Households' investments in durable and productive assets in Niger: quasi-experimental evidence from a cash transfer project[1]

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Abstract

Cash transfers programs are an increasingly popular tool to alleviate poverty by raising households' consumption and well-being. However, the long-term effect of the transfers is still an open question in Sub-Saharan Africa. By studying a cash transfer project in rural Niger 18 months after its termination, this article investigates whether transfers induce investments in assets and productive activities that result in improvements in well-being that survive the termination of program payments. Results indicate that livestock asset and local credit (*tontines*) participation significantly increase among project participants. There is also evidence of improvement in private assets, living standards, micro-enterprises and agriculture. The findings imply that cash transfer programs can have long-term sustainable impacts even in extremely poor, rural areas.

Keywords: Household investments, Productive Assets, Micro-enterprises, Unconditional Cash Transfers, Long-term Impact, Niger, Quasi-experiments

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1. Introduction

Social safety nets, and cash transfer programs in particular, are increasingly popular tools for "reducing present and future poverty" of vulnerable households and "protection and promotion" (Grosh et al. 2008, Fiszbein and Schady 2009). While cash transfer programs have numerous and diverse objectives, all aim to reduce household poverty in the long-run, rather than merely rising consumption temporarily as a result of the transfers. This paper empirically explores one specific pathway to generate long-term sustainable improvements in household well-being: durable asset accumulation by poor households. Specifically, the study uses a controlled design to analyze differences between participants and non-participants investments in physical assets and productive activities after termination of an unconditional cash transfer (UCT) pilot program in Niger.

Pathways by which cash transfers can have a productive impact on beneficiaries and contribute to household income growth have been identified at the micro-economic level (Barrientos 2012). Transfers can alleviate the cash constraints directly or indirectly by facilitating access to credit and saving. Similarly, transfers can reduce the effect of risk and uncertainty ex-ante, promoting riskier and higher-return investments, and helping households to avoid harmful coping strategies in the face of adverse shocks (Macours, Premand, and Vakis 2012). Consistent with these theoretical expectations, the impact of Conditional Cash Transfers (CCT) programs have been shown to generate productive investments in Latin America (Gertler, Martinez, and Rubio-Codina 2012). However, impacts in very low income communities where marginal propensities to consume additional income are quite high have not been fully explored. This paper provides the first empirical evidence of long-term productive impact of cash transfers in Sub-Saharan Africa. The article also contributes to the poverty trap literature by identifying relaxation of

barriers to asset accumulation as a specific pathway for long-term impact (Carter and Barrett 2006).

This study focuses on a pilot cash transfer program in rural Niger. The government of Niger has started to implement social safety nets, with a cash transfers component, as a means to fight food insecurity after recurrent food crises in the first decade of the millennium. One of the goals of this strategy is to "fight household's vulnerability and help them to promote productive behaviors" (Maina 2010). The *Projet Pilote des Filets Sociaux par le Cash Transfert* (PPFS-CT) took place between October 2010 and March 2012, providing 2,281 households in the Tahoua and Tillabéri regions with monthly transfers of 10,000 FCFA (about 20 USD) for 18 months. This pilot has several unique features. First, it focuses on very poor, food insecure households in rural Sahel, one of the poorest regions of the world subject to recurrent crises of several types.[4] Second, the program delivers regular, foreseeable, monthly transfers rather than a one-time grant. Thirdly, the project offered very limited support activities during the pilot phase, effectively isolating the impact of the cash transfer from other interventions which are often bundled with this type of program as a "protection and promotion" package.[5] Fourth, and most importantly, the transfers ceased 18-months before the follow-up survey for measurement of the long-term improvements independently from current transfers, after households have been able to realize investments and benefit from them and also had the opportunity to disinvest and were possibly affected by adverse shocks.

This paper evaluates the impact of the PPFS-CT on household investments 18 months after the last transfers, to assess the durable effect of the program after it has stopped, using quasi-

[4] Niger has the lowest Human Development Index (HDI) in 2012 (see http://hdr.undp.org/en/statistics/).
[5] A notable exception is the promotion of *tontines* (local saving/credit systems), see section 4.

experimental methods. The main impact identification strategy exploits the design of eligibility criteria for the project. Project eligibility is determined by the ranking resulting from the household Proxy Means Testing (PMT) scores that is computed from their characteristics. Households whose PMT scores are below a village-specific threshold are beneficiaries of the project. Because eligibility thresholds vary by village, households with similar PMT scores and yet different eligibility status can be compared in the analysis. Other quasi-experimental methods are used in combination with this primary strategy to assess the robustness of the results. First, a difference-in-difference approach is employed for variables included in the 2010 baseline survey and 2013 follow-up survey. Second, a regression discontinuity design is used for within-village comparisons of eligible and non-eligible households. Thirdly, propensity score matching, based on 2010 baseline characteristics, is used as well. Results across methods consistently show that cash transfers generate long-term sustained increases in household assets and productive activities after program termination.

The structure of the article is as follows. The next section briefly reviews the literature on cash transfers and possible impact pathways. The third section presents a simple asset accumulation framework. Section four describes the project, the data, and the empirical approach. Section five reports and discuss the results and robustness tests. The last section formulates policy recommendations and concludes.

2. Productive impact of cash transfers: review of evidence

The rise in direct cash transfers programs has been paralleled by rigorous impact evaluations, in Latin America where these programs originated, as well as in Sub-Saharan Africa where cash transfer programs quickly spread in the 2000s (Davis et al. 2012, Monchuk 2013). The impact of

conditional and unconditional cash transfers have been widely studied using a wide range of experimental and quasi-experimental methods. Positive impacts on indicators of education, health, consumption, nutrition, as well as other dimensions, have been found (Fiszbein and Schady 2009, Garcia and Moore 2012, Baird et al. 2013). In addition, a recent but rapidly growing literature has analyzed and shown *productive* impacts of cash transfers (Barrientos 2012, Premand 2014).

The first empirical studies come from cash transfer programs in Mexico. In the Procampo program in Mexico, a multiplier effect of between 1.5 and 2.6 has been estimated, suggesting that farmers are able to realize income opportunities which were previously constrained (Sadoulet, Janvry, and Davis 2001). This finding is confirmed by a seminal study of investments in productive assets from the beneficiaries of the Progresa/Oportunidades program (Gertler, Martinez, and Rubio-Codina 2012). Beneficiary households are found to invest up to 26% of the cash they receive in productive assets, increasing in particular animal ownership and production, bean cropping, land use, and micro-enterprise activities. Beneficiaries raise their agricultural income, which translates in long-term consumption increase of 1.6 peso for each peso received. Another study of the same program shows that an increase in asset holding is also found among non-beneficiaries in beneficiary villages, due to local economic spillovers (Barrientos and Sabatés-Wheeler 2010).

In Sub-Saharan Africa, where most of the population is rural and households are generally poorer than in Latin America, early cash transfers impact evaluations have often focused on understanding if (and how) cash transfer programs can help households develop revenue generating activities, through agricultural activities or non-agricultural micro-enterprises. Impact evaluation results are mixed in that some increases in investment are found, but increases usually

do not occur across all the dimensions considered. In the CT-OVC program in Kenya, households showed improvements in some housing characteristics and increased savings and several private assets, but no increases are found in productive assets such as livestock holdings and land farmed (Ward et al. 2010).[6] Similarly in Zambia a UCT project in the Monze district, the Social Cash Transfer (SCT), is found to generate an increase in livestock holding, purchase of fertilizer and cash cropping, but not in private assets (Seidenfeld and Handa 2011). In three other districts, the SCT had a positive impact on micro-enterprises in urban areas and on livestock holding in rural areas, but not on cultivated land or private assets (Tembo and Freeland 2009).[7] In Malawi, the beneficiaries of the (unconditional) Social Cash Transfer Scheme accumulated private and productive assets (livestock and tools), and increased agricultural production through purchase of fertilizer and farm labor (Miller, Tsoka, and Reichert 2009). In Tanzania, the Community Based-CCT had a positive impact on non-bank savings, livestock, but not in private assets (Evans and Salazar 2011). The Ethiopian Productive Safety Net Program (PSNP) is a (largely cash-based) social protection program with an explicit objective of raising agricultural productivity. The PSNP had a mixed impact on yields, but a positive impact on asset accumulation, growth in livestock holding, use of fertilizer, durable investments in agriculture, and borrowing for productive purposes. The effect was clearer when transfers were larger and when participants also benefitted from complementary interventions (Gilligan et al. 2009, Hoddinott et al. 2012, Gilligan, Hoddinott, and Taffesse 2009). Another study of the PSNP compare food and cash transfers, and finds that in a context of growing inflation, food transfers were more popular and generated a higher growth in income and livestock, but a lower increase

[6] Qualitative research indicates investment in farming activities and livestock for the most well-off beneficiaries, suggesting heterogeneity of impact.

[7] The impact was heterogenous, and significantly negative in some districts for micro-enterprises and cultivated areas. The positive impact on investments in school-related expenditures indicates potential trade-offs between physical and human capital investments.

in non-productive assets (Sabates-Wheeler and Devereux 2010). Conversely, a comparison of cash vs. voucher delivery by an unconditional transfer program in DRC shows that cash transfers were more efficient: among others, recipients increasing their savings compared to voucher recipients, but not their private assets (Aker 2013). In summary, all these studies in Sub-Saharan Africa show an increase in savings, durable assets and/or productive activities, but the exact composition of households' investments depend on each program, and the long-term effect after program termination is not assessed.

In Niger, direct cash transfers have become very popular in recent years. A comparison of transfers delivered by mobile phone vs. by cash, in rural areas of the Tahoua region, shows that mobile phone transfers have several advantages in the short-term, including the depletion of fewer assets and an increase in the number of cash crops cultivated (Aker et al. 2011). Another study compares cash vs. food transfers in rural Zinder, and finds that food transfers result in increases in food security in the short-term, but households receiving cash spent more money to repair their dwelling and on agricultural inputs (Hoddinott, Sandstrom, and Upton 2013). Finally, a small-sample study of cash transfers in the Tillabéri region focused on food security showed that the project helped beneficiaries to rely less on debt to buy food, a harmful coping strategy (Tumusiime 2013). In addition to these quantitative analyses, an in-depth qualitative study of the "implementation gap" of cash transfer programs in Niger noticed that households invested in livestock and agricultural activities (Olivier de Sardan 2013).[8] These studies in Niger also point out the need for further research on the long-term effect of cash transfers.

[8] Some projects tried to prevent households to buy livestock in order to focus on other objectives (improving nutrition), which illustrates well the trade-off between immediate and long-term improvement in well-being for cash transfer implementers and recipients. According to the report, beneficiaries bought livestock nonetheless.

One-time, direct grants to stimulate micro-enterprises growth (and for other purposes) are a slightly different type of program than regular cash transfers used as social safety nets. However, articles which studied them are highly informative, since one-time grants are seen as a tool to promote productive investments by providing cash directly to households. A recent influential cash grant program experiment in Sri Lanka presents encouraging evidence of impact, with increased micro-enterprises returns of 60% per year, much higher than the local interest rate, suggesting threshold effects (consistently with the poverty trap literature) and puzzling credit market failures (De Mel, McKenzie, and Woodruff 2008).[9] Five years after the grant, survival rates and profits were still significantly higher for male enterprises (De Mel, McKenzie, and Woodruff 2012b). However, such long-term effects were not found in another experiment where grants were combined with training and given to female entrepreneurs. In this case, profitability increase is only temporary and not visible two-years after the baseline (De Mel, McKenzie, and Woodruff 2012a). Evidence from one-time grants programs in Sub-Saharan Africa contrasts with the promising findings elsewhere (for men). In semi-urban Uganda, cash grants do not generate any impact, whereas loans (and loans plus trainings) raised men's short-term profit by 54% (Fiala 2013). In urban Ghana, cash grants did not generate female micro-enterprises growth (in the short or long-term), and in-kind transfers only benefited larger businesses (Fafchamps et al. 2014).[10] However, a recent impact evaluation of a project giving large unconditional grants (lump-sum or monthly transfers) to rural households in Kenya found evidence of impact on several dimensions, including assets (58% increase, or 39% of the average amount transferred), investment in and revenue from livestock and micro-enterprises (large increases), but the impact on farm activities is ambiguous (Haushofer and Shapiro 2013).

[9] Similar results have been found by two of the authors in Mexico (McKenzie and Woodruff 2008).
[10] This literature usually finds a smaller impact (or no impact) on female micro-enterprises in Sub-Saharan Africa.

In summation, there is a reasonable amount of evidence that transferring cash directly to the poor generates *some* increases in productive investment. But the specific nature of the impact varies across programs. In the next section, we present a simple general model illustrating why in the rural Africa contaxt household investments may be very low (or inexistent) and how cash transfers can change this situation.

3. A simple model of household investment

A simple model of household saving behavior, following Deaton (1990), illustrates the process of asset accumulation and how cash transfers can enable households to increase (or trigger) asset accumulation. Let households maximize intertemporal utility:

(1) $$u = E_t\left[\sum_{t}^{\infty}(1+\delta)^{-t}v(c_t)\right]$$

where $\delta > 0$ is the time preference parameter, c_t household consumption at time t, and $v(c_t)$ instantaneous utility associated with c_t (which is assumed to be a concave, monotically increasing function). The budget constraint associated with consumption, physical assets A, real income y_t and real interest rate r, shows the process of asset accumulation for the next period:

(2) $$A_{t+1} = (1+r)(A_t + y_t - c_t)$$

The associated Euler equation is:

(3) $$\lambda(c_t) = E_t\left[\frac{(1+r)\lambda(c_{t+1})}{(1+\delta)}\right]$$

where $\lambda(c_t) = v'(c_t)$, the marginal utility of consumption at t, a monotically decreasing function, from the assumption of concavity of $v(c_t)$ – which is related to decreasing absolute

risk aversion. This guaranties a precautionary motive for saving.[11] Cash transfers can be seen, in this framework, as a component of y_t, because they temporarily increase income. Thus, a first obvious cause for cash transfers to increase savings is when cash transfers are temporary, because households want to spread out the increase of consumption over time (permanent income hypothesis).[12]

Now, let's assume that: i) households value present time highly so that $\delta > r$; and ii) households cannot borrow so that $A_t \geq 0$.[13] When households do not want to borrow (first case), the Euler equation (3) still holds. When households do want to borrow but cannot (second case), the following conditions now holds:

(4)
$$\lambda(A_t + y_t) > E_t\left[\frac{(1+r)\lambda(c_{t+1})}{(1+\delta)}\right]$$
$$c_t = A_t + y_t\,, \qquad y_t \leq c_t\,, \qquad A_{t+1} = 0$$

This means that households do not accumulate new assets and consume all current assets. Both cases can be summarized as such:

(5)
$$\lambda(c_t) = \max\left\{\lambda(A_t + y_t), E_t\left[\frac{(1+r)\lambda(c_{t+1})}{(1+\delta)}\right]\right\}$$

Equation (5) suggests that consumption is a function of total wealth at hand, $x_t \equiv A_t + y_t$, such that:

[11] Savings are commonly made in productive assets such as livestock in rural Sub-Saharan Africa. Although there is not a perfect equivalence between savings and productive investment, this simple theoretical framework does not need to differentiate them to illustrate how cash transfers can lead to productive investment.

[12] Note that this increase in savings for consumption smoothing purposes is expected in the short term, but these savings are consumed over time, so that the effect found two years after the transfers have stopped may be small, especially if δ is large.

[13] A large δ means that households have urgent consumption needs so that they value consumption more than market real interest rate r. For economic justifications of the two assumptions i) and ii), see Deaton (1990) or Adams (1998).

(6) $$c_t = f(x_t)$$

As shown by Deaton (1990), by inverting the monotically decreasing function $\lambda(.)$, (5) becomes:

(7) $$c_t = f(x_t) = \min\left\{x_t, \lambda^{-1}\left(E_t \frac{(1+r)\lambda(c_{t+1})}{(1+\delta)}\right)\right\}$$

This means that when total wealth x_t is low, all wealth is consumed at t, such that for low levels of wealth, a unit increase in x_t translates into a unit increase of c_t: all cash transfers would be used immediately for consumption purposes. However if wealth increases enough, there is a discontinuity in the consumption increase, and instead of consuming x_t, the household saves part of the wealth and only consumes $\lambda^{-1}\left(E_t \frac{(1+r)\lambda(c_{t+1})}{(1+\delta)}\right)$.

Thus, according to this model, a *sustainable* increase in assets can occur under two conditions: i) while households receive cash transfers, the increase in wealth due to the transfers at time t is important enough to shift the consumption function from x_t to $\lambda^{-1}\left(E_t \frac{(1+r)\lambda(c_{t+1})}{(1+\delta)}\right)$; ii) after program termination, the savings accumulated during the cash transfers period are important enough so that when the transfers stop, A_t is large enough and households do not revert to a pre-transfers saving behavior by consuming x_t (and thus depleting assets they accumulated).

Other models lead to a similar, positive effect on investment and asset accumulation. For example, Ramsey models lead to solutions in form of a Bellman equation that can explain asset investments related to cash transfers (Fafchamps et al. 2014) as well as ex-ante and ex-post behaviors with respect to risk (Elbers, Gunning, and Kinsey 2007). Lack of asset investment can also be explained by the presence of a poverty trap with two technologies. Some households would be stuck in a low equilibrium (a low-risk, low-return technology) and need additional capital (because of the sunk cost or riskiness of the high-return technology) to cross the threshold

where adoption of the high-return technology becomes more profitable (Barrett, Carter, and Ikegami 2008, Carter and Barrett 2006). Finally, a micro-enterprise model can be employed to show that lack of access to credit or insurance causes underinvestment in the productive activity and that cash transfers can alleviate these constraints (De Mel, McKenzie, and Woodruff 2008). All these models suggest a positive impact of cash transfers on household productive investments but a minimum threshold level of transfers may be needed to spark asset accumulation. The next section presents the empirical approach and the data used in this paper to assess if in the Niger PPFS-CT, beneficiary households have invested in productive activities, as suggested by this simple model.

4. Data and Empirical Approach

Project Description and Data Collection

The PPFS-CT was designed to address chronic food insecurity in Niger and household's high vulnerability in general, in a context of recurring droughts and other economic adverse shocks. This pilot project was led by the government of Niger with technical assistance from the World Bank.[14] The pilot took place in 52 villages of the Tahoua and Tillabéri regions and reached 2,281 beneficiary households. They received monthly transfers of 10,000 FCFA (about 20 USD) for 18 month, delivered in cash in the villages, between October 2010 and March 2012. One feature of the project is that it encouraged beneficiaries to set-up of *tontines* and involved micro-finance institutions (MFI), which were put into contact with local farmers organizations.[15]

[14] The pilot project was scaled-up to the region. The regional program started in March 2013 and will eventually reach 140,000 poor households in different geographic areas. Qualitative fieldwork has been conducted in the areas covered by the scaled-up program.

[15] *Tontines* are local saving/credit systems where each member brings cash to a common pot each time they meet (daily, weekly or monthly). Members rotate so that at each meeting, one of them takes all the cash from the pot

Household targeting was based on a Proxy Means Testing (PMT), which is an increasingly common targeting method in Sub-Saharan Africa (Stoeffler and Mills 2014, Del Ninno and Mills 2014). The PMT formula was calculated beforehand, based on a regression on consumption data from a nationally representative survey (Katayama 2010). By using this formula, a PMT score was computed for each household in project villages, based on the characteristics of the households (demographics, education, livestock, etc.). The PMT score approximates a long term expenditure /consumption level, so that a low PMT score is a proxy for a low consumption level. In each village, a village-specific PMT eligibility threshold was chosen so that 30% of the households were beneficiaries. Thus, a household with a score below its village threshold received transfers from the project. Ex-post assessments of the targeting method show that the PPFS-CT reached poor households relatively efficiently (McBride 2014).

This study uses two rounds of data collection, in Fall 2010 and Fall 2013, i.e. before and after project operations (from October 2010 to March 2012). In September 2010, the PMT (baseline) questionnaire was administered among all households of the project villages. The information collected in this baseline survey is limited: it includes mostly variables necessary to construct the PMT formula, as well as some information on shocks and food security (only in Tahoua). Additional data were collected during a follow-up survey in the Fall 2013 among 2,000 households, when about 20 beneficiaries and 20 non-beneficiaries were randomly surveyed in each of the 52 project villages. This follow-up survey includes all the modules of the 2010 questionnaire, and additional modules on investments (private assets, local credit, micro-

and spends it. *Tontines* are often referred to as Rotating savings and credit association (ROSCA) in English. According to project managers, almost 90% of the beneficiaries took part to *tontines* (personal communication).

enterprises, agriculture), education, health and consumption.[16] The methodology employed to evaluate the impact of the cash transfer program on households' investments is driven by data availability. In particular, the fact that some variables are included in the 2010 baseline survey, but most of investment variables have only been collected in the 2013 follow-up survey.

Table 1 presents descriptive statistics for the whole 2013 sample (not only households in the PMT range used for the SD analysis). After data entry, cleaning and merging with the 2010 dataset, 1,579 questionnaires are usable for the analysis (see attrition tests in section 5). As expected from the PMT formula used, non-beneficiary households are smaller, have more physical assets, and have higher PMT scores on average. However in 2013, beneficiary households have a higher level of livestock, MEs activities and *tontine* usage.

Empirical approach and identification strategy

To study the effect of cash transfers on household i's investments, we try to estimate the impact of being beneficiary on several variables of interest y_i. The first set of outcomes considered is related to the use of *tontines* (number of *tontines*, amount received, usage), which were project direct output and are an important vector of investments in rural Niger. Then, several investment dimensions are considered: housing quality and living standards (house material, access to water, toilets, etc.); physical assets investment (number and value of physical assets); livestock (stock at the survey in 2013, stock 12 months before, difference between 2012 and 2013, consumption and sales); micro-enterprises (MEs) (number of MEs, revenues, charges and profits, value of equipment); and agricultural investments (surface cultivated, quantity produced and yields, input

[16] In October 2011, another round of survey was conducted, including a consumption and a food security modules (but not all the PMT variables). It was not possible to use this survey because of data quality issues. An analysis of these data suggests a possible reduction of food security caused by the project, but results are ambiguous (McBride 2014).

spending, type of crops). Finally, variables related to economic shocks (type of shocks, coping strategy) are studied to understand if potential investments translated into better households resilience to adverse shocks. These variables cover a wide range of possible household investments and other outcomes related to investments.

The main identification strategy, for impact variables only observed in the follow-up survey (i.e. most variables), exploits the design of the project: in particular, the difference in eligibility thresholds across villages, since the PMT cut-off was adjusted by the project to include 30% of the population of each village as beneficiaries. Because the eligibility threshold varies by villages, it is possible to have households with similar PMT scores but different eligibility status (see figure 1). The method employed is to use a subset of the whole sample: households with PMT scores in a certain range will be either beneficiaries or non-beneficiaries depending on the village to which they belong. This difference in eligibility status is not due to random assignment, which is why the identification strategy is quasi-experimental rather than experimental. However, for beneficiary (treatment) households, non-beneficiary (control) households with similar PMT scores constitute a credible counter-factual of what would have happened to beneficiary households in the absence of the program.[17] PMT scores range boundaries are selected so that each household with a given PMT score can be either beneficiary or non-beneficiary: from the lowest PMT threshold ($PMT\_threshold_{min}$, in the village with the lowest overall PMT threshold) to the highest PMT threshold ($PMT\_threshold_{max}$, in the villages with the highest overall PMT threshold). With this sub-sample, the estimation is a Simple Difference (SD) OLS regression:

[17] The main two assumptions for a selection bias to be avoided are: i) the PMT difference between beneficiaries and non-beneficiaries, in the subsample, is small enough for them to be "similar"; ii) the fact that some villages will have more beneficiaries and other more non-beneficiaries does not introduce another selection bias. Village dummies are added in some specifications to be certain to control for the latter possible bias.

(8) $$y_i = \beta_0 + \beta_1 \mathrm{B}_i + \varepsilon_i \,, \qquad i \epsilon A$$

where B_i is a dummy variable indicating that the household is beneficiary (received cash transfers), and $i \epsilon A$ if $PMT\_threshold_{min} \leq PMT\_score_i \leq PMT\_threshold_{max}$, and β_1 measures the impact of the cash transfer. We also show results based on equation (8) with errors ε_i are clustered at the village level to take into account village shocks and effects; and in a third variant, with village dummies– with the same purpose.

Robustness tests

A small number of variables (some physical assets, livestock stock) are also included in the baseline (2010) survey. For these variables, it is possible to use a difference-in-difference (DID) OLS regression as a first robustness test:

(9) $$y_{i \epsilon A,t} = \beta_0 + \beta_1 \mathrm{B}_i + \beta_2 T_t + \beta_3 \mathrm{B}_i * T_t + \varepsilon_{i,t}$$

where T is a dummy variable for $t = 2$ and β_3 measures the impact of the transfer. As for SD OLS regressions, we also present results from (9) with errors ε_i are clustered at the village level to take into account village shocks and effects.

Second, because village conditions may influence household outcomes, village-level discontinuity around the eligibility threshold is employed as another identification strategy as another robustness test. This identification strategy consists in comparing households with similar PMT scores within the same village around the eligibility threshold. After normalizing the PMT threshold[18], we use a regression discontinuity (RD) design to estimate the impact of the cash transfer:

[18] Because the PMT threshold varies by village, household's PMT score is normalized by subtracting the village PMT threshold to all PMT scores in this village (in such way that the common normalized PMT threshold is 0).

(10) $$y_{ij} = \beta_0 + \beta_1 \mathrm{B}_i + \delta(PMT_i) + \mu_j + \varepsilon_i$$

where PMT_i is the PMT score of household i in 2010 and is the forcing variable of the RD and μ_j are fixed-effects for village j of household's .

The last robustness test consist in employing a Propensity Score Matching (PSM) estimator to compare beneficiaries to non-beneficiaries with similar characteristics (Caliendo and Kopeinig 2008, Rosenbaum and Rubin 1983). The propensity to participate to the program $P(X)$ is estimated via a probit regression including 2010 baseline characteristics as covariates X. Then, the Average Treatment Effect (ATT) can be estimated via PSM:

(11) $$\tau_{ATT}^{PSM} = E_{P(X)|D=1}\{E[Y(1)|D=1, P(X)] - E[Y(0)|D=0, P(X)]\}$$

where $D = 1$ indicates treatment, $Y(1)$ is the outcome of interests for treated observations and $Y(0)$ for untreated observations. The PSM estimator is estimated with Stata (Leuven and Sianesi 2014).

5. Results & Discussion

Tests of Attrition and Balance

The level of attrition in our sample is relatively high: 361 questionnaires are lost or not usable out of 2,000 sampled, or 148 out of the 932 in the PMT range used for the main identification strategy. Attrition is due to the loss of questionnaires in three villages (108 questionnaires), the impossibility to match identifiers, but also failure to survey households on the field (186 questionnaires out of 2,000 sampled). A formal test of difference at baseline (2010) between attrition and non-attrition households is performed in the PMT range used for the main analysis (Table 2). Among all the variables collected in 2010, only ownership of cart (lower) and PMT score (higher) are significantly different at 5% for attrition households. This test suggests that attrition does not affect results of the main identification strategy.

In Table 3, the difference between beneficiaries and non-beneficiaries at baseline (in 2010) is formally tested in the sub-sampled used for the SD analysis (within the range of PMT score thresholds). All the variables tested are included in the PMT formula, so significant differences across groups are expected. Besides the difference in PMT scores (beneficiaries have lower scores), the main significant differences are household size and the number of goats. The difference in motorcycle and motor-pump ownership is also significant, but almost no household owns these items at all. These tests indicate that our SD design did not produce a perfectly balanced sample, but limited the differences between the treatment and control groups in terms of number and the magnitude of these differences. Moreover, control households appear to be better off, which makes positive effects of the treatment harder to find, but does not threaten their validity (see section 4).

Results

The Simple Difference (SD) results (the main identification strategy, equation (8)) are presented in Table 4, 5 and 6, in three different specifications: without (model 1) and with (model 2) standard errors adjusted at the village level, and with village dummies (model 3). Rows indicate for each outcome of interest the coefficient associated with being "beneficiary" of the PPFS-CT, which is positive and significant for several of the outcomes considered.

First, the long-term impact of the project on *tontines* (local group saving/credit systems) is measured, as they are almost a direct output of the project (see section 4). Also, *tontines* are an important vector of investment in rural West-Africa. There is a large and significant increase of the use, number, and amount invested in and received from *tontines* among beneficiary households (Table 4). This translated into an increase in consumption from *tontine*-funds, but

also investment in productive activities and private assets, as well as other usages. These results suggest that beneficiary household were able to continue to participate in the *tontines* set-up during the project after its termination.

Secondly, we analyze how this greater participation in tontines translated into investments from beneficiary households (Table 5). A large impact on housing and standard livings (Panel A) is not expected because they did not appear as priority investments for most households and because the number of households with solid walls or roofs at baseline was very low. However, there are some indications of improvement in access to clean water, toilets, and solid walls according to some specifications, but not in solid roofs, home lighting or cooking fuel. There are indications of investment in private assets (Panel B) from beneficiary households, who have a higher number of different assets than non-beneficiaries in 2013. The value of assets purchased in the last 3 years is also greater for beneficiaries (by about 20,000 FCFA). But overall, results are not robust across all specifications for private assets.

On the other hand, the impact on livestock is large and clearly significant (Panel C). Beneficiary households have on average 0.3 TLU more than non-beneficiaries, which represents almost half a cow (or 3 goats, or 30 chicken). In FCFA, this increase represents about 60,000 FCFA (one third of the total transfers received). This has not translated into a significant increase of livestock sales (according to most specifications), but into a significant increase in consumption from own livestock. Finally, the difference between livestock in December 2013 and December 2012 (asked retrospectively in the 2013 survey) is insignificant and very small, suggesting that beneficiary households are not depleting livestock assets since the end of the project.

A clear effect on micro-enterprises (MEs) activities is not found (Panel D). The point estimates indicate a large increase in revenues, charges and profits from MEs, but the standard deviation is too large for these coefficients to be significant. This was perhaps to be expected given the relatively small number of MEs, and their diversity in terms of activities and scale. There is indication of an increase in the number of transportation MEs, as well as in equipment purchased in the last 3 years, but the magnitudes are small.

On the other hand, there is evidence of improvement in agricultural activities (Panel E) for beneficiaries. As expected, the project did not seem to have overcome initial differences in land structure (owned and borrowed surfaces, etc.). Also, a smaller number of beneficiaries seem to use any fertilizer. However, for the entire sample, fertilizer spending is higher for beneficiaries, which means that among beneficiaries those using fertilizer compensate for households not using fertilizer. There is also a small but significant increase in quantity produced and yields from beneficiaries. Note that when village dummies are used, there only remains the positive effect on fertilizer spending, number of crops farmed, quantity produced and yields.

Thirdly, we study if these investments translated into a better resilience of households to shocks (Table 6). Occurrence of shocks during the last 12 months (Panel D) for beneficiary households has not clearly changed in 2013, except the loss of private transfers[19], and interestingly, a lower rate of occurrence of theft for beneficiary households – perhaps because they have been identified as "poor" by the project – indicating that if cash transfers generated negative feelings in the community, they did not translate into stealing from beneficiaries despite the increased

[19] This loss of private transfers is puzzling because it occurred at least 6 months after project termination. These results may be due to a confusion in the recall period from respondents and/or to a confusion between project cash transfers and private transfers.

opportunity generated by the circulation of cash and the purchase of livestock.[20] Regarding household resilience to shocks, the evidence is not clear: beneficiaries do not differ from non-beneficiaries in terms of harmful coping strategies (depletion of assets, etc.) but they mention using less coping strategies overall, which does not mean that they have better coped with shocks.

Robustness tests results

As detailed in section 4, several other quasi-experimental methods are used to assess the robustness of the results. First, a Difference-in-Difference (DID) estimator measures the impact of the program on beneficiaries in 2013 for a limited number of outcomes included in the 2010 baseline survey (Table 7). DID results do not differ largely from Simple Difference estimates which increases confidence in the SD results. A significant impact on access to toilet is found, but no other housing and living standards variables see a significant coefficient.[21] The number of assets considered being limited to those included in the baseline survey (not all of these included in the 2013 list), no significant impact is found on the number of different assets. However, the impact on livestock is still clearly significant and slightly larger than the SD estimates, because beneficiaries had less livestock than non-beneficiaries at baseline.

RD results are presented in Table 8. There are several econometric issues that decrease the reliability of RD estimates, which is why RD is not considered as the main identification strategy of this study. First, some variables of interest enter positively into the construction of the forcing

[20] There is actually no evidence of jealousy or feeling of injustice towards beneficiaries, according to the quantitative survey and the qualitative work conducted in the project.

[21] Note that by comparing 2010 and 2013 values for housing characteristics such as roof and walls quality (for which definitions are not consensual), it seems that the questions have not been asked the same way in the two surveys. While questionnaires are identical, surveying firms have changed. For these variables, SD estimates may be more reliable.

variable itself (PMT score) at baseline: households with higher livestock at baseline have higher PMT scores, which introduce a downward bias and make it more difficult to expect a significant impact. Second, the PMT threshold used is arbitrary, because village thresholds vary, requiring an adjustment to obtain a common threshold (see section 4). This adjustment makes households with similar *adjusted* PMT scores very different in terms of real PMT scores (i.e. having different characteristics, expected wealth, etc.). This is likely to greatly increase the variance of the outcome around the threshold and limit the relevance and significance of the discontinuity. Third, it appears that at certain level of bandwidth, continuity of the forcing variable (an important assumption to obtain valid RD estimates) is violated since a significant jump in the forcing variable is observed (Lee and Lemieux 2009). Despite these limitations, RD is useful to observe behavior of outcomes of interest around the discontinuity at the village-level.

A significant impact is found for several of these outcomes, but not as many as in the SD or DID results. This may be, in part, due to the fact that there are few observations (and even fewer in each village) close to the PMT threshold with the bandwidth used (Table 8). The main difference with SD results is that RD results suggest that beneficiary households still encounter a greater occurrence of shocks, and use more coping mechanisms.[22] Overall, RD estimates confirm that beneficiary households retained *tontines* after project termination, did not invest a lot in their dwelling or in MEs, but acquired some private assets, and realized significant investments in livestock and agricultural activities.

The last robustness test is to compute ATT estimates for the outcomes considered (see section 4). The propensity score (propensity to be treated, i.e. beneficiary of the project) is computed from

[22] RD estimates of the effect on shocks, however, are limited because shocks are relatively rare events. Thus, estimation is not possible (with village effects) for many of the shock variables.

the PMT score, since it is known that project eligibility is determined by this PMT score. One-on-one matching without replacement is computed for all households, not only those in the PMT range of the main specification.[23] The test of balance between treated and control observations is performed for unmatched (before PSM is employed) and matched observations (after PSM weighting). The test show that standardized percentage bias is relatively small, except for household size and the PMT score itself (which was expected) (Figure 2). Common support is not found only for 89 households, which means that most observations are used.

Results from PSM are very close to those obtained from the main identification strategy, with two main exceptions (Table 9). First, the PSM estimator finds a significant, negative effect on house quality, which confirms that most households have not invested in their dwelling and not caught up with non-beneficiaries (house quality variables are included in the PMT score). Second, the effect on agricultural activities is more pronounced with the PSM estimator that with the main specification: all coefficients are positive, and a significant effect is found on land owned, fertilizer spending, number of crops and quantity produced. Overall, these three tests confirm the robustness of the results obtained with the main specification.

Discussion

Taken as a whole, these results suggest that households have not realized large private investments (in private assets, housing and living standard improvements) but have rather focused on productive activities to raise future revenues. The effect is particularly large and clear for livestock and agriculture, which are the primary sources of income in rural Niger. Beyond

[23] Several other PSM specifications have been tested, including: a specification for households in the PMT range only; a specification using all baseline (2010) variables instead of the PMT score only; and a specification using a different matching algorithm, i.e. radius matching. Results are relatively similar across specifications, but results from the PMT range specification are much closer to results from the main identification strategy. Also, the magnitude of the effect tends to be larger in PSM specifications.

statistical significance, the magnitude of project beneficiaries investments is also noteworthy. For livestock alone, they represent 74,992 FCFA (according to the DID estimator), whereas beneficiary households only received 10,000 FCFA per month, and 180,000 FCFA over the whole duration of the project (18 months). The amount invested raises to 94,284 FCFA by adding investments in household belongings, which is more than half of the total cash received. Because monthly transfers are relatively small compared to the size of investments required in livestock and agriculture *tontines* may have been key to carry out these investments: the average value of a sheep is 37,500 FCFA, whereas monthly transfers were 10,000 FCFA only. While the transfers did not clearly lead to a better resilience to shocks in the long-run, 18-months after they stopped, shocks do not seem to dissipate acquired assets, as indicated by the similar level of livestock in 2012 and 2013 for beneficiary households.

Considering the theoretical framework outlined in section 3, it appears that the PPFS-CT was able to shift consumption-saving decision behaviors of beneficiaries away from a full-consumption pattern towards a partial-saving one, meaning that they accumulated assets during the project. Interestingly, these investments have not been geared towards private assets or improvement in housing and living standards, from which households could have derived an immediate consumption flow (e.g. lighting at night, use of a motorcycle, etc.). Instead, households have focused on *productive* investments to raise their long-term revenues, showing a concern for longer-term inter-temporal consumption improvements. This priority was noticed during qualitative fieldwork, where most households emphasized the need to "keep something when the project will end in two years". However, choosing to invest in productive activities (including agricultural inputs) means going beyond the idea of "keeping something":

households' investment choices illustrate their objective of raising long-term income and agricultural productivity and to retain accumulated assets.

This interpretation of the results is in contradiction with the critics of social assistance, which argue that cash transfers would create dependency for its beneficiaries, who would passively raise consumption only during the time of and by the amount of the transfers. While evidence from elsewhere is already at odds with this widespread fear (see section 2), the study of the Niger PPFS-CT suggests that even very poor households – living in Sahelian rural areas lacking infrastructures and prone to adverse shocks – are able to actively take advantage of cash transfers.

The large increase in the use of *tontines* (strongly encouraged by the project) and their survival after project termination have important implications for the household finance-related development projects and policies such as savings incentives and access to credit. Our results suggest that the main constraint faced by very poor rural households in Niger for investing is not the lack of financial instruments or other social or technical constraints, but the lack of funds to invest. By receiving predictable amounts of cash over 18 months, these households were able to satisfy immediate consumption needs and thus find the financial space required to save and invest. Also, the provision of regular cash transfers allowed them to take part to these credit/saving schemes, by making them credible participants able to bring their contribution each time. The fact that *tontines* survived project termination shows that households saw the potential of these financial instruments and remained credible *tontines*-participants. These results suggest a strong potential for complementary activities associated with cash transfers such as those related to financial instruments (saving or credit) and to agricultural extension (e.g. training or

technology adoption projects) since agricultural households seem to have reacted quickly to the alleviation of the cash constraints.

Finally, several limitations to the impact evaluation presented in this paper are worth noting. First, the precise mechanisms leading to and limiting investment are not fully investigated, due to limitations of the survey (e.g. no measure of risk aversion, etc.) or to the evaluation design. Among others, there is only one arm of treatment rather than comparing different type of interventions or different levels of treatment (e.g. changing the level or temporality of the cash transfers). Second, there may be some concerns with internal validity due to the composition of the counterfactual in the main identification strategy: control households belong to poorer villages, since they are not among the poorest 30% while having similar PMT scores than beneficiary households.[24] Conversely, control households have higher PMT scores than treatment households, in each village and overall – which is clearly a downward bias.[25] Also, local spillover effects generated by the cash transfers in the village may cause contamination of the control group.[26] Finally, the external validity of the study is limited, because the sample is not representative of the country or of the region, and general equilibrium effects due to the transfers (e.g. inflation) are not taken into account. For these reasons, this paper does not claim to assess the impact of any cash transfer or social safety nets intervention in the world, but rather to

[24] This issue could create a positive bias on the impact estimate if beneficiary households benefit from the better overall economic position of their village (for instance by receiving higher agricultural wages). Conversely, the bias could be negative if they suffer from their lower position in a richer village (for instance if their relative poverty prevents them to have access to leading positions in the village). Adding village-effects partly resolves this potential bias, but given the few number of observations per village, there is a large loss of degrees of freedom (especially for outcomes with few non-zero values such as "having a solid roof").

[25] This downward bias does not cast doubt on the significance of a positive impact, but generates a higher probability to find insignificant results.

[26] There are evidence of such a spillover effect in other cash transfers programs (Angelucci and De Giorgi 2009). Again, this contamination would only create a negative bias on the impact estimate; consequently it does not cast doubt on the significance of a positive impact.

add empirical evidence of cash programs potential in a rural, extremely poor, African environment.

6. Conclusion

This article studies the impact of a cash transfers on households' investment in assets and productive activities 18 months after termination of a cash transfer project in rural Niger. By comparing beneficiary households to non-beneficiaries with similar PMT scores, a positive impact on livestock, agricultural activities and other assets is found. Notably, beneficiary households increase their livestock by half a cow on average (or equivalently, three goats or thirty chicken), corresponding to more than half of their baseline stock (in TLU). The findings suggest that social safety nets can be efficient tools to help households build a lasting asset base in the medium-term, and thus tackle some of the "deep roots" of poverty.

These results confirm promising findings from Latin America (and increasingly, from Sub-Saharan Africa as well) regarding sustainable asset accumulation by beneficiaries of cash transfer projects. Recipients appear to react to cash transfers by investing rather than only consuming the transfers. This article is one of the first to study, in Africa, changes in productive investments stemming from monthly transfers 18 months after they have stopped. The findings demonstrates the potential for cash transfers to stimulate investment even in poor rural households which, because of multiple constraints, are not expected to take advantage of the cash transfers to realize medium-term investments and accumulate assets.

These findings suggest a strong potential role for complementary activities accompanying cash transfer programs to help households realize profitable *investments*. Indeed, in Niger, *tontines* appear to be key successful means for assets accumulation, suggesting a great potential for

complementary saving and micro-credit programs. Because household investments strategies are diverse and include agricultural capital and inputs, agricultural training programs for instance could be proven useful to foster household productive investments.

The results, while promising, also raise many questions regarding the precise mechanisms which foster asset accumulation. The duration of the cash transfers for instance need to be more careful studied to understand what type of productive impact can be expected from households and for how long. The temporality of delivery and magnitude of transfers are likely to affect whether or not households can reach the threshold where immediate consumption needs are satisfied and asset accumulation becomes possible. More studies are needed to determine this threshold in a context of cash transfer program. The role of risk alleviation, thought as one of the main channel through which social safety nets improve households' well-being and stimulate investments, also needs to be identified. Finally, while investments have positive aggregate effects at the local economy level, at the household level they are a means to improve households' well-being rather than an end. For this reason, the long-term improvements in education, health, consumption, food security, living standards, and other dimensions need to be studied to understand the complementarities and trade-offs between the productive impact of social safety nets on household assets and investments, and impact on households human development and overall well-being.

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Tables and Figures

Figure 1: eligibility status

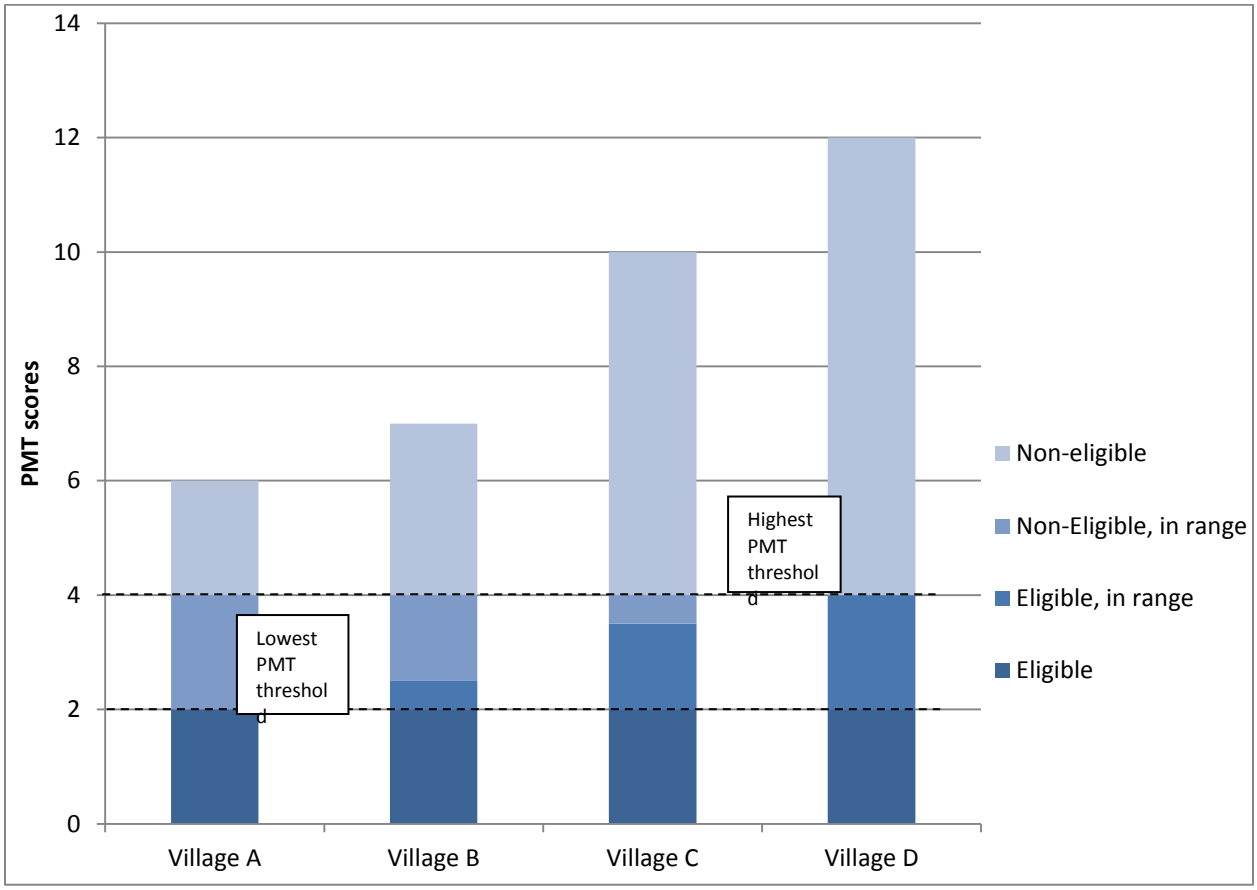
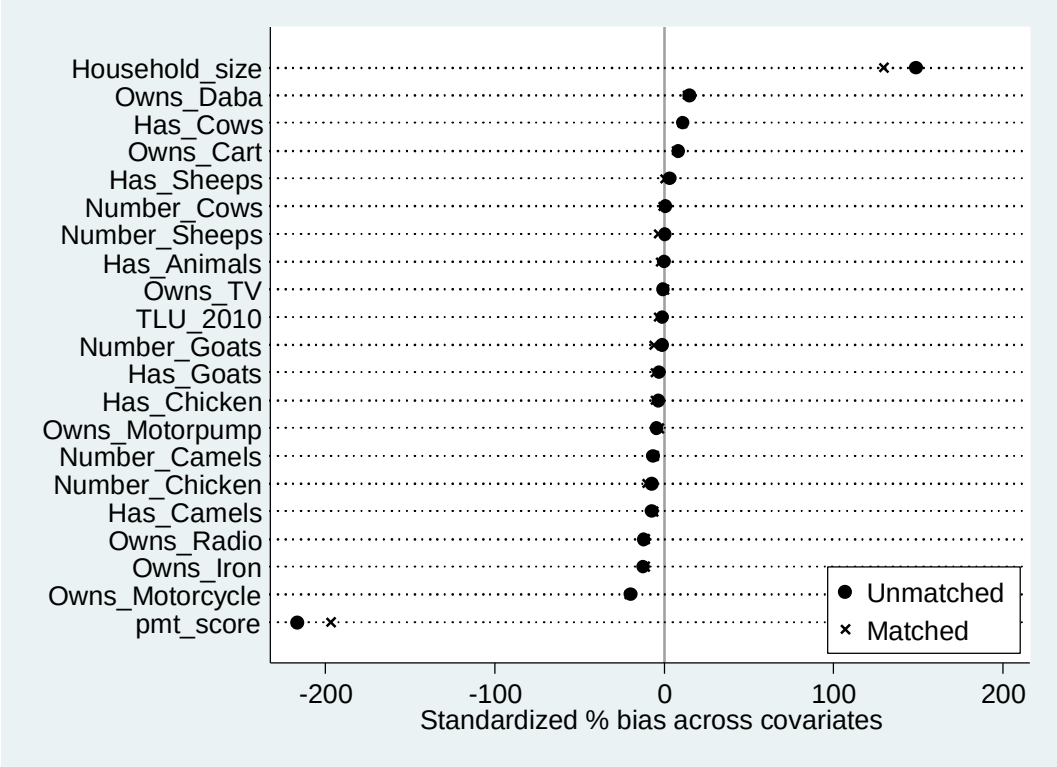


Figure 2: Propensity Score Matching estimator, test of balance



Note: test of balance for the PSM estimator for baseline (2010) variables.

Table 1: Descriptive Statistics, 2013 sample

	All	Non-Beneficiary	Beneficiary
Household size	8.16	6.49	9.63
Widow household head	0.028	0.028	0.027
Female household head	0.036	0.038	0.035
Handicapped household head	0.95	0.97	0.92
Household Dietary Diversity Score	5.25	5.11	5.38
PMT score	11,612.7	11,921.4	11,340.9
Adjusted PMT score	49.2	360.1	-224.5
Solid Walls	0.0076	0.0054	0.0096
Solid Roof	0.0076	0.013	0.0024
Access to clean water	0.30	0.29	0.31
Access to toilets	0.068	0.080	0.059
Home lighting	0.33	0.36	0.30
Cooking fuel	0.097	0.12	0.078
Different assets own (#)	6.52	6.30	6.72
Total value of assets (FCFA)	22,7938.9	26,3883.6	19,6074.0
Livestock (TLU)	1.16	0.90	1.39
Livestock in 2012 (TLU)	1.14	0.87	1.39
Livestock sales (FCFA)	20,785.6	14,066.4	26,742.1
Livestock consumption (FCFA)	9,987.3	7,687.3	12,026.2
Shock: any	0.64	0.63	0.65
Shock: loss of private transfers	0.023	0.015	0.030
Shock: theft	0.027	0.034	0.022
Shock: agriculture	0.58	0.58	0.58
Coping mechanism: any	0.25	0.25	0.24
Has tontine(s)	0.16	0.094	0.23
Number of tontines	0.20	0.11	0.28
Tontine amount (montly, FCFA)	363.6	122.1	577.8
Has Micro-Enterprise(s) (MEs)	0.13	0.12	0.14
Number of types of MEs	0.14	0.12	0.16
MEs revenues (monthly, FCFA)	5,335.8	3,427.2	7,027.8
MEs charges (monthly, FCFA)	3,039.6	2,689.9	3,349.7
MEs equipment total value	5.24	7.29	3.42
Total land	5.09	4.57	5.55
Total land owned	4.75	4.35	5.11
Total land borrowed	0.27	0.22	0.32
Uses fertilized	0.69	0.69	0.70
Total fertilizer spending	2,026.8	1,348.7	2,627.9
Total field spending	4,269.3	3,376.0	5,061.1
Number of crops	2.16	2.11	2.20
Quantity produced per hectare (kg)	164.8	155.1	173.2
Total quantity produced (kg)	616.0	532.7	689.8
Observations	1579	742	837

The Tropical Livestock Unit formula used is: TLU = #camels * 1 + #cows * 0.7 + (#sheeps + #goats) * 0.1 + (#chicken + #other poultry) * 0.01 + (#donkeys+#horses) * 0.5

Table 2: Test of Attrition in PMT Range at Baseline (2010)

	All	Non-Attrition Households	Attrition Households	Difference p-valu
Household size	7.88	7.94	7.54	(0.09)
# children (0-5)	1.38	1.40	1.24	(0.13)
Owns Iron	0.011	0.011	0.0068	(0.61)
Owns Radio	0.035	0.031	0.061	(0.07)
Owns TV	0.0043	0.0051	0	(0.38)
Owns Motorcycle	0.0086	0.0089	0.0068	(0.79)
Owns Daba (hoe)	0.95	0.95	0.95	(0.93)
Owns Motor-pump	0.019	0.019	0.020	(0.93)
Owns Fridge	0	0	0	-
Owns Cart	0.10	0.12	0.041	**(0.01)**
Has Cows	0.22	0.22	0.21	(0.74)
Has Sheeps	0.34	0.35	0.28	(0.09)
Has Goats	0.27	0.27	0.28	(0.69)
Has Camels	0.021	0.022	0.020	(0.91)
Has Chicken	0.24	0.25	0.20	(0.20)
# Cows	0.57	0.54	0.72	(0.26)
# Sheeps	0.89	0.90	0.83	(0.66)
# Goats	0.88	0.86	0.99	(0.47)
# Camels	0.038	0.043	0.0068	(0.29)
# Chicken	0.81	0.83	0.69	(0.44)
Tropical Livestock Unit	0.62	0.61	0.70	(0.51)
PMT score	11624.7	11618.8	11655.6	**(0.02)**
Adjusted PMT score	11.5	6.69	37.0	(0.09)
Observations	932	784	148	

Mean coefficients; p-values in parentheses. Bold indicates significance.
The Tropical Livestock Unit formula used is: $\text{TLU} = \#camels * 1 + \#cows * 0.7 + (\#sheeps + \#goats) * 0.1 + (\#chicken + \#other\ poultry) * 0.01 + (\#donkeys + \#horses) * 0.5$

Table 3: Test of Balance in PMT Range at Baseline (2010)

	All	Non-Beneficiary	Beneficiary	Difference p-value
Household size	7.89	6.64	8.83	**(0.00)**
# children (0-5)	1.38	1.11	1.58	**(0.00)**
Owns Iron	0.012	0.015	0.0093	(0.45)
Owns Radio	0.036	0.039	0.033	(0.64)
Owns TV	0.0042	0.0024	0.0056	(0.46)
Owns Motorcycle	0.0084	0.020	0	**(0.00)**
Owns Daba (hoe)	0.95	0.94	0.96	(0.15)
Owns Motor-pump	0.023	0.0098	0.033	**(0.02)**
Owns Fridge	0.0011	0	0.0019	(0.38)
Owns Cart	0.10	0.098	0.11	(0.61)
Has Cows	0.22	0.21	0.22	(0.72)
Has Sheeps	0.34	0.35	0.32	(0.39)
Has Goats	0.27	0.29	0.25	(0.13)
Has Camels	0.021	0.024	0.019	(0.54)
Has Chicken	0.24	0.25	0.24	(0.91)
# Cows	0.57	0.60	0.54	(0.61)
# Sheeps	0.88	0.96	0.81	(0.17)
# Goats	0.87	1.02	0.76	**(0.05)**
# Camels	0.037	0.054	0.024	(0.24)
# Chicken	0.80	0.89	0.73	(0.23)
Tropical Livestock Unit	0.62	0.68	0.57	(0.26)
PMT_score	11,627.2	11,756.5	11,528.8	**(0.00)**
Adjusted PMT score	8.21	194.4	-133.4	**(0.00)**
Observations	949	410	539	949

Mean coefficients; *p*-values in parentheses. Bold indicates significance.
The Tropical Livestock Unit formula used is: $\text{TLU} = \#camels * 1 + \#cows * 0.7 + (\#sheeps + \#goats) * 0.1 + (\#chicken + \#other\ poultry) * 0.01 + (\#donkeys + \#horses) * 0.5$

Table 4: Simple Difference Results: Tontines

	(1) Simple Difference, Basic model		(2) Simple Difference, Errors Clustered at the Village level		(3) Simple Difference, Village Dummies	
	"Beneficiary" Coefficient	Standard Errors	"Beneficiary" Coefficient	Standard Errors	"Beneficiary" Coefficient	Standard Errors
Has tontine(s)	**0.080*** **	(0.026)	**0.080*** **	(0.029)	**0.087*** **	(0.030)
Number of tontines	**0.085** **	(0.038)	**0.085** **	(0.036)	**0.101*** **	(0.031)
Tontine amount invested (montly, FCFA)	**376.179***	(203.736)	**376.179** **	(186.807)	**447.383***	(229.817)
Tontine amount received (ponctual, FCFA)	**2,797.609*** **	(953.101)	**2,797.609*** **	(949.105)	**3,906.961** **	(1,636.218)
Log of tontine amount invested (montly, FCFA)	**0.609*** **	(0.182)	**0.609*** **	(0.207)	**0.664*** **	(0.218)
Log of tontine amount received (ponctual, FCFA)	**0.785*** **	(0.230)	**0.785*** **	(0.262)	**0.886*** **	(0.280)
Tontine usage: consumption	**0.056*** **	(0.020)	**0.056*** **	(0.020)	**0.067*** **	(0.022)
Tontine usage: productive investment	**0.037*** **	(0.014)	**0.037** **	(0.016)	**0.035***	(0.019)
Tontine usage: private investment	**0.014***	(0.008)	**0.014** **	(0.006)	**0.018** **	(0.009)
Tontine usage: other	**0.031** **	(0.014)	**0.031** **	(0.014)	**0.047*** **	(0.017)

Notes: Observations: 784 households.

Table 5: Simple Difference Results: Investments

	(1) Simple Difference, Basic model		(2) Simple Difference, Errors Clustered at the Village level		(3) Simple Difference, Village Dummies	
Panel A: Housing						
	"Beneficiary" Coefficient	Standard Errors	"Beneficiary" Coefficient	Standard Errors	"Beneficiary" Coefficient	Standard Errors
Aggregate index of housing quality	0.023	(0.058)	0.023	(0.073)	-0.020	(0.060)
Solid Walls	0.007	(0.007)	**0.007***	(0.004)	-0.003	(0.004)
Solid Roof	-0.001	(0.004)	-0.001	(0.004)	-0.001	(0.004)
Access to clean water	**0.063***	(0.033)	0.063	(0.043)	0.024	(0.030)
Access to toilets	**0.041***	(0.024)	0.041	(0.027)	-0.005	(0.019)
Home lighting	-0.049	(0.033)	-0.049	(0.038)	-0.025	(0.030)
Cooking fuel	0.019	(0.021)	0.019	(0.037)	0.006	(0.028)
Panel B: Physical Assets						
# of different assets own	**0.279***	(0.152)	**0.279***	(0.163)	0.275	(0.168)
# of different assets purchased, last 3 years	-0.047	(0.140)	-0.047	(0.138)	-0.032	(0.152)
Total value of assets (FCFA)	-243,875	(251,888)	-243,875	(298,595)	-325,673	(378,684)
Assets purchased, last 3 years (FCFA)	**19,292****	(8,241)	**19,292****	(8,757)	**21,553****	(10,618)
Log of total value of assets (FCFA)	**0.305*****	(0.092)	**0.305*****	(0.095)	**0.271*****	(0.097)
Log of assets purchased, last 3 years (FCFA)	**0.246***	(0.130)	**0.246***	(0.142)	0.236	(0.146)
Panel C: Livestock						
Livestock (TLU)	**0.295*****	(0.106)	**0.295*****	(0.077)	**0.286*****	(0.077)
Livestock in 2012 (in TLU)	**0.312****	(0.128)	**0.312*****	(0.091)	**0.308*****	(0.098)
Value of livestock (FCFA)	**62,360.759*****	(18,919.485)	**62,360.759*****	(14,342.684)	**55,299.655*****	(14,688.627)
Value of livestock sales (FCFA)	2,755.309	(5,676.500)	2,755.309	(3,880.446)	**8,884.269****	(4,405.824)
Value of livestock consumption (FCFA)	**4,261.585***	(2,235.016)	**4,261.585****	(1,706.855)	**3,147.724***	(1,671.783)
Log of value of livestock (FCFA)	**0.702****	(0.351)	**0.702****	(0.339)	**0.867****	(0.363)
Log of livestock sales (FCFA)	-0.211	(0.316)	-0.211	(0.384)	0.452	(0.392)

Log of livestock consumption (FCFA)	**0.822*** **	(0.309)	**0.822** **	(0.336)	**0.584***	(0.340)
Livestock difference: 2013 - 2012 (TLU)	0.012	(0.057)	0.012	(0.045)	0.004	(0.057)
Panel D: Micro-Enterprises (ME)						
Has ME(s)	0.015	(0.025)	0.015	(0.030)	0.013	(0.032)
Number of types of ME	0.028	(0.027)	0.028	(0.031)	0.025	(0.032)
Has ME type: transportation	**0.013** **	(0.006)	**0.013*** **	(0.005)	**0.014** **	(0.006)
ME created, last 3 years	0.017	(0.016)	0.017	(0.012)	0.019	(0.014)
ME(s) revenues (monthly, FCFA)	6,335.662	(5,431.992)	6,335.662	(4,561.961)	11.735	(1,098.065)
ME(s) charges (monthly, FCFA)	3,678.288	(3,114.931)	3,678.288	(2,738.846)	-16.639	(544.745)
ME(s) profits (monthly, FCFA)	2,652.988	(5,124.771)	2,652.988	(1,978.102)	22.644	(820.029)
ME equipment total value	1.686	(1.341)	1.686	(1.049)	1.964	(1.548)
ME equipment purchased, last 3 years	**0.023***	(0.013)	**0.023** **	(0.010)	**0.019***	(0.011)
Panel E: Agriculture						
Total land	-0.240	(0.325)	-0.240	(0.355)	0.302	(0.312)
Total land owned	**-0.544***	(0.325)	-0.544	(0.357)	0.131	(0.301)
Total land borrowed	**0.213** **	(0.104)	**0.213***	(0.111)	0.127	(0.104)
Uses fertilized	**-0.063***	(0.032)	**-0.063***	(0.035)	-0.007	(0.030)
Total fertilizer spending (FCFA)	**2,362.968** **	(1,085.080)	**2,362.968***	(1,297.166)	**1,040.473***	(557.235)
Total field spending (FCFA)	1,881.400	(1,292.853)	1,881.400	(1,457.967)	1,133.570	(738.918)
Number of crops	0.068	(0.050)	0.068	(0.043)	**0.073***	(0.039)
Quantity produced per hectare (kg)	**31.095*** **	(10.908)	**31.095** **	(12.687)	**21.855***	(11.617)
Total quantity produced (kg)	**68.915***	(40.466)	**68.915***	(40.966)	**111.862*** **	(42.936)

Notes: Observations: 784 households. The Tropical Livestock Unit formula used is: TLU $= \#camels * 1 + \#cows * 0.7 + (\#sheeps + \#goats) * 0.1 + (\#chicken + \#other\ poultry) * 0.01 + (\#donkeys + \#horses) * 0.5$

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

Table 6: Simple Difference Results: Shocks

	(1) Simple Difference, Basic model		(2) Simple Difference, Errors Clustered at the Village level		(3) Simple Difference, Village Dummies	
	"Beneficiary" Coefficient	Standard Errors	"Beneficiary" Coefficient	Standard Errors	"Beneficiary" Coefficient	Standard Errors
Shock: any	0.027	(0.034)	0.027	(0.037)	0.008	(0.029)
Shock: loss of private transfers	**0.019****	(0.008)	**0.019****	(0.009)	**0.020***	(0.011)
Shock: theft	**-0.036*****	(0.014)	**-0.036****	(0.014)	**-0.024***	(0.014)
Shock: agriculture	0.028	(0.035)	0.028	(0.044)	-0.010	(0.036)
Coping mechanism: nothing	**0.063***	(0.036)	0.063	(0.042)	-0.032	(0.032)
Coping mechanism: any	**-0.072****	(0.032)	**-0.072****	(0.030)	0.040	(0.029)
Coping mechanism: cash spending	-0.018	(0.023)	-0.018	(0.027)	0.029	(0.028)
Coping mechanism: sale of assets	-0.012	(0.016)	-0.012	(0.020)	0.008	(0.018)
Coping mechanism: other	**-0.055****	(0.024)	**-0.055****	(0.022)	0.002	(0.025)

Notes: Observations: 784 households.

Table 7: DID model

	(1) Index of housing quality	(2) Cooking fuel	(3) Access to clean water	(4) Home lighting	(5) Access to toilets	(6) Different assets own (#)	(7) Livestock (TLU)
2013	0.0366	-0.0335	0.204**	-0.244***	0.0152	0.613***	-0.0207
	(0.16)	(-1.16)	(2.43)	(-4.42)	(0.53)	(6.26)	(-0.16)
Beneficiary	-0.0540	0.0186	0.0633	-0.0487	-0.0165	0.118	-0.0671
	(-0.40)	(0.50)	(1.49)	(-1.29)	(-0.85)	(1.31)	(-0.54)
2013 * Beneficiary	**0.0358**	**-0.0279**	**-0.0683**	**0.0553**	**0.0571***	**-0.0119**	**0.363****
	(0.21)	**(-0.77)**	**(-1.23)**	**(1.48)**	**(1.71)**	**(-0.11)**	**(2.59)**
Constant	2.052***	0.0823***	0.274***	0.314***	0.0823***	4.320***	0.648***
	(13.39)	(3.18)	(4.81)	(6.34)	(3.59)	(53.54)	(5.22)
Observations	1568	1568	1568	1568	1568	1568	1568

t statistics in parentheses

Standard Errors are clustered at the village level. The Tropical Livestock Unit formula used is: TLU = #camels * 1 + #cows * 0.7 + (#sheeps + #goats) * 0.1 + (#chicken + #other poultry) * 0.01 + (#donkeys + #horses) * 0.5. Bold indicates the DID estimator.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Regression Discontinuity Design Results

	(1) lwald (default bandwidth)		(2) lwald (default bandwidth * 0.5)		(3) lwald (default bandwidth * 2)	
Aggregate index of housing quality	-0.952	(0.873)	-0.500	(0.657)	0.025	(0.763)
Access to clean water	**-0.552*** **	(0.192)	(dropped)		0.176	(0.261)
Access to toilets	-0.000	(0.000)	(dropped)		-0.000	(0.000)
Home lighting	0.017	(0.140)	**0.000** **	(0.000)	0.304	(0.299)
Cooking fuel	-0.750	(1.003)	(dropped)		-0.584	(0.614)
Number of different assets own	**7.943*** **	(2.881)	**8.063***	(4.676)	**6.230*** **	(1.762)
Number of different assets purchased in the last 3 years	3.735	(3.991)	5.250	(5.051)	**3.859***	(2.166)
Total value of assets (USD)	-347.460	(968.178)	243.274	(151.857)	-3,735.744	(3,618.542)
Total value of assets purchased in the last 3 years (USD)	45.762	(117.155)	138.816	(101.717)	185.621	(160.172)
Livestock (TLU)	-1.428	(2.527)	**1.135*** **	(0.151)	-0.470	(1.876)
Livestock in 2012 (TLU)	-0.797	(2.060)	-1.374	(3.346)	-0.032	(1.472)
Value of livestock sales (USD)	101.148	(66.391)	166.493	(101.650)	**85.827***	(47.204)
Value of livestock consumption (USD)	8.649	(16.817)	-28.219	(24.681)	6.417	(20.090)
Shock: any	**1.377***	(0.819)	0.500	(0.664)	**0.758***	(0.445)
Shock: loss of private transfers	(dropped)		(dropped)		(dropped)	
Shock: theft	0.000	(0.000)	0.000		-0.000	(0.000)
Shock: agriculture	**1.378***	(0.816)	0.500	(0.664)	**0.731***	(0.442)
Coping mechanism: nothing	-0.005	(0.205)	0.000	(0.000)	0.058	(0.079)
Coping mechanism: any	**1.370***	(0.795)	(dropped)		0.712	(0.434)
Coping mechanism: cash spending	1.250	(1.003)	(dropped)		0.915	(0.627)
Coping mechanism: sale of assets	(dropped)		(dropped)		0.393	(0.470)
Coping mechanism: other	-0.000	(0.000)	0.000	(0.000)	-0.039	(0.072)
Has tontine(s)	**0.843***	(0.511)	0.725	(0.553)	**0.918** **	(0.402)
Number of tontines	**0.851***	(0.447)	0.723	(0.553)	**0.909** **	(0.369)
Tontine amount (montly, FCFA)	522.968	(443.534)	1,097.833	(958.128)	272.475	(246.577)
Tontine usage: consumption	0.840	(0.513)	0.725	(0.553)	**0.919** **	(0.404)
Tontine usage: productive investment	0.200	(0.569)	0.273	(0.658)	0.403	(0.382)
Tontine usage: private investment	(dropped)		(dropped)		0.686	(0.726)
Tontine usage: other	0.756	(0.498)	0.726	(0.554)	0.671	(0.436)
Has ME(s)	0.397	(0.468)	0.000	(0.000)	**0.491*** **	(0.082)
Number of types of ME	0.665	(0.823)	(dropped)		**0.567*** **	(0.209)
ME created (the last 3 years)	0.283	(0.495)	(dropped)		0.038	(0.096)

ME(s) revenues (monthly, FCFA)	-4,561.563	(6,004.664)	-9,121.722	(6,496.578)	-9,560.981	(6,181.285)
ME(s) charges (monthly, FCFA)	-3,886.571	(4,906.437)	-6,510.161	(4,939.100)	-4,425.742	(3,422.584)
ME(s) profits (monthly, FCFA)	1,098.002	(4,307.590)	-2,192.680	(1,433.788)	-5,126.499	(3,242.651)
ME equipment total value	0.224	(0.342)	-0.578	(1.505)	0.736	(0.765)
ME equipment purchased (last 3 years)	-0.316	(0.451)	0.000	(0.000)	-0.055	(0.101)
Total land	0.889	(2.828)	-0.200	(3.412)	0.202	(1.778)
Total land owned	1.176	(2.866)	0.362	(3.429)	0.450	(1.676)
Total land borrowed	-0.288	(0.602)	(dropped)		0.063	(0.136)
Uses fertilized	-0.163	(0.540)	-0.275	(0.553)	-0.187	(0.404)
Total fertilizer spending (FCFA)	**1,583.549***	(962.163)	218.405	(1,049.886)	**1,426.713****	(701.360)
Total field spending (FCFA)	**3,863.749****	(1,768.716)	855.071	(1,189.173)	-219.788	(2,267.315)
Number of crops	1.565	(1.559)	0.901	(1.257)	0.764	(0.819)
Quantity produced per hectare (kg)	11.048	(54.499)	**-57.297***	(31.986)	25.754	(36.544)
Total quantity produced (kg)	95.791	(253.060)	-231.457	(321.917)	256.065	(156.632)

Standard Errors in parentheses.
Observations: 1553 households. The Tropical Livestock formula used is: TLU = #camels * 1 + #cows * 0.7 + (#sheeps + #goats) * 0.1 + (#chicken + #other poultry) * 0.01 + (#donkeys + #horses) * 0.5. Bold indicates the DID estimator.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 9: Propensity Score Matching estimators

	Average Treatment Effect on the Treated (ATT)	
Aggregate index of housing quality	**-0.126*** **	(0.041)
Access to clean water	0.013	(0.023)
Access to toilets	-0.019	(0.013)
Home lighting	**-0.071*** **	(0.024)
Cooking fuel	**-0.039*** **	(0.015)
Number of different assets own	**0.410*** **	(0.111)
Number of different assets purchased in the last 3 years	**0.242** **	(0.102)
Total value of assets (FCFA)	-68,080.843	(125,918.726)
Total value of assets purchased in the last 3 years (FCFA)	**25,353.787*** **	(6,087.865)
Livestock (TLU)	**0.475*** **	(0.081)
Livestock in 2012 (TLU)	**0.514*** **	(0.092)
Value of livestock sales (FCFA)	**12,772.135*** **	**12,772.135*** **
Value of livestock consumption (FCFA)	**4,403.817*** **	**4,403.817*** **
Shock: any	0.013	(0.024)
Shock: loss of private transfers	**0.015** **	(0.008)
Shock: theft	-0.012	(0.008)
Shock: agriculture	-0.005	(0.025)
Coping mechanism: nothing	0.024	(0.025)
Coping mechanism: any	-0.010	(0.022)
Coping mechanism: cash spending	0.003	(0.016)
Coping mechanism: sale of assets	-0.001	(0.011)
Coping mechanism: other	-0.017	(0.016)
Has tontine(s)	**0.135*** **	(0.018)
Number of tontines	**0.164*** **	(0.027)
Tontine amount (montly, FCFA)	**466.974*** **	(125.789)
Tontine usage: consumption	**0.105*** **	(0.015)
Tontine usage: productive investment	**0.077*** **	(0.012)
Tontine usage: private investment	**0.019*** **	(0.006)
Tontine usage: other	**0.071*** **	(0.011)
Has ME(s)	0.022	(0.017)
Number of types of ME	**0.034** *	(0.019)
ME created (the last 3 years)	0.007	(0.011)
ME(s) revenues (monthly, FCFA)	3,688.613	(2,930.713)
ME(s) charges (monthly, FCFA)	657.609	(2,003.616)
ME(s) profits (monthly, FCFA)	3,041.531	(2,867.565)
ME equipment total value	-3.906	(4.528)
ME equipment purchased (last 3 years)	0.013	(0.009)
Total land	**0.962*** **	(0.244)
Total land owned	**0.749*** **	(0.244)
Total land borrowed	0.099	(0.062)

Uses fertilized	0.005	(0.023)
Total fertilizer spending (FCFA)	**1,358.365****	(619.772)
Total field spending (FCFA)	1,669.798	(1,062.384)
Number of crops	**0.092****	(0.037)
Quantity produced per hectare (kg)	**19.364****	(7.910)
Total quantity produced (kg)	**160.160*****	(32.260)

Standard Errors in parentheses. Bold indicates statistical significance.
Observations: 1553 households. The Tropical Livestock formula used is: TLU = #camels * 1 + #cows * 0.7 + (#sheeps + #goats) * 0.1 + (#chicken + #other poultry) * 0.01 + (#donkeys + #horses) * 0.5. Bold indicates the DID estimator.
* p < 0.10, ** p < 0.05, *** p < 0.01