fats and fruit was higher in the Zap group. For these variables, the coefficients have statistical significances of 5 percent or more for the comparison of Zap–cash and Zap–mobile. Consumption of meats and condiments had a significance level of 10 percent, but only for the contrast between Zap and mobile.

In relation to *number of meals eaten by children under 5 in past 24 hours*, our replication presents the same findings as the Current Tables. It shows a significant coefficient at the 5 percent level for the Zap group, with respect to the other treatment arms. Furthermore, the number of nondurable assets is better in the Zap group than the mobile group, but similar to the cash group. In general, the main difference found between our replication process and the original tables is a decreased level of statistical significance of the variable *diet diversity of children under 5.* The mobile–cash coefficient estimated by our replication process does not have statistical significance, whereas it has a significance of 10 percent in the Current Tables.

Another difference was found in the standard deviation of *household diet diversity score*; we calculated 1.69, while the Current Tables calculated 1.70. Another difference is the

[4] The household dietary diversity score is the aggregation of 12 food groups: cereals, white tubers and roots, vegetables, fruits, meat, eggs, fish and other seafood, legumes and seeds, milk and milk products, oil and fats, sweets, and spices (condiments and beverages).

standard error for *number of asset categories owned (out of 11, excluding mobile phones)*: we estimated 0.10, whereas the Current Tables calculated 0.11. These differences are attributable to potential round-off errors based on software estimations (McCullough and Vinod 1999).

The results are consistent with international evidence about the impact of access to a new storage value, in this case, m-transfer. In northeastern Burkina Faso, Gash and Gray (2016) showed that providing ways of storing value and removing barriers to formal savings could significantly improve households' abilities to withstand shocks without having to reduce consumption or sell livestock. Like Niger, northeastern Burkina Faso is an area with low rainfall and therefore a high propensity for droughts.

Table 5: Impact on food security and nutritional status

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Food security						
Household diet diversity score (out of 12)	736	3.17 (*1.69*)	2167	0.28* (0.15)	–0.23* (0.13)	0.51*** (0.14)
Consumption of:						
Grains	735	0.99 (0.10)	2164	0.00 (0.01)	0.00 (0.01)	0.00 (0.00)
Beans	735	0.18 (0.39)	2165	0.06** (0.03)	–0.01 (0.02)	0.07** (0.03)
Fats	735	0.29 (0.45)	2162	0.09** (0.03)	–0.02 (0.03)	0.11*** (0.03)
Meat	734	0.06 (0.24)	2165	0.02 (0.02)	–0.00 (0.02)	0.03* (0.01)
Condiments	734	0.36 (0.48)	2162	-0.01 (0.05)	–0.08** (0.04)	0.07* (0.04)
Fruit	734	0.02 (0.15)	2165	0.03** (0.01)	–0.01 (0.01)	0.03*** (0.01)
B. Child nutritional status						
Number of meals eaten by children under 5 in past 24 hours	157	3.17 *(1.71)*	543	0.33** (0.15)	0.05 (0.14)	0.28** (0.12)
Diet diversity of children under 5	153	2.31 (1.83)	536	0.18 (0.22)	*–0.23* (0.17)	0.41** (0.16)
Weight-for-height z-score	212	–1.15 (0.96)	691	0.06 (0.12)	–0.03 (0.15)	0.09 (0.13)
C. Durable and nondurable goods						
Number of asset categories owned (out of 11, excluding mobile phones)	748	3.05 (1.28)	2210	0.12 (0.11)	–0.19* (*0.10*)	0.31*** (0.09)
Durable assets (plows, carts, bikes, and motos)	748	0.18 (0.49)	2210	–0.01 (0.04)	–0.07** (0.03)	0.05 (0.03)
Nondurable assets (flashlights, petrol lamps and radios)	748	1.63 (0.87)	2210	0.12 (0.07)	–0.08 (0.07)	0.20*** (0.07)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01. Major differences between the pure replication table and this table are italicized and underlined.

2.2.4 Exploring the potential mechanism: tables 6–9

These tables show the evidence regarding the causal channels of the impacts that occurred. The authors identified and developed four causal mechanisms: reducing costs of obtaining the transfer, changing in the timing and location of household expenditures, increasing use of mobile phones and intra-household dynamics.

Table 6 tries to find the effects on level leakage. However, the results show that leakage was very low for the three intervention arms; around 98 percent of recipients reported receiving their transfers and received CFA95,000 over 4.4 transfers. These findings are consistent with an actual leakage between 4 percent and 10 percent of the total value of the transfer. According to the United Kingdom's Department of International Development (2009), the level of leakage in cash paid is around 4–15 percent.

Our Table 6 replication results are very similar to the original result, with only one rounding difference found. As reported by the original authors, only one difference between Zap and mobile recipients was statistically significant, with Zap households 4 percentage points less likely to receive their transfer than mobile households. Additionally, the three payment delivery channels are not statistically different in terms of number of transfers received or amount of money received.

Table 6: Leakage

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
Leakage						
Program recipient received cash transfer	361	0.98 (0.16)	1079	–0.02 (0.02)	0.02 (0.01)	–0.04** (0.02)
Number of transfers received	361	4.44 (1.27)	1079	–0.12 (0.11)	–0.03 (0.13)	–0.09 (0.13)
Amount of money received (CFA)	361	95637.12 *(30844.75)*	1079	–501.7 (2762.16)	–454.96 (3137.43)	–46.74 (2903.12)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01. Major differences between the pure replication table and this table are italicized and underlined.

The second causal mechanism is approached in Table 7, which shows potential impacts in eight variables, grouped into four categories: timing of receipt of transfer, timing of expenditures, location of expenditure and knowledge of cash transfer.

However, there are no statistically significant differences across the three treatment arms, except for one variable, *obtained transfer the same day*. In this case, Zap households were 36 or 39 percentage points less likely to receive their cash on the same day it was available.

This evidence suggests that the m-transfer increased the lag time between learning about the transfer and receiving it. Nonetheless, there was not a causal mechanism in terms of timing of expenditures, location of expenditures or knowledge of cash transfer.

Overall, in Table 7, the replication study results are the same as the published findings.

Table 7: Location, knowledge and timing of cash transfer expenses

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Timing of receipt of transfer						
Obtained transfer the same day	348	0.89 (0.32)	1037	–0.39*** (0.06)	–0.03 (0.03)	–0.36*** (0.05)
B. Timing of expenditures						
Spent money all at once	344	0.60 (0.49)	1030	–0.03 (0.04)	–0.03 (0.04)	0.00 (0.04)
Spent money at least two lines	344	0.40 (0.49)	1030	0.03 (0.04)	0.03 (0.04)	–0.00 (0.04)
C. Location of expenditures						
Spent transfer at kiosk in village	340	0.42 (0.49)	1022	0.04 (0.06)	–0.04 (0.05)	0.08 (0.06)
Spent transfer at market within village	340	0.23 (0.42)	1022	–0.01 (0.09)	0.03 (0.08)	–0.04 (0.08)
Spent transfer at market outside village	340	0.63 (0.48)	1022	0.03 (0.08)	–0.00 (0.08)	0.03 (0.08)
D. Knowledge of cash transfer						
Knew correct amount of cash transfer	346	0.13 (0.33)	1033	0.01 (0.03)	–0.01 (0.02)	0.02 (0.03)
Knew correct duration of cash transfer	352	0.12 (0.33)	1047	0.02 (0.03)	–0.02 (0.02)	0.04 (0.03)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01.

Table 8 shows evidence of the use of mobile phones as a causal mechanism. It also explores the impacts of phone use on migration, remittances and mobile transfer. According to the results, there were statistically significant differences between the three treatment arms regarding mobile phone usage.

Compared to their counterparts in the cash group, Zap and mobile households were 33 and 15 percentage points more likely to use their mobile phones, respectively. Both coefficients had a statistical significance at the 1 percent level.

In addition, Zap program recipients were 30 and 15 percentage points more likely to make or receive calls than cash and mobile program recipients, respectively. Likewise, the mobile group was 15 percentage points more likely to make or receive calls than the cash group. These three coefficients referred to calls had a statistical significance at the 1 percent level. Moreover, there was no impact of m-transfer on some outcomes, such as *used mobile phone to obtain price information* and *used mobile phone to ask for help/support*.

In Table 8, our pure replication results are very similar to the original authors' findings, with only one rounding difference. As the original authors report, we do not find any

significant impact of the Zap or mobile interventions in most of the variables related to migration, remittances or mobile transfer.

Concerning migration, remittances, and mobile transfer outcomes, there were only small statistically significant differences between Zap and cash households on outcomes such as *household member migrates* and *percentage of household member migrates*. Zap households were 8 percentage points more likely to have had at least one household member migrate and 2 percentage points more in the overall percentage of household members who migrated. Both coefficients had a statistical significance at the 1 percent level.

Table 8: Mobile phone ownership and usage

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Mobile phone ownership and usage						
Program recipient used mobile phone since last harvest	702	0.46 (0.50)	2116	0.33*** (0.04)	0.15*** (0.04)	0.18*** (0.04)
Made or received calls	697	0.45 (0.50)	2106	0.30*** (0.04)	0.15*** (0.04)	0.15*** (0.04)
Sent or received a "beep"	699	0.03 (0.17)	2108	0.12*** (0.02)	0.04*** (0.01)	0.08*** (0.02)
Received credit via Zap	698	0.00 (0.07)	2107	0.19*** (0.02)	0.03** (0.01)	0.16*** (0.02)
Communicated with family/friends inside Niger	702	0.18 (0.39)	2116	0.29*** (0.04)	0.13*** (0.03)	0.16*** (0.04)
Communicated with family/friends outside Niger	702	0.16 (0.36)	2116	0.09*** (0.03)	0.02 (0.02)	0.07*** (0.02)
Communicated with commercial contacts inside Niger	702	0.00 (0.00)	2116	0.01** (0.00)	0.01*** (0.00)	–0.00 (0.01)
Used mobile phone to communicate death/ceremony	354	0.07 (0.26)	1065	0.12*** (0.03)	0.08*** (0.02)	0.04 (0.03)
Used mobile phone to obtain price information	354	0.01 (0.11)	1065	–0.00 (0.01)	0.01 (0.01)	–0.01 (0.01)
Used mobile phone to ask for help/support	354	0.07 (0.26)	1065	0.04 (0.03)	0.03 (0.02)	0.00 (0.02)
B. Migration, remittances, and mobile transfers						
At least one household member migrates	384	0.39 (0.49)	1145	0.08* (0.05)	0.05 (0.05)	0.03 (0.04)
Percentage of household members who migrated	384	0.05 (0.08)	1145	0.02* (0.01)	0.01 (0.01)	0.01 (0.01)
Household received remittances as income	747	0.21 (0.41)	2205	0.05 (0.03)	0.01 (0.03)	0.04 (0.03)
Amount of remittances received for last transfer (CFA)	744	4216.4 (*12385.72*)	2198	493.24 (842.57)	225.33 (875.49)	267.92 (825.93)
Number of remittances since last harvest	748	0.52 (2.45)	2217	0.19 (0.16)	-0.00 (0.12)	0.19 (0.14)
Received remittance via Western Union	748	0.06 (0.25)	2213	–0.01 (0.01)	–0.02 (0.01)	0.02 (0.01)
Received remittance via friend	748	0.10 (0.30)	2212	0.04 (0.02)	0.03 (0.02)	0.01 (0.02)
Received remittance via Zap	748	0.00 (0.04)	2213	0.00 (0.00	–0.00 (0.00)	0.00 (0.00)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01. Major differences between the pure replication table and this table are italicized and underlined.

The last causal mechanism – changes in the intra-household dynamics – is revised in Table 9. The hypothesis is that the Zap transfer mechanism makes it more difficult for others to immediately observe the arrival of the transfer; recipients have private information about the arrival, which increases their bargaining power with respect to how the funds can be used.

International evidence suggests that payment products giving women more control over income and spending can lead to positive outcomes for female bargaining power in the household. According to Jack and Suri (2016), mobile money could contribute to the alleviation of women's poverty in Kenya.

Table 9 groups the variables into three categories: *decision-making regarding cash transfer*, *women's involvement in agriculture* and *clothing expenditures for Muslim festivals*. We did not identify statistically significant differences among the treatment arms in terms of responsibility for spending part of the cash or involvement in deciding how to transfer cash. However, we did find statistically significant differences between the Zap and cash groups in terms of visiting the market and buying clothes for children. Zap program recipients were more likely to travel to weekly markets and increase their expenditures on children's clothing for festivals than were mobile or cash households.

In Table 9, the replication study results are very similar to the published findings with minor differences. We identified two statistical parameters of the variable *amount spent on children's clothing for festivals* that had rounding differences from those estimated by the original authors. The coefficient estimated by our replication process is 5,605, whereas in the Current Tables it is 5,604. Also, our standard deviation is 8,214, whereas in Current Tables the value is 8,213. Another variable with a slight difference is *household spent money on women's or children's clothing for festivals*. The coefficient estimated in pure replication is 0.43, whereas in the Current Tables it was 0.44.

Table 9: Intrahousehold decision-making

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Decision making regarding cash transfer						
Program recipient responsible for spending part of cash transfer	347	0.53 (0.50)	1040	–0.01 (0.03)	–0.03 (0.04)	0.02 (0.04)
Program recipient involved in deciding how to transfer	342	0.99 (0.09)	1019	0.01 (0.01)	0.01 (0.01)	–0.00 (0.01)
B. Women's involvement in agriculture						
Program recipient visited market in past week	355	0.19 (0.39)	1063	0.09** (0.04)	–0.04 (0.04)	0.14*** (0.04)
Program recipient involved in selling grain for household	717	0.15 (0.36)	2130	0.04 (0.03)	–0.02 (0.03)	0.06** (0.03)
C. Clothing expenditures for Muslim festivals						
Household spent money on women's or children's clothing for festivals	341	*0.43* (0.50)	1007	0.10* (0.05)	0.03 (0.05)	0.07 (0.05)
Amount spent on children´s clothing for festivals (CFA)	332	*4604.52* (*8213.90*)	978	1745.86* (892.33)	–363.42 (785.57)	2109.28** (840.22)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01. Major differences between the pure replication table and this table are italicized and underlined.

2.2.5 Exploring an alternative explanation: Table 10

The original authors explore potential confounders to the results in Table 10. One confounder could emerge if the registration of Zap agents provided new types of financial or commercial services. In this way, Zap households can improve their access to food as agricultural inputs. Another potential confounder is the differential effect of the transfer mechanism on food prices. The idea is that manual cash transfers put greater inflationary effects on local markets than the m-transfer mechanism, potentially reducing the value of cash transfers.

Table 10 demonstrates that these confounders are not a problem. There are no statistically significant differences in the likelihood or number of Zap agents among the villages of each treatment arm. Additionally, there is no evidence that the percentage of households affected by drought or illness differs among cash, mobile or Zap villages.

Thus, our Table 10, results of the replication study, are the same as the published results.

Table 10: Alternative explanations

Variable	Observations Cash	Mean Cash (SD)	Observations OLS (Zap, Mobile, Cash)	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Access to village-level infrastructure						
Market located within the village	32	0.25 (0.44)	96	–0.02 (0.11)	–0.13 (0.10)	0.11 (0.09)
Zap agent in village	32	0.03 (0.18)	96	–0.05 (0.03)	0.01 (0.05)	–0.06 (0.05)
Number of Zap agents in village	28	0.07 (0.38)	88	–0.10 (0.08)	–0.05 (0.11)	–0.05 (0.05)
B. Shocks						
Household was affected by drought in 2010/2011	371	0.66 (0.47)	1093	–0.04 (0.05)	–0.02 (0.05)	–0.02 (0.05)
Household was affected by illness in 2010/2011	371	0.69 (0.46)	1093	–0.00 (0.03)	–0.02 (0.03)	0.02 (0.03)

Note: OLS = ordinary least squares; SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01.

2.3 Figures: mean cost by transfer mechanism

Figure 1 presents evidence of the first causal mechanism – reduced costs of obtaining the transfer – showing recipients' travel costs related to obtaining the cash transfer. There are two groups, because mobile and cash households received the cash transfer by the same mechanism. In general, program recipients in Zap villages incurred lower costs in terms of kilometers traveled and hours used to obtain the transfer.

The published version affirms that cash and mobile recipients traveled an average of around 3.6 kilometers (round trip) from their homes to obtain the transfer, while Zap recipients traveled around 2 kilometers to cash out at the nearest agent.

However, we found some differences between Figures 1a and 1b (Appendix B). The first was created based on pure replication results and the second present the published version of Figure 1. Specifically, the mean of distance (kilometers) to the cashpoint for

Zap is around 0.8 in the pure replication and around to 1 in the original article. Moreover, the mean of distance (hours) to cashpoint for cash/mobile is around 0.6 in the pure replication and around 0.4 in the original article.

2.4 Challenges with our pure replication

We encountered a few difficulties in the completion of our replication analysis. First, the evaluation of original results was based on two documents shared by the original authors, the published version with the erratum and the corrigendum. We evaluated our differences in comparison to those documents, which could be confusing for reviewers and readers of our pure replication process.

We did not need to develop a data cleaning process because the original authors had already developed this procedure. Therefore, it may be useful to have a guide to explain the recoding decisions used during the cleaning process, so that we could detect potential observations generated by this process.

In addition, the files shared by the original authors did not include a code book, which could be helpful for the exploration and use of the data. Access to survey questionnaires also would be useful to describe the way information was collected in the field.

Another challenge identified during the pure replication study relates to information about the seed program. A more detailed explanation of seed program characteristics could have helped us better understand their potential as confounding factors.

The original authors suggest that the seed distribution program could explain a fraction of the amount of cash that beneficiaries did not receive, beyond the leakage impact. As part of the seed program, recipient households could voluntarily replace two of their cash transfer payments with the equivalent value in seeds. In this way, the presence of the seed program would have a negative relationship with leakage indicators.

We cannot identify a variable that indicates whether a household participated in the seed program and how many transfers were replaced with seeds. Therefore, it is not clear whether household members who decided to participate in the seed program always could replace two, or fewer, cash transfers. If beneficiaries were able to choose the number of transfers to replace, then the intensity of the seed program's influence for each intervention group could be affecting the evaluation design.

A final challenge found during the replication process was the estimations of the costs of the delivery mechanism. The authors affirmed that the per recipient cost was US$16.43 in cash and mobile villages and US$24.14 in Zap villages.[5] However, we could not identify any variable that allowed us to replicate the authors' cost calculations.

[5] The authors refer to Figure A2. However, we could not find this reference.

3. Measurement and estimation analysis

The measurement and estimation analysis considers the sensitivity of measurement, the sensitivity of estimation or, in some cases, both. The measurement and estimation analysis can be implemented by redefining and recalculating the variables of interest, introducing additional control or interaction variables and using alternative methodologies (Brown et al. 2014). For our analysis, we explored heterogeneous impacts of age and the imputation of missing values. These procedures are described in our replication plan (Beteta et al. 2017).

3.1 Exploring heterogeneous impact

Aker and colleagues (2016) evaluated the potential impact of m-transfer as a cash transference mechanism for women in vulnerable household in Niger. These beneficiaries had heterogeneous distribution of age and education, features that could influence the impact of this intervention. For example, there are studies that explore the heterogeneous impact of similar interventions based on head of household characteristics like age and education level (Dammert 2008). Furthermore, there is evidence of a higher probability of information and communication technology, Internet and cell phone usage among populations of 14–25 years old in rural areas in Peru (Guerrero and Ritter 2014).

Mbiti and colleagues (2011) find that M-Pesa, a m-transfer system, is more likely to be used by younger, wealthier and better educated populations, which would suggest that these groups find more advantages in this financial tool.

Based on this evidence, we proposed to analyze the heterogeneity of money transfer interventions, according to the age and education of beneficiaries. However, we did not find variables to define beneficiaries' education level. Therefore, we could not explore the heterogeneous treatment effects of education, even when other studies showed its impact on dietary diversity, nutritional status and female empowerment. According to Oyekale and Oyekale (2009), attainment of secondary education by mothers in Niger, urbanization, presence of pipe water, presence of mother and father at home, and ever breastfed significantly reduce the probability of stunting, wasting and underweight. Likewise, Iversen and Palmer-Jones (2014) show that the education of women conditioned the positive effect of cable TV on female empowerment.

This section focuses on heterogeneity impact by age. For our analysis, we hypothesized that younger program recipients would obtain more benefits from m-transfer. It should be noted that the survey did not have a stratified design by age.

The beneficiaries[6] were grouped based on shared behavior according to age. For this purpose, we used the classification developed by Newman and Newman (2017), with

[6] The original survey was applied to women who received the intervention, but we found one male in the analysis. We suppose this is due to the absence of a female receptor or a typing error.

three groups sorted by age.[7] Cohort 1, early and later adolescence, comprised beneficiaries aged 12–24 years old. Cohort 2, early adulthood, comprised beneficiaries aged 25–34 years old. Cohort 3, middle and later adulthood, comprised beneficiaries aged 35 years or more.

Our heterogeneity analysis included multiple interactions within the regression model. Likewise, stratification was applied in order to isolate the effect of each age cohort. We rejected the use of HTE, the Stata module to perform heterogeneous treatment effect analysis, because it estimates treatment effects at various points over the range of the propensity score, which was not the purpose of our analysis.

The regression model used to identify heterogeneous impact is composed of the following two equations:

$$Y_{iv} = \beta_0 + \beta_1\, Zap_v + \beta_2\, Zap_v.G_2 + \beta_3\, Zap_v.G_3$$

$$+ \alpha_1\, Mobile_v + \alpha_2\, Mobile_v.G_2 + \alpha_3\, Mobile_v.G_3$$

$$+ X'_{iv}\,\gamma + X'_{iv}\,.Q_2\,\gamma_2 + \ldots + seed_v + seed_v.G_2 + \ldots + \theta_C + \theta_C.G_2 + \ldots + \varepsilon_{iv} \quad (1)$$

$$Y_{iv} = \tau_0 + \tau_1\, Zap_v + \tau_2\, Zap_v.G_2 + \tau_3\, Zap_v.G_3 +$$

$$\delta_1\, Cash_v + \delta_2\, Cash_v.G_2 + \delta_3\, Cash_v.G_3$$

$$+ X'_{iv}\,\gamma + X'_{iv}\,.Q_2\,\gamma_2 + \ldots + seed_v + seed_v.G_2 + \ldots + \theta_C + \theta_C.G_2 + \ldots + \varepsilon_{iv} \quad (2)$$

Y_{iv} represents the relevant outcomes of individual or household *i* in village *v*. $Cash_v$ is an indicator for villages assigned to the cash group Zap_v is an indicator for villages assigned to the Zap group. $Mobile_v$ is an indicator for villages assigned to the mobile group. The categorical variables G_2 and G_3 describe the group to which the beneficiaries belong and cohort 1 is the reference group to identify heterogeneous impact.

For the Zap versus cash impact evaluation, our coefficients of interest are β_2 and β_3, which indicate the heterogeneous impact of cohorts 2 and 3 in relation to β_1 , which is the impact coefficient for cohort 1. In the same way, for mobile versus cash impact evaluation, our coefficients of analysis of heterogeneity are α_2 and α_3 in relation to α_1, which is the impact coefficient for cohort 1. In the second equation, the impact evaluation for Zap versus mobile is represented by our coefficients τ_2 and τ_3 in relation to τ_1, which is the impact coefficient for cohort 1.

Finally, we applied Benjamini and Hochberg (1995) analysis in order to identify the false discovery rate (FDR), which is the proportion of the rejected null hypothesis that was erroneously rejected. FDR analysis is represented by q value. Coefficients with FDR lower than 10 percent are presented with **q** in the table.

The tables created by our heterogeneity analysis are organized to observe the coefficients of the interactions in the first three columns, with the stratified results in the

[7] We also evaluated quartile grouping (Appendix C). We used Stata command *xtile* to create four groups with similar number of observations sorted by age. We did not find major differences in relation to our behavioral grouping analysis.

final three columns. The presentation of our results is based on the recommendations suggested by Knol and VanderWeele (2012) for analysis of heterogeneity. According to this format, the coefficients of the interactions are complemented by the stratified results in order to clarify the effect modification by strata.

In the original study, 96 villages were stratified by commune and villages were randomly assigned to the cash, mobile or Zap interventions. In this way, the same number of villages, 32 per group, was assigned to each group. This randomized assignment suggests a similar age distribution across treatment arms. However, we considered the limitations of this analysis, in recognition of the need for care in the interpretation of results, especially when a significant coefficient is found. Furthermore, we recognize that the original study did not have the intention to find heterogeneous impact by age, which is an additional limitation for this analysis.[8]

3.1.1 Impact on uses of cash transfer

The original results showed that Zap intervention would have a higher impact on outcomes of interest in relation to the cash and mobile groups. Especially, in the use of cash transfer to buy food items, such as corn, rice, condiments, oil, and meat, all statistically significant at the 5 percent level. Nevertheless, the original analysis does not explore the heterogeneity of impact among groups of age by treatment arms (cash, mobile and Zap).

Dammert (2008) explored the heterogeneous effects of conditional cash transfer by age of head of household as a continuous variable; while Galiani and colleagues (2011) studied how children age modified the impact of a conditional cash-transfer program in outputs as school attendance and child labor. These studies showed the relevance of age as an impact modifier. Therefore, we will evaluate the heterogeneous impact between age groups in relation to the uses of cash transfer.

Table 11 shows evidence of heterogeneous impact in the beneficiaries in cohort 3, which supports our hypothesis previously described. The oldest beneficiaries made fewer purchases of specific food items than cohort 1 beneficiaries. Cohort 3, in the Zap versus mobile comparison, had a lower impact on purchasing decisions for grains such as corn and rice, with a coefficient of –0.33 ($p < 0.01$) in relation to cohort 1. Between cohorts 3 and 1, purchase of oil shows a coefficient of –0.18 ($p < 0.1$).

The results for the Zap versus mobile interaction suggest an effect modification in which the oldest cohort buys fewer food and nonfood items than the youngest group. An explanation could be that this group uses the transfer to pay debt or for savings. According to Demirguc-Kunt and colleagues (2015), in Niger 71 percent of adults have borrowed money and 56 percent have borrowed from family or friends in the past 12 months.

[8] Although it was not a pre-specified analysis, we found it interesting to explore what type of heterogeneity impact would be in the presence of polygamous households. In this sense, we analyzed heterogeneity by polygamy condition, but did not find important differences. It is relevant to mention that the presence of polygamous households was similar across the treatment groups (original Table 2).

Table 11: Uses of cash transfer for food items

From Table 4 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (cohort)			Impact estimate of intervention within strata of age group (cohort)		
		Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)	Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)
A.1. Number of food and nonfood items purchased with cash transfer							
Cohort 1	195	1.03** (0.51)	–0.39 (0.50)	1.42***q (0.47)	1.03**q (0.51)	–0.39 (0.50)	1.42*** q (0.47)
Cohort 2	419	–0.41 (0.51)	0.27 (0.49)	–0.68 (0,47)	0.62** q (0.28)	–0.13 (0.26)	0.74** q (0.32)
Cohort 3	430	–0.22 (0.52)	0.58 (0.56)	–0.79 (0.50)	0.81** q (0.31)	0.18 (0.35)	0.63* q (0.32)
A.2. Transfer used to buy staple grains (millet, sorghum)							
Cohort 1	195	–0.01 (0.01)	0.01 (0.01)	–0.02 (0.02)	–0.01 (0.01)	0.01 (0.01)	–0.02 (0.02)
Cohort 2	415	0.01 (0.02)	–0.01 (0.01)	0.02 (0.02)	–0.01 (0.00)	–0.01 (0.01)	0.00 (0.01)
Cohort 3	422	0.01 (0.02)	0.00 (0,01)	0.02 (0,02)	0.00 (0.01)	0.00 (0.01)	–0.01 (0.01)
A.3. Transfer used to buy other grains (corn, rice)							
Cohort 1	195	0.34***q (0.11)	–0.07 (0.11)	0.41*** q (0.10)	0.34*** q (0.11)	–0.07 (0.11)	0.41*** q (0.10)
Cohort 2	415	–0.21* (0.11)	–0.01 (0.11)	–0.21** q (0.08)	0.13** q (0.06)	–0.08 (0.06)	0.21*** q (0.07)
Cohort 3	422	–0.18 (0.11)	0.15 (0.11)	–0.33*** q (0.09)	0.16** q (0.06)	0.08 (0.07)	0.08 (0.07)
A.4. Transfer used to buy cowpeas							
Cohort 1	195	0.09 (0.11)	–0.09 (0.10)	0.18* (0.09)	0.09 (0.11)	–0.09 (0.10)	0.18* (0.09)
Cohort 2	415	–0.05 (0.12)	0.02 (0.10)	–0.08 (0.10)	0.03 (0.07)	–0.07 (0.05)	0.10 (0.07)
Cohort 3	422	0.06 (0.11)	0.20* (0.10)	–0.14 (0.09)	0.14** q (0.06)	0.11* (0.06)	0.04 (0.05)
A.5. Transfer used to buy condiments							
Cohort 1	195	0.11 (0.09)	–0.07 (0.08)	0.18** (0.09)	0.11 (0.09)	–0.07 (0.08)	0.18** q (0.09)
Cohort 2	415	0.02 (0.10)	0.07 (0.10)	–0.05 (0.10)	0.13** q (0.06)	0.00 (0.06)	0.13** q (0.06)
Cohort 3	422	–0.05 (0.10)	0.06 (0.09)	–0.10 (0.09)	0.06 (0.06)	–0.01 (0.06)	0.07 (0.06)
A.6. Transfer used to buy oil							
Cohort 1	195	0.12 (0.09)	–0.14* (0.08)	0.26***q (0.09)	0.12 (0.09)	–0.14* (0.08)	0.26*** q (0.09)
Cohort 2	415	0.01 (0.10)	0.13 (0.10)	–0.12 (0.10)	0.13** q (0.06)	–0.01 (0.06)	0.14** q (0.07)
Cohort 3	422	0.01 (0.10)	0.18* (0.10)	–0.18* (0.09)	0.13** q (0.06)	0.04 (0.07)	0.08 (0.05)
A.7. Transfer used to buy meat							
Cohort 1	195	0.16 (0.10)	–0.14 (0.09)	0.30***q (0.08)	0.16 (0.10)	–0.14 (0.09)	0.30*** q (0.08)
Cohort 2	415	–0.06 (0.11)	0.16* (0.09)	–0.22**q (0.09)	0.10 (0.06)	0.02 (0.06)	0.08 (0.06)
Cohort 3	422	0.03 (0.11)	0.13 (0.10)	–0.10 (0.09)	0.19*** q (0.05)	–0.01 (0.05)	0.20*** q (0.05)

Note: SE = standard error; *p < 0.1,**p < 0.05, ***p < 0.01; FDR < 10% is represented by **q**.

Table 12 shows an absence of differences between age cohorts in health, clothes and school spending between cohorts. These homogeneous results could be due to the elevated rates of births in young women and the general presence of children under 15 years in households. According to the Demographic and Health Surveys Niger - 2012 surveys, 76 percent of women aged 20 to 24 were married before the age of 18. One in four girls is married before the age of 15 and the median age at marriage increased from 15.1 years in 1992 to 15.5 years in 2006 and 15.7 years in 2012 (INS 2013). Moreover, 89 percent of households in Niger have children under 15 years (UN 2017).

Table 12: Uses of cash transfer for nonfood items

From Table 4 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (cohort)			Impact estimate of intervention within strata of age group (cohort)		
		Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)	Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)
B.1. Transfer used to pay school fees							
Cohort 1	195	0.01	–0.03	0.02	–0.01	–0.03	0.02
		(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)
Cohort 2	415	–0.02	0.04	–0.06	–0.03	0.01	0.02
		(0.05)	(0.05)	(0.04)	(0.02)	(0.03)	(0.03)
Cohort 3	422	–0.01	0.00	–0.01	–0.01	–0.03	–0.04
		(0.06)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)
B.2. Transfer used to pay health expenses							
Cohort 1	195	0.04	0.00	0.04	0.04	0.00	0.04
		(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Cohort 2	415	–0.05	–0.06	0.01	–0.01	–0.06	0.05
		(0.11)	(0.10)	(0.11)	(0.06)	(0.06)	(0.07)
Cohort 3	422	–0.04	0.00	–0.04	0.00	0.00	0.00
		(0.09)	(0.09)	(0.09)	(0.05)	(0.05)	(0.05)
B.3. Transfer used to buy clothes							
Cohort 1	195	0.01	0.04	–0.03	0.01	0.04	–0.03
		(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)
Cohort 2	415	0.00	–0.05	0.05	0.01	–0.01	0.01
		(0.04)	(0.04)	(0.04)	(0.02)	(0.03)	(0.03)
Cohort 3	422	–0.02	–0.05	0.04	–0.01	–0.01	0.00
		(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.03)

Note: SE = standard error; *p < 0.1, **p < 0.05, ***p < 0.01 ; FDR < 10% is represented by **q**

3.1.2 Impact on food security, durable goods and nondurable goods

The original findings indicate that Zap households had dietary diversity scores higher than those of cash and mobile households. The original results also suggest that household members did not reduce their contribution of public or private goods to the household as result of the m-transfer intervention. Our evaluation of heterogeneous impact reaffirmed these findings.

As part of our heterogeneous evaluation of food security, disaggregated by products, we identified that the consumption of condiments and fruits were influenced most by Zap treatment. In cohort 2, there was increased consumption of condiments with a 0.26 coefficient, in comparison to cohort 1. Moreover, in cohort 2, the Zap group increased the consumption of condiments in 14 percentage points in comparison to mobile group. Furthermore, in cohort 3, Zap households recipients were 5 percentage points more

likely to consume fruits in comparison to mobile households and 4 percentage points more in relation to cash. All differences described are statistically significant.

The heterogeneous impact on consumption of fruits could be explained by household income. According to Kakwani and Subbarao (2005), the poverty level for households with elderly members is much higher than the national average in several African countries.[9] Fruit and vegetable consumption rises with income and the income elasticity of demand for fruit and vegetables is more sensitive for low-income households than high-income households (Ruel et al. 2005).[10] This suggest that the oldest group, who are more likely to be in a vulnerable situation, may benefit most by the income increase as a consequence of the use of m-transfer.[11]

The described benefits of Zap among later-adulthood populations could be helpful for designing future interventions. For example, a non-contributory social pension program could consider e-money as a delivery mechanism. Salinas-Rodriguez and colleagues (2014) show that the impacts of the pension were significantly higher among women and recipients with lowest income, a group similar to the group evaluated by Aker and colleagues (2016).

[9] In Malawi, Uganda and Zambia, the poverty gap ratio for various household types in which the elderly are living is 6–20 percentage points higher than the average ratio.

[10] The fact that fruit and vegetables are an expensive source of energy is an important constraint for poor households.

[11] The original study suggests that reducing the transfer's observability by m-transfer could also affect interhousehold sharing, thereby leaving more income available for the household (Jakiela and Ozier 2015).

Table 13: Heterogeneous impacts on dietary diversity

From Table 5 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (cohort)			Impact estimate of intervention within strata of age group (cohort)		
		Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)	Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)
A.1. Household diet diversity score (out of 12)							
Cohort 1	198	0.23 (0.42)	0.20 (0.36)	0.03 (0.36)	0.23 (0.42)	0.20 (0.36)	0.03 (0.36)
Cohort 2	442	0.01 (0.49)	–0.52 (0.42)	0.53 (0.42)	0.24 (0.27)	–0.32 (0.22)	0.56**q** (0.25)
Cohort 3	453	0.05 (0.46)	–0.57 (0.44)	0.62 (0.43)	0.28 (0.26)	–0.37 (0.27)	0.65**q** (0.25)
A.2. Consumption of grains							
Cohort 1	198	–0.01 (0.02)	–0.03 (0.02)	0.02 (0.02)	–0.01 (0.02)	–0.03 (0.02)	0.02 (0.02)
Cohort 2	442	0.01 (0.02)	0.03 (0.02)	–0.01 (0.02)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Cohort 3	453	0.02 (0.02)	0.03 (0.02)	–0.01 (0.03)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)
A.3. Consumption of beans							
Cohort 1	198	0.01 (0.09)	–0.03 (0.07)	0.05 (0.09)	0.01 (0.09)	–0.03 (0.07)	0.05 (0.09)
Cohort 2	442	–0.01 (0.11)	–0.01 (0.10)	0.00 (0.11)	0.01 (0.06)	–0.04 (0.06)	0.05 (0.07)
Cohort 3	453	0.17 (0.11)	0.01 (0.08)	0.06 (0.10)	0.18***q** (0.06)	0.07 (0.06)	0.11* (0.06)
A.4. Consumption of fats							
Cohort 1	198	0.10 (0.10)	–0.01 (0.10)	0.10 (0.10)	0.10 (0.10)	–0.01 (0.10)	0.10 (0.10)
Cohort 2	442	–0.05 (0.12)	–0.03 (0.12)	–0.01 (0.12)	0.05 (0.07)	–0.04 (0.06)	0.09 (0.07)
Cohort 3	453	0.01 (0.12)	–0.04 (0.12)	0.04 (0.12)	0.10 (0.07)	–0.04 (0.07)	0.15** (0.07)
A.5. Consumption of meat							
Cohort 1	198	0.00 (0.04)	0.00 (0.04)	0.00 (0.04)	0.00 (0.04)	0.00 (0.04)	0.00 (0.04)
Cohort 2	442	0.02 (0.04)	0.02 (0.04)	0.01 (0.04)	0.03 (0.03)	0.02 (0.03)	0.01 (0.03)
Cohort 3	453	0.03 (0.05)	0.00 (0.05)	0.03 (0.05)	0.04 (0.04)	0.00 (0.04)	0.04 (0.03)
A.6. Consumption of condiments							
Cohort 1	198	–0.05 (0.10)	0.07 (0.09)	–0.12 (0.09)	–0.05 (0.10)	0.07 (0.09)	–0.12 (0.09)
Cohort 2	442	0.03 (0.11)	–0.23** (0.11)	0.26***q** (0.09)	–0.02 (0.07)	–0.16***q** (0.07)	0.14**q** (0.06)
Cohort 3	453	–0.01 (0.10)	–0.22** (0.10)	0.20** (0.10)	–0.06 (0.07)	–0.15* (0.08)	0.08 (0.06)
A.7. Consumption of fruit							
Cohort 1	198	0.08** (0.03)	0.00 (0.02)	0.08* (0.04)	0.08** (0.03)	0.00 (0.02)	0.08* (0.04)
Cohort 2	442	–0.06* (0.04)	–0.01 (0.02)	–0.06 (0.04)	0.01 (0.02)	0.00 (0.01)	0.02 (0.01)
Cohort 3	453	–0.03 (0.04)	–0.01 (0.02)	–0.02 (0.05)	0.04**q** (0.02)	–0.01 (0.01)	0.05***q** (0.02)

Note: SE = standard error; *p < 0.1, **p < 0.05, ***p < 0.01; FDR < 10% is represented by **q**

In Table 14, we found statistically significant differences on the number of asset categories owned by recipients in cohort 3. For durable assets, cohort 3 had the greatest coefficient for Zap–Cash comparison (p-value < 0.1). Additionally, in cohort 3, Zap beneficiaries owned 0.28 more nondurable assets (flashlights, petrol lamps and radios) than the mobile group members with a statistical significance of 1 percent.

According to Villaverde and Krueger (2011), during the first part of the life cycle, households are forced to progressively accumulate durable goods as well as financial assets. In Kenya, households with elderly heads showed higher level of durable goods ownership than younger households, probably reflecting more years of potential accumulation (Zezza et al. 2010).

Table 14: Heterogeneous impacts on durable and nondurable assets

From Table 5 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (cohort)			Impact estimate of intervention within strata of age group (cohort)		
		Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)	Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)
C.1. Number of asset categories owned (out of 11, excluding mobile phones)							
Cohort 1	201	–0.08	–0.29	0.22	–0.08	–0.29	0.22
		(0.25)	(0.24)	(0.22)	(0.25)	(0.24)	(0.22)
Cohort 2	448	0.22	0.27	–0.05	0.20	–0.33**	0.16
		(0.23)	(0.23)	(0.25)	(0.17)	(0.15)	(0.13)
Cohort 3	461	0.27	0.11	0.15	0.00	–0.22	0.37**q
		(0.29)	(0.27)	(0.24)	(0.22)	(0.24)	(0.15)
C.2. Durable assets (plows, carts, bikes, and motos)							
Cohort 1	201	–0.11	–0.10	–0.01	–0.11	–0.10	–0.01
		(0.09)	(0.08)	(0.07)	(0.09)	(0.08)	(0.07)
Cohort 2	448	0.13	0.08	0.05	0.02	–0.01	0.04
		(0.09)	(0.09)	(0.07)	(0.05)	(0.05)	(0.04)
Cohort 3	461	0.15*	0.05	0.10	0.04	–0.05	0.09
		(0.09)	(0.09)	(0.08)	(0.06)	(0.05)	(0.06)
C.3. Nondurable assets (flashlights, petrol lamps, and radios)							
Cohort 1	201	0.08	–0.23	0.31**	0.08	–0.23	0.31**
		(0.16)	(0.17)	(0.15)	(0.16)	(0.17)	(0.15)
Cohort 2	448	0.04	0.25	–0.22	0.11	0.03	0.09
		(0.16)	(0.16)	(0.18)	(0.10)	(0.09)	(0.11)
Cohort 3	461	0.07	0.10	–0.03	0.15	–0.13	0.28***q
		(0.21)	(0.19)	(0.18)	(0.13)	(0.13)	(0.10)

Note: SE = standard error; *p < 0.1, **p < 0.05, ***p < 0.01; FDR < 10% is represented by **q**

3.2 Robustness analysis: multiple imputation and Lee bounds

As proposed in our replication plan (Beteta et al. 2017), we used multiple imputation to deal with missing values and the Lee bounds method for attrition.

After we accessed the data set, we verified that the attrition and missing data were part of the same problem, since the original authors used a limited number of covariates in their regression model. We did not find missing values for covariates at village level. In

contrast, outcomes were the unique variables where we found missing data, since they describe individual information. For our purposes, both methods allowed us to perform analysis of regressions to resolve potential problems about missing values and attrition. These are the main contribution of both methodologies in our replication study.

We decided to use multiple imputation and Lee bounds as alternative methods to evaluate the results from Tables 4–10 of the original paper. The summary of results is presented in Tables 15 and 16 and discussed in the following sections. We present the complete multiple imputation results in Appendix D and Lee bounds results in Appendix E.

3.2.1 Multiple imputation

Multiple imputation is widely accepted as an accurate method for imputation (Enders 2010; Schafer and Graham 2002) and has theoretical advantages with respect to other procedures. Recent studies by Lall (2016) and Arel-Bundock and Pelc (2018) show the advantages of multiple imputation on political and epidemiological sciences.

The first step in the multiple imputation method is to define the predictive model. For this study, we considered the three treatment assignments (Zap, mobile and cash), the seed treatment and the commune fixed effects as predictors, which were the same covariates used by the original authors in their regression model. Moreover, we estimated heteroskedasticity-robust standard errors using clusters at the village level, as did the original authors.

According to Enders (2010), it is necessary to include the covariates of the regression in the imputation model in order to avoid a biased estimation. Moreover, it is particularly important to include the treatment variables. If our multiple imputation model failed to have a strong predictive power, our imputations would have a large variance, which would affect the final significance of our point estimates. If there is no low or null variance in the imputation, then the multiple imputation results should be essentially the same as the original study. Furthermore, it was possible to gain efficiency in the estimation due to the larger sample size. We summarize these in Table 15, with complete results in Appendix D.

Multiple imputation results

As can be observed in tables D4–D10 in Appendix D, the majority of coefficients tend to be of lower magnitude and have higher standard errors, measured by p-values. In this regard, multiple imputation estimation produces fewer coefficients that could reject the null hypothesis. Even when the null hypothesis is rejected, the coefficients have a lower statistical level of confidence. Changes in statistical significance of coefficients between multiple imputation and original results are underlined in the tables.

In Table 15, we summarize the main results from the multiple imputation robustness analysis by topic. We define a robust result when the statistically significant coefficients from the original tables keep at least a significance of 10 percent.[12] The first step was to count the number of coefficients that were statistically significant different in the original

[12] As we can see in Table 15, the original results have 60 statistically significant coefficients, while multiple imputation suggests that three coefficients lost their statistical significance. This represents 3 percent of all original significant coefficients from tables 4–10.

study; we present these findings in column 3. Most of the statistically significant results from Aker and colleagues (2016) are in tables 4, 5, 8 and 9, so we are particularly interested on their changes.

In addition, Table 15 presents the changes observed from the original coefficients, with statistical significance, due to the application of the multiple imputation method for each original authors' tables.[13] Column 4 indicates how many of these coefficients increased their significance and column 5 indicates how many did not change. Finally, columns 6 and 7 show the number of previously statistically significant coefficients that reduce their p-values. Some retain their significance at 10 percent and others lose it.

We realized that multiple imputation results agree with the majority of the original authors' conclusions. Nevertheless, some coefficients presented changes. In Table D4, four Zap–cash coefficients lose significance with respect to the original table: *transfer used to buy oil, number of food and nonfood items purchased with cash transfer to buy food, transfer used to buy cowpeas and transfer used to buy condiments*; these last two coefficients stop being statistically significant even at the 10 percent level. Likewise, one Zap–mobile coefficient – transfer used to buy cowpeas – decreased its statistical significance.

Also in Table D6, the only statistically significant result in the original table for the alternative explanation of leakage – program recipient received cash transfer – is no longer significant. In the original Table 10, there were no statistically significant coefficients. Nevertheless, we found one to be significant after multiple imputation method in Table D10 – number of Zap agents in village.

Meanwhile, Tables D5 and D9 present changes that tend to strengthen the original author´s results. For instance, in Table D5, one coefficient increased its significance in comparison to the original table: consumption of fats. Similarly, in Table D9, we found one change: an increase in significance on the variable program in which the recipient was involved for selling grain per household.

According to Lall (2016), the pattern of missing values in public policy data sets is probably never completely random. Furthermore, adopting multiple imputation can be expected to reduce bias and alter parameter estimates in most studies, such that changes will be largest under three conditions: (1) the proportion of missing data is high; (2) the data set contains a large number of variables that are strongly related to missingness; and (3) hypotheses are tested on a heterogeneous sample in terms of missingness correlates. For our case, we considered that the third condition could explain the different coefficients estimated by multiple imputation, assuming a potential heterogeneous behavior in the missing group.

Likewise, in the original research, the main reason for missing data is data attrition. The original authors documented that there is no evidence of differential attrition across the experimental arms.

[13] We refer to increases or reductions of significance if p-value increases or reduces at least 0.01.

Table 15: Summary of results from multiple imputation robustness analysis

Table number	Table title	Number of statistically significant results in Aker et al. (2016)	After using multiple imputation, how is the statistical significance of the results is affected?			
			Increased	Unaltered	Reduced	
					Still significant	No longer significant
Table 4	Uses of cash transfer	12	0	7	3	2
Table 5*	Food security and nutritional status	16	1	15	0	0
Table 6	Leakage	1	0	0	0	1
Table 7	Location, knowledge and timing of cash transfer	2	0	2	0	0
Table 8	Mobile phone ownership and usage	23	0	22	1	0
Table 9	Intrahousehold decision making	6	1	5	0	0
Table 10	Alternative explanations	0	1	0	0	0

Note: * For Table 5, we do not include Panel B estimations, since there is not a baseline for children under 5.

3.2.2 Lee bounds analysis

We performed Lee bounds to analyze the robustness of the results from the reported attrition problem. We used this analysis for dealing with missing values even if they were not related to attrition. According to Horowitz and Manski (2000), bounds analysis is a widely accepted methodology to test for attrition and Lee (2009) bounds methodology is one of the most used (Glennerster and Takavarasha 2013; Molina and Macours 2017).[14]

The original study reported attrition of 7 percent, balanced across treatment arms. A recent study by Molina and Macours (2017) notes the importance of dealing with attrition even when it is balanced, finding that not controlling it could lead to an overestimation of the impacts.

Lee Bound methodology has two assumptions. The first is that the treatment is randomly assigned, which is satisfied by the original study design. The second is that the effect of the attrition is only in "one direction" (also known as the "monotonicity assumption").

The Lee bounds procedure consists of trimming the data to construct the bounds. First, we identified which of the treatment groups had the lower attrition and calculated the mean of the variable for that group. Then, we estimated the differential attrition between treatment arms and dropped this differential percentage from the lowest part of the distribution, after which we estimated the mean with the remaining observations. Finally, we calculated the average difference, or the intention to treat, between this trimmed group and the mean of the group with less attrition, and defined this as our lower bound. We used a similar procedure to estimate the upper bound, but using the highest part of the distribution.[15]

[14] Some recent and influential studies that use Lee bounds analysis to test for robustness are Baird and colleagues (2011), Hidrobo and colleagues (2014), Kremer and colleagues (2009), Cunha (2014) and Drexler and colleagues (2014).

[15] We used commune fixed effects to make our bounds tighter. We were not able to add heteroskedasticity-robust errors nor cluster the errors at the village level.

In Lee bounds, we had to deal with the statistical uncertainty in the estimation. Following the standard procedure in Lee bounds analysis, we reported the combination of confidence intervals, at the 95 percent, from both bounds, and then the range obtained was evaluated if it included zero. If the range did not contain zero, we concluded that the results are robust enough to deal with extreme bounds with Lee (2009) methodology.

Lee bounds results

We present the results of the Lee bounds analysis for Tables 4–10 of the original study in Appendix E. In each table, we present the combination of the confidence intervals, the lower bound and the upper bound. The coefficients with a range that does not include zero are presented with an asterisk. Tables E4–E10 show the range of the Lee bounds estimation for the three coefficients of interest (Zap–Cash, Mobile–Cash and Zap–Mobile).

Table 16 reports the summary of the results for each original table. The second column indicates the number of coefficients that were statistically significant in Aker and colleagues (2016). The third column indicates the number of robust coefficients in the Lee bounds estimation (those that do not contain zero in the estimated range).

We define robust in the Lee bounds when the statistically significant coefficients from the original Tables 4–10 keep at least with a significance of 10 percent. As Table 16 illustrates, 47 of 60 significant coefficients keep their significant after this procedure. This suggests those original conclusions are maintained.

For example, in Table E4, we find that not all the original significant coefficients are robust in the Lee bounds analysis. The Lee bounds confirm that Zap households, on a scale from zero to eight, buy between 0.1 and 1.06 more types of food and nonfood items, compared to the cash group. However, the Zap versus Cash coefficients related to use of the transfer to buy cowpeas, condiments or oil are not robust in the Lee bounds results.

In Table E5, the Zap versus Cash effects related to household dietary diversity score (out of 12) or consumption of beans are not robust to the Lee bounds procedure. Similarly, Table D8 shows that the Zap versus Cash coefficients related to use of communication with commercial contacts inside Niger and the probability that at least one household member migrates are not robust to the Lee bounds.

In conclusion, we consider that the main coefficients of interest were robust for the Lee bounds test.

Table 16: Summary of the results from Lee bounds robustness analysis

Table number	Table title	Number of statistically significant results in Aker et al. (2016)	After using Lee bounds, how many of the results are still significant?
Table 4	Use of cash transfer	12	9
Table 5*	Food security and nutritional status	16	13
Table 6	Leakage	1	1
Table 7	Location, knowledge and timing of cash transfer	2	2
Table 8	Mobile phone ownership and usage	23	17
Table 9	Intrahousehold decision making	6	5
Table 10*	Alternative explanations	0	0

Note: * For Table 5, we do not include Panel B estimations, since we do not have baseline to estimate attrition, and for Table 10 we do not include Panel A, since it is at the locality level and there is no attrition at that level.

4. Theory of change analysis

The theory of change analysis aims to provide a better understanding of the causal pathway underlying the studied intervention, which is crucial to design public policies (Brown et al. 2014). In this sense, we focused on the impact of cash transfer mechanisms on nutritional status of children under 5 years old.[16] According to our replication plan (Beteta et al. 2017), we added wasting and stunting diagnosis to develop a broader assessment about nutrition.

4.1 Nutrition evaluation

After replicating the original authors' evaluation we found that the original results were robust to alternative analysis and measurement, supporting the positive effects of Zap for beneficiaries.

In this section, we develop a broader assessment about nutrition in children under 5 years in order to estimate the effect of different transfer mechanisms. Changes in dietary diversity without a significant impact on malnutrition and the absence of stunting evaluation represented an opportunity for our replication study.

According to UNICEF strategies, nutritional status depends on three axes for young children: (1) access to and utilization of adequate foods (including quantity, quality, safety and socio-cultural acceptability); (2) the effectiveness of health services and healthiness of the environment (including resources, opportunities and the roles and responsibilities of duty bearers); and (3) the quality and level of maternal and child healthcare. Niger has a 42 percent prevalence of moderate and severe stunting (UNICEF 2016), which poses a major challenge for its evaluation.

[16] Children from 0–5 months were not included.

Initially, we used WHO malnutrition parameters for children under 5 years old to define wasting and stunting. Moderate wasting is defined as having a weight-for-height Z-score falling below –2 to –3 standard deviations. Severe wasting is defined as weight-for height Z-score falling below –3 standard deviations. Moderate stunting is defined as height-for-age Z-score falling below –2 to –3 standard deviations. Severe stunting is defined as height-for-age Z-score falling below –3 standard deviations.

The weight-for-height Z-score and height-for-age Z-score were already calculated for each child under study in the original data set, so both variables were useful in creating new ones for our complementary analysis. We created four new dichotomous variables for wasting and stunting evaluation: *Was_sev* – a dichotomous variable with values 1 and 0, where 1 means the child under 5 years presented severe wasting; *Was_mod* – a dichotomous variable with values 1 and 0, where 1 means the child under 5 years presented moderate wasting; *Stu_sev* – a dichotomous variable with values 1 and 0, where 1 means the child under 5 years presented severe stunting; and *Stu_mod* – a dichotomous variable with values 1 and 0, where 1 means the child under 5 years presented moderate stunting.

In our original replication plan, we described a bivariate analysis using a Chi-square test to evaluate potential associations between malnutrition diagnosis and specific intervention groups: Zap, mobile and cash. Instead, we used a regression model because, in our case, it improved the assessment by analyzing multiple covariates in order to adjust the relation of interest.

Like the original authors, we considered the control variables *commune* and *seed*. The *commune* variable was used to control the potential differences between communes; *seed* was included to adjust the potential influence of the seed distribution program. We found it relevant to include such control variables to avoid bias in our findings. With the aim of including control variables, regressions are performed with the same structure of the regressions used in the original study and pure replication for outcome estimation.

For impact evaluation of the nutritional status, we estimated the two regression models found in the original publication:

$$Y_{iv} = \beta_0 + \beta_1 Zap_v + \beta_2 Mobile_v + \beta_3 seed_v + \theta_C + \varepsilon_{iv} \quad (3)$$

$$Y_{iv} = \tau_0 + \tau_1 Zap_v + \tau_2 Cash_v + \tau_3 seed_v + \theta_C + \mu_{iv} \quad (4)$$

Y_{iv} represents the relevant nutrition outcomes of individual *i* in village *v*. $Cash_v$ is an indicator for villages assigned to the cash group. Zap_v is an indicator for villages assigned to the Zap group. $Mobile_v$ is an indicator for villages assigned to the mobile group.

We also considered for this analysis $seed_v$, which is an indicator for the presence of a seed distribution program in the village. Finally, θ_C are geographic fixed effects at the commune level and ε_{iv} and μ_{iv} are the error terms.

The results about wasting and its severity and the impact of cash transfer mechanisms are presented in Table 17. In this case, an evaluation of weight-for-height z-score as a continuous variable was performed in the original article. For *severe wasting* and *severe*

and moderate wasting, a greater coefficient represented a higher harmful condition. For this table, there is no statistically significant impact of the interventions on wasting.

Table 17: Child wasting status

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
B. Wasting						
Weight-for-height z-score	212	–1.15 (0.96)	691	0.06 (0.12)	–0.03 (0.15)	0.09 (0.13)
Severe wasting	212	0.01 (0.12)	691	0.00 (0.01)	0.01 (0.02)	–0.01 (0.02)
Severe and moderate wasting	212	0.17 (0.38)	691	–0.02 (0.04)	0.00 (0.06)	–0.02 (0.05)

Note: SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01.

Table 18 describes results about stunting and its severity, as well as the impact of cash-transference mechanisms, including a complementary analysis of the continuous variable height-for-age z-score evaluation. Stunting analysis complements weight-for-height z-score evaluation in the original article.

Regarding severe and moderate stunting, the Zap–cash coefficient is 0.07, which shows a small and isolated positive relation between Zap intervention and severe and moderate stunting, with no significant findings in the Zap–mobile coefficient to confirm the e-money impact for this variable.[17] We considered that the absence of a nutritional baseline evaluation is important to explain this finding, since we were not able to evaluate a progression based in anthropometric measures. According to Bamberger (2010), the availability of appropriate baseline data is always critical for performance evaluation.

There are no other statistically significant coefficients that support this negative nutritional result on stunting.

Table 18: Child stunting status

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap–Cash Coeff. (SE)	Mobile–Cash Coeff. (SE)	Zap–Mobile Coeff. (SE)
A. Stunting measurement						
Height-for-age z-score	216	–1.42 (1.51)	702	–0.26 (0.24)	–0.06 (0.18)	0.21 (0.28)
Severe stunting	216	0.13 (0.33)	702	0.02 (–0.03)	–0.03 (0.04)	0.05 (0.04)
Severe and moderate stunting	216	0.32 (0.47)	702	0.07* (0.04)	–0.02 (0.06)	0.10 (0.06)

Note: SD = standard deviation; SE = standard error; * p < 0.1; ** p < 0.05; *** p < 0.01.

[17] About programs with negative impact, in Nicaragua, children in coffee producing households receiving conditional cash transfers saw greater declines in their anthropometric outcomes, height-for-age Z-score measure, with a –0.27 coefficient after treatment. A program in Brazil found that six months after benefits began to be distributed, beneficiary children were 0.13 z-scores lighter (weight-for-age) than excluded children. On the other hand, Houngbe and colleagues (2017) found no evidence that unconditional cash transfers reduced the incidence of wasting among children.

4.2 Heterogeneity analysis by age

We performed a heterogeneity analysis to identify the age of children for whom this intervention had a greater impact. Policymakers often find it important to understand how the benefits of social programs might vary by individual or household characteristics, even if the average effect of the program is not significant. The information obtained from this procedure could have a complementary relevance for focusing future public policies in a specific age range.

We established two evaluation groups, sorted by age and grouped based on shared behavioral patterns and impact of nutrition: 6–24 months (group 1) and 25–60 months (group 2). According to Krebs and colleagues (2017), children under 24 months share specific opportunities and vulnerabilities for development related to the fast central nervous system development and nutritional requirements, as well as the impact of environment on their nutritional homeostasis. Likewise, children under 6 months were excluded, based on the special behavior of this age group, including exclusive breastfeeding, and the duration of the original cash-transfer program.

Table 19, created by our heterogeneity analysis, shows the coefficients of the interactions in the first three columns and the stratified results in the final three columns.

Table 19: Heterogeneity of children nutritional status

Variable	Observations by stratum	Heterogeneity impact of intervention by age groups			Impact estimate of intervention within strata of age group		
		Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)	Zap–Cash (SE)	Mobile–Cash (SE)	Zap–Mobile (SE)
Height for age z-score							
Group 1: 6–24 months	279	–0.27 (0.28)	–0.02 (0.22)	–0.25 (0.28)	–0.27 (0.28)	–0.02 (0.22)	–0.25 (0.28)
Group2: 25–60 months	423	0.02 (0.19)	–0.03 (0.26)	0.04 (0.02)	–0.25 (0.24)	–0.05 (0.21)	–0.21 (0.31)
Weight for height z-score							
Group 1: 6–24 months	275	0.01 (0.12)	–0.12 (0.16)	0.12 (0.15)	0.01 (0.12)	–0.12 (0.16)	0.12 (0.15)
Group2: 25–60 months	415	0.09 (0.12)	0.16 (0.16)	–0.07 (0.14)	0.10 (0.14)	0.04 (0.17)	0.05 (0.15)
Stunting moderate							
Group 1: 6–24 months	279	0.07 (0.07)	–0.05 (0.08)	0.12* (0.07)	0.07 (0.07)	–0.05 (0.08)	0.12* (0.07)
Group2: 25–60 months	423	0.00 (0.07)	0.03 (0.10)	–0.03 (0.07)	0.07* (0.36)	–0.02 (0.07)	0.09 (0.08)
Stunting severe							
Group 1: 6–24 months	279	0.01 (0.05)	–0.01 (0.05)	0.01 (0.06)	0.01 (0.05)	–0.01 (0.05)	0.01 (0.06)
Group2: 25–60 months	423	0.02 (0.06)	–0.04 (0.06)	0.06 (0.06)	0.03 (0.04)	–0.05 (0.04)	0.08 (0.05)
Wasting moderate							
Group 1: 6–24 months	275	–0.06 (0.05)	–0.02 (0.07)	–0.04 (0.05)	–0.06 (0.05)	–0.02 (0.07)	–0.04 (0.05)
Group2: 25–60 months	415	0.06 (0.07)	0.02 (0.08)	0.04 (0.06)	0.01 (0.05)	0.00 (0.07)	0.00 (0.06)
Wasting severe							
Group 1: 6–24 months	275	0.03 (0.02)	0.02 (0.02)	0.01 (0.03)	0.03 (0.02)	0.02 (0.02)	0.01 (0.03)
Group2: 25–60 months	415	–0.04** **q** (0.02)	–0.02 (0.02)	–0.03 (0.02)	–0.02 (0.01)	0.00 (0.02)	–0.02 (0.12)

Note: SE = standard error; *p < 0.1, **p < 0.05, ***p < 0.01, FDR < 10% is represented by **q**
Not all children present information of height-for-age z-score and weight-for-height z-score; some have only one of these.

Regarding the z-score evaluation of height for age and weight for height, our analysis of heterogeneity did not find nutrition impact. We were able to find significant impact between Zap and cash for the reduction of severe wasting in group 2. This group (25–60 months), benefited most from this intervention, with a statistically significant coefficient of –0.04. We also applied Benjamini and Hochberg's (1995) analysis for this coefficient; it showed FDR lower than 10 percent.[18]

[18] According to Andrews and Buchinsky (2000), we estimated the coefficients using bootstrap. The statistical significance of coefficient is maintained using 1498 repetitions.

Although the significant coefficients suggest potential heterogeneous impact on the results, we cannot establish a causal relationship, first because of the absence of baseline focused on children, and second due to the limitations of power given by the number of observations.

5. Conclusion

Our study replicated analysis and results of the paper, *Payment mechanisms and antipoverty programs: evidence from a mobile money cash transfer experiment in Niger* by Aker and colleagues (2016). Through this replication, we were able to verify the original results, using similar statistical methods as the original authors. Using push-button replication, we were able to replicate original author´s results using their code.

The pure replication section, our independent reproduction of findings, confirmed the comparability of our results to the original authors'. We did not find any major differences in relation to the results shown in the published paper and its complementary corrigendum. The minor observations we identified do not affect the relevant results established by the original paper.

Our measurement and estimation analysis included analysis of heterogeneity and robustness tests. The heterogeneity evaluation suggests that the Zap intervention had a different impact on older beneficiaries than younger ones. Robustness analysis considered multiple imputation and Lee bounds analysis, which confirmed that the original results are robust to the evaluation of these methods.

Finally, our nutritional assessment in the theory of change analysis described stunting and wasting status and severity in children under 5 years, using anthropometric measures available in the data set We were able to find significant impact between Zap and cash for the reduction of wasting in group 2 (children 25–60 months old).

Appendix A: Push-button replication

The data sets, .do file and versions of the original project were obtained from the original authors. We modified the path for the files indicated in the .do file and logged the analysis.

The organized sequence of analysis and its correlation to the presentation of tables in the original article were helpful to identify which results belonged to which tables in the article.

After we identified the results and commands, we replicated the tables as they appear in the paper using Stata version 14.0., we compared the coefficients and significance level of each table and reported the results with observations.

As the statistical significance remained consistent throughout our push-button replication and the coefficients reproduced, we classified our push-button replication as a comparable status. We were able to reproduce all the tables included in the published paper with erratum (2-10). We compared the push-button replication results with the published findings along with the publicly available corrigendum and found them to be comparable.

Push-button replication comparison tables and description

To facilitate comparison between original author´s results and our push button replication findings, we joined the results of the published version with the erratum and the corrigendum in new tables, which were named “Current Tables”.

A) Description of push-button replication table comparisons:

Table A1

Comparable replication

- Exactly the same p-values
- One rounding difference in a standard error in column 4

Table A2

Comparable replication

- Exactly the same p-values
- One rounding difference in a standard error in column 2

Table A3

Comparable replication

- Exactly the same p-values
- One rounding difference in a standard error in column 3

Table A4

Comparable replication

- One different p-value in column 3 in the corrigendum
  Corrigendum p-value: –.23* (* p < 0.1)
  Push button replication p-value: –.23 (p >0.1)
- One rounding difference in a standard error in column 3

Table A5

Comparable replication

- Exactly the same p-values
- One rounding difference in a standard deviation in column 1

Table A6

Comparable replication

- Exactly the same p-values
- Exactly the coefficients and standard errors

Table A7

Comparable replication

- Exactly the same p-values
- One rounding difference in a coefficient in column 2 and one rounding difference in a standard deviation in columns 1

Table A8

Comparable replication

- Exactly the same p-values
- Differences in two means and in a standard deviation in column 1

  Corrigendum "Household spent money on … festivals" Cash average mean: .44. Push button replication "Household spent money on … festivals" Cash average mean: .43

  Corrigendum "Amount spent on children´s clothing … (CFA)" Cash average mean: 4604. Push button replication "Amount spent on children´s clothing … (CFA)" Cash average mean: 4605

  Corrigendum "Amount spent on children´s clothing … (CFA)" standard deviation: 8213. Push button replication "Amount spent on children´s clothing … (CFA)" standard deviation: 8214

Table A9

Comparable replication

- Exactly the same p-values
- Exactly the coefficients and standard errors

PBR TABLES

	Comparable results
	Minor differences
	Major differences
	No access to data
	Information not reported in table

Table A1a: Current Table

	Baseline individual and household covariates (by treatments status)			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Sociodemographic characteristic				
Age of respondent	33.22 (11.05)	1.90 (1.21)	-.90 (1.24)	2.79** (1.24)
Polygamous household	.28 (.45)	.04 (.04)	.02 (.04)	.01 (.04)
Respondent is member of Hausa ethnic group	.81 (.39)	-.05 (.08)	.08 (.06)	-.13 (.08)
Number of household members	9.31 (4.95)	-.40 (.63)	-.21 (.52)	-.18 (.50)
Number of household members under 15 years	5.65 (3.42)	-.35 (.38)	-.11 (.34)	-.24 (.34)
Percentage of household members ... education	.58 (.32)	-.01 (.03)	.04 (.03)	-.04 (.03)
B. Household income sources and assets				
Agriculture is an income source	.98 (.15)	-.01 (.01)	-.01 (.01)	-.00 (.01)
Livestock is an income source	.61 (.49)	.06 (.06)	-.03 (.06)	.09* (.05)
Remittances are an income source	.34 (.47)	-.01 (.04)	-.05 (.04)	.04 (.04)
Number of asset categories owned (out of 12)	3.62 (1.60)	.07 (.18)	-.15 (.16)	.22 (.14)
C. Mobile phone ownership and usage				
Household owns mobile pone	.29 (.45)	.04 (.05)	-.03 (.04)	.06 (.04)
Respondent has used mobile phone since last harvest	.61 (.49)	.06 (.05)	.00 (.05)	.05 (.04)
Respondent made or received call since last harvest	.61 (.49)	.06 (.05)	.00 (.05)	.05 (.04)
Respondent sent or received m-money transfer since last harvest	.00 (.00)	.00 (.00)	.00 (.00)	-.00 (.00)
D. Shock				
Household experienced drought in past year	.98 (.15)	-.00 (.01)	.01 (.01)	-.01 (.01)
Household experienced crickets in past year	.81 (.39)	-.02 (.04)	-.04 (.05)	. 01 (.05)
Number of household observations				
E. Village - Level covariate				
Market locate within the village	.35 (.49)	-.04 (.13)	.01 (.13)	-.04 (.12)
School located within villaje	.97 (.18)	.01 (.04)	-.04 (.05)	.05 (.05)
Presence of a seed distribution program	.26 (.44)	.04 (.08)	-.04 (.08)	.08 (.09)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

…

Table A1b: Replication Table

	Baseline individual and household covariates (by treatments status)			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Sociodemographic characteristic				
Age of respondent	33.22 (11.05)	1.90 (1.21)	-.90 (1.24)	2.79** (1.24)
Polygamous household	.28 (.45)	.04 (.04)	.02 (.04)	.01 (.04)
Respondent is member of Hausa ethnic group	.81 (.39)	-.05 (.08)	.08 (.06)	-.13 (.08)
Number of household members	9.31 (4.95)	-.40 (.63)	-.21 (.52)	-.18 (.50)
Number of household members under 15 years	5.65 (3.42)	-.35 (.38)	-.11 (.34)	-.24 (.34)
Percentage of household members ... education	.58 (.32)	-.01 (.03)	.04 (.03)	-.04 (.03)
B. Household income sources and assets				
Agriculture is an income source	.98 (.15)	-.01 (.01)	-.01 (.01)	-.00 (.01)
Livestock is an income source	.61 (.49)	.06 (.06)	-.03 (.06)	.09* (.05)
Remittances are an income source	.34 (.47)	-.01 (.04)	-.05 (.04)	.04 (.04)
Number of asset categories owned (out of 12)	3.62 (1.60)	.07 (.18)	-.15 (.16)	.22 (.14)
C. Mobile phone ownership and usage				
Household owns mobile pone	.29 (.45)	.04 (.05)	-.03 (.04)	.06 (.04)
Respondent has used mobile phone since last harvest	.61 (.49)	.06 (.05)	.00 (.05)	.05 (.04)
Respondent made or received call since last harvest	.61 (.49)	.06 (.05)	.00 (.05)	.05 (.04)
Respondent sent or received m-money transfer since last harvest	.00 (.00)	.00 (.00)	.00 (.00)	-.00 (.00)
D. Shock				
Household experienced drought in past year	.98 (.15)	-.00 (.01)	.01 (.01)	-.01 (.01)
Household experienced crickets in past year	.81 (.39)	-.02 (.04)	-.04 (.05)	. 01 (.05)
Number of household observations				
E. Village - Level covariate				
Market locate within the village	.35 (.49)	-.04 (.13)	.01 (.13)	-.04 (.12)
School located within villaje	.97 (.18)	.01 (.04)	-.04 (.05)	.05 (.05)
Presence of a seed distribution program	.26 (.44)	.04 (.08)	-.04 (.08)	.08 (.09)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A2a: Current Table

	Baseline individual and household outcomes (by treatments status)			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Food security outcomes and coping strategies				
Number of months of household food provisioning (scale of 6)	1.93 (1.56)	.19 (.15)	.14 (.14)	.06 (.14)
Household diet diversity index (scale of 12)	3.10 (2.03)	.04 (.19)	-.08 (.18)	.12 (.16)
B. Migration and remittances				
One household member migrated since the last harvest	.47 (.50)	.03 (.05)	.02 (.05)	.01 (.05)
Number of remittances received since the past harvest	.71 (1.89)	.24 (.20)	.08 (.17)	.16 (.19)
Received remittance via m-money transfer (Zap)	.02 (.13)	.00 (.01)	.01 (.01)	-.00 (.01)
C. Agricultural production and livestock				
Cultivate land	.98 (.13)	-.02 (.01)	-.01 (.01)	-.01 (.01)
Produce millet	.97 (.17)	-.01 (.01)	.01 (.01)	-.01 (.01)
Quantity of millet produced (kg)	267 (363)	19.97 (52.86)	-16.25 (43.77)	36.22 (40.03)
Produce cowpeas	.87 (.34)	-.03 (.03)	-0.07* (0.04)	.05 (.04)
Quantity of cowpeas produced (kg)	9.06 (30)	2.34 (2.44)	.98 (2.73)	1.36 (2.49)
Produce vouandzou or okra	.54 (.50)	.00 (.06)	-.02 (.05)	.02 (.05)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Table A2b: Replication Table

	Baseline individual and household outcomes (by treatments status)			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Food security outcomes and coping strategies				
Number of months of household food provisioning (scale of 6)	1.93 (1.56)	.19 (.15)	.14 (.14)	.06 (.14)
Household diet diversity index (scale of 12)	3.10 (2.03)	.04 (.19)	-.08 (.18)	.12 (.16)
B. Migration and remittances				
One household member migrated since the last harvest	.47 (.50)	.03 (.05)	.02 (.05)	.01 (.05)
Number of remittances received since the past harvest	.71 (1.89)	.24 (.20)	.08 (.17)	.16 (.19)
Received remittance via m-money transfer (Zap)	.02 (.13)	.00 (.01)	.01 (.01)	-.00 (.01)
C. Agricultural production and livestock				
Cultivate land	.98 (.13)	-.02 (.01)	-.01 (.01)	-.01 (.01)
Produce millet	.97 (.17)	-.01 (.01)	.01 (.01)	-.01 (.01)
Quantity of millet produced (kg)	267 (363)	19.97 (52.86)	-16.25 (43.77)	36.22 (40.03)
Produce cowpeas	.87 (.34)	-.03 (.04)	-0.07* (0.04)	.05 (.04)
Quantity of cowpeas produced (kg)	9.06 (30)	2.34 (2.44)	.98 (2.73)	1.36 (2.49)
Produce vouandzou or okra	.54 (.50)	.00 (.06)	-.02 (.05)	.02 (.05)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A3a: Current Table

	Uses of cash transfer			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Uses of cash transfer for food items				
Number of food and nonfood items purchased with cash transfer	4.32 (2.46)	.78*** (.24)	-.07 (.24)	.85*** (.25)
Transfer used to buy staple grains (millet, s)	1.00 (.05)	-.01 (.01)	.00 (.01)	-.01 (.01)
Transfer used to buy other grains (com, rice)	.56 (.50)	.18*** (.05)	-.02 (.05)	.20*** (.06)
Tramsfer used to buy cowpeas	.40 (.49)	.09* (.05)	-.01 (.05)	.10** (.05)
Transfer used to buy condiments	.68 (.47)	.11** (.05)	-.02 (.04)	12*** (.04)
Transfer used to buy oil	.68 (.47)	.13*** (.05)	-.01 (.05)	.15*** (.05)
Transfer used to buy meat	.38 (.49)	.16*** (.04)	-.02 (.04)	.18*** (.04)
B. Uses of cash transfer for nonfood items				
Transfer used to pay school fees	.07 (.26)	-.02 (.02)	-.01 (.02)	-.01 (.02)
Transfer used to pay health expenses	.30 (.46)	-.01 (.03)	-.03 (.04)	.03 (.03)
Transfer used to buy clothes	.04 (.20)	.01 (.02)	.00 (.03)	.00 .(02)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A3b: Replication Table

	Uses of cash transfer			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Uses of cash transfer for food items				
Number of food and nonfood items purchased with cash transfer	4.32 (2.46)	.78*** (.24)	-.07 (.24)	.85*** (.25)
Transfer used to buy staple grains (millet, s)	1.00 (.05)	-.01 (.01)	.00 (.00)	-.01 (.01)
Transfer used to buy other grains (com, rice)	.56 (.50)	.18*** (.05)	-.02 (.05)	.20*** (.06)
Tramsfer used to buy cowpeas	.40 (.49)	.09* (.05)	-.01 (.05)	.10** (.05)
Transfer used to buy condiments	.68 (.47)	.11** (.05)	-.02 (.04)	12*** (.04)
Transfer used to buy oil	.68 (.47)	.13*** (.05)	-.01 (.05)	.15*** (.05)
Transfer used to buy meat	.38 (.49)	.16*** (.04)	-.02 (.04)	.18*** (.04)
B. Uses of cash transfer for nonfood items				
Transfer used to pay school fees	.07 (.26)	-.02 (.02)	-.01 (.02)	-.01 (.02)
Transfer used to pay health expenses	.30 (.46)	-.01 (.03)	-.03 (.04)	.03 (.03)
Transfer used to buy clothes	.04 (.20)	.01 (.02)	.00 (.03)	.00 .(02)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A4a: Current Table

	Impact on food security and nutritional status			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Food security				
Household diet diversity score (out of 12)	3.17 (1.70)	.28* (.15)	-0.23* (0.13)	.51*** (.14)
Consumption of:				
Grains	.99 (.10)	.00 (.01)	.00 (.01)	.00 (.00)
Beans	.18 (.39)	.06** (.03)	-.01 (.02)	.07** (.03)
Fats	.29 (45)	.09** (.03)	-.02 (.03)	.11*** (.03)
Meat	.06 (.24)	.02 (.02)	-.00 (.02)	.03* (.01)
Condiments	.36 (.48)	-.01 (.05)	-.08** (.04)	.07* (.04)
Fruit	.02 (.15)	.03** (.01)	-.01 (.01)	.03*** (.01)
B. Child nutritional status				
Number of meals eaten by children under 5 in past 24 hours	3.17 (1.71)	.33** (.15)	.05 (0.14)	.28** (0.12)
Diet diversity of children under 5	2.31 (1.83)	.18 (.22)	-23*(.17)	.41** (0.16)
Weight-for-height z-score	-1.15 (0.96)	.06 (.12)	-.03 (0.15)	.09 (0.13)
Number of observations				
C. Durable and nondurable goods				
Number of asset categories owned (out …)	3.05 (1.28)	.12 (.11)	-.19*(.11)	.31*** (.09)
Durable assets (plows, carts, bikes, and motos)	.18 (.49)	-.01 (.04)	-.07** (.03)	.05 (.03)
Nondurable assets (flashlights, petrol lamps, and radios)	1.63 (.87)	.12 (.07)	-.08 (.07)	.20*** (.07)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A4b: Replication Table

	Impact on food security and nutritional status			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Food security				
Household diet diversity score (out of 12)	3.17 (1.70)	.28* (.15)	-0.23* (0.13)	.51*** (.14)
Consumption of:				
Grains	.99 (.10)	.00 (.01)	.00 (.01)	.00 (.00)
Beans	.18 (.39)	.06** (.03)	-.01 (.02)	.07** (.03)
Fats	.29 (45)	.09** (.03)	-.02 (.03)	.11*** (.03)
Meat	.06 (.24)	.02 (.02)	-.00 (.02)	.03* (.01)
Condiments	.36 (.48)	-.01 (.05)	-.08** (.04)	.07* (.04)
Fruit	.02 (.15)	.03** (.01)	-.01 (.01)	.03*** (.01)
B. Child nutritional status				
Number of meals eaten by children under 5 in past 24 hours	3.17 (1.71)	.33** (.15)	.05 (0.14)	.28** (0.12)
Diet diversity of children under 5	2.31 (1.83)	.18 (.22)	-23(.17)	.41** (0.16)
Weight-for-height z-score	-1.15 (0.96)	.06 (.12)	-.03 (0.15)	.09 (0.13)
Number of observations				
C. Durable and nondurable goods				
Number of asset categories owned (out …)	3.05 (1.28)	.12 (.11)	-.19*(.10)	.31*** (.09)
Durable assets (plows, carts, bikes, and motos)	.18 (.49)	-.01 (.04)	-.07** (.03)	.05 (.03)
Nondurable assets (flashlights, petrol lamps, and radios)	1.63 (.87)	.12 (.07)	-.08 (.07)	.20*** (.07)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A5a: Current Table

	Leakage			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Food security				
Program recipient received cash transfer	.98 (.16)	-.02 (.02)	.02 (.01)	-.04** (.02)
Number of transfer received	4.44 (1.27)	-.12 (.11)	-.03 (.13)	-.09 (.13)
Amount of money received (CFA)	95,637 (30,844)	-501.70 (2,762.16)	-454.96 (3,137.43)	-46.74 (2,903.12)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A5b: Replication Table

	Leakage			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Food security				
Program recipient received cash transfer	.98 (.16)	-.02 (.02)	.02 (.01)	-.04** (.02)
Number of transfer received	4.44 (1.27)	-.12 (.11)	-.03 (.13)	-.09 (.13)
Amount of money received (CFA)	95,637 (30,845)	-501.70 (2,762.16)	-454.96 (3,137.43)	-46.74 (2,903.12)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A6a: Current Table

	Location, knowledge, and timing of cash transfer expenses			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Timing of receipt of transfer				
Obtained transfer the same day	.89 (.32)	-.39*** (.06)	-.03 (.03)	-.36*** (.05)
B. Timing of expenditures				
Spent money all at once	.60 (.49)	-.03 (.04)	-.03 (.04)	.00 (.04)
Spent money at least two lines	.40 (.49)	.03 (.04)	.03 (.04)	-.00 (.04)
C. Location of expenditures				
Spent transfer at kiosk in village	.42 (.49)	.04 (.06)	-.04 (.05)	.08 (.06)
Spent transfer at market within village	.23 (.42)	-.01 (.09)	.03 (.08)	-.04 (.08)
Spent transfer at market outside village	.63 (.48)	.03 (.08)	-.00 (.08)	.03 (.08)
D. Knowledge of cash transfer				
Knew correct amount of cash transfer	.13 (.33)	.01 (.03)	-.01 (.02)	.02 (.03)
Knew correct duration of cash transfer	.12 (.33)	.02 (.03)	-.02 (.02)	.04 (.03)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

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Table A6b: Replication Table

	Location, knowledge, and timing of cash transfer expenses			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Timing of receipt of transfer				
Obtained transfer the same day	.89 (.32)	-.39*** (.06)	-.03 (.03)	-.36*** (.05)
B. Timing of expenditures				
Spent money all at once	.60 (.49)	-.03 (.04)	-.03 (.04)	.00 (.04)
Spent money at least two lines	.40 (.49)	.03 (.04)	.03 (.04)	-.00 (.04)
C. Location of expenditures				
Spent transfer at kiosk in village	.42 (.49)	.04 (.06)	-.04 (.05)	.08 (.06)
Spent transfer at market within village	.23 (.42)	-.01 (.09)	.03 (.08)	-.04 (.08)
Spent transfer at market outside village	.63 (.48)	.03 (.08)	-.00 (.08)	.03 (.08)
D. Knowledge of cash transfer				
Knew correct amount of cash transfer	.13 (.33)	.01 (.03)	-.01 (.02)	.02 (.03)
Knew correct duration of cash transfer	.12 (.33)	.02 (.03)	-.02 (.02)	.04 (.03)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

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Table A7a: Current Table

	Mobile phone ownership and usage			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Mobile phone ownership and usage				
Program recipient used mobile phone since last harvest	.46 (.50)	.33*** (.04)	.15*** (.04)	.18*** (.04)
Made or received calls	.45 (.50)	.30*** (.04)	.15*** (.04)	.15*** (.04)
Sent or received a "beep"	.03 (.17)	.12*** (.02)	.04*** (.01)	.08*** (.02)
Received credit via Zap	.00 (.07)	.19*** (.02)	.03** (.01)	.16*** (.02)
Communicated with family/friends inside Niger	.18 (.39)	.29*** (.04)	.13*** (.03)	.16*** (.04)
Communicated with family/friends outside Niger	.16 (.36)	.09*** (.03)	.02 (02)	.07*** (.02)
Communicated with commercial contacts inside Niger	.00 (.00)	.01** (.00)	.01*** (.00)	-.00 (.01)
Used mobile phone to communicate death/ceremony	.07 (.26)	.12*** (.03)	.08*** (.02)	.04 (.03)
Used mobile phone to obtain price information	.01 (.11)	-.00 (.01)	.01 (.01)	-.01 (.01)
Used mobile phone to ask for help/support	.07 (.26)	.04 (.03)	.03 (.02)	.00 (.02)
B. Migration, remittances, and mobile transfers				
At least one household member migrates	.39 (.49)	.08* (.05)	.05 (.05)	.03 (.04)
Percentage of household members who migrated	.05 (.08)	.02* (.01)	.01 (.01)	.01 (.01)
Household received remittances as income	.21 (.41)	.05 (.03)	.01 (.03)	.04 (.03)
Amount of remittances … (CFA)	4,216 (12,385)	493.24 (842.57)	225.33 (875.49)	267.92 (825.93)
Number of remittances since last harvest	.52 (2.45)	.19 (.16)	-.00 (.12)	.19 (.14)
Received remittance via Western Union	.06 (.25)	-.01 (.01)	-.02 (.01)	.02 (.01)
Received remittance via friend	.10 (.30)	.04 (.02)	.03 (.02)	.01 (.02)
Received remittance via Zap	.00 (.04)	.00 (.00)	-.00 (.00)	.00 (.00)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A7b: Replication Table

	Mobile phone ownership and usage			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Mobile phone ownership and usage				
Program recipient used mobile phone since last harvest	.46 (.50)	.33*** (.04)	.15*** (.04)	.18*** (.04)
Made or received calls	.45 (.50)	.30*** (.04)	.15*** (.04)	.15*** (.04)
Sent or received a "beep"	.03 (.17)	.12*** (.02)	.04*** (.01)	.08*** (.02)
Received credit via Zap	.00 (.07)	.19*** (.02)	.03** (.01)	.16*** (.02)
Communicated with family/friends inside Niger	.18 (.39)	.29*** (.04)	.13*** (.03)	.16*** (.04)
Communicated with family/friends outside Niger	.16 (.36)	.09*** (.03)	.02 (02)	.07*** (.02)
Communicated with commercial contacts inside Niger	.00 (.00)	.01** (.00)	.01*** (.00)	-.00 (.01)
Used mobile phone to communicate death/ceremony	.07 (.26)	.12*** (.03)	.08*** (.02)	.04 (.03)
Used mobile phone to obtain price information	.01 (.11)	-.00 (.01)	.01 (.01)	-.01 (.01)
Used mobile phone to ask for help/support	.07 (.26)	.04 (.03)	.03 (.02)	.00 (.02)
B. Migration, remittances, and mobile transfers				
At least one household member migrates	.39 (.49)	.08* (.05)	.05 (.05)	.03 (.04)
Percentage of household members who migrated	.05 (.08)	.02* (.01)	.01 (.01)	.01 (.01)
Household received remittances as income	.21 (.41)	.05 (.03)	.01 (.03)	.04 (.03)
Amount of remittances … (CFA)	4,216 (12,386)	493.25 (842.57)	225.33 (875.49)	267.92 (825.93)
Number of remittances since last harvest	.52 (2.45)	.19 (.16)	-.00 (.12)	.19 (.14)
Received remittance via Western Union	.06 (.25)	-.01 (.01)	-.02 (.01)	.02 (.01)
Received remittance via friend	.10 (.30)	.04 (.02)	.03 (.02)	.01 (.02)
Received remittance via Zap	.00 (.04)	.00 (.00)	-.00 (.00)	.00 (.00)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A8a: Current Table

	Intrahousehold decision making			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Decision making regarding cash transfer				
Program recipient responsible … of cash transfer	.53 (.50)	-.01 (.03)	-.03 (.04)	.02 (.04)
Program recipient involved … transfer	.99 (.09)	.01 (.01)	.01 (.01)	-.00 (.01)
B. Women´s involvement in agriculture				
Program recipient visited market in past week	.19 (.39)	.09** (.04)	-.04 (.04)	.14*** (.04)
Program recipient involved in … household	.15 (.36)	.04 (.03)	-.02 (.03)	.06** (.03)
Number of observations				
C. Clothing expenditures for Muslim festivals				
Household spent money on … festivals	.44 (.50)	.10* (.05)	.03 (.05)	.07 (.05)
Amount spent on children´s clothing … (CFA)	4604 (8213)	1,745.86* (892.33)	-363.42 (785.57)	2,109.28** (840.22)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A8b: Replication Table

	Intrahousehold decision making			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Decision making regarding cash transfer				
Program recipient responsible … of cash transfer	.53 (.50)	-.01 (.03)	-.03 (.04)	.02 (.04)
Program recipient involved … transfer	.99 (.09)	.01 (.01)	.01 (.01)	-.00 (.01)
B. Women´s involvement in agriculture				
Program recipient visited market in past week	.19 (.39)	.09** (.04)	-.04 (.04)	.14*** (.04)
Program recipient involved in … household	.15 (.36)	.04 (.03)	-.02 (.03)	.06** (.03)
Number of observations				
C. Clothing expenditures for Muslim festivals				
Household spent money on … festivals	.44 (.50)	.10* (.05)	.03 (.05)	.07 (.05)
Amount spent on children´s clothing … (CFA)	4605 (8214)	1,745.86* (892.33)	-363.42 (785.57)	2,109.28** (840.22)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A9a: Current Table

	Alternative explanations			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Access to village-level infrastructure				
Market located within the village	.25 (.44)	-.02 (.11)	-.13 (0.10)	.11 (.09)
Zap agent in village	.03 (.18)	-.05 (.03)	.01 (.05)	-.06 (.05)
Number of Zap agents in village	.07 (.38)	-.10 (.08)	-.05 (.11)	-.05 (.05)
B. Shocks				
Household was affected by drought in 2010/2011	.66 (.47)	-.04 (.05)	-.02 (.05)	-.02 (.05)
Household was affected by drought in 2010/2011	.69 (.46)	-.00 (.03)	-.02 (.03)	.02 (.03)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

Table A9b: Replication Table

	Alternative explanations			
	Cash Average Mean (SD)	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap -Mobile Coeff. (SE)
A. Access to village-level infrastructure				
Market located within the village	.25 (.44)	-.02 (.11)	-.13 (0.10)	.11 (.09)
Zap agent in village	.03 (.18)	-.05 (.03)	.01 (.05)	-.06 (.05)
Number of Zap agents in village	.07 (.38)	-.10 (.08)	-.05 (.11)	-.05 (.05)
B. Shocks				
Household was affected by drought in 2010/2011	.66 (.47)	-.04 (.05)	-.02 (.05)	-.02 (.05)
Household was affected by drought in 2010/2011	.69 (.46)	-.00 (.03)	-.02 (.03)	.02 (.03)

Note: * p < 0.1; ** p < 0.05; *** p < 0.01

List of files received from the original authors

Instructions/PUBLISHED VERSION WITH ERRATUM paper/other	NONE			
data sets files	zapanthro	Zapchilddiet	zaphousehold	zapprices
do files	Zap Replication Do File_11aug2017			
Surveys/Codebooks	NONE			
output	NONE			

Appendix B: Figures

Figure B1: Mean cost

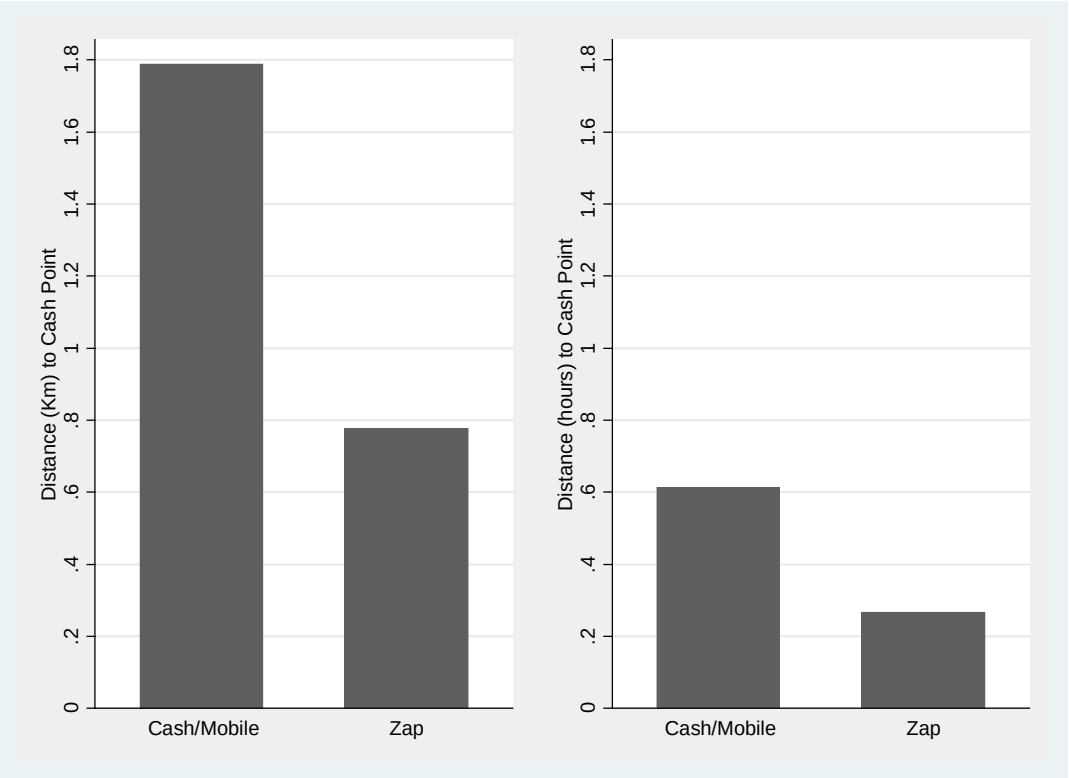
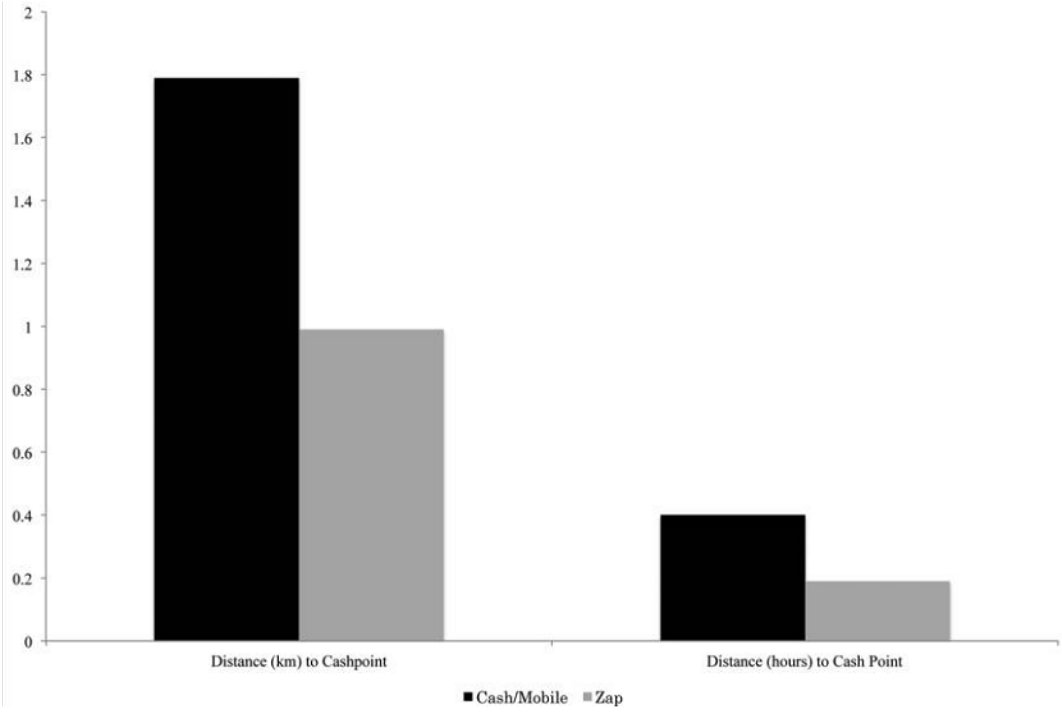


Figure B2: Mean cost (original paper)



Appendix C: Quartile results

Table C1: Uses of cash transfer for food items

From Table 4 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)	Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)
A.1. Number of food and nonfood items purchased with cash transfer							
Quartile 1: 13-25 years	289	0.89*	-0.33	1.22***	0.89*	-0.33	1.22***q
		(0.47)	(0.44)	(0.44)	(0.47)	(0.44)	(0.44)
Quartile 2: 26-30 years	277	-0.18	0.23	-0.40	0.72***q	-0.10	0.82**q
		(0.51)	(0.53)	(0.47)	(0.27)	(0.30)	(0.31)
Quartile 3: 31-40 years	264	-0.18	-0.06	-0.12	0.72*	-0.39	1.10**q
		(0.51)	(0.53)	(0.49)	(0.39)	(0.42)	(0.45)
Quartile 4: 41-78 years	214	-0.07	0.95	-1.01*	0.83**q	0.62	0.21
		(0.56)	(0.61)	(0.55)	(0.38)	(0.44)	(0.35)
A.2. Transfer used to buy staple grains (millet, sorghum)							
Quartile 1: 13-25 years	289	-0.01	0.00	-0.01	-0.01	0.00	-0.01
		(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)
Quartile 2: 26-30 years	273	0.00	-0.01	0.01	-0.01	-0.01	0.00
		(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Quartile 3: 31-40 years	259	0.00	0.00	0.01	-0.01	0.00	-0.01
		(0.01)	(0.00)	(0.02)	(0.01)	(0.00)	(0.01)
Quartile 4: 41-78 years	211	0.02	0.01	0.01	0.01	0.01	0.00
		(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
A.3. Transfer used to buy other grains (corn, rice)							
Quartile 1: 13-25 years	289	0.24**q	-0.11	0.35***q	0.24**q	-0.11	0.35***q
		(0.10)	(0.09)	(0.10)	(0.10	(0.09)	(0.10)

From Table 4 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash	Mobile - Cash	Zap - Mobile	Zap - Cash	Mobile - Cash	Zap - Mobile
		(SE)	(SE)	(SE)	(SE)	(SE)	(SE)
Quartile 2: 26-30 years	273	-0.06	0.05	-0.11	0.18***q	-0.06	0.24***q
		(0.11)	(0.10)	(0.10)	(0.06)	(0.07)	(0.07)
Quartile 3: 31-40 years	259	-0.15	0.06	-0.21**	0.09	-0.05	0.14*
		(0.11)	(0.11)	(0.10)	(0.07)	(0.08)	(0.08)
Quartile 4: 41-78 years	211	-0.04	0.29***q	-0.33***q	0.21**q	0.18**q	0.03
		(0.10)	(0.11)	(0.10)	(0.08)	(0.09)	(0.08)
A.4. Transfer used to buy cowpeas							
Quartile 1: 13-25 years	289	0.05	-0.08	0.14*	0.05	-0.08	0.14*
		(0.09)	(0.09)	(0.08)	(0.09)	(0.09)	(0.08)
Quartile 2: 26-30 years	273	0.00	0.00	0.00	0.05	-0.09	0.14*
		(0.10)	(0.10)	(0.09)	(0.07)	(0.06)	(0.07)
Quartile 3: 31-40 years	259	0.07	0.11	-0.04	0.12	0.03	0.09
		(0.10)	(0.10)	(0.09)	(0.08)	(0.09)	(0.08)
Quartile 4: 41-78 years	211	0.09	0.24**	-0.15	0.14**q	0.16**q	-0.02
		(0.10)	(0.11)	(0.10)	(0.07)	(0.07)	(0.07)
A.5. Transfer used to buy condiments							
Quartile 1: 13-25 years	289	0.09	-0.07	0.17**	0.09	-0.07	0.17**q
		(0.08)	(0.07)	(0.08)	(0.08)	(0.07)	(0.08)
Quartile 2: 26-30 years	273	0.08	0.11	-0.03	0.17***q	0.03	0.14**q
		(0.10)	(0.09)	(0.09)	(0.06)	(0.06)	(0.06)
Quartile 3: 31-40 years	259	-0.01	-0.03	0.02	0.08	-0.11	0.19**q
		(0.09)	(0.09)	(0.08)	(0.07)	(0.08)	(0.08)
Quartile 4: 41-78 years	211	-0.03	0.15	-0.18**	0.06	0.07	-0.01
		(0.10)	(0.10)	(0.09)	(0.07)	(0.08)	(0.06)

From Table 4 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)	Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)
A.6. Transfer used to buy oil							
Quartile 1: 13-25 years	289	0.09	-0.11	0.20**	0.09	-0.11	0.20**q
		(0.09)	(0.08)	(0.08)	(0.09)	(0.07)	(0.08)
Quartile 2: 26-30 years	273	0.10	0.14	-0.04	0.19***q	0.03	0.16***q
		(0.10)	(0.10)	(0.09)	(0.06)	(0.07)	(0.06)
Quartile 3: 31-40 years	259	-0.01	-0.03	0.03	0.09	-0.14*	0.23***q
		(0.09)	(0.09)	(0.09)	(0.07)	(0.08)	(0.08)
Quartile 4: 41-78 years	211	0.06	0.28**	-0.22**	0.16**q	0.17**q	-0.01
		(0.11)	(0.11)	(0.09)	(0.07)	(0.08)	(0.06)
A.7. Transfer used to buy meat							
Quartile 1: 13-25 years	289	0.17*	-0.07	0.24***q	0.17*	-0.07	0.24***q
		(0.09)	(0.08)	(0.07)	(0.09)	(0.08)	(0.07)
Quartile 2: 26-30 years	273	-0.11	0.05	-0.17**	0.06	-0.01	0.07
		(0.10)	(0.10)	(0.08)	(0.06)	(0.07)	(0.07)
Quartile 3: 31-40 years	259	0.08	0.08	0.00	0.25***q	0.01	0.24***q
		(0.10)	(0.10)	(0.09)	(0.07)	(0.06)	(0.06)
Quartile 4: 41-78 years	211	-0.05	0.03	-0.08	0.12	-0.03	0.15**q
		(0.10)	(0.12)	(0.10)	(0.07)	(0.09)	(0.06)

Note: *p < 0.1,**p < 0.05, ***p < 0.01; FDR < 10% is represented by q

Table C2: Uses of cash transfer for nonfood items

From Table 4 of the original article	Obs by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash (SE)	Mobile - Cash (SE)	Zap -Mobile (SE)	Zap–Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)
B.1. Transfer used to pay school fees							
Quartile 1: 13-25 years	289	0.00	-0.02	0.02	0.00	-0.02	0.02
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Quartile 2: 26-30 years	273	-0.05	0.03	-0.08*	-0.06*	0.01	-0.07*
		(0.05)	(0.05)	(0.05)	(0.03)	(0.04)	(0.04)
Quartile 3: 31-40 years	259	-0.01	0.00	-0.01	-0.01	-0.02	0.01
		(0.06)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)
Quartile 4: 41-78 years	211	0.00	0.01	-0.02	-0.01	-0.01	0.00
		(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.03)
B.2. Transfer used to pay health expenses							
Quartile 1: 13-25 years	289	0.05	0.02	0.03	0.05	0.02	0.03
		(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Quartile 2: 26-30 years	273	-0.09	-0.11	0.02	-0.03	-0.09	0.06
		(0.10)	(0.09)	(0.10)	(0.07)	(0.06)	(0.08)
Quartile 3: 31-40 years	259	-0.06	0.03	-0.09	0.00	0.05	-0.05
		(0.08)	(0.09)	(0.08)	(0.06)	(0.08)	(0.07)
Quartile 4: 41-78 years	211	-0.03	-0.05	0.02	0.03	-0.03	0.06
		(0.10)	(0.09)	(0.08)	(0.07)	(0.07)	(0.05)
B.3. Transfer used to buy clothes							
Quartile 1: 13-25 years	289	0.01	0.04	-0.03	0.01	0.04	-0.03
		(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)
Quartile 2: 26-30 years	273	0.01	-0.06*	0.07*	0.02	-0.01	0.04
		(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Quartile 3: 31-40 years	259	-0.06	-0.06	0.00	-0.05	-0.01	-0.03
		(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)
Quartile 4: 41-78 years	211	0.02	-0.05	0.07	0.03	-0.01	0.04
		(0.04)	(0.05)	(0.06)	(0.04)	(0.05)	(0.05)

Note: *p < 0.1, **p < 0.05, ***p < 0.01 ; FDR < 10% is represented by **q**

Table C3: Heterogeneous impacts on diet diversity

From Table 5 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash	Mobile - Cash	Zap - Mobile	Zap - Cash	Mobile - Cash	Zap - Mobile
		(SE)	(SE)	(SE)	(SE)	(SE)	(SE)
A.1. Household diet diversity score (out of 12)							
Quartile 1: 13-25 years	299	0.20	0.02	0.18	0.20	0.02	0.18
		(0.37)	(0.30)	(0.33)	(0.37)	(0.30)	(0.33)
Quartile 2: 26-30 years	289	0.09	-0.27	0.36	0.29	-0.26	0.54*
		(0.43)	(0.37)	(0.40)	(0.28)	(0.22)	(0.29)
Quartile 3: 31-40 years	282	-0.09	-0.41	0.33	0.11	-0.40	0.51*
		(0.41)	(0.37)	(0.37)	(0.29)	(0.28)	(0.30)
Quartile 4: 41-78 years	223	0.13	-0.47	0.60	0.32	-0.45	0.77**q
		(0.48)	(0.44)	(0.46)	(0.35)	(0.36)	(0.30)
A.2. Consumption of grains							
Quartile 1: 13-25 years	299	-0.02	-0.03**	0.01	-0.02	-0.03**	0.01
		(0.02)	(0.01)	(0.03)	(0.02)	(0.01)	(0.02)
Quartile 2: 26-30 years	289	0.02	0.02	0.00	0.00	-0.01	0.01
		(0.02)	(0.01)	(0.03)	(0.00)	(0.01)	(0.01)
Quartile 3: 31-40 years	282	0.06*	0.06**	0.00	0.04*	0.03	0.00
		(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)
Quartile 4: 41-78 years	223	0.02	0.03	-0.01	0.00	0.00	0.00
		(0.03)	(0.03)	(0.04)	(0.02)	(0.02)	(0.02)
A.3. Consumption of beans							
Quartile 1: 13-25 years	299	0.05	-0.01	0.06	0.05	-0.01	0.06
		(0.06)	(0.05)	(0.06)	(0.06)	(0.05)	(0.06)
Quartile 2: 26-30 years	289	-0.08	-0.05	-0.03	-0.03	-0.06	0.03
		(0.10)	(0.08)	(0.10)	(0.08)	(0.07)	(0.08)
Quartile 3: 31-40 years	282	0.09	0.08	0.01	0.14*	0.07	0.07
		(0.10)	(0.09)	(0.10)	(0.07)	(0.08)	(0.08)

From Table 5 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)	Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)
Quartile 4: 41-78 years	223	0.10 (0.11)	0.01 (0.09)	0.09 (0.11)	0.15 (0.10)	0.01 (0.08)	0.14 (0.09)
A.4. Consumption of fats							
Quartile 1: 13-25 years	299	0.11 (0.09)	-0.01 (0.08)	0.12 (0.08)	0.11 (0.09)	-0.01 (0.07)	0.12 (0.08)
Quartile 2: 26-30 years	289	-0.03 (0.10)	0.01 (0.10)	-0.04 (0.10)	0.08 (0.07)	0.00 (0.07)	0.09 (0.07)
Quartile 3: 31-40 years	282	-0.04 (0.11)	0.00 (0.11)	-0.05 (0.11)	0.07 (0.08)	-0.01 (0.07)	0.08 (0.07)
Quartile 4: 41-78 years	223	-0.08 (0.14)	-0.15 (0.12)	0.07 (0.13)	0.03 (0.11)	-0.16 (0.10)	0.19* (0.10)
A.5. Consumption of meat							
Quartile 1: 13-25 years	299	0.02 (0.04)	-0.01 (0.04)	0.03 (0.04)	0.02 (0.04)	-0.01 (0.04)	0.03 (0.04)
Quartile 2: 26-30 years	289	0.01 (0.05)	0.04 (0.04)	-0.03 (0.05)	0.03 (0.04)	0.03 (0.04)	0.00 (0.04)
Quartile 3: 31-40 years	282	-0.02 (0.07)	-0.02 (0.05)	-0.01 (0.06)	0.00 (0.05)	-0.02 (0.04)	0.02 (0.04)
Quartile 4: 41-78 years	223	0.03 (0.06)	0.02 (0.06)	0.01 (0.06)	0.05 (0.06)	0.01 (0.05)	0.04 (0.05)
A.6. Consumption of condiments							
Quartile 1: 13-25 years	299	-0.06 (0.09)	0.00 (0.07)	-0.06 (0.08)	-0.06 (0.09)	0.00 (0.07)	-0.06 (0.08)
Quartile 2: 26-30 years	289	0.09 (0.11)	-0.14 (0.09)	0.23** (0.10)	0.02 (0.08)	-0.14** (0.07)	0.16****q*** (0.07)
Quartile 3: 31-40 years	282	-0.07 (0.10)	-0.20** (0.09)	0.13 (0.09)	-0.13* (0.08)	-0.20****q*** (0.08)	0.07 (0.07)

From Table 5 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)	Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)
Quartile 4: 41-78 years	223	0.06 (0.12)	-0.09 (0.12)	0.15 (0.12)	0.00 (0.10)	-0.09 (0.11)	0.09 (0.08)
A.7. Consumption of fruit							
Quartile 1: 13-25 years	299	0.05** (0.02)	0.01 (0.02)	0.04 (0.02)	0.05** (0.02)	0.01 (0.02)	0.04 (0.02)
Quartile 2: 26-30 years	289	-0.04 (0.03)	-0.02 (0.02)	-0.02 (0.03)	0.01 (0.01)	-0.01 (0.01)	0.01 (0.01)
Quartile 3: 31-40 years	282	0.00 (0.04)	-0.02 (0.03)	0.02 (0.03)	0.04 (0.03)	-0.01 (0.02)	0.05**q (0.02)
Quartile 4: 41-78 years	223	0.01 (0.03)	-0.01 (0.02)	0.03 (0.04)	0.06***q (0.02)	0.00 (0.01)	0.06***q (0.02)

Note: *p < 0.1, **p < 0.05, ***p < 0.01; FDR < 10% is represented by **q**

Table C4: Heterogeneous impacts on durable and nondurable assets

From Table 5 of the original article	Observations by stratum	Heterogeneity impact of intervention by age groups (quartiles)			Impact estimate of intervention within strata of age group (quartiles)		
		Zap - Cash (SE)	Mobile - Cash (SE)	Zap -Mobile (SE)	Zap - Cash (SE)	Mobile - Cash (SE)	Zap - Mobile (SE)
C.1. Number of asset categories owned (out of 11, excluding mobile phones)							
Quartile 1: 13-25 years	304	-0.10 (0.20)	-0.27 (0.19)	0.17 (0.16)	-0.10 (0.20)	-0.27 (0.19)	0.17 (0.16)
Quartile 2: 26-30 years	292	0.36 (0.22)	0.29 (0.22)	0.07 (0.22)	0.25 (0.17)	0.02 (0.14)	0.23 (0.17)
Quartile 3: 31-40 years	287	0.26 (0.30)	0.18 (0.27)	0.08 (0.23)	0.16 (0.21)	-0.09 (0.20)	0.25 (0.18)
Quartile 4: 41-78 years	227	0.36 (0.30)	0.12 (0.29)	0.23 (0.25)	0.25 (0.25)	-0.15 (0.27)	0.40* (0.23)
C.2. Durable assets (plows, carts, bikes, and motos)							
Quartile 1: 13-25 years	304	-0.05 (0.06)	-0.06 (0.06)	0.01 (0.05)	-0.05 (0.06)	-0.06 (0.06)	0.01 (0.05)
Quartile 2: 26-30 years	292	0.09 (0.07)	0.02 (0.08)	0.07 (0.07)	0.03 (0.06)	-0.05 (0.05)	0.08 (0.06)
Quartile 3: 31-40 years	287	0.16* (0.08)	0.06 (0.09)	0.10 (0.07)	0.11 (0.07)	0.00 (0.06)	0.11* (0.06)
Quartile 4: 41-78 years	227	0.04 (0.08)	0.04 (0.10)	0.00 (0.09)	-0.01 (0.08)	-0.03 (0.08)	0.01 (0.08)
C.3. Nondurable assets (flashlights, petrol lamps, and radios)							
Quartile 1: 13-25 years	304	-0.03 (0.15)	-0.17 (0.14)	0.14 (0.12)	-0.03 (0.15)	-0.17 (0.14)	0.14 (0.12)
Quartile 2: 26-30 years	292	0.28 (0.18)	0.23 (0.16)	0.05 (0.17)	0.26** (0.13)	0.06 (0.11)	0.19 (0.14)
Quartile 3: 31-40 years	287	0.01 (0.21)	0.09 (0.20)	-0.08 (0.17)	-0.02 (0.13)	-0.08 (0.14)	0.07 (0.13)
Quartile 4: 41-78 years	227	0.38* (0.23)	0.05 (0.22)	0.33* (0.19)	0.36** (0.17)	-0.12 (0.18)	0.48***q (0.15)

Note: *p < 0.1, **p < 0.05, ***p < 0.01; FDR <10% is represented by **q**

Appendix D: Multiple imputation results

Table D1: Uses of cash transfer using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Uses of cash transfer for food items						
Number of food and nonfood items purchased with cash transfer	385	4.17 (0.16)	1148	*0.73*** (0.29)	-0.05 (0.26)	0.78*** (0.27)
Transfer used to buy staple grains (millet, sorghum)	385	1 (0.00)	1148	-0.01 (0.01)	0.00 (0.00)	-0.01 (0.01)
Transfer used to buy other grains (corn, rice)	385	0.56 (0.03)	1148	0.15*** (0.05)	-0.04 (0.05)	0.19*** (0.06)
Transfer used to buy cowpeas	385	0.41 (0.03)	1148	*0.07* (0.05)	-0.02 (0.05)	*0.09** (0.05)
Transfer used to buy condiments	385	0.69 (0.03)	1148	*0.07* (0.05)	-0.04 (0.04)	0.11*** (0.04)
Transfer used to buy oil	385	0.67 (0.03)	1148	*0.11*** (0.05)	-0.03 (0.05)	0.14*** (0.05)
Transfer used to buy meat	385	0.38 (0.03)	1148	0.15*** (0.05)	-0.03 (0.04)	0.18*** (0.04)
B. Uses of cash transfer for nonfood items						
Transfer used to pay school fees	385	0.07 (0.01)	1148	-0.01 (0.02)	-0.01 (0.02)	0.00 (0.02)
Transfer used to pay health expenses	385	0.3 (0.03)	1148	0.00 (0.04)	-0.03 (0.04)	0.03 (0.04)
Transfer used to buy clothes	385	0.04 (0.01)	1148	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)

Note. Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment (Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation.

* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table D2: Impact on food security and nutritional status using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Food security						
Household diet diversity score (out of 12)	767	3.17 (0.06)	2284	0.28* (0.15)	-0.23* (0.13)	0.52*** (0.14)
Consumption of:						
Grains	767	0.99 (0.00)	2284	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)
Beans	767	0.18 (0.01)	2284	0.06** (0.03)	-0.01 (0.02)	0.07** (0.03)
Fats	767	0.29 (0.02)	2284	*0.09*** (0.03)	-0.02 (0.03)	0.11*** (0.03)
Meat	767	0.06 (0.01)	2284	0.02 (0.02)	0.00 (0.02)	0.03* (0.01)
Condiments	767	0.36 (0.02)	2284	-0.01 (0.04)	-0.08** (0.04)	0.07* (0.04)
Fruit	767	0.03 (0.01)	2284	0.02** (0.01)	-0.01 (0.01)	0.03*** (0.01)
B. Child nutritional status						
Number of meals eaten by children under 5 in past 24 hours	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Diet diversity of children under 5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Weight-for-height z-score	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
C. Durable and nondurable goods						
Number of asset categories owned (out of 11, excluding mobile phones)	767	3.05 (0.05)	2284	0.12 (0.11)	-0.19* (0.1)	*0.31*** (0.09)
Durable assets (plows, carts, bikes, and motos)	767	0.18 (0.02)	2284	-0.01 (0.04)	-0.07** (0.03)	0.05 (0.03)
Nondurable assets (flashlights, petrol lamps, and radios)	767	1.63 (0.03)	2284	0.12 (0.07)	-0.09 (0.07)	0.2*** (0.07)

Note: Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment (Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation. * Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table D3: Leakage using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
Leakage						
Program recipient received cash transfer	385	0.97 (0.01)	1148	-0.02 (0.02)	0.01 (0.02)	*-0.03* (0.02)
Number of transfer received	385	4.44 (0.07)	1148	-0.13 (0.11)	-0.03 (0.13)	-0.1 (0.13)
Amount of money received (CFA)	385	93637.66 (1912.31)	1148	-1544.78 (3308.9)	-358.72 (3364.11)	-1186.06 (3222.99)

Note. Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment :(Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation.
* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.
We present "n.a". when the analysis is not feasible. In this case, data at the child-level is a sub-sample and does not have attrition information, because we do not have that sub-sample in the baseline.

Table D4: Location, knowledge and timing of cash transfer expenses using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Timing of receipt of transfer						
Obtained transfer the same day	385	0.89 (0.02)	1148	-0.37*** (0.06)	-0.04 (0.03)	-0.34*** (0.05)
B. Timing of expenditures						
Spent money all at once	385	0.62 (0.03)	1148	-0.03 (0.04)	-0.03 (0.04)	0.01 (0.04)
Spent money at least two lines	385	0.38 (0.03)	1148	0.03 (0.04)	0.03 (0.04)	0.00 (0.04)
C. Location of expenditures						
Spent transfer at kiosk in village	385	0.44 (0.03)	1148	0.03 (0.06)	-0.05 (0.05)	0.08 (0.06)
Spent transfer at market within village	385	0.24 (0.03)	1148	-0.02 (0.09)	0.02 (0.08)	-0.04 (0.07)
Spent transfer at market outside village	385	0.61 (0.03)	1148	0.03 (0.08)	-0.01 (0.08)	0.04 (0.07)
D. Knowledge of cash transfer						
Knew correct amount of cash transfer	385	0.12 (0.02)	1148	0.01 (0.03)	0.00 (0.02)	0.02 (0.02)
Knew correct duration of cash transfer	385	0.12 (0.02)	1148	0.02 (0.03)	-0.01 (0.02)	0.04 (0.03)

Note. Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment (Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation.
* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table D5: Mobile phone ownership and usage using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Mobile phone ownership and usage						
Program recipient used mobile phone since last harvest	767	0.46 (0.02)	2284	0.31*** (0.04)	0.16*** (0.04)	0.16*** (0.04)
Made or received calls	767	0.46 (0.02)	2284	0.29*** (0.04)	0.15*** (0.04)	0.14*** (0.04)
Sent or received a "beep"	767	0.03 (0.01)	2284	0.11*** (0.02)	0.05*** (0.02)	*0.06*** (0.02)
Received credit via Zap	767	0.00 (0.00)	2284	0.19*** (0.02)	0.03** (0.01)	0.15*** (0.02)
Communicated with family/friends inside Niger	767	0.18 (0.01)	2284	0.28*** (0.04)	0.14*** (0.03)	0.14*** (0.04)
Communicated with family/friends outside Niger	767	0.15 (0.01)	2284	0.09*** (0.03)	0.02 (0.02)	0.07*** (0.02)
Communicated with commercial contacts inside Niger	767	0.00 (0.00)	2284	0.02** (0.01)	0.02*** (0.01)	0.00 (0.01)
Used mobile phone to communicate death/ceremony	385	0.07 (0.01)	1148	0.13*** (0.03)	0.09*** (0.02)	0.04 (0.03)
Used mobile phone to obtain price information	385	0.02 (0.01)	1148	0.00 (0.01)	0.01 (0.01)	-0.01 (0.01)
Used mobile phone to ask for help/support	385	0.07 (0.01)	1148	0.03 (0.03)	0.03 (0.02)	0.00 (0.02)
B. Migration, remittances, and mobile transfers						
At least one household member migrates	385	0.38 (0.02)	1148	0.08* (0.05)	0.05 (0.05)	0.03 (0.04)
Percentage of household members who migrated	385	0.05 (0.00)	1148	0.02* (0.01)	0.01 (0.01)	0.01 (0.01)
Household received remittances as income	767	0.21 (0.01)	2284	0.04 (0.03)	0.01 (0.03)	0.03 (0.03)
Amount of remittances received for last transfer (CFA)	767	4336.93 (452.29)	2284	284.87 (856.93)	97.6 (867.22)	187.27 (831.98)
Number of remittances since last harvest	767	0.51 (0.09)	2284	0.18 (0.15)	0.00 (0.12)	0.18 (0.13)
Received remittance via Western Union	767	0.07 (0.01)	2284	-0.01 (0.02)	-0.02 (0.01)	0.01 (0.01)
Received remittance via friend	767	0.1 (0.01)	2284	0.04 (0.02)	0.03 (0.02)	0.01 (0.02)
Received remittance via Zap	767	0.00 (0.00)	2284	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)

Note. Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment (Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation.
* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table D6: Intrahousehold decision making using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Decision making regarding cash transfer						
Program recipient responsible for spending part of cash transfer	385	0.53 (0.03)	1148	-0.01 (0.04)	-0.03 (0.04)	0.01 (0.04)
Program recipient involved in deciding how to transfer	385	0.99 (0.00)	1148	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)
B. Women´s involvement in agriculture						
Program recipient visited market in past week	385	0.19 (0.02)	1148	0.09** (0.04)	-0.04 (0.04)	0.12*** (0.04)
Program recipient involved in selling grain for household	767	0.14 (0.01)	2284	*0.04** (0.03)	-0.01 (0.03)	0.06** (0.03)
C. Clothing expenditures for Muslim festivals						
Household spent money on women´s or children´s clothing for festivals	382	0.44 (0.03)	1136	0.08* (0.05)	0.04 (0.05)	0.05 (0.05)
Amount spent on children´s clothing for festivals (CFA)	382	4593.88 (440.96)	1136	1688.06* (882.35)	-214 (766.59)	1902.06** (895.7)

Note. Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment (Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation.

* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Table D7: Alternative explanations using multiple imputation

Variable	Observations Cash	Mean Cash (SD)	Observations	Zap - Cash Coeff. (SE)	Mobile - Cash Coeff. (SE)	Zap - Mobile Coeff. (SE)
A. Access to village-level infrastructure						
Market located within the village	32	0.25 (0.44)	96	-0.02 (0.11)	-0.13 (0.1)	0.11 (0.09)
Zap agent in village	32	0.03 (0.18)	96	-0.05 (0.03)	0.01 (0.05)	-0.06 (0.05)
Number of Zap agents in village	32	0.1 (0.38)	96	*-0.12** (0.06)	-0.08 (0.08)	-0.04 (0.05)
B. Shocks						
Household was affected by drought in 2010/2011	385	0.65 (0.02)	1148	-0.05 (0.05)	-0.02 (0.05)	-0.03 (0.05)
Household was affected by illness in 2010/2011	385	0.69 (0.02)	1148	0.00 (0.03)	-0.03 (0.03)	0.03 (0.03)

Note. Simple difference comparison of households in each of the different treatment areas. Column 2 shows the mean and SD of the basic treatment (Cash) households, whereas cols. 4 and 5 show the average difference between the different treatments and the Cash households. Column 6 shows the average difference between the Zap and Mobile treatment households. All regressions control for geographic level fixed effects and for the presence of a seed distribution program in the village. Heteroskedasticity consistent SEs clustered at the village level are in parentheses. Missing values are estimated using multiple imputation and standard errors are adjusted to multiple imputation.

* Significant at the 10% level. ** Significant at the 5% level. *** Significant at the 1% level.

Appendix E: Lee bounds results

Table E1: Uses of cash transfer using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI	Mobile - Cash Lee bounds effect 95% CI	Zap - Mobile Lee bounds effect 95% CI
A. Use of cash transfer for food items			
Number of food and nonfood items purchased with cash transfer	[0.1 - 1.06]*	[-0.6 - 0.36]	[0.35 - 1.38]*
Transfer used to buy staple grains (millet, sorghum)	[-0.02 - 0.00]	[0.00 - 0.01]	[-0.03 - 0.00]
Transfer used to buy other grains (corn, rice)	[0.03 - 0.24]*	[-0.13 - 0.05]	[0.12 - 0.28]*
Transfer used to buy cowpeas	*[-0.04 - 0.16]*	[-0.12 - 0.08]	[0.03 - 0.19]*
Transfer used to buy condiments	*[-0.03 - 0.15]*	[-0.11 - 0.06]	[0.04 - 0.21]*
Transfer used to buy oil	*[0.00 - 0.17]*	[-0.13 - 0.06]	[0.07 - 0.22]*
Transfer used to buy meat	[0.04 - 0.23]*	[-0.12 - 0.04]	[0.11 - 0.28]*
B. Uses of cash transfer for nonfood items			
Transfer used to pay school fees	[-0.08 - 0.03]	[-0.07 - 0.02]	[-0.03 - 0.05]
Transfer used to pay health expenses	[-0.11 - 0.06]	[-0.12 - 0.07]	[-0.06 - 0.1]
Transfer used to buy clothes	[-0.12 - 0.03]	[-0.04 - 0.04]	[-0.02 - 0.06]

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.
* The range of the combination of the confidence intervals does not contains zero.

Table E2: Impact on food security and nutritional status, using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI	Mobile - Cash Lee bounds effect 95% CI	Zap - Mobile Lee bounds effect 95% CI
A. Food security			
Household diet diversity score (out of 12)	*[-0.07 - 0.5]*	[-0.46 - -0.02]*	[0.38 - 0.78]*
Consumption of:			
Grains	[-0.01 - 0.03]	[-0.02 - 0.03]	[0.00 - 0.02]
Beans	*[0.00 - 0.1]*	[-0.07 - 0.02]	[0.02 - 0.12]*
Fats	[0.01 - 0.15]*	[-0.08 - 0.04]	[0.07 - 0.17]*
Meat	[-0.01 - 0.06]	[-0.03 - 0.03]	[0.00 - 0.05]*
Condiments	[-0.08 - 0.06]	[-0.14 - -0.01]*	[0.04 - 0.13]*
Fruit	[0.01 - 0.06]*	[-0.02 - 0.01]	[0.02 - 0.05]*
B. Child nutritional status			
Number of meals eaten by children under 5 in past 24 hours	n.a.	n.a.	n.a.
Diet diversity of children under 5	n.a.	n.a.	n.a.
Weight-for-height z-score	n.a.	n.a.	n.a.
C. Durable and nondurable goods			
Number of asset categories owned (out of 11, excluding mobile phones)	[-0.17 - 0.15]	[-0.48 - -0.09]*	[0.21 - 0.43]*
Durable assets (plows, carts, bikes, and motos)	[-0.11 - 0.07]	*[-0.15 - 0.01]*	[0.02 - 0.08]*
Nondurable assets (flashlights, petrol lamps, and radios)	[-0.06 - 0.17]	[-0.24 - -0.01]*	[0.12 - 0.32]*

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.
* The range of the combination of the confidence intervals does not contains zero.

Table E3: Leakage using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI	Mobile - Cash Lee bounds effect 95% CI	Zap - Mobile Lee bounds effect 95% CI
Leakage			
Program recipient received cash transfer	[-0.05 - 0.00]	[-0.01 - 0.03]	[-0.05 - -0.01]*
Number of transfer received	[-0.36 - 0.18]	[-0.15 - 0.1]	[-0.41 - -0.03]*
Amount of money received (CFA)	[-3909 - 8286]	[-4808 - 3259]	[-5831 - 1440]

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.

* The range of the combination of the confidence intervals does not contains zero.

Table E4: Location, knowledge and timing of cash transfer expenses, using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI	Mobile - Cash Lee bounds effect 95% CI	Zap - Mobile Lee bounds effect 95% CI
A. Timing of receipt of transfer			
Obtained transfer the same day	[-0.43 - -0.28]*	[-0.04 - 0.09]	[-0.47 - -0.32]*
B. Timing of expenditures			
Spent money all at once	[-0.06 - 0.12]	[-0.12 - 0.07]	[-0.09 - 0.1]
Spent money at least two lines	[-0.14 - 0.06]	[-0.07 - 0.13]	[-0.09 - 0.09]
C. Location of expenditures			
Spent transfer at kiosk in village	[-0.1 - 0.12]	[-0.14 - 0.07]	[0.00 - 0.19]*
Spent transfer at market within village	[-0.18 - 0.00]	[-0.1 - 0.06]	[-0.08 - 0.09]
Spent transfer at market outside village	[0.02 - 0.21]*	[-0.07 - 0.12]	[-0.08 - 0.08]
D. Knowledge of cash transfer			
Knew correct amount of cash transfer	[-0.01 - 0.07]	[-0.08 - 0.06]	[-0.04 - 0.09]
Knew correct duration of cash transfer	[-0.01 - 0.09]	[-0.09 - 0.03]	[0.00 - 0.13]

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.

* The range of the combination of the confidence intervals does not contains zero.

Table E5: Mobile phone ownership and usage, using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI	Mobile - Cash Lee bounds effect 95% CI Interval	Zap - Mobile Lee bounds effect 95% CI Interval
A. Mobile phone ownership and usage			
Program recipient used mobile phone since last harvest	[0.28 - 0.38]*	[0.05 - 0.19]*	[0.08 - 0.17]*
Made or received calls	[0.26 - 0.37]*	[0.05 - 0.2]*	[0.04 - 0.16]*
Sent or received a "beep"	[0.08 - 0.17]*	*[0.00 - 0.05]*	[0.03 - 0.07]*
Received credit via Zap	[0.16 - 0.23]*	*[-0.01 - 0.02]*	[0.11 - 0.15]*
Communicated with family/friends inside Niger	[0.26 - 0.38]*	[0.05 - 0.16]*	[0.08 - 0.17]*
Communicated with family/friends outside Niger	[0.04 - 0.15]*	[-0.05 - 0.06]	[0.01 - 0.1]*
Communicated with commercial contacts inside Niger	*[0.00 - 0.02]*	*[0.00 - 0.02]*	[-0.01 - 0.01]
Used mobile phone to communicate death/ceremony	[0.09 - 0.21]*	*[0.00 - 0.14]*	[-0.03 - 0.09]
Used mobile phone to obtain price information	[-0.02 - 0.01]	[-0.03 - 0.04]	[-0.04 - 0.02]
Used mobile phone to ask for help/support	[-0.03 - 0.08]	[-0.03 - 0.09]	[-0.03 - 0.05]
B. Migration, remittances, and mobile transfers			
At least one household member migrates	*[-0.01 - 0.17]*	[-0.01 - 0.11]	[-0.03 - 0.12]
Percentage of household members who migrated	[0.00 - 0.03]*	[-0.01 - 0.02]	[0.00 - 0.02]
Household received remittances as income	[-0.01 - 0.1]	[-0.04 - 0.07]	[-0.01 - 0.07]
Amount of remittances received for last transfer (CFA)	[-1868.25 - 1931.15]	[-1785.55 - 1371.01]	[-646.88 - 1956.43]
Number of remittances since last harvest	[-0.1 - 0.47]	[-0.19 - 0.14]	[0.05 - 0.48]*
Received remittance via Western Union	[-0.03 - 0.03]	[-0.04 - 0.01]	[0.00 - 0.04]*
Received remittance via friend	[0.00 - 0.09]	[-0.01 - 0.08]	[-0.04 - 0.03]
Received remittance via Zap	[0.00 - 0.00]	[0.00 - 0.00]	[0.00 - 0.00]

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.

* The range of the combination of the confidence intervals does not contains zero.

Table E6: Intrahousehold decision making using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI Interval	Mobile - Cash Lee bounds effect 95% CI Interval	Zap - Mobile Lee bounds effect 95% CI
A. Decision making regarding cash transfer			
Program recipient responsible for spending part of cash transfer	[-0.1 - 0.07]	[-0.16 - 0.05]	[-0.05 - 0.12]
Program recipient involved in deciding how to transfer	[-0.02 - 0.01]	[0.00 - 0.02]	[-0.02 - 0.01]
B. Women´s involvement in agriculture			
Program recipient visited market in past week	[0.01 - 0.13]*	[-0.12 - 0.00]	[0.05 - 0.18]*
Program recipient involved in selling grain for household	[-0.06 - 0.07]	[-0.07 - 0.02]	[0.02 - 0.1]*
C. Clothing expenditures for Muslim festivals			
Household spent money on women´s or children´s clothing for festivals	[0.02 - 0.25]*	[-0.06 - 0.15]	[-0.04 - 0.12]
Amount spent on children´s clothing for festivals (CFA)	[205 - 4139]*	[-1814 - 1832]	*[-818 - 3721]*

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.

* The range of the combination of the confidence intervals does not contains zero.

Table E7: Alternative explanations using Lee bounds

Variable	Zap - Cash Lee bounds effect 95% CI	Mobile - Cash Lee bounds effect 95% CI	Zap - Mobile Lee bounds effect 95% CI
A. Access to village-level infrastructure			
Market located within the village	n.a.	n.a.	n.a.
Zap agent in village	n.a.	n.a.	n.a.
Number of Zap agents in village	n.a.	n.a.	n.a.
B. Shocks			
Household was affected by drought in 2010/2011	[-0.19 - 0.00]	[-0.17 - 0.04]	[-0.09 - 0.07]
Household was affected by illness in 2010/2011	[-0.1 - 0.05]	[-0.12 - 0.05]	[-0.07 - 0.09]

Note: In columns 2 to 4 contain the combination of the confidence intervals of the estimated lower and upper bounds. Standard errors are estimated using bootstrap with 100 repetitions.

* The range of the combination of the confidence intervals does not contains zero.

Appendix F: Summary of multiple imputation and Lee bounds

Table F1: Detailed changes on significance after multiple imputation and Lee bounds analyses

	Zap-Cash		Mobile-Cash		Zap-Mobile	
Variable	Before	After	Before	After	Before	After
Multiple Imputation						
Table 4. Uses of Cash Transfer						
Number of food and nonfood items purchased with cash transfer	0.78*** (0.24)	0.73** (0.29)				
Transfer used to buy cowpeas	0.09* (0.05)	0.07 (0.05)			0.1** (0.05)	0.09* (0.05)
Transfer used to buy condiments	0.11** (0.05)	0.07 (0.05)				
Transfer used to buy oil	0.13*** (0.05)	0.11** (0.05)				
Table 5. Impact on food security and nutritional status						
Consumption of: fats	0.09** (0.03)	0.09*** (0.03)				
Table 6. Leakage						
Program recipient received cash transfer					-0.04** (0.02)	-0.03 (0.02)
Table 8. Mobile phone ownership and usage						
Sent or received a "beep"					0.08*** (0.02)	0.06** (0.02)
Lee bounds						
Table 4. Uses of cash transfer						
Transfer used to buy cowpeas	0.09* (0.05)	[-0.04 - 0.16]				
Transfer used to buy condiments	0.11** (0.05)	[-0.03 - 0.15]				
Transfer used to buy oil	0.13*** (0.05)	[0 - 0.17]				
Table 5. Impact on food security and nutritional status						
Household diet diversity score (out of 12)	0.28* (0.15)	[-0.07 - 0.5]				
Consumption of: Beans	0.06** (0.03)	[0 - 0.1]				
Durable assets (plows, carts, bikes, and motos)			-0.01 (0.04)	[-0.15 - 0.01]		
Table 8. Mobile phone ownership and usage						
Sent or received a "beep"			0.04*** (0.01)	[0 - 0.05]		
Received credit via Zap			0.03** (0.01)	[-0.01 - 0.02]		
Communicated with commercial contacts inside Niger	0.01** (0.00)	[0.00 - 0.02]	0.01*** (0.00)	[0 - 0.02]		

Variable	Zap-Cash		Mobile-Cash		Zap-Mobile	
	Before	After	Before	After	Before	After
Used mobile phone to communicate death/ceremony			0.08*** (0.02)	[0 - 0.14]		
At least one household member migrates	0.08* (0.05)	[-0.01 - 0.17]				
Table 9: Intrahousehold decision making						
Amount spent on children´s clothing for festivals (CFA)					2109.28** (840.22)	[-818 - 3721]

Appendix G: Demographic statistics of Niger

Table G1: Population of Niger

REGIONS OF NIGER	2012			Average annual intercensal growth rate %
	TOTAL	MEN	WOMEN	2001-2012
Region d'Agadez	487,620	251,257	236,363	3.6
Region de Diffa	593,821	304,246	289,575	4.7
Region de Dosso	2,037,713	1,005,641	1,032,072	2.7
Region de Maradi	3,402,094	1,673,783	1,728,311	3.7
Region de Tahoua	3,328,365	1,660,934	1,667,431	4.6
Region de Tillaberi	2,722,482	1,346,295	1,376,187	3.2
Region de Zinder	3,539,764	1,765,496	1,774,268	4.7
Ville de Niamey	1,026,848	511,166	515,682	2.9
TOTAL NIGER	17,138,707	8,518,818	8,619,889	3.9

Note: Source: INS-Niger (2015). Annuaire Statistique Du Niger 2010–2014.

Table G2: Population of Niger: Region of Tahoua and departments

Region of Tahoua	**2012**		
Departments	**MEN**	**WOMEN**	**TOTAL**
Département de ABALAK	134,005	122,296	256,301
Département de BAGAROUA	35,336	36,957	72,293
Département de BIRNI N'KONNI	157,066	155,820	312,886
Département de BOUZA	220,749	224,614	445,363
Département de ILLELA	168,142	168,479	336,621
Département de KEITA	165,280	171,818	337,098
Département de MADAOUA	274,507	271,031	545,538
Département de MALBAZA	117,481	114,926	232,407
Département de TAHOUA	208,931	222,892	431,823
Département de TASSARA	12,602	11,855	24,457
Département de TCHINTABARADEN	72,675	72,411	145,086
Département de TILLIA	20,064	18,930	38,994
COMMUNAUTE URBAINE DE TAHOUA	74,096	75,402	149,498
TOTAL REGION TAHOUA	1,660,934	1,667,431	3,328,365

Note: Source: INS-Niger (2015).

Table G3: Population of Niger: Department of Tahoua and communes

Department of Tahoua	2012		
	MEN	WOMEN	TOTAL
Commune Affala	32,364	35,861	68,225
Commune Bambeye	53,967	58,995	112,962
Commune Barmou	20,756	23,100	43,856
Commune Kalfou	54,804	55,634	110,438
Commune Takanamat	21,420	22,629	44,049
Commune Tebaram	25,620	26,673	52,293
Département de TAHOUA	208,931	222,892	431,823

Note: Source: INS-Niger (2015) Annuaire Statistique Du Niger 2010 – 2014.

Table G4: Population of Niger: Region of Tahoua and number of villages by department

Department	Total Nº of Communes	Total Nº of Villages	Nº Production deficit Villages
Abalak	5	67	24
Bagaroua	1	42	11
Birnin'konni	4	140	
Bouza	7	216	52
Illela	3	125	56
Keita	4	251	76
Madaoua	6	360	71
Malbaza	2	118	4
Tahoua	6	192	67
Tassara	1	0	0
Tchintabaraden	2	43	6
Tillia	1	9	4
Ville de tahoua	2	25	4
TOTAL	44	1 588	375

Note: Source: INS-Niger (2012).

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