2018
OKSWP1802

Economics Working Paper Series
Department of Economics
OKLAHOMA STATE UNIVERSITY
http://spears.okstate.edu/ecls/

Will Urban Migrants Formally Insure their Rural Relatives? Family Networks and Rainfall Index Insurance in Burkina Faso*

Harounan Kazianga
Oklahoma State University

Zaki Wahhaj
University of Kent

Department of Economics
Oklahoma State University
Stillwater, Oklahoma

339 BUS, Stillwater, OK 74078, Ph 405-744-5110, Fax 405-744-5180

Will Urban Migrants Formally Insure their Rural Relatives? Family Networks and Rainfall Index Insurance in Burkina Faso*

Harounan Kazianga† and Zaki Wahhaj‡
Oklahoma State University and University of Kent

March 2018

Abstract

We present findings from a pilot study exploring whether and how existing ties between urban migrants and rural farmers may be used to provide the latter improved access to formal insurance. Urban migrants in Ouagadougou (the capital of Burkina Faso) originating from nearby villages were offered, at the prevailing market price, a rainfall index insurance product that can potentially protect their rural relatives from adverse weather shocks. The product had an uptake of 22% during the two-week subscription window. Uptake rates were higher by 17-22 percentage points among urban migrants who were randomly offered an insurance policy that would make pay-outs directly to the intended beneficiary rather than the subscriber. We argue that rainfall index insurance can complement informal risk-sharing networks by mitigating problems of informational asymmetry and self-control issues.

Keywords: Microinsurance markets, Indexed insurance, Rainfall, Migration, Informal insurance networks

JEL Codes: O15, O16, G21

*The field work reported in this paper was made possible by a grant from the International Initiative for Impact Evaluation (3IE) with support from Oklahoma State University and the University of Kent and the collaboration of PlaNet Guarantee. Alassane Koulibaly, Arthur Sagot-Duvauroux and Oumar Sory from The Innovation for Poverty Action (IPA) provided exceptional administrative and research assistance throughout the project. Harounan Kazianga acknowledges also support from the Carson Priority Endowed Professorship.

†Email: harounan.kazianga@okstate.edu. Address: 324 Business Building, Spears School of Business, Oklahoma State University, Stillwater, OK 74078, USA

‡Email: z.wahhaj@kent.ac.uk. Address: School of Economics, Keynes College, University of Kent, Canterbury CT2 7NP, United Kingdom.

1 Introduction

It is a well-documented fact that large segments of the population in developing countries, especially in rural areas, have a high level of vulnerability to weather-related shocks. Yet, there is limited usage of formal insurance products among these populations. A study by the International Labor Organization estimated that, in Africa alone, there are approximately 700 million working poor and vulnerably non-poor on the continent, with an annual income of 500 billion USD, who can potentially benefit from formal insurance (Matul et al., 2010). However, less than 3% of this population currently use insurance products.

In recent years, microfinance institutions have experimented with insurance products, in particular rainfall index insurance, in different parts of the world. But the uptake of these products has generally been very low (Cole et al. 2013). It is evident that there is a mismatch between the type of formal insurance products that microfinance institutions are currently providing and the demand of poor rural farmers. The existing literature points to a number of explanations for this phenomenon including the high opportunity cost of insurance premiums for poor farmers (Giné et al., 2008; Gaurav et al., 2011), their reliance on informal risk-sharing networks (Mobarak and Rosenzweig, 2013, 2012; Binswanger-Mkhize, 2012) as well as lack of trust in the insurance provider and liquidity constraints (Cole et al. 2013). Recent research on the topic has argued that formal insurance can complement existing informal risk-sharing arrangements by providing informal insurance groups protection against aggregate shocks (Dercon et al., 2014; Mobarak and Rosenzweig, 2013, 2012; Berg et al., 2009).

In this paper, we present findings from a pilot study exploring how existing ties between urban migrants and rural farmers can be used to provide the latter improved access to formal insurance. The study was motivated by well-established evidence regarding the use of rural-urban migration as a risk-coping and risk-management strategy (e.g. Lucas, 1997; Rosenzweig and Stark, 1989; Stark and Lucas, 1988) and that rural households in developing countries often rely upon assistance from close relatives among urban migrants to cope with adverse weather-related shocks (e.g. Rosenzweig and Stark, 1989; Kazianga, 2006; Yang and Choi, 2007; Dustmann et al., 2017). Our central hypothesis is that demand for weather index insurance can be increased by offering the product to urban migrants, as a mean of providing coverage for their rural relatives engaged in farming. The advantage of marketing the product to urban migrants is that they are easier to access for the insurance provider, thus lowering transaction costs; they are likely to have more experience with formal financial products; and they are likely to be less financially constrained when required to pay for the policy.

To test this hypothesis, we collected contact information on all individuals who had migrated to urban areas from a random sample of rural households from villages close to Ouagadougou, the capital city in Burkina Faso. The urban migrants were traced, and invited to attend a demonstration

of an existing rainfall index insurance product designed for small-scale rural farmers in Burkina Faso (by the organisation PlaNet Guarantee). Subsequently, the urban migrants were contacted and offered subscription to an insurance policy (at the existing market price) for agricultural plots farmed by their rural relatives, with the contract specifying indemnity payments to be paid either to the subscriber or directly to the farmer. The exercise generated an uptake rate of 22% among the urban migrants, over the two-week period of the trial. In comparison, Planet Guarantee's subscription rates in rural areas where the product has been offered and marketed for a number of years range from 20 to 35%.

The uptake rate was higher (by 17-22 percentage points) among urban migrants who were randomly offered an insurance policy in which payouts would be made directly to the rural farmer rather than the urban migrant. In the focus group discussions conducted prior to the marketing phase, urban migrants explained that they preferred this option because of the possible temptation to use an insurance payout, intended for their rural relative, for some other purpose (Banerjee and Mullainathan, 2010). We also find that the uptake was higher among urban migrants who reported at least one shock covered by the policy suffered by their rural relative in the preceding 5 years. However, the shock reports of the urban migrants and the rural relatives do not correspond – pointing to informational asymmetry within the informal risk-sharing network – and the uptake rates do not respond to shocks reported by the latter.

Our findings have a number of important implications for understanding the potential of formal index-based insurance in developing countries. First, we demonstrate that it is feasible to market rainfall index insurance via urban migrants. Thus, the market is not limited to those who are directly engaged in rural farming; given the importance of rural-urban migrant links for coping with risk in developing countries, the potential client base is substantially larger. Additionally, the evidence suggests that rainfall index insurance can complement informal risk-sharing networks by mitigating problems of informational asymmetry – given that insurance payments are contingent on objective reports of shocks – and self control issues that may cause funds to be diverted to other uses.

While we were not able to test the following hypothesis, we also surmise that marketing rainfall index insurance via urban migrants can (i) improve understanding of such products among their rural relatives covered under the policy, and eventually increase uptake among rural farmers themselves; (ii) reduce the need for urban migrants to maintain liquidity to assist their rural relatives in the event of adverse weather shocks, and thus enable them to pursue more profitable economic opportunities.

2 Study Context and Intervention

The study was conducted with small-holder farmers in rural Burkina Faso and migrants from these households presently living in Ouagadougou. The majority of farmers are engaged in rainfed subsistence agriculture. The rainfall occurs during a single wet season lasting three to five months (May to September) and is highly variable. Consequently, the majority of rural households are exposed to weather-related risks and rely primarily on informal insurance mechanisms (Kazianga and Udry, 2006). According to data from the Burkinabe Ministry of Agriculture survey of 2015, nearly 78% of households cope with adverse shocks through consumption of own stocks. By contrast, less than 2% rely on formal insurance.

The wider context for the study is that there are approximately 700 million working poor and vulnerable non-poor in Africa, who can potentially benefit from formal insurance. However, less than 3% of this population currently uses micro-insurance products (Matul et al., 2010). As of 2016, there were 16 insurance companies registered with the Burkinabe Ministry of Finance including PlaNet Guarantee. A specific regulatory framework for micro-insurance was introduced in 2011 by CIMA (Conférence InterAfricaine des Marchés de l'Assurance), which groups 14 countries, including Burkina Faso, under the same regional regulation and control mechanism.

In our study area (discussed in more detail in the following sections) more than half the rural households have at least one relative living in Ouagadougou and more than two-thirds of them report receiving transfers from their Ouagadougou-based relative. The literature on rural-urban linkages in West Africa, including Burkina Faso, points to a slowdown of urban growth since the 1990's and a new phenomenon of 'reverse migration' from urban to rural areas in response to financial insecurity and the high cost of living in urban areas (Beauchemin, 2011; Potts, 2008). More generally, "migrants still maintain close relations with their birth village even from a distance; they return to visit; they invest in housing, social activities, education, and health amenities ... Traditionally, the birth village is the preferred place for eventual retirement ... Most first try to find a new job in cities or towns [but] ... If they fail (as many do) the village is their last resort"(Beauchemin and Bocquier, 2004). Thus, for urban migrants, the possibility of eventual return as a social safety net serves as a strong incentive to invest in their existing social ties in rural areas, including providing financial support to their rural relatives in times of need.

The intervention was based on PlaNet Guarantee's existing rainfall index insurance product designed for small-scale rural farmers in Burkina Faso. Subscribers can insure themselves against rainfall shortages in a specified location within the organisation's coverage area. Rainfall is measured using satellite data at a resolution of 10 square kilometers, and payouts are a function of rainfall realisation at three stages of plant growth (germination, second-stage growth, fruit and flowering). Planet Guarantee's current subscription rate in rural areas is between 20 and 35% with

marketing costs between 20,000 FCFA[1] and 40,000 FCFA per subscription. The intervention involved marketing the product to urban migrants in Ouagadougou who originate from villages and have relatives engaged in farming. More precisely, urban migrants were given the opportunity to purchase insurance for agricultural plots farmed by their rural relatives, with the contract specifying indemnity payments to be paid either to the subscriber or directly to their rural relative. This feature of the contract was randomised across the urban migrants, with half being offered a contract in which payments would be made to the subscriber and half being offered a contract in which payments would be made to the rural relative.

3 Description of the Study Sample and Surveys

The study required both a sample of rural farmers and a sample of urban migrants with family ties in rural areas. Furthermore, to meet the broader objectives of the study, we needed an urban migrant sample with village-based extended family members representative of the rural population – at least for some regions of Burkina Faso.

To construct the sample, we began by randomly selecting 20 villages from the *Plateau Central* and *Centre Ouest* regions of Burkina Faso. These two regions were chosen for their proximity to Ouagadougou. At the time of the study, the implementing agency Planet Guarantee was active in one of the regions but not in the other. We randomly selected 10 villages in each region from a restricted set of villages meeting the following criteria: (i) located less than 50 km from Ouagadougou; (ii) having no more than 75 households; (iii) within 15 km of other villages within the restricted set.[2] Planet Guarantee was not active in any of the selected villages at the time of the study although this was not a condition for selection[3].

A household census was conducted in each village, gathering, in particular, information on whether a household had migrant relatives living in the capital city, Ouagadougou. Based on the census, a stratified random sample ($\frac{3}{4}$) with relatives in Ouagadougou) of 20 households were chosen from each village for the rural household survey. The rural survey respondents were asked to list all household members who have left the village, and all migrants based in the capital city Ouagadougou were traced for inclusion in the urban survey. Both the rural and urban surveys included questions on transfers made and received via their social network, experience of adverse shocks in the preceding 5 years, and strategies adopted to cope with the shocks.

All urban migrants successfully traced and interviewed were invited to an hour-long demonstration of Planet Guarantee's existing rainfall insurance product. The demonstrations were followed

[1] At the time of the survey, the exchange rate was about 1 USD for 580 CFA.

[2] In villages with 50 or fewer households, all the households were included in the census. In villages with more than 50 households, one or more neighbourhoods with close to 50 households were chosen for the census.

[3] The full list of villages, neighbourhoods and number of census households, as well as a map are provided in Table A1 and Figure A1 in the appendix.

up by telephone interviews to check whether the respondent would be willing to purchase the product on offer. House visits for the purpose of subscription were carried out for those who expressed interest at the market price[4]. Additional questions were asked to elicit WTP (willingness-to-pay) for those who declined the market price offer, with a promise of a house visit in the event that Planet Guarantee was able to offer the product at a subsidised price that exceeded their reported WTP at some future date. In addition, the respondents in the rural and urban surveys were presented with a hypothetical rainfall index product, described in careful detail, followed by questions to test their understanding of the product and to elicit their willingness-to-pay for such a product.

A focus group discussion (FGD) was conducted with a random sample of urban migrants who were traced as part of the urban survey. This FGD was focused on understanding whether and how effectively they were able to provide assistance to their rural relatives following adverse weather shocks, their experience with formal financial products, their interest in a potential rainfall index insurance product marketed to urban migrants, and how such a product could be tailored to their needs and specific circumstances.

4 Empirical analysis

4.1 Descriptive Analysis

In this section we use data from the rural census and the rural and urban household surveys to establish some key patterns regarding social ties between rural farm households and urban migrants and the role that these social ties play in helping rural farmers cope with adverse weather shocks.

The census data, summarized in columns 1 and 2 of Table 1, shows that 56% of the rural households had at least one relative living in Ouagadougou. Of those, 70% declared that they had previously received transfers from their Ouagadougou-based relative. The rural household questionnaire included more detailed questions on out-migration from the household shown in columns 3-6 of Table 1. These data reveal that 83% of rural households had at least one relative over 15 years of age who was previously a household member but has since moved away, either temporarily or permanently. Of these households, about half reported that they have relatives currently living in Ouagadougou and a third that they have relatives in other urban areas. Recall that the rural survey was based on a stratified sample, with $\frac{3}{4}$ of the sample drawn from census households with at least one relative in Ouagadougou).

We compare the basic characteristics between the rural (panel A) and the urban (panel B) samples in Table 2. The household characteristics we focus on include household size, gender,

[4]In situations where the rural household reported multiple migrant relatives in Ouagadougou, the study team attempted to contact all of them, even if this meant contacting multiple urban migrants linked to the same rural household. Given that urban migrants had the opportunity to discuss the insurance policy with their rural relatives before signing up, urban migrants who shared the same rural relatives would have been able to coordinate their subscription decisions.

age, education, and for the migrants how long they have been living in Ouagadougou. For rural households, we report age, gender and education of the household head. For the urban sample, we report the characteristics of the migrant whose name was reported by the rural relatives.

The data in the table reveal a number of striking differences between rural and urban households. On average, rural households consist of 12 members compared to 6 members on average for urban households, i.e. rural households are twice as large as urban ones. Rural household heads are, on average, older and are more likely to be men. Moreover, rural household heads have received less formal education than urban migrants. About 69% of rural household head report not receiving any form of education. This proportion falls to 27% among urban migrants. Among urban migrants, 24% report receiving some elementary school level education, and 46% report attaining secondary school or higher education. In contrast, 8% of rural household heads report having attended elementary school and only 2.75% report having attended secondary school. On average, migrants have been living in Ouagadougou for about 13 years. Given that the average age of migrants is 33 years, one can infer that on average migrants moved to Ouagadougou in their early twenties.

The next question we ask is whether and to what extent urban migrants provide assistance to their rural relatives during adverse weather shocks. The urban survey included questions on whether they had received request for assistance during each of the three years prior to the survey (2014, 2015 and 2016) and, if so, if they had been able to respond to this request for assistance positively. The urban respondents were also asked to assess the level of rainfall during each of those years in terms of agricultural needs. This information allows us to construct Figure 1. The figure shows that while less than 30% of urban migrants receive requests for assistance from their rural relatives when there is sufficient rainfall, this figure rises to nearly 60% when the rainfall was thought to be insufficient. In a majority of instances, the urban migrants are able to, and do, respond positively to the request for assistance.

The rural survey also provides corroborative evidence on the importance of transfers from relatives in coping with adverse shocks as demonstrated in Table 3. For the three years preceding the survey (2014-16), rural respondents classified 51.2% of the years as periods in which they experienced at least one adverse shock. They coped with the shock with a transfer from a relative in 16.3% of cases, by engaging in asset sales in 31.7% of cases and did not adopt any coping mechanism in 33.1% of cases. None of the respondents reported using formal insurance, and less than one percent of the respondents had coped with the shock using credit from a formal institution. These figures suggest that there is potential for relatives of rural farmers to play a greater role in helping with adverse shocks.

The rural survey included questions on the types of adverse shocks experienced during the five years preceding the survey. Figure 2 shows the the distributions of adverse shocks the households report having faced. Among the most commonly reported shocks are droughts (34.75%) and interruptions in rainfall (29.25%) but flooding (29.75%) and off-season rains (35.75%) appear to be

equally important.

Urban migrants were asked to report on shocks experienced by their rural relatives. Comparing the reports by the urban migrants and their rural relatives, as shown in Table 4, gives an indication of the knowledge of urban migrants of shocks experienced by rural farmers, a necessary criteria for informal risk-sharing. The table shows large differences. Conditional on a report of a shock by the rural farmer, there is only a 30% probability that the urban migrant from the same household would report a shock of the same type, and a 46% probability that the migrant would report a shock in the same year. The correlation between the farmer's and migrant's shock reports are worse further back in time: using the Pearson's Chi-square test, we cannot reject the null hypothesis that the two sets of reports are independent in the years 2012-2014. We can reject the null hypothesis in 2015 and 2016 but even in 2016 – the year immediately before the survey – the correlation between the two sets of reports stands at 0.35. Therefore, while the shock reports are likely to be affected by problems of recall, the evidence suggests that the urban migrants lack information about the shocks experienced by their rural relatives.

A key question we aimed to tackle in the study was the marketability of the insurance product to urban migrants, as compared to their rural relatives. Resource constraints and logistical challenges meant that it was not possible to pilot the product with rural farmers or include incentivised willingness-to-pay questions in the rural survey. Nevertheless, a module on a hypothetical insurance product included in both surveys provides some insights about relative marketability.

In both surveys, a hypothetical rainfall index insurance product was described in careful detail to the respondents, followed by questions to test their comprehension. After the product had been described, respondents were asked if they understood how it worked and if they replied negatively the demonstration was repeated. When a respondent confirmed that they had understood, they were subject to a short quiz about the product. We compare the performance of urban and rural respondents in Table 5. The performance of the urban and rural migrants were very similar: an average of 1.37 incorrect answers in both cases. In total, 30% of urban migrants requested that the description of the product be repeated compared to 29% of rural farmers.

Following the quiz, the respondents were asked if they would be willing to purchase the product at the market price of 2000 CFA. Those who replied negatively were subsequently asked, in succession, if they would be willing to purchase at a price of 1800, 1600 or 1400 CFA and, if not, at what price they would be willing to buy the product. In both surveys, 83% of the respondents expressed a willingness to buy the product at 2000 CFA. Averaging across the price at which respondents expressed a willingness to buy, urban respondents had a mean WTP of 1840 CFA compared to 1843 CFA for rural farmers.

Focus Group Discussions: We summarise here the key remarks to emerge from the focus-group discussions with the migrant network associations and the random sample of urban migrants:

- An almost universal interest in a rainfall index insurance product marketed at urban migrants

provided that the price was within their means;

- Concerns about basis risk and measurement of rainfall at the plot level;
- Indications that they would find the product more attractive if it also covered the risk of flooding and high winds;
- A strong preference that indemnity payments are paid directly to the rural farmers for whom urban subscribers purchase insurance, primarily to avoid the temptation that urban subscribers use the money for other needs before it can be transmitted to their rural relatives;
- A strong preference for individual subscription rather than group subscription.

The feedback from the focus group discussions informed the design of the pilot intervention in a number of ways. The pilot offered individual subscriptions rather than group subscriptions. To investigate the declared preference for indemnity payments being paid directly to the rural farmer, we designed two contracts: (a) indemnity payments made to the urban subscriber; (b) indemnity payments made directly to a rural beneficiary indicated in the contract. As mentioned above, the contract on offer was randomised across respondents during the pilot to compare the demand for each. Regarding the stated concerns with basis risk, Planet Guarantee's use of high precision satellite technology to measure rainfall at different stages of the growth cycle would enable the subscribers to define an area of 10 square kilometers that maps onto their relatives' farm plots (see the description of the intervention in Section 2 above) and thus address this issue at least to some extent.[5]

4.2 Determinants of Insurance Uptake by Urban Migrants

Planet Guarantee's rainfall index insurance had an uptake rate of 27 out of 124, i.e. 21.7% , among urban migrants with relatives in rural areas during the pilot. For the purpose of comparison, Planet Guarantee's subscription rate in rural areas is between 20 and 35% but this includes areas where the product has been offered and marketed over several years. By contrast, the subscription offer for urban migrants was made during a tight two-week window, given that policies had to be signed before the rainy season got fully underway. Based on PlaNet Guarantee's administrative data, the cost per subscription among urban migrants ranged from 10,000 to 25,000 CFA. This includes the cost of marketing, phone calls, home visits, etc. In comparison, the initial cost per subscription among rural farmers range from 20,000 to 40,000 CFA.

We conduct an exploratory analysis of the insurance product uptake by urban migrants. We use simple regression analysis, using a binary dependent variable (y) indicating whether an urban migrant subscribed to the product or not, and the following explanatory variables:

[5]The focus group discussions were conducted before the details of Planet Guarantee's rainfall index insurance product was demonstrated to the participants.

- Compensation is paid directly to the relative: at the subscription stage, each migrant was randomly offered either to have the insurance company pay the eventual compensation to their relative, or to collect the compensation himself or herself. The variable *pay_to_relative* takes a value of 1 in the first case and 0 in the second case.

- How long the migrant has been living in the city of Ouagadougou (*duration_ouaga*) measured in years. We hypothesize that migrants who moved recently to Ouagadougou may have stronger ties with their household of origin. On the other hand, it is plausible that individuals who have lived in Ouagadougou for a longer period of time would be less financially constrained, and hence could afford the premium.

- How frequent were crop shocks experienced by the rural household between 2012 and 2016 as reported by the migrant (*shocks_freq_mg*). We hypothesize that migrants who believe (correctly or incorrectly) that their household of origin is often exposed to harvest losses would be likely to purchase the coverage.

- How frequent were crop shocks experienced by the rural household between 2012 and 2016 as reported by the rural household (*shocks_freq_hh*). We hypothesize that if households who face frequent shocks usually turn to their urban relatives for help, then the urban migrant would be likely to purchase insurance.

- Whether the rural household reported receiving financial support to cope with negative shocks during the last 5 years (*financial_support*).

- Whether the migrant reports having provided financial support during the last 5 years (*migrant_financial*)

- Whether the shocks (experienced by the rural household) and reported by the migrant are covered by the product (*coverable_shock_mg*). In our data, only droughts and adverse rainfall distribution would be covered. Other shocks (e.g. illness, pest invasion, bushfire, flooding) are not covered. We hypothesize that the migrant is more likely to purchase the insurance if he/she thinks that the shocks experienced by his/her relatives most of the time are covered.

- Whether the shocks (experienced by the rural household) and reported by the household are covered by the product (*coverable_shock_hh*). We hypothesize that the migrant is more likely to purchase the insurance if the shocks his/her relatives experience most of the time are covered.

Because we have a relatively small sample of 124 observations and relatively few clusters (20 villages), we enter these variables individually in order to keep the specifications parsimonious. We also control for the relationship between the migrant and the household head of the rural

household[6]. Table 6 shows the estimates for each specification. We find that the coefficient for *pay_to_relative* consistently has a positive and statistically significant effect on uptake, i.e. migrants who were offered the product in which indemnity payments were made directly to the rural farmer were more likely to purchase.

We also find that migrants who reported a higher number of shocks (*shocks_freq_mg*), or reported at least one coverable shock (*coverable_shock_mg*), experienced by their rural relative were more likely to purchase (coefficients statistically significant at the 10% level). However, the corresponding reports from the rural households themselves have no effects on uptake (coefficients are slightly negative and statistically insignificant). This pattern suggests that there is informational asymmetry about shocks experienced by the rural household, and the urban migrant's purchase decision is sensitive to his/her own perception or memory of shocks experienced by the rural farmer, but not to the rural relatives own reports.

To explore possible heterogeneity of the effects of the "pay to relative" offer on uptake of the product, in Table 7, we report on estimations where the *pay_to_relative* variable is interacted, one at a time, with the other explanatory variables. In most instances, the estimated interaction coefficients are statistically insignificant with two exceptions. We find that the longer a migrant has lived in Ouagadougou, the weaker is the effect of the "pay to relative" offer on uptake, while its effect is stronger if the rural household reported a coverable shock.

The estimates in Table 8 show that, at the sample mean, the effect of the "pay to relative" offer on uptake is positive and statistically significant, consistently in the range between 16-20%. Turning to the other explanatory variables, we again find the pattern the probability of uptake is increasing in the migrant's report of the number of adverse shocks experienced by the household but is unaffected by the rural household's own reports. Similarly, we find that uptake is significantly higher if the migrant reported a coverable shock but the corresponding effect for the rural household's own report of a coverable shock is statistically insignificant.

Robustness Checks: Sample Selection

A potential concern is that the urban migrants included in the regressions could be different from the ones who could not be tracked. As a consequence, the estimates reported above may be biased. For example, if migrants who are successfully tracked are more likely to subscribe to the policy than migrants who were not found, then we may be overstating the uptake rate. To assess the extent of this sample selection issue, we start by using information on the urban migrants collected from their rural relatives to compare the migrants who were found with the ones who were not. We summarise these comparisons and test for their statistical significance in Table A2 in the appendix. The differences are statistically significant at least at the 10% level when the migrant is reported to have some investment in the village, has provided some financial support within the past five

[6]In practice, we control for whether the migrant is a child of the household head, or the household head's sibling.

years, is a sibling of the rural household head, is male or is a formal sector employee.

In Table 9, we report alternatives of Table 6 where we adjust for the sample selection[7]. In panel A, we control for the variables listed in Table A2.[8] In Panels B and C, we use probability inverse weighting (Wooldridge, 2010, 2002) to correct for selection bias using the probability estimates in Table A3, columns 1 and 2 respectively (in column 2, we add village dummies to the model). Thus, the estimates in Panels B and C give more weight to migrants with the characteristics similar to those who could not be tracked relative to those who were in fact tracked. Overall, the point estimates in Panels A-C remain very similar to those reported in Table 9. While this pattern does not rule out sample selection bias entirely, it is reassuring that the estimates remain remarkably similar across the different specifications.

5 Discussion

The findings from the pilot intervention described in this paper provide significant evidence regarding the potential for using urban migrants for channeling weather index insurance to small-scale rural farmers in a developing country.

First, we provide evidence on linkages between rural households in villages close to Ouagadougou (within a 50km radius) and urban migrants from these villages presently residing in Ouagadougou: 56% of rural households have a relative residing in Ouagadougou; and about 70% of them receive transfers from a Ouagadougou-based relative (Table 1). These proportions are potentially lower for villages located further from Ouagadougou but they do not take into account relatives living in other major cities (e.g. Bobo-Dioulasso and Koudougou). Using survey data on Ougadougou-based migrants from the same villages, we find that about 30% receive requests for assistance from rural relatives in years that the rains have been sufficient for agriculture, and this figure rises to nearly 60% when the rains have been insufficient (Figure 1).

Second, we provide evidence of significant demand for rainfall index insurance from urban migrants with relatives in rural areas: with an uptake rate of 22% during a two-week window following a demonstration of the insurance product. The uptake rate is higher for migrants who have recently arrived in Ouagadougou and for migrants who reported that their rural relative had experienced an adverse shock during the previous 5 years (Tables 6, 7 and 8). For the purpose of comparison, Planet Guarantee's subscription rate in rural areas is between 20 and 35% but this includes areas where the product has been offered and marketed over several years.

Third, the uptake rate is higher (estimates ranging from 17 to 22%) when the migrant was offered an insurance contract which specified that indemnity payments to be paid directly to the

[7]The full set of the regressions are shown in Tables **??** and A6 in the appendix.

[8]The list of control variables does not include *'financial support'*, *'biological child'* and *'sibling'* since these variables are already in the regressions. Notice that the family relation variables here are reported by the rural respondent while these variables are reported by the urban migrant in Tables 6 and 7.

rural relative (Tables 6 and 8). This was consistent with findings from the focus group discussions, where urban migrants explained that they preferred this option because of the possible temptation to use an insurance payout, intended for their rural relative, for some other purpose. It demonstrates that formal insurance products can address issues related to temptation and self-control in informal risk-sharing networks and the subscribers are aware of this potential.

We found large differences in adverse shock reports by rural farmers and reports of the same shocks by their urban relatives. The uptake rate of the marketed insurance policy was higher when the migrant reported that their rural relative had experienced at least one adverse shock – covered by the insurance policy – during the preceding 5 years; but the uptake rate did not respond to the incidence of such shocks as reported by the relatives themselves. A similar pattern emerges when we use the "total number of shocks" in lieu of "at least one coverable shock". There are two explanations that suggest themselves. The first is that the urban migrant does not have as good a recollection of the shocks suffered as their rural relatives. The second is that the urban migrant does not trust the shock reports that he or she obtains from the rural relatives.

If either explanation holds true, a marketing strategy where urban migrants are given information about the weather-related incidents in their villages of origin would help them make better decisions regarding the purchase of the insurance policy, and potentially improve uptake. The evidence also points to important informational asymmetries about weather shocks between urban migrants and their rural relatives which would hinder informal risk-sharing. The rainfall index insurance product, by providing third-party verification of these shocks would remove these informational asymmetries and thus improve the scope for risk-sharing.

References

Banerjee, A. and S. Mullainathan (2010). The shape of temptation: Implications for the economic lives of the poor. Technical report, National Bureau of Economic Research.

Beauchemin, C. (2011). Rural–urban migration in West Africa: towards a reversal? migration trends and economic situation in Burkina Faso and Côte d'ivoire. *Population, Space and Place 17*(1), 47–72.

Beauchemin, C. and P. Bocquier (2004). Migration and urbanisation in Francophone West Africa: An overview of the recent empirical evidence. *Urban Studies 41*(11), 2245–2272.

Berg, A., P. Quirion, and B. Sultan (2009). Weather-index drought insurance in Burkina-Faso: assessment of its potential interest to farmers. *Weather, Climate, and Society 1*(1), 71–84.

Binswanger-Mkhize, H. P. (2012). Is there too much hype about index-based agricultural insurance? *Journal of Development studies 48*(2), 187–200.

Dercon, S., R. V. Hill, D. Clarke, I. Outes-Leon, and A. S. Taffesse (2014). Offering rainfall insurance to informal insurance groups: Evidence from a field experiment in Ethiopia. *Journal of Development Economics 106*, 132–143.

Dustmann, C., F. Fasani, X. Meng, and L. Minale (2017). Risk attitudes and household migration decisions. *IZA Working Paper 10603*.

Gaurav, S., S. Cole, and J. Tobacman (2011). Marketing complex financial products in emerging markets: Evidence from rainfall insurance in India. *Journal of marketing research 48*(SPL), S150–S162.

Giné, X., R. Townsend, and J. Vickery (2008). Patterns of rainfall insurance participation in rural India. *The World Bank Economic Review 22*(3), 539–566.

Kazianga, H. (2006). Motives for household private transfers in Burkina Faso. *Journal of Development Economics 79*(1), 73–117.

Kazianga, H. and C. Udry (2006). Consumption smoothing? Livestock, insurance and drought in rural Burkina Faso. *Journal of Development economics 79*(2), 413–446.

Lucas, R. E. (1997). Internal migration in developing countries. In M. R. Rosenzweig and O. Stark (Eds.), *Handbook of population and family economics*, pp. 721–798. Elsevier.

Matul, M., M. J. McCord, C. Phily, and J. Harms (2010). *The landscape of microinsurance in Africa*. International Labor Organization.

Mobarak, A. M. and M. R. Rosenzweig (2012). Selling formal insurance to the informally insured.

Mobarak, A. M. and M. R. Rosenzweig (2013). Informal risk sharing, index insurance, and risk taking in developing countries. *American Economic Review 103*(3), 375–80.

Potts, D. (2008). Recent trends in rural-urban and urban-rural migration in Sub-Saharan Africa: The empirical evidence and implications for understanding urban livelihood insecurity. *Environment, Politics and Development Working Paper Series, Paper 6*.

Rosenzweig, M. R. and O. Stark (1989). Consumption smoothing, migration, and marriage: Evidence from rural India. *Journal of political Economy 97*(4), 905–926.

Stark, O. and R. E. Lucas (1988). Migration, remittances, and the family. *Economic Development and Cultural Change 36*(3), 465–481.

Wooldridge, J. M. (2002). Inverse probability weighted m-estimators for sample selection, attrition, and stratification. *Portuguese Economic Journal 1*(2), 117–139.

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data.* MIT press.

Yang, D. and H. Choi (2007). Are remittances insurance? evidence from rainfall shocks in the Philippines. *The World Bank Economic Review 21*(2), 219–248.

Figure 1: Assistance from Urban Migrants vs Rainfall Shortage

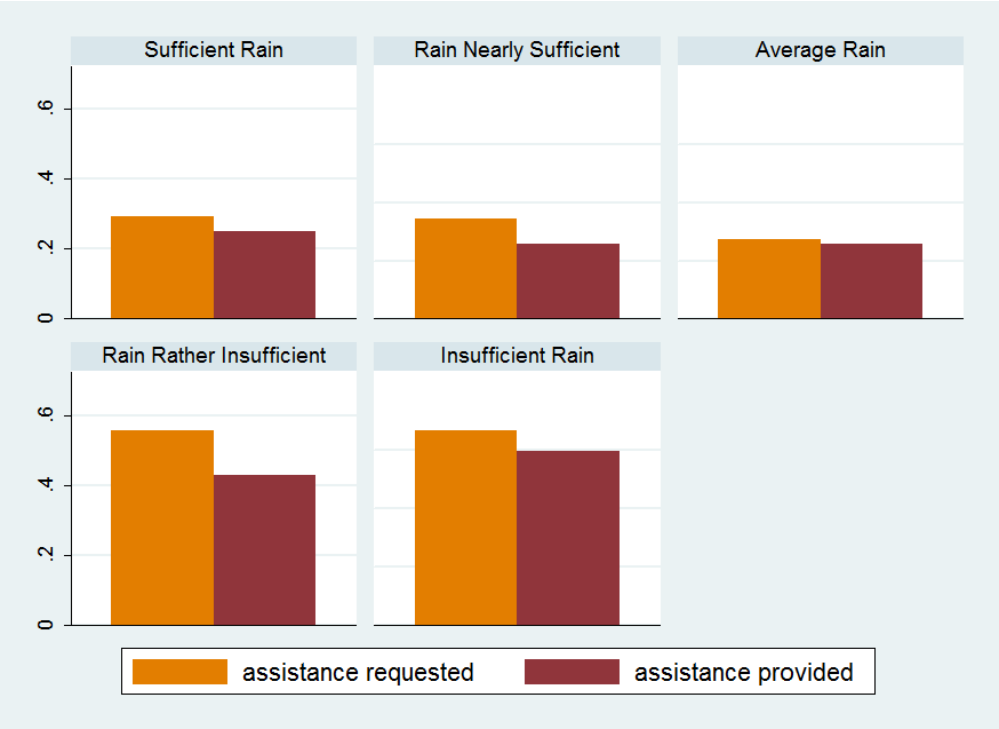

Figure 2: Types of Shocks Faced by Farmers

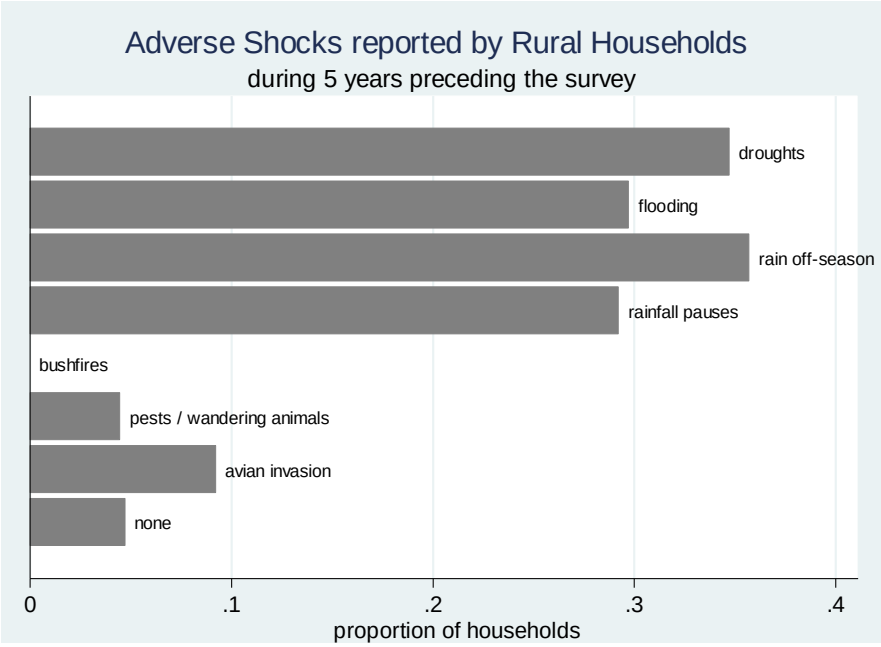

Table 1: Migrant Link Information from Rural Census

	(1)	(2)	(3)	(4)	(5)	(6)
	Rural census: household		Rural household survey: % households with			# Ouga migrants (if > 0)
	has relatives in Ouaga	receives transfers from relative	with migrants	migrants in Ouaga	migrants in other urban areas	
mean	0.56	0.70	0.83	0.43	0.32	1.45
95% conf. int.	[0.53-0.59]	[0.66-0.74]	[0.79 - 0.87]	[0.38 - 0.47]	[0.27 - 0.37]	[1.34 - 1.56]
N	978	546	400	400	400	170

Source: Authors' calculations using survey data

Table 2: Descriptive Statistics for Rural and Urban Samples

	Household size	Head age (years)	Female head (%)	Years urban residence	Education						N
					None	Elementary	Secondary	Higher Ed.	Koranic	Literacy	
Panel A: Rural Sample	11.48 (7.18)	53.2 (16.21)	9.68	NA	69.25	8	2.75	-	14.25	5.75	400
Panel B: Urban Sample	5.59 (3.54)	34.29 (10.87)	22.76	13.03 (11.25)	26.83	24.39	39.02	7.32	2.44	-	124

Source: Authors' calculations using survey data

Standard deviations in parentheses

Table 3: Rural Households Risk-Coping Mechanisms (2014-2016)

	Perctentage
household experienced shock	51.2
household coped with shock with	
asset sales	31.7
help from relations	16.3
formal credit	0.9
other measures	26.2
nothing	33.1
N	1,128

Source: Authors' calculations using survey data

Table 4: Comparing Farmer Shock Reports by Rural Farmer & Urban Migrant

	shocks by type	shocks by year
both urban migrant + rural farmer	52	94
rural farmer only	121	111
urban migrant only	106	107
neither	589	308
prob(urban 0 — rural 0)[1]	0.847	0.742
prob(urban 1 — rural 1)[2]	0.301	0.459
correlation coefficient	0.153	0.202
Pearson's Chi2	20.39	25.23

Source: Authors' calculations using survey data. Note: Table shows number of agricultural shocks reported by an urban migrant and the migrant's rural relatives. In the first column, each report corresponds to a shock type and in the second column each report corresponds to a year in which a shock was experienced.

1. Probability of no shock report by urban migrant conditional on no rural report.

2. Probability of a shock report by urban migrant conditional on a rural report.

Table 5: Comparing WTP Responses of Rural farmers and Urban Migrants

	urban	95% conf. int.	rural	95% conf. int.
explained more than once	0.30	[0.22 - 0.38]	0.29	[0.24 - 0.33]
# incorrect answers	1.37	[1.27 - 1.48]	1.37	[1.30 - 1.43]
contract interesting	0.96	[0.92 - 0.99]	0.94	[0.92 - 0.97]
willing to pay 2000 CFA	0.83	[0.76 - 0.90]	0.83	[0.80 - 0.87]
mean WTP in CFA	1840	[1766 - 1913]	1843	[1803 - 1882]

Source: Authors' calculations using survey data

Table 6: Determinants of Take-Up of Rainfall Indexed Insurance by Urban Migrants

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	urban migrant subscribed							
pay_to_relative	0.176*	0.186*	0.207*	0.176*	0.180*	0.184*	0.222**	0.176*
	(0.10)	(0.09)	(0.11)	(0.10)	(0.09)	(0.10)	(0.10)	(0.10)
duration_ouaga		0.024						
		(0.05)						
shocks_freq_mg			0.059*					
			(0.03)					
shocks_freq_hh				-0.024				
				(0.05)				
financial_support					0.113			
					(0.09)			
migrant_financial_support						0.098		
						(0.08)		
coverable_shock_mg							0.195*	
							(0.10)	
coverable_shock_hh								-0.003
								(0.07)
Brother_Sister	0.131	0.157	0.148	0.131	0.138	0.12	0.095	0.131
	(0.16)	(0.14)	(0.16)	(0.17)	(0.17)	(0.16)	(0.16)	(0.16)
Child	-0.021	0.003	-0.022	-0.024	-0.005	-0.026	-0.064	-0.021
	(0.15)	(0.13)	(0.16)	(0.15)	(0.16)	(0.16)	(0.16)	(0.15)
Constant	0.102	0.048	-0.013	0.143	0.02	0.062	-0.041	0.104
	(0.15)	(0.12)	(0.19)	(0.17)	(0.15)	(0.17)	(0.17)	(0.16)
Observations	123	122	123	123	123	123	123	123
R-squared	0.193	0.198	0.215	0.194	0.207	0.204	0.216	0.193

Source: Authors' calculations using survey data

Robust standard errors in parentheses, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Table 7: Heterogeneity Analysis of the Take-up of Rainfall Indexed Insurance by Urban Migrants

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	urban migrant subscribed						
pay_to_relative	0.423**	0.218	0.171	0.128	0.166	0.273*	-0.117
	(0.16)	(0.15)	(0.20)	(0.17)	(0.12)	(0.14)	(0.13)
duration_ouaga	0.09						
	(0.06)						
pay_to_relative#c.duration_ouaga	-0.183***						
	(0.06)						
shocks_freq_mg		0.062					
		(0.05)					
pay_to_relative#c.shocks_freq_mg		-0.007					
		(0.08)					
shocks_freq_hh			-0.025				
			(0.07)				
pay_to_relative#c.shocks_freq_hh			0.003				
			(0.10)				
financial_support				0.071			
				(0.14)			
pay_to_relative#financial_support				0.083			
				(0.24)			
migrant_financial_support					0.077		
					(0.11)		
pay_to_relative#migrant_financial_support					0.047		
					(0.13)		
coverable_shock_mg						0.237**	
						(0.10)	
pay_to_relative#coverable_shock_mg						-0.063	
						(0.20)	
coverable_shock_hh							-0.205*
							(0.11)
pay_to_relative#coverable_shock_hh							0.459**
							(0.19)
Constant	-0.097	-0.02	0.146	0.058	0.074	-0.087	0.283
	(0.16)	(0.21)	(0.19)	(0.17)	(0.18)	(0.20)	(0.17)
Observations	122	123	123	123	123	123	123
R-squared	0.239	0.215	0.194	0.209	0.205	0.216	0.247
F-Stat. joint signficance	2.963	1.673	1.107	2.932	2.019	5.065	2.384
p value	0.0582	0.207	0.371	0.0599	0.145	0.00958	0.101

Source: Authors' calculations using survey data

Robust standard errors in parentheses, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Table 8: Marginal Effects at Sample Means on Urban Migrant Uptake of Insurance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
pay_to_relative	0.176	0.206	0.176	0.18	0.186	0.223	0.167
p-value	*0.09*	*0.07*	*0.09*	*0.07*	*0.07*	*0.04*	*0.08*
Interacted with:	duration	shocks freq. by		financial support by		coverable shocks by	
	in Ouaga	migrant	rural hh	migrant	rural hh	migrant	rural hh
	0.004	0.059	-0.024	0.11	0.099	0.207	0.012
p-value	*0.1*	*0.11*	*0.61*	*0.24*	*0.2*	*0.02*	*0.18*

Source: Authors' calculations using survey data

Robust standard errors in parentheses, clustered at the village level

.

Table 9: Determinants of Take-Up of Rainfall Indexed Insurance by Urban Migrants, Adjusting for Attrition

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	urban migrant subscribed						
Panel A							
pay_to_relative	0.248**	0.257**	0.232**	0.230**	0.236**	0.280**	0.231**
	(0.090)	(0.103)	(0.096)	(0.096)	(0.099)	(0.100)	(0.097)
Panel B							
pay_to_relative	0.200**	0.222*	0.185*	0.185*	0.202*	0.235**	0.191*
	(0.095)	(0.108)	(0.097)	(0.102)	(0.103)	(0.104)	(0.102)
Panel C							
pay_to_relative	0.173*	0.193*	0.156	0.150	0.165	0.202*	0.157
	(0.093)	(0.108)	(0.099)	(0.097)	(0.101)	(0.100)	(0.100)

Source: Authors' calculations using survey data

Robust standard errors in parentheses, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Appendix

Figure A1: Census Villages

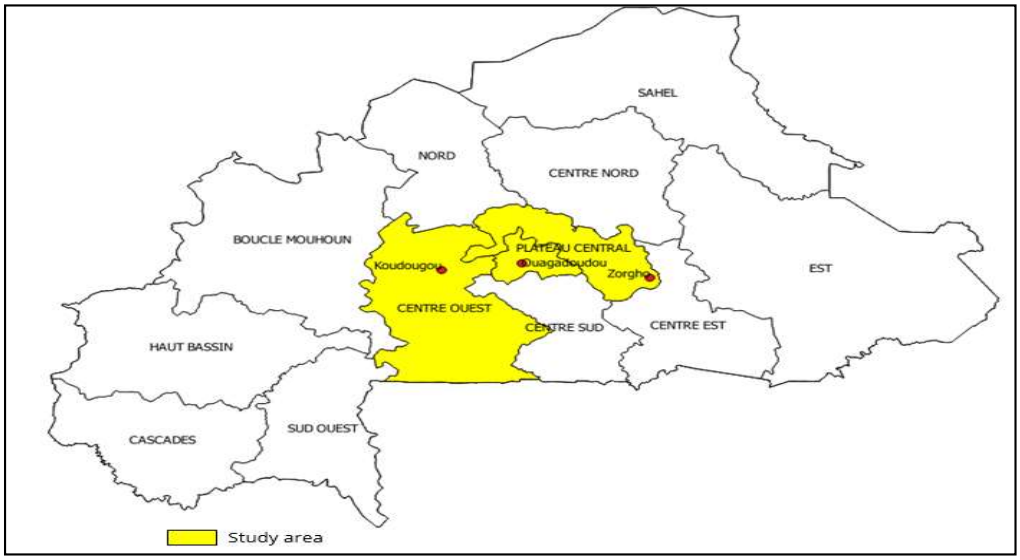

Table A1: List of survey villages and neighborhoods, and numbers of census households

Village Name	**Neighborhoods**	**Number of Households**
Bayandi-Nabyiri	Bayandi-Nabyiri	50
Bayandi-Tanguen	Bayandi	61
Badnogo	Badnogo	33
Bouloum-Nabyiri	Relwende	50
Dakongo	Rassembin	49
Kabinou	Tensogyiri	53
Kamsi	Katingyiiri	53
Kolonkand	Rana	54
Nobtenga	Nobtenga	47
Ouavouss	Natenga	51
Ralo	Gouroungo	31
	Nabyiri	22
Ramatoulaye	Farangin	45
Ramonkodogo	Ramonkodogo-Centre	29
	Baongnonre	25
Silmiougou	Kombi	43
Tanguen	Tanguen	43
Tansga	Tansga	51
Wemyaoguen	Nabtenga	49
Yagoam	Yagoam	40
Yargo-Yarce	Kouglin	51
Zantonr	Zantonre Natenga	48

Source: Authors' calculations using survey data.

Table A2: Differences between migrants who were successfully tracked and those not found based on rural respondents' reports

	Uban migrant found	Urban migrant not found	Difference
Rural respondent reporting that urban migrant:			
has invesment in village	0.149	0.075	0.074*
			[0.039]
provided financial support	0.636	0.456	0.181***
			[0.069]
is biological child	0.504	0.605	-0.101*
			[0.056]
is sibling	0.347	0.211	0.136***
			[0.044]
is male	0.777	0.599	0.178***
			[0.068]
migrated for work	0.686	0.626	0.06
			[0.050]
is formal wage worker	0.149	0.068	0.081*
			[0.044]
works in informal sector	0.207	0.19	0.016
			[0.054]
is a trader	0.248	0.293	-0.045
			[0.064]
attended primary education	0.256	0.184	0.073
			[0.058]
attended secondary education	0.281	0.231	0.05
			[0.044]
attended university	0.091	0.041	0.05
			[0.031]

Source: Authors' calculations using survey data

Robust standard errors in brackets, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Table A3: Determinants of the probability that an urban migrant is tracked successfully based on rural survey

	(1)	(2)
Dependent variable:	urban migrant tracked successfully	
Rural respondent reporting that urban migrant:		
has invesment in village	0.386	0.322
	(0.242)	(0.270)
is biological child	0.075	0.094
	(0.215)	(0.221)
is sibling	0.444**	0.397*
	(0.227)	(0.236)
is male	0.455*	0.590*
	(0.262)	(0.301)
migrated for work	-0.210	-0.248
	(0.182)	(0.217)
is formal wage worker	0.349	0.283
	(0.241)	(0.255)
works in informal sector	0.196	0.154
	(0.240)	(0.290)
is a trader	0.006	0.015
	(0.235)	(0.298)
attended primary education	0.443*	0.405
	(0.245)	(0.249)
attended secondary education	0.321*	0.338
	(0.185)	(0.222)
attended university	0.584	0.606
	(0.430)	(0.471)
Constant	-0.798***	-0.345
	(0.233)	(0.314)
vill. dummies	no	yes
Chi2-Stat. joint signficance	71.07	51.79
p value	0.00	0.00

Source: Authors' calculations using survey data

Robust standard errors in brackets, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Table A4: Determinants of take-up of rainfall indexed insurance by urban migrants, controlling for migrant characteristics as reported by rural respondents

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	urban migrant subscribed						
pay_to_relative	0.248**	0.257**	0.232**	0.230**	0.236**	0.280**	0.231**
	(0.090)	(0.103)	(0.096)	(0.096)	(0.099)	(0.100)	(0.097)
duration_ouaga	0.041						
	(0.052)						
shocks_freq_mg		0.057					
		(0.033)					
shocks_freq_hh			-0.014				
			(0.057)				
financial_support				0.076			
				(0.095)			
migrant_financial_support					0.062		
					(0.077)		
coverable_shock_mg						0.212*	
						(0.106)	
coverable_shock_hh							0.010
							(0.075)
Constant	0.071	0.038	0.178	0.113	0.139	0.013	0.149
	(0.157)	(0.210)	(0.195)	(0.179)	(0.200)	(0.208)	(0.196)
Observations	120	121	121	121	121	121	121
R-squared	0.274	0.284	0.267	0.271	0.271	0.293	0.267

Source: Authors' calculations using survey data

Robust standard errors in brackets, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Table A5: Determinants of take-up of rainfall indexed insurance by urban migrants: inverse-probability weighted estimations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	urban migrant subscribed						
pay_to_relative	0.200**	0.222*	0.185*	0.185*	0.202*	0.235**	0.191*
	(0.095)	(0.108)	(0.097)	(0.102)	(0.103)	(0.104)	(0.102)
duration_ouaga	0.060						
	(0.052)						
shocks_freq_mg		0.057					
		(0.033)					
shocks_freq_hh			-0.027				
			(0.047)				
financial_support				0.112			
				(0.091)			
migrant_financial_support					0.115		
					(0.082)		
coverable_shock_mg						0.212**	
						(0.091)	
coverable_shock_hh							-0.023
							(0.080)
Constant	0.057	0.062	0.225	0.089	0.123	0.015	0.192
	(0.127)	(0.188)	(0.163)	(0.164)	(0.176)	(0.172)	(0.156)
Observations	120	121	121	121	121	121	121
R-squared	0.225	0.225	0.207	0.218	0.220	0.231	0.205

Source: Authors' calculations using survey data

Robust standard errors in brackets, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.

Table A6: Determinants of take-up of rainfall indexed insurance by urban migrants: inverse-probability weighted estimations with village dummies included in the probability regression

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	urban migrant subscribed						
pay_to_relative	0.173*	0.193*	0.156	0.150	0.165	0.202*	0.157
	(0.093)	(0.108)	(0.099)	(0.097)	(0.101)	(0.100)	(0.100)
duration_ouaga	0.075						
	(0.048)						
shocks_freq_mg		0.066					
		(0.039)					
shocks_freq_hh			-0.007				
			(0.055)				
financial_support				0.142			
				(0.094)			
migrant_financial_support					0.130		
					(0.089)		
coverable_shock_mg						0.225**	
						(0.097)	
coverable_shock_hh							0.007
							(0.083)
Constant	0.088	0.116	0.270	0.151	0.199	0.083	0.253
	(0.145)	(0.207)	(0.177)	(0.188)	(0.188)	(0.180)	(0.170)
Observations	120	121	121	121	121	121	121
R-squared	0.225	0.220	0.194	0.215	0.213	0.223	0.194

Source: Authors' calculations using survey data

Robust standard errors in brackets, clustered at the village level

. ***: significant at the 1% level, **: significant at the 5% level, *: significant at the 10% level.