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Improving Financial Inclusion through the Delivery of Cash Transfer Programmes: The Case of Mexico's Progresa-Oportunidades-Prospera Programme

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ABSTRACT *This paper follows a quasi-experimental research design to assess the impact of the electronic payment system of Mexico's Progresa-Oportunidades-Prospera (POP) programme. The switch from cash payments to electronic payments delivered via savings accounts is found to have medium-term effects on savings decisions, transaction costs, and coping strategies. Overall, the study finds that, following the intervention, a substitution effect emerged between saving portfolio choices, with the poor favouring bank accounts over informal saving arrangements. It also found that the Oportunidades savings account led to an increase in remittance reception, which in turn had important implications for household consumption smoothing and risk management decisions. The study also reveals impact heterogeneity depending on household composition and the rural-urban divide, with important implications for replicability of similar policy innovations in other countries.*

1. Introduction

Social service delivery for the poor remains a major challenge for development effectiveness. While public-private alliances can represent a viable solution to improve the efficacy of social services, rigorous evidence of their impact is scarce. It is all the more important to fill into this gap given that at the moment several cash transfer programmes around the world are currently in a transition from cash to electronic payments. Our study contributes to the literature on conditional cash transfer programmes and financial inclusion by examining the impact of a recent electronic payment system introduced by the Mexican government to distribute Progresa-Oportunidades-Prospera programme.

Progresa, which was renamed as Oportunidades in 2001 and then as Prospera in 2010 (referred hereafter to as POP) is Mexico's flagship antipoverty social assistance programme, with the aim of breaking the intergenerational cycle of poverty by enhancing human development through investment in education, health, and nutrition. POP provides income support to poor families in exchange for

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regular school attendance of children and periodic health check-ups of household members (Niño-Zarazúa, 2011). POP was launched in August 1997 to cover 300,700 households in 6,344 rural municipalities. By the end of 2015, the programme supported 6.1 million households living in poverty, 25 per cent of Mexico's population.

POP's income support was initially paid in cash at distribution points located in towns, which entailed long travelling and queuing times for many recipient households. The repercussions were also in terms of opportunity costs for leaving productive activities unattended, and personal safety, as recipients carrying cash were exposed to the risk of theft and assault (Klein & Mayer, 2011). In 2003, the National Savings and Financial Services Bank (BANSEFI), a state-owned development bank, entered a partnership with a network of non-banking institutions known as *L@ Red de la Gente* (People's Network) that includes credit unions, savings and credit associations (SCAs), savings and credit co-operatives (SACCOs), and microfinance institutions. They began, together with POP's National Co-ordination Unit, a pilot phase to deliver POP's grants in savings accounts.

The fact that BANSEFI and L@ Red de la Gente targeted communities where POP also operated provided the opportunity to introduce the pilot phase. In 2009, Visa debit cards were issued to pilot beneficiaries who had already been receiving the grant in savings accounts. Pre-paid cards were also distributed, especially among the rural poor who lived in localities with limited banking infrastructure. By 2011, all POP recipients throughout the country received their transfer in savings accounts with debit or prepaid cards (see Figure 1).

This study examines the treatment effect of the pilot phase transition from cash to electronic payments in savings accounts. We take advantage of the availability of a rich household-level survey, the BANSEFI-SAGARPA Panel Survey 2004–2007, collected by BANSEFI and the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA). The survey coincided with the phasing-in of the electronic payment programme, which allowed us to construct a quasi-experimental evaluation design. More precisely, we exploit as an exogenous rule the fact that the selection of participation in the electronic transfer programme was made by the managers of L@ Red de la Gente and POP, and not the households themselves. This allowed us to rule out any potential

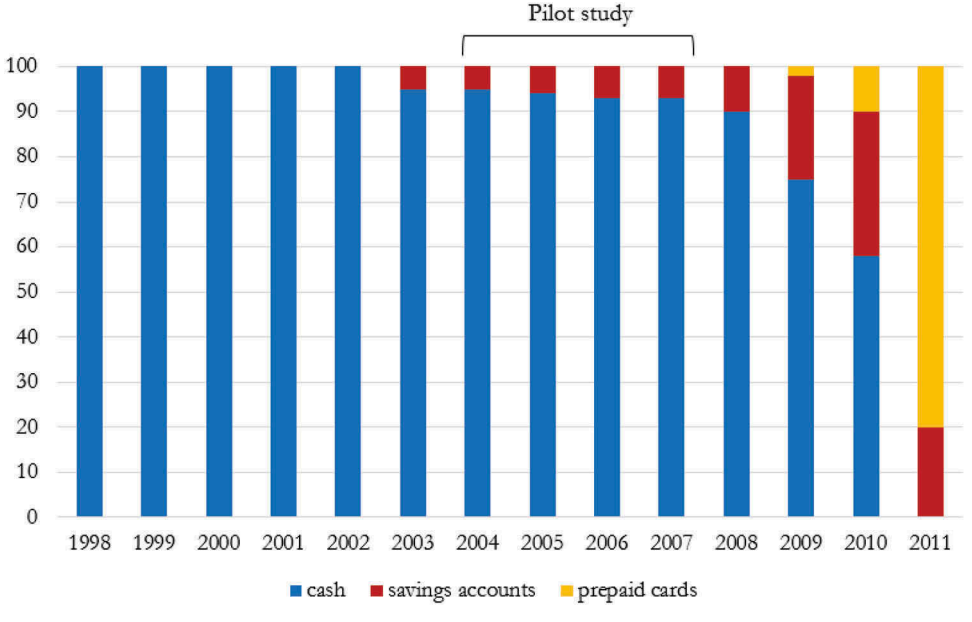

Figure 1. Phase-in and roll-out of Oportunidades electronic payment system.
Source: Authors, with data from Oportunidades (2012).

endogeneity problem due to household self-selection. However, since the selection into treatment was not random, and most likely influenced by the availability of financial infrastructure in localities treated by POP, we exploit the variation in observed heterogeneity to compute average treatment effect on the treated (ATT) matching estimators.

The literature on the topic is scant and can be grouped into two strands: the first focuses on the effects of access to savings accounts with preferential conditions, including no opening or minimum balance fees, and minimum transaction costs to the poor (Prina, 2015, Aportela, 1999; Brune, Giné, Goldberg, & Yang, 2016; Banerjee & Duflo, 2011; Dupas & Robinson, 2013; Dupas, Green, Keats, & Robinson, 2016). The second branch of the literature examines the transition from cash to electronic payments of cash transfer programmes (Aker, Boumnijel, McClelland, & Tierney, 2016; Bachas, Gertler, Higgins, & Seira, 2017; Chiapa & Prina, 2014,; Seira, 2010). In the particular context of Mexico, Seira (2010) and Chiapa and Prina (2017) examined financial transactions and the propensity to save among a limited sample of POP's beneficiaries that received payments in savings accounts. More recently, Bachas et al. (2017) examined the second phase of POP's payment system, that is the rollout of debit cards to pilot electronic payment beneficiaries.

Our study focuses specifically on the initial phase, that is the transition from cash payments to electronic payments in savings accounts. This is relevant as the transition from cash payments to savings accounts represented, for a significant proportion of POP beneficiaries, the first direct encounter with formal financial services. More specifically, we analyse the four-year, medium-term effect of POP's electronic payments on savings decisions, transaction costs, and coping strategies against idiosyncratic risks. Our analysis also identifies the possible medium-term underlying mechanisms through which better access to financial services can have add-on effects on beneficiaries of cash transfer programmes.

The results indicate that households who received their cash transfer in a BANSEFI savings account decreased their participation in some forms of informal saving arrangements, faced less constrains on remittance reception, and as a result, were less likely to reduce consumption or contract loans to cope with idiosyncratic shocks. We also find a degree of outcome heterogeneity, which seems to be contingent upon the environments that characterise rural and urban areas in Mexico.[1] Furthermore, our analysis suggests that the certainty created for the poor by regular income transfers from POP and the incentive mechanisms that the intervention generated, played an important role. It also highlights that the scale and type of financial institutions behind the reform matters: these were in fact smaller entities which attracted more trust on the part of beneficiaries, requested no opening or maintenance fees, and were much more densely distributed on the territory than formal commercial banks.

Overall, our study shows that cash transfers, in addition to their intended social impacts, can contribute to improve financial inclusion and risk management portfolios of the poor. An important policy conclusion of our study is that, for cash transfer programmes to effectively facilitate financial inclusion, extending financial access per se is not enough. Providing incentives to get people to use a broader spectrum of financial services is also key. The rest of the paper is structured as follows: Section 2 reviews the relevant literature and outlines the theoretical background; Section 3 provides a discussion on the context in which the pilot of the electronic payment system of POP was introduced; Sections 4 and 5 provide information on the data, identification strategy, and the estimation methods. Section 6 presents the results, while Section 7 concludes with some reflections on policy.

2. Literature review

The importance of financial inclusion for poverty reduction has long been highlighted in the Economics literature (Burgess & Pande, 2005; Deaton, 1990; Demirgüç-Kunt, Thorsten, & Honohan, 2008; Giné & Townsend, 2004; Karlan & Morduch, 2009). Several studies discuss the unconventional forms of savings by the poor and the need for taking them into account when financial inclusion interventions are designed and implemented. For example, Deaton (1990) has pointed out that consumption-smoothing and insurance motives are common reasons behind savings

decisions by the poor. Demirgüç-Kunt et al. (2008) and Demirgüç-Kunt and Klapper (2013) highlight the importance of having access to financial services such as payments and transfers instruments linked to remittances, despite the fact that nearly 80 per cent of the global poor remain unbanked.

Over the past 15 years, cash transfer programmes have become one of the most prominent policy instruments against poverty and vulnerability in low- and middle-income countries. About 100 cash transfer programmes in more than 60 countries currently reach 190 million low-income households worldwide (Barrientos & Niño-Zarazúa, 2011). Given the scale and transfer volume of many of these programmes, there has been a growing interest in making cash payments more efficient and financially inclusive, and in recent times, several cash transfer programmes have begun a transition to deliver cash benefits through electronic payments in savings accounts or prepaid cards.[2]

While the literature on financial inclusion is vast and expanding, the scholarly work closely related to our study remains limited and broadly divided into two strands of literature: the first group of studies examine the effects of being exposed to savings accounts offered with no opening or minimum balance fees and which minimise transaction costs for the poor. A significant contribution in this area is the field experiment in Nepal by Prina (2015), which reports that access to savings accounts with zero fees and in close proximity to households led to high take-up rates and use of savings among female household heads, which also improved their ability to cope with income shocks. She found no evidence of crowding out effects of savings accounts on non-monetary assets, liabilities, and monetary assets, including informal savings such as in ROSCAs. In Kenya, Jack and Suri (2014) found that the mobile-based transaction system M-PESA considerably reduced users' transaction costs, which in turn improved consumption smoothing against income shocks through increases in amount, and diversity of sources, of remittances. Klein and Mayer (2011) also found that the M-PESA mobile money system cut transaction and opportunity costs, especially for the poor, while also increasing their exposure to financial innovations.

In the context of Mexico, Aportela (1999) examined a natural experiment involving the opening of new branches of National Savings Trust Fund (PAHNAL) – a state-owned savings bank – in post offices. He found that improved accessibility to PAHNAL led to higher levels of savings, especially among low-income households. However, as in Prina (2015), he did not find evidence of a substitution effect between savings accounts and various forms of informal savings. Other relevant studies that highlight the positive effects of accessible low-cost savings accounts are Brune et al. (2016), Banerjee and Duflo (2011), Dupas and Robinson (2013), and Dupas et al. (2016).[3]

The second strand of literature examines cash transfer programmes' transition to electronic payments. These studies generally find positive demand-side effects with the reduction of risk factors associated to carrying cash and lower transaction costs for recipient households; especially in relation to travel, transportation costs, and waiting times. In Niger, for instance, Aker et al. (2016) found evidence of higher diet diversity among households receiving a cash transfer programme distributed through mobile money technology, which was partially attributed to time savings associated with lower travel and waiting time.

More closely related to our study are Seira's (2010), and Chiapa and Prina's (2014) studies of the transaction flows related to POP's electronic payment system, and the more recent study by Bachas et al. (2017) that examined the rollout of Visa debit cards among POP's urban beneficiaries. Seira's transaction flow data was recorded only for the subset of beneficiaries who already received payments through savings accounts, whereas Chiapa and Prina's (2014) study focused on POP's beneficiaries living in urban and peri-urban areas. Both studies show that a fraction of the banked poor did not withdraw the whole sum corresponding to their POP grant and saved part of it in their saving account, suggesting that low income households do save when appropriate financial instruments are available to them. These results are in line with the earlier findings by Gertler, Martinez, and Rubio-Codina (2012), who reported that beneficiaries of POP saved about a tenth of their grant for investment, which led to increases in consumption in the medium-term. Interestingly, Bachas et al.'s (2017) study reports that having debit cards, in addition to a savings account, enabled POP beneficiaries to reduce the transaction costs of accessing their savings, and also the monitoring costs

of checking account balances. As a result, the number of POP beneficiaries that held positive saving balances increased from 13 per cent to 87 per cent in two years. The proportional increase in savings corresponded to a reduction in consumption of similar magnitude, and was not due to crowding out other forms of saving.

Of particular interest for our study is the fact that electronic payments of cash transfer programmes often represent the first entry point for the poor into the financial system. Regular visits to the branches belonging to BANSEFI and L@ Red de la Gente exposed the poor to other financial services that can widen their risk management and investment portfolios. Remittances are distinctly important in the context of Mexico, where they act as an insurance mechanism that protects household consumption against income shocks (Amuedo-Dorantes & Pozo, 2006, Skoufias & Quisumbing, 2005).[4] Recent studies, notably Jack and Suri (2014) and Blumenstock, Eagle, and Fafchamps (2016), presented remittances as one key underlying mechanism explaining why access to electronic payments can help the poor to smooth consumption. The study by Arestoff and Venet (2011) supports this line of argument too. They analysed the introduction of 'Orange-money' in Madagascar, which provided mobile-based deposit and transfer services, and found a sizable effect on the frequency of remittances. Our study also highlights the role of remittances as a key transmission mechanism through which electronic payments of cash transfer programmes can contribute to widening portfolio choices for risk management by the poor.

3. Context and intervention

POP is the largest nation-wide antipoverty policy in Mexico, currently reaching 28.1 million people or a fourth of Mexico's population. POP's income support is distributed every two months and is primarily given to women. The monthly average transfer size is about 130 USD, or 20 per cent of households' labour income among the targeted population, this can vary depending on household composition (ECLAC, 2016). The fact that POP provides regular and predictable income support to beneficiaries is critical to understanding consumption smoothing, risk management, and savings decisions made by the poor (Angelucci & Attanasio, 2009, Gertler et al., 2012, Hoddinott & Skoufias, 2004).

POP's income support was initially paid in cash at distribution points located in towns. This usually entailed long travelling and queuing times for recipient households. The repercussions were also in terms of opportunity cost for leaving their economic activities unattended, as well as endangered personal safety, as collectors carrying cash were exposed to the risk of theft and assault (Klein & Mayer, 2011). In 2001, the Mexican Congress passed a new law – *Ley de Ahorro y Crédito Popular* – as part of a wider reform of the financial system, with the aim of transforming non-banking financial institutions into fully regulated and monitored entities, legally authorised to receive deposits. The law also transformed the National Savings Trust Fund (PAHNAL) into a development bank, the National Savings and Financial Services Bank (BANSEFI) with the mandate of deepening financial intermediation and inclusion among low-income households (Niño-Zarazúa, 2009).

A census conducted by BANSEFI in 2002 found that the non-banking sector – composed of about 630 institutions – had a market penetration rate of only 17 per cent (Gavito, 2002).[5] Data on financial inclusion collected in 2006 by the National Banking and Securities Commission showed that financial penetration in rural and peri-urban communities still remained very limited. Financial inclusion rates were slightly higher in the urban sector, with just 26 per cent of urban households being banked (Honohnan, 2008). This was in line with early findings by Caskey, Ruiz Duran, and Solo (2006), who reported that only 24 per cent of households in Mexico City had access to formal financial services provided by either banking or non-banking institutions.

The initial pilot phase of the electronic payment system analysed in this study is the result of a joint effort that began in 2003 by the Secretariat of Social Development (SEDESOL), POP's National Coordination Unit, BANSEFI and non-banking institutions affiliated to L@ Red de la Gente. Two central objectives guided the policy: first, to make the delivery of POP more efficient, by cutting transaction and opportunity costs to beneficiary households, and second, to broaden the limited

financial inclusion in the country. The pilot intervention involved the opening of savings accounts for POP beneficiaries in nearby branches belonging to BANSEFI and non-banking institutions that formed part of L@ Red de la Gente (hereafter referred to as programme branches). All these savings accounts were qualitatively similar: free of opening and maintenance fees, they did not require a minimum savings balance, and most importantly, they provided a considerable proportion of POP beneficiaries with access to formal financial services for the first time.[6]

The accounts also function as any other savings account: POP beneficiaries could withdraw the full amount of their grant or keep part as savings. They could also receive deposits from other sources, including remittances. Remittance services offered by BANSEFI and L@ Red de la Gente are particularly attractive as they represent the cheapest option on the market. Both institutions charge very similar fees as the result of a partnership with a group of remittance companies operating in the United States (see Table 1).

The intervention design meant that transactions and opportunity costs of receiving POP's grant were reduced for treated households. Indeed, Seira (2010) finds that opportunity and financial costs associated with the collection of POP decreased by 77 per cent and 98.5 per cent, respectively.[7] Equally important is the fact that, by distributing POP regularly in the BANSEFI savings accounts, the grant served as an incentive device that increased the exposure of poor households to financial services. In fact, POP beneficiaries had to visit programme branches at least fortnightly to collect their grant; by doing so, they were exposed to information about all financial services offered by the BANSEFI and L@ Red de la Gente.

During the pilot phase, more than 90 per cent of POP beneficiaries continued to receive the grant in cash (see Figure 1).[8] BANSEFI's distribution network expanded over time as a result of the partnership with L@ Red de la Gente, and by 2009, it had reached nearly 2000 municipalities with 80 per cent national coverage. The network specifically targeted rural and peri-urban localities with limited access to financial services, which is where many POP beneficiaries live. The same year, BANSEFI

Table 1. Savings and remittance services by largest financial institutions in Mexico: figures in pesos of 2004 for savings products

	Savings Accounts			Remittances
Bank	Required amount to open account	Minimum balance	Administrative fees (annual)	Average fee in dollars for sending US $300 from the US[a]
BANSEFI and L@ Red de la Gente[b]	0	0	0	3–5
Banamex	500	Not required	10 + extra fee for savings balance below 500	5.5–6.5
Banorte	750	750 required to received interests	75	5.5–6.5
BBVA-Bancomer	750	750	182	5.5–6.5
HSBC	250	250	50	5.5–6.5
Scotiabank-Inverlat	500	Not required	Not available	5.5–6.5
Banco Azteca	50	50	10	5.5–6.5

Source: Authors, based on PROFECO (2010).
Notes: [a]Average depends on the location of transfer. Figures based on 21 intermediaries operating in the following cities: Chicago, Illinois; Dallas, Texas; Houston, Texas; Indianapolis, Indiana; Los Angeles, California; Miami, Florida; New York, New York; Sacramento, California; and San José, California; [b]BANSEFI and L@ Red de la Gente work in partnership with the following remittance companies: BTS, Dolex, Intermex, Giromex, Grupomex, Ria Financial, Moneygram, Sigue, Transnetwork, Viamericas, and Western Union.

and POP began a second phase, which consisted of issuing Visa debit cards to beneficiaries that were already receiving POP in a savings account. This allowed POP beneficiaries to withdraw cash and check account balances at ATMs. In addition, pre-paid cards with biometric technology were also distributed, mainly among the rural poor who lived in localities with limited banking infrastructure. By 2011, all POP beneficiaries in the country received their grants in savings accounts with debit or prepaid cards (see Figure 1). This study focuses on the pilot phase specifically, that is the initial transition from cash to electronic payments in savings accounts.[9]

4. Data and identification strategy

In 2004, BANSEFI and SAGARPA began the collection of a household panel survey in 25 of Mexico's 32 federal states. This happened in parallel with the pilot phase of POP electronic payment system, which had started operating the year before, in 2003. The survey sampling frame was designed to be representative of three regions: north, centre, and south, and of both users and non-users of financial services. A sample of branches belonging to BANSEFI and L@ Red de la Gente was randomly selected with a probability proportional to their number of clients (Woodruff, 2006). Then, for each of the selected branches, between 20 and 30 households were randomly selected from a listing of clients, while an equal number of households with no recorded use of formal financial services in the previous five years to the survey were also included in the survey. The survey consists of four rounds: 2004, 2005, 2006, and 2007. This gives us an overall sample of 3003 observations corresponding to POP beneficiaries, who, between 2004 and 2007, received their income support either in cash (1,197) or in a savings account (1,806).

For the identification strategy, we exploit the fact that the selection of households into the electronic transfer programme was made by the managers of L@ Red de la Gente and POP and not the households themselves. More specifically, programme enrolment was not optional for the household, the inclusion into treatment was based on its proximity to a BANSEFI branch, or the nearest affiliate of L@ Red de la Gente, generally within a radius of 10 kilometres. This identification strategy allowed us to rule out household self-selection. However, the selection of branches into the electronic payments pilot was not random and was influenced by specific factors, including the availability of financial infrastructure in localities treated by POP and security. We exploited the variation in related observables to mitigate such non-random placement and compute ATT matching estimators.[10]

It is important to note that in our sample, more than one branch exists per locality but only some branches were selected for participation into the pilot. This means that branches did not univocally identify treated localities. What is more, localities did not univocally identify household treatment status.[11] Specifically, in over a third of our sample, localities contained both treated and untreated households (see Tables S15 to S17).[12] This variation at both levels means that the Conditional Independence Assumption (CIA) is not violated. Further sensitivity tests, which consisted of simulating a potential violation of the CIA (see Table S14), confirmed that that our results are robust to potential confounding effects.

5. Outcomes

Given the data requirements of matching estimations, we employ the pooled sample over the four available years. Since we are interested in the treatment effects of the electronic payments on savings decisions, transaction costs, and risk management decisions, we considered four outcome variables: the first is a binary variable, *tandas*, taking the value of one for households that participate in informal rotating saving associations (ROSCAs), known in Mexico as tandas. Only slightly more than 10 per cent of our sample used tandas in the 12 months prior to the survey. This is explained by the socio-economic profile of the sampled households. Theft risks and budget constraints are likely factors underpinning the low participation of POP beneficiaries in tandas, which require a

commitment to a fixed sum of money for a given period. *Homesavings* is a binary indicator that takes the value one if the household keeps part or its entire savings at home. Table S1 shows that, on average, 30 per cent of the households kept money at home in the 12 months prior to the survey.

Remittances measures the frequency with which households receive remittances during the year. *ShockCoping* is a binary indicator recording whether a household has used its own savings to cope with idiosyncratic shocks; 15 per cent of the sample reported having used their savings as a coping strategy. Idiosyncratic shocks include calamities associated with injuries, illness, or death of a household member, the job loss experienced by a household member, a drop in either the price or the quantity of the produce sold by the household, and the loss or damage of tools and machinery used for economic activity.

6. Methodology

We begin our exposition by considering a simple linear ordinary least squares (OLS) model, in which control variables along with the impact variable are regressed on the outcomes of interest. The OLS specification takes the form:

$$y_i = \alpha + D_i\beta + X_i\gamma + \varepsilon_i \tag{1}$$

where D_i is a dummy variable taking the value of one for households receiving POP through electronic payments and zero for households receiving the grant in cash, whereas X_i is a vector of household- and location-level characteristics as described in Table S1. OLS estimates would simply compare average outcomes between treatment and control groups after controlling for the effect of covariates. Shortcomings of this approach arise from model misspecification as well as from the risk of overlooking the potential effect of observed and unobserved heterogeneity affecting the outcomes of interest. A partial step towards addressing observable heterogeneity is the estimation of a fully interacted linear model (FILM), which relaxes the homogeneity assumption and allows for interactions of all control variables with the treatment status. If statistically significant interaction terms are found, impact heterogeneity can be regarded as an issue. In such cases, only comparable individuals should be considered to estimate treatment effects. For that purpose, matching estimators based on the propensity score or other distance metrics can be used to construct a synthetic quasi-experimental counterfactual. More formally, if we let y_{i1} denote the outcome of household i when treatment occurs $(D_i = 1)$ and y_{i0} the outcome of a control household, $(D_i = 0)$, the average treatment effect on the treated (ATT) corresponds to $\bar{y}_1 - \bar{y}_0$, where each outcome is averaged over the respective population. Under such a setting, the vector of covariates in X allows us to balance the distribution of those determinants across treated and control groups using matching estimation methods.

Rosenbaum and Rubin (1983) show that this can be achieved by matching directly on the covariates, or by matching on the propensity score, which is calculated as the probability of treatment given a set of X covariates. They indicate that while propensity score methods provide the coarsest balancing score, covariate matching provides the finest. Zhao (2004) points out, however, that the latter approach is impractical when there are many covariates and a metric is needed to combine them into a scalar.

A metric often adopted for its desirable properties is the Mahalanobis distance metric, which minimises the distance between treated unit i and control unit j as follows:

$$d(i,j)_M = \left(X_{ik} - X_{jk}\right)' D^{-1} \left(X_{ik} - X_{jk}\right) \tag{2}$$

where X identifies k matching covariates and D^{-1} is the variance covariance matrix of X. The Mahalanobis metric assigns weights to each co-ordinate of X in inverse proportion to the variance of that co-ordinate, so that the control unit with the minimum distance $d(i,j)_M$ is chosen as a match for each treated unit. The estimation is only performed within the boundaries of the common support region, defined as the region within which comparable treatment and control units lie, so that the ATT corresponds to:

$$ATT = E\left[y_1 \middle| T = 1,\ d(i,j)_M\right] - E\left[y_0 \middle| T = 0,\ d(i,j)_M\right] \tag{3}$$

or

$$ATT = E\left[y_1 - y_0 | d(i,j)_M\right] \tag{4}$$

In order to test for the sensitivity of our results, three different matching algorithms are presented in Tables 3–5, where standard errors are calculated according to Abadie and Imbens' (2006) analytical asymptotic variance method. The first set of results is that of a nearest neighbour matching estimation in which treated observations are only matched to the closest untreated neighbour (Cochran & Rubin, 1973). Results are also presented for a kernel-based matching, where a weighting structure is imposed over the whole data distribution to estimate the counterfactual. We calibrate caliper and bandwidth restrictions according to the bias reduction performance measured as in Leuven and Sianesi (2003). In all instances, we choose the least restrictive caliper and bandwidth which allow us to get rid of all bias. The last set of results presented in Tables 3–5 use the nearest neighbour bias-adjusted Abadie and Imbens (2011) estimator. Here, the distance metric corresponds to:

$$d(i,j)_{AI} = \left(X_{ik} - X_{ij}\right) diag(D^{-1}) \left(X_{ik} - X_{ij}\right) \tag{5}$$

This metric is similar to the Mahalanobis distance, except for the weighting matrix adopted. In fact, $d(i,j)_{AI}$ is weighted by a diagonal matrix, with the inverse of the variances of the X's as its elements. The bias-correction algorithm proposed in Abadie, Drukker, Herr, and Imbens (2004) and Abadie and Imbens (2011) allows us to overcome the finite sample bias deriving from non-exact matching. The correction adjusts the difference between the matches with the differences in their covariate values, without affecting the asymptotic variance. We use a propensity score-based adjustment. In addition to this, to improve overlap, we follow Crump, Hotz, Imbens, and Mitnik (2009) and Abadie and Imbens (2011) and restrict the matching region to the subset of observations with $0.1<p(Z)<0.9$; where $p(Z)$ denotes the propensity score. Crump et al. (2009) calculate the percentage propensity score distribution (α) to be dropped according to a condition based on the marginal distribution of the propensity score. They establish a rule of thumb for the parameter α to be fixed at 0.1.

To address local-level heterogeneity, we first include all covariates for which a statistically significant difference between treatment and control groups exists. This includes the geographical location variables and the rural/urban location identifier. Second, we separate rural from urban localities and re-estimate the model by matching only households within each area separately. As explained in List, Millimet, Fredriksson, and McHone (2003), this is the matching analogy to the fixed effects estimator, which removes any location-related unobservable not already controlled for by the distance metric. In addition, such estimator satisfies an important condition set out in Smith and Todd (2005), namely, that, for treated and non-treated units to be comparable they should reside in the same local markets. Once this further condition is imposed, the ATT in Equation (5) becomes:

$$ATT = E\left[y_1 \middle| T = 1,\ d(i,j)_M,\ loc\right] - E\left[y_0 \middle| T = 0,\ d(i,j)_M,\ loc\right] \tag{6}$$

or

$$\mathrm{ATI} = \mathrm{E}\left[\mathrm{y}_1 - \mathrm{y}_0 | \mathrm{d}(\mathrm{i},\mathrm{j})_{\mathrm{M}}, \mathrm{loc}\right] \tag{7}$$

where *loc* corresponds to the rural-urban identifier.

7. Results

Based on both the baseline balance of covariates and the FILM estimators, we observe significant heterogeneity in covariates along the rural versus urban dimension as well as according to regional patterns, age of household head, dependency ratios, and whether or not household heads speak an indigenous language (see Sections 1 and 2 and Tables S1 and S2 in the Supplementary Materials). In order to address such heterogeneity, we rely on a Mahalanobis distance metric approach to identify households with similar treatment probabilities, conditional on a set of covariates capturing such heterogeneity. Table 2 presents the results from the probit estimation. The findings broadly conform to our expectations in terms of significance and direction.

Tables 3–5 present, for each outcome, the results obtained with the different matching algorithms described in Section 5. In Table 3, the whole sample is considered, while in Tables 4 and 5, the fixed effect matching estimators are presented. Details of the balancing of the covariate distribution in the treated and control groups, and of the overall mean bias reduction are presented in Tables S3–S6.

Starting with Table 3, matching on the whole sample indicates that electronic payments of POP decrease the propensity to participate in tandas by between 3.3 and 4.8 per cent, depending on the estimator. By forcing enrolment, the electronic payments seem to have acted as an incentive device that increased the exposure to, and then utilisation of, formal savings. In addition, the pilot also improved information about financial services by requiring regular visits to the programme branches, while tandas entail high opportunity and financial costs – both in terms of time allocation and peer-monitoring of savings groups – and risk of theft or losing the funds.[13] Interestingly, the propensity to save at home, which is our second outcome of interest, is not affected by the treatment. This reinforces our point on transaction costs: the possibility of saving in a bank account provides a desirable alternative to informal savings when transaction costs are high. However, when transaction costs are minimal, as in the case of keeping money 'under the mattress', no substitution takes place. Our findings are in line with those of Aportela (1999) who reports insignificant crowding out effects from the expansion of PAHNAL on home savings in Mexico.

The magnitude of the substitution effect between saving portfolio choices is, however, small and it increases when the sample of urban beneficiaries is considered on its own. This is due to the fact that in Mexico, participation in tandas is higher among urban dwellers. Indeed, Klaehn, Helms, and Deshpande (2006), Campos (1998), and Mansell Carstens (1995), among others, found that in urban contexts with monetised markets, poor households have liquidity requirements for consumption and production that often lead to a higher propensity to save in tandas and other informal sources of savings and credit. In contrast, the rural poor exhibit higher preferences for saving in livestock, agricultural inputs, building materials, and other tangibles over liquid assets. While this reflects the risk portfolios of the rural poor, it could also reflect the multiplicity of specific benefits that participation in tandas brings to them. These may range from positive signalling in this type of trust interactions in tightly knit communities, to improving fragmented information and enhancing inclusion. In view of these elements, rural participation in tandas would be expected to be relatively unaffected by formal savings, which is also in line with the results of Jack and Suri (2014).[14]

It must be noted that, due to data limitations, we cannot disregard the possibility of other potential channels that drive the substitution effect between savings accounts and tandas. It may be the case that intra-household dynamics also influenced savings decisions. Administrative data reported in González Rosas (2008) indicates that the median savings account balance among POP beneficiaries at the end of the pilot was about 22.40 USD, more than twice that observed among non-POP users of BANSEFI saving products. This is relevant since 96 per cent of POP beneficiaries are women. Previous studies have underscored the role of savings accounts in enabling women to hide income from family members and neighbours, particularly in rural settings (Dupas & Robinson, 2013, Jakiela & Ozier, 2015). Thus, the benefits of anonymity from savings accounts may well be outweighing the benefits of tandas (Anderson & Baland, 2002; Gugerty, 2007), although we cannot confirm this transmission channel empirically.

Table 2. Probit regressions, marginal effects

	Tanda	Home Saving	Remittances	Shock Coping	Tanda	Home Saving	Remittances	Shock Coping	Tanda	Home Saving	Remittances	Shock Coping
	Whole sample				Urban sample				Rural sample			
LocalType	.136***	.138***	.136***	.107**								
	(.02)	(.02)	(.02)	(.045)								
FInst	−.111***	−.111***	−.111***	−.128*	−.256***	−.256***	−.256***	−.287***	−.116**	−.117**	−.116**	.044
	(0.036)	(0.036)	(0.036)	(0.075)	(.049)	(.049)	(.049)	(0.108)	(0.032)	(0.032)	(0.032)	(0.113)
South_Mexico	−.336***	−.336***	−.336***	−.336***	−.478***	−.478***	−.478***	−.642***	−.268***	−.268***	−.268***	−.184**
	(.025)	(.025)	(.025)	(.059)	(0.042)	(0.042)	(0.042)	(.082)	(.032)	(.032)	(.032)	(.077)
Centr_Mexico	−.275***	−.276***	−.275***	−.218***	−.477***	−.477***	−.477***	−.378***	−.192***	−.193***	−.192***	−.157*
	(.031)	(.031)	(.031)	(.066)	(.054)	(.054)	(.054)	(.114)	(.038)	(.038)	(.038)	(.084)
HouseFloor	.159***	.159***	.159***	.135**	.137***	.136***	.137***	.281***	.159***	.174***	.175***	.095
	(.025)	(.025)	(.025)	(.053)	(.046)	(.046)	(.046)	(.096)	(.025)	(.029)	(.025)	(.066)
PipedWater	.1***	.101***	.1***	.111*	.053	.054	.053	.1	.1***	.119***	.117***	.173**
	(.027)	(.027)	(.027)	(.061)	(.05)	(.05)	(.05)	(.142)	(.027)	(.031)	(.027)	(.067)
DepRatio	−.043***	−.043***	−.043***	−.011	−.058***	−.058***	−.058***	−.063	−.016	−.016	−.016	.015
	(.011)	(.011)	(.011)	(.024)	(.016)	(.016)	(.016)	(.04)	(.015)	(.015)	(.015)	(.032)
Age	.001**	.001*	.001**	.001	.004**	.004**	.004**	.005*	.000	.000	.000	−.002
	(.0008)	(.0008)	(.0008)	(.001)	(.001)	(.001)	(.001)	(.003)	(.001)	(.001)	(.001)	(.002)
Education	.071***	.07**	.071***	.003	.14***	.14***	.14***	.21**	.012	.012	.012	−.1
	(.027)	(.027)	(.027)	(.06)	(.044)	(.044)	(.044)	(.103)	(.036)	(.036)	(.036)	(.08)
IdioSock	−.07***	−.07***	−.07***		−.1**	−.1**	−.1**		−.05*	−.053*	−.055*	
	(.024)	(.024)	(.024)		(.004)	(.004)	(.004)		(.031)	(.031)	(.031)	
Indigenous	.245***	.245***	.245***	.19***	.164***	.166***	.164***	.3***	.29***	.29***	.29***	.162***
	(.022)	(.022)	(.022)	(.05)	(.04)	(.04)	(.04)	(.09)	(.026)	(.026)	(.026)	(.063)
Obs.	2694	2691	2694	566	1024	1023	1024	223	1670	1668	1670	343
LR χ^2	378.38	379.37	378.38	61.05	225.03	224.94	225.03	63.85	205.1	204.95	205.1	24.95
$p > \chi^2$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Psuedo R^2	0.101	0.102	0.101	0.078	0.164	0.164	0.164	0.207	0.088	0.088	0.088	0.053

Notes: *Significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 3. Mahalanobis distance metric and bias-adjusted nearest neighbour matching estimators

	Tanda			Home Saving			Remittances			Shock Coping		
	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj
ATT	−0.048**	−0.033*	−0.046**	−0.05	−0.031	−0.053	0.114	0.03	0.106	0.08**	0.08**	0.06*
	(0.024)	(0.018)	(0.021)	(0.037)	(0.02)	(0.035)	(0.238)	(0.16)	(0.129)	(0.038)	(0.033)	(0.033)
Obs.	2456	2456	2456	2454	2454	2454	2456	2456	2456	510	510	510
Treated	1200	1097	1399	1198	1095	1099	1200	1200	1413	224	224	264
Controls	1043	1043	1043	1043	1043	1043	1043	1043	1043	246	246	246
Comm Supp	2243	2140	2442	2241	2138	2052	2243	2243	2456	470	470	510
Off sup	213	316	14	213	316	402	213	213	0	40	40	0

Notes: Abadie and Imbens' (2006) heteroskedasticity-robust analytical standard errors are reported in parentheses. *Significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

Table 4. Mahalanobis distance metric and bias-adjusted nearest neighbour matching estimators (urban sector)

	Tanda			Home Saving			Remittances			Shock Coping		
	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj
ATT	−0.1*	−0.077*	−0.14***	−0.026	−0.016	−0.071	−0.712	−0.485	−0.427	0.036	0.024	0.024
	(0.053)	(0.046)	(0.05)	(0.057)	(0.057)	(0.052)	(0.49)	(0.3)	(0.26)	(0.064)	(0.062)	(0.062)
Obs.	896	896	896	896	896	896	896	896	896	196	196	196
Treated	456	433	466	456	433	467	444	444	346	83	87	107
Controls	293	293	293	293	293	293	293	293	293	78	78	78
Comm Supp	749	717	759	749	717	759	737	717	639	161	175	175
Off sup	147	170	137	147	170	136	159	159	257	35	21	11

Notes: Abadie and Imbens (2006)'s heteroskedasticity-robust analytical standard errors are reported in parentheses. *Significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

The third outcome of interest is the frequency of remittance reception, which for the full sample is not influenced by POP's savings accounts (see Table 3). However, when we computed the fixed effects estimators, the results turn out to be positive for rural households (see Table 5). As the frequency of remittance reception is expressed in log-form, we take the antilog of the ATT coefficients and compute $(e^{y} - 1) \times 100$ as in Halvorsen and Palmquist (1980), which calculates the percentage change of the median of remittance reception of treatment households relative to the control group. Two of the three matching algorithms indicate that the frequency of remittance reception increases by 90 per cent in the rural sector. To gauge the extent of the impact, consider the hypothetical case of a household *i* that receives remittances six times a year before the intervention. Following the opening of savings accounts, the same household would be able to receive remittances on a monthly basis.[15]

We highlight several plausible channels underpinning our results. First, improved information: since POP grants are paid regularly, recipients were forced to visit programme branches at least fortnightly. By doing so, they received regular exposure to information on other financial services, including remittances. Second, reduced transaction costs: BANSEFI and non-banking institutions affiliated to L@ Red de la Gente achieved a very extensive territorial coverage, specifically targeting localities with limited or no access to banking services. Therefore, travelling distance to programme branches is much lower than to other remittance companies which usually operate only in municipal capitals. Third, lower prices: POP's savings accounts were provided free of opening and maintenance

fees, they did not require a minimum savings balance and allowed POP beneficiaries to receive deposits from other sources, including remittances. Remittance services are particularly competitive, as the fee charged by BANSEFI and L@ Red de la Gente corresponds to one-half the average market price offered by other remittance providers (see Table 1). Fourth: improved security may have also played a role here, as the transition from cash to electronic payments is likely to have reduced crime rates associated with theft and assault (Klein & Mayer, 2011; Wright et al., 2014), which in turn positively impacts remittance behaviour (Coon, 2015, Vargas-Silva, 2009).

Finally, we find in Table 3 that households who received POP in a bank account were 6–8 per cent more likely to use their savings to cope with idiosyncratic shocks. The increased reliance on savings implies that resorting to contracting loans or reducing consumption become less frequent. Karlan, McConnell, Mullainathan, and Zinman (2011) point out that, when unexpected events arise, failure to smooth consumption as a consequence of inadequate financial planning can result in households resorting to contracting new debt or defaulting on existing loans. These are undesirable consequences, particularly when considering that, for POP beneficiaries who live near the subsistence level, any reduction in consumption can drastically impact health status, schooling, work productivity, and also future consumption and income levels.

Furthermore, as social and financial sanctions usually accompany loan defaults, the improved portfolio of copying strategies is a desirable result of electronic payments. Administrative data on the balance of savings among POP's beneficiaries (see González Rosas, 2008) suggest that the shift from debt accumulation and cuts in consumption to usage of savings reflects an increase in the levels of savings, which in turn may be partly attributed, at least in the rural context as we discuss below, to increases in the frequency of remittances reception. The impact is concentrated in the rural sector, as visible in Table 5, where better and more frequent access to remittances, coupled with the certainty of regular, predictable, and reliable income transfers from POP, represented an incentive mechanism generated by the programme. This, together with the fact that the programme effectively forced regular use of savings accounts, enabled the poor to better diversify their risk management portfolios. Our results are in line with those of Jack and Suri (2014) who report that the availability of a mobile-based transaction system in Kenya translated into consumption smoothing in times of income shocks, through an increased remittances channel. The absence of significant impacts in urban areas may reflect the higher incidence of idiosyncratic shocks in rural areas as indicated by the sample size differential. This may also reflect a more pronounced effect on households that were more economically disadvantaged to begin with.

In order to verify the robustness of our results, we conducted several tests of impact heterogeneity and we also checked for potential CIA violations due to non-random placement of programme branches, by applying the test developed by Ichino, Mealli, and Nannicini (2008). Due to space limitations, we present these results in the Supplementary Materials. In all instances, outcomes are remarkably stable, which indicate that unobservable factors do not pose a threat to our results. Nevertheless, due to the nature of our data, our results should be taken with caution when considering the policy implications of our findings.

8. Conclusions

This study examined the effect of the initial phase of the electronic payment system of POP. This is relevant as the transition from cash payments to savings accounts represented, for most POP beneficiaries, the first direct encounter with a formal financial institution.

We found that the programme produced positive effects, although with a degree of impact heterogeneity between rural and urban areas. Access to savings accounts led to a reduction in the rate of participation in tandas in urban areas, where participation is more recurrent in the context of Mexico. The incentives that the electronic payments generated for the utilisation of savings accounts, combined with the transaction costs tandas entail in terms of peer-monitoring, organisation effort, and risks of theft, are the most likely underlying transmission mechanisms explaining the substitution

Table 5. Mahalanobis distance metric and bias-adjusted nearest neighbour matching estimators (rural sector)

	Tanda			Home Saving			Remittances			Shock Coping		
	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj	NN mahal	Kernel weighted	NN bias_adj
ATT	−0.019	−0.008	−0.017	−0.035	−0.05	−0.044	0.642***	0.327	0.644**	0.089**	0.079**	0.097**
	(0.021)	(0.02)	(0.021)	(0.044)	(0.033)	(0.043)	(0.239)	(0.25)	(0.257)	(0.041)	(0.031)	(0.042)
Obs.	1560	1560	1560	1558	1558	1558	1560	1560	1560	314	314	314
Treated	810	752	810	808	750	808	810	752	810	146	134	146
Controls	750	750	750	750	750	750	750	750	750	168	168	168
Comm Supp	1560	1502	1560	1558	1500	1558	1560	1502	1560	314	302	314
Off sup	0	58	0	0	58	0	0	58	0	0	12	0

Notes: Abadie and Imbens (2006)'s heteroskedasticity-robust analytical standard errors are reported in parentheses. *Significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent.

effect between formal and informal savings; although we cannot rule out the possibility that intra-household dynamics also influenced savings decisions.

In addition, by forcing regular visits to programme branches, POP's electronic payments increased households' exposure to other formal financial services that are vital to accumulating assets and improving their risk management portfolios. Specifically, the intervention improved information on remittance services, reduced associated transaction costs and service fees, possibly improved security and consequently increased the frequency of remittances reception. This, in turn, contributed to smoothing consumption and mitigating the catastrophic effects of income shocks. Moreover, the fact that treated households were more likely to resort to their own savings as a shock coping strategy is in itself a desirable outcome of the intervention.

Our findings have clear implications for policy, especially at a time when other cash transfer programmes around the world are undertaking the transition from cash to electronic payments. Firstly, our study underscores the potential welfare benefits from public-private alliances. Moreover, we show that, beyond their intended objectives, cash transfer programmes can also contribute to improving financial inclusion among the poor. However, to achieve this target, simply extending access to financial services will not be enough. Providing incentives to get people to gain exposure to, and use a broader spectrum of financial services is crucial. Further research is needed to improve our understanding of the longer-term and second-order effects of electronic payments in the context of cash transfer programmes, and of their link to other financial services such as insurance and credit.

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Notes

1. We refer to 'urban' areas in contexts of peri-urban and marginalised neighbourhoods. It is, therefore, not uncommon to observe 'urban' dwellers living in houses without concrete floor or walls. See Bazán et al. (2005) for further details.
2. Pickens, Porteous, and Rotman (2009) report that only 25 per cent of cash transfer programmes worldwide are distributed through electronic payments that are inclusive in terms of improved accessibility to financial services.
3. For a comprehensive review of this strand of the literature, see Prina (2015).
4. Migrant workers, 25 per cent of which were poor, sent in 2015 nearly US $25 billion to their families in Mexico, which contributed to 2.3 per cent of the country's GDP.
5. Non-banking institutions in Mexico include credit unions, savings and credit associations (SCAs), savings and credit co-operatives (SACCOs), and microfinance institutions. Credit unions have formally operated in Mexico since the creation of the National Banking Commission in 1924. Their original objective was to form syndicates of producers and small firms to distribute direct credits and technical assistance from development banks and other governmental agencies. SCAs are non-profit organisations with open membership. As in the case of credit unions, financial operations within SCAs are constrained to receive deposits and give credits to their members. SACCOs are organisations that operate under a set of simple principles: i) one person, one vote; ii) no returns on capital, and iii) the use of profits for social purposes. SCAs as well as SACCOSs usually operate in rural and peri-urban areas.
6. Indeed, in our sample, only 17.5 per cent of Oportunidades beneficiaries reported having had savings accounts prior to the BANSEFI electronic transfer programme.
7. When transfers had to be collected in cash at the nearest distribution point, the figures for rural beneficiaries indicated an average time allocation of four hours, corresponding to an opportunity cost of 17 pesos, and an average travelling expense

of 30 pesos. These costs go down to half an hour of time allocation, corresponding to an opportunity cost of 2.22 pesos, and 0.5 pesos for travelling expenses, on average, after the pilot implementation.

8. It is important to note that, while programme branches were in many cases already physically accessible to Oportunidades beneficiaries, a very small fraction of these households reported having had a savings account prior to the introduction of the BANSEFI account. In Mexico, as in many other contexts, the utilisation of financial services is not strictly contingent upon access. There are other entry barriers, including limited information and lack of trust in financial institutions. In fact, lack of trust has been reported as an important reason explaining why the poor do not use formal financial services (see Dupas et al., 2016; Mehrotra, Vandewalle, & Somville, 2016, Osili & Paulson, 2014). Thus, by forcing enrolment, the intervention mitigated these entry barriers into the formal financial sector.
9. For an analysis of the second phase, that is the inclusion of Visa debit cards to the existing savings accounts, see Bachas et al. (2017).
10. While using information at locality and household level imperfectly controls for branch characteristics, we find that nearly 60 per cent of the probability of being treated is explained by the covariates used in the matching estimators (see Table S18 in the Supplementary Material).
11. The Oportunidades sample is relatively homogeneous due to the targeting method adopted by the programme, which relies on the marginality index and the proxy-means test to identify the poor eligible to receive Oportunidades.
12. Tables numbered after an S are available in the Supplementary Materials.
13. Earlier studies have highlighted the risks associated with ROSCAs participation, particularly for the poor and vulnerable (see Vonderlack & Schreiner, 2002; Wright & Muteesassira, 2001).
14. We thank one of the referees for bringing this point to our attention.
15. Unfortunately, due to data limitations, we were unable to assess whether the size of remittances changed over time.

Disclosure statement

No potential conflict of interest was reported by the authors.

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