# Risk Sharing and Internal Migration

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Over the past two decades over half the population in rural Tanzania migrated within the country. Such mass internal migration has created geographically disperse networks, on which the authors collected detailed panel data. By quantifying how shocks and consumption co-vary across linked households, we show how migrants unilaterally insure their extended family members at home. This finding contradicts risk sharing models based on reciprocity, but is consistent with assistance driven by social norms. Migrants sacrifice only 2.1% of their very substantial consumption growth to provide this insurance, which seems too trivial to have any stifling effect on their growth through migration.

JEL codes: O12, O15, O17, R23

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## 1. Introduction

If, in the next decades, Africa catches up with the rest of the world, then that will almost certainly coincide with intergenerational mobility out of rural into urban areas and out of agriculture into non-agricultural activities (Lewis, 1954; Harris and Todaro, 1970). Historically, in both rich developed countries and fast-growing developing countries, this type of migration has moved in lockstep with development and poverty reduction (Collier and Dercon, 2009). Recently, China's urban population officially surpassed its rural one: of China's 1.35 billion people, 51.3 per cent lived in urban areas at the end of 2011, rising from under 20 per cent in 1980 (UN, 2012). Furthermore, UNDP (2009) reports that out of the one billion migrants worldwide, three quarters are internal migrants. With international migration open to only very few Africans, we should expect massive internal migration to form a core part of the development process.

The scale of this demographic process is captured in the data that form the basis of this paper, further motivating our focus on internal migration. These data are part of a panel data set from the Kagera region in Tanzania, spanning nearly two decades of migration and development. The 2010 follow-up survey attempted to trace all 6,353 individuals listed on the baseline 1991/94 household rosters and re-interview them irrespective of their location. Once we exclude the 1,275 individuals who had died by 2010, we are left with 4,996 baseline individuals whose 2010 locations are known.[1] Of those, 2,253 individuals (45 per cent) were found residing in the baseline village, 2,624 (53 per cent) had migrated within the country, 105 (2 per cent) to another East African country (primarily Uganda) and 14 (0.3 per cent) had moved outside of East Africa. This region – not atypical of remote rural Africa – is clearly on the move, with internal migration dwarfing international migration.

Our data show that despite only minor welfare differences during the 1991-94 baseline survey, those who moved out of the region to other parts of Tanzania have grown roughly twice as rich as those who did not by the time we interview them again nearly two decades later. As we are measuring consumption and not income, it

[1] We miss location information on 82 individuals. Because this is after multiple attempts through various sources it is unlikely that these individuals have moved outside of East Africa. Information on such an important, low-occurrence event is unlikely to be hidden.

is clear that the main beneficiaries of this migration-led growth were the migrants themselves and certainly not their relatives who remained at home. But did these migrants simply leave and never look back, or did they maintain links with the home community? We investigate this question by exploiting the fact that the 3,314 households interviewed in 2010 are grouped in 817 geographically disperse extended family networks. Using techniques from the risk sharing literature we quantify how migrants' consumption responds to shocks experienced by others in their extended family network.

Our analysis departs from a number of other studies in the migration literature by focusing on consumption instead of transfers. This choice of the outcome variable is motivated by the fact that risk sharing and other economic exchange could happen through a multitude of different mechanisms, of which transfers is just one. Other mechanisms could include looking for a job for someone, employing them directly, providing them with tips, advice or a network link, or providing migration opportunities (Munshi, 2003). By analysing consumption we focus on the joint and final effect of all such mechanisms.

The observed divergence between migrants and non-migrants in these data also persists within extended family networks (Beegle, De Weerdt and Dercon, 2011), which violates the full risk sharing hypothesis (Townsend, 1994), and does not support the notion that migration is the result of a household level maximisation strategy (Stark and Bloom, 1985; Rosenzweig and Stark, 1989; Grimard, 1997). It could, however, be consistent with other reciprocity-based models (e.g. limited commitment, moral hazard, or hidden income) that permit the co-existence of divergent consumption growth and risk sharing. In our empirical analysis, we find that migrants are affected by shocks to others in the network whereas non-migrants are not. Such unilateral insurance leads us to reject the reciprocity-based risk sharing models.

One explanation to this observed lack of reciprocity could be that migrants insure non-migrants in exchange for other benefits (Lucas and Stark, 1985; Hoddinott, 1994). These benefits could accrue to the migrant later in life and outside the purview of our survey data. We consider, but reject a number of such longer-run transactional motives for the observed unilateral insurance. This leads us to argue that our results can be understood by reference to the diverse literature on social norms (Platteau, 2000; Cox and Fafchamps, 2008; Burke and Young, 2009), where those who move ahead remain obligated to their extended family in the home community.

These results speak to an emerging literature that worries about home communities imposing a stifling ‘kin-tax’ on the upwardly mobile. Baland, Guirkinger and Mali (2011) show how people take out costly loans in order to conceal their income, while Platteau (2010) sees migration as a means to escape the implied prying eyes and incessant demands of the kinship group. The kinship poverty trap model of Hoff and Sen (2006) predicts possible resistance from the home communities as they feel threatened by productive forces leaving and severing links with home to escape taxing demands for assistance. Anticipating this, the home community may set up subtle exit-barriers, which could lead to below-optimal levels of migration. Jakiel and Ozier (2012) report laboratory evidence from Kenya that women feel obliged to share four to eight per cent of the income gains realised in the experiment. In our sample, Tanzanian migrants sacrifice 2.5 percentage points out of a total growth of 119 per cent to insure their relatives. This (lower-bound) estimate is equivalent to a ‘tax’ of 2.1 per cent. We regard this tax rate as too trivial to exert any constraining effect on migrants.

After describing the model, the data and the estimation strategy in the next three sections, we discuss the results in Section 5. Section 6 tackles the issue of longer-run transactional motives, Section 7 discusses robustness, while Section 8 provides a concluding discussion.

## 2. Risk sharing in theory

The full risk sharing hypothesis is based on the idea that the network acts as if it was a single household that maximised utility subject to a joint budget constraint. The model predicts that incomes are completely pooled (according to predetermined weights) and all idiosyncratic shocks are smoothed through the network. To demonstrate this, we follow the previous literature on risk sharing contracts (e.g. Altonji et al., 1992; Townsend, 1994; Ligon, 1998; Kinnan, 2012).

We use a simple two-household extended family network as an example. Both households derive utility from consumption: $v(c)$. Insurance and credit markets are missing.[2] Furthermore, we assume that households live infinitely.[3] Income ($y_s$) is uncertain and depends on the state of the world ($s$) as well as on the effort level ($e_{t-1}$) exerted by the household in the previous period. The effort level is decided by the extended family and a higher work effort increases the probability ($\pi$) of a higher income.

Assuming that households maximize a well behaving utility function [4], the future expected utility for household $i \in \{1,2\}$ can be expressed as:

(1) $$E\left\{\sum_t \beta^t \left[v_i(c_t) - z_i(e_t)\right]\right\},$$

where $\beta < 1$ is the discount rate, $z_i(e_t)$ is the disutility from effort, and $t$ is the time period.

In each period, the extended family's current joint consumption is constrained by the current joint income. This resource constraint can be expressed as:

(2) $$c_1(y_s) + c_2(y_s) = y_1(y_s) + y_2(y_s).$$

The full insurance hypothesis rests on three key assumptions: (i) there are no *ex post* commitment problems, (ii) information about households' effort is perfectly available; there is no incentive to shirk, and (iii), households can perfectly observe each other's realised income. Now a household's joint maximization problem can be expressed as:

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[2] To simplify notation, we abstract away savings. This does not affect the main predictions of the model (see, for example, Ligon (1998) for a characterisation of the full risk sharing model with savings). However, the ability to save may exacerbate the efficiency problems if the key assumptions listed below do not hold (see Ligon, 1998; Chandrasekhar, Kinnan and Larreguy, 2012).

[3] If the time frame is finite, in the absence of altruism, households would not have any incentive for risk sharing in the final period, and as result in T-1, T-2, etc. The assumption of infinite time frame holds if the new household head inherits from the previous head and maintains the risk sharing contract with same households. See Fafchamps (1992) for an alternative justification for this assumption.

[4] The utility function is inter-temporally separable, strictly increasing but concave ($v' > 0$ & $v'' < 0$).

$$\max_{c_1, c_2, e} \quad \omega_1 \sum_{t=0}^{\infty} \beta^t \sum_{s=1}^{S} \pi(y_s) \{v_1[c_{1t}(y_s)] - z_1(e_t)\} \tag{3}$$
$$+ \omega_2 \sum_{t=0}^{\infty} \beta^t \sum_{s=1}^{S} \pi(y_s) \{v_2[c_{2t}(y_s)] - z_2(e_t)\},$$

subject to the resource constraint (2). The parameters $\omega_1$ and $\omega_2$ are the Pareto weights attached to households 1 and 2, respectively. These weights are determined by the extended family, and once negotiated, remain constant over time.

Solving this utility maximization problem yields a following first order condition:

$$\frac{u'[c_1(y)]}{u'[c_2(y)]} = \lambda = \frac{\omega_2}{\omega_1}, \tag{4}$$

where $\lambda$, the Lagrange multiplier, is the marginal utility of income. According to equation (4), households equate their marginal utilities of income in all states of the world. The allocation depends on the Pareto weights $\omega_1$ and $\omega_2$ .

If utility functions follow a constant relative risk aversion function: $u(c) = \frac{c^{1-\psi}}{1-\gamma}$, where $\psi$ is a measure of risk aversion, the first order conditions for household $i$ at time $t$ become: $\omega_i c_{it}(y)^{-\psi} - \lambda = 0$. Equating these conditions for the two households, taking logarithms and re-arranging yields:

$$\Delta \ln c_1 (y) = \Delta \ln c_2 (y). \tag{5}$$

Equation (5) implies that if full risk sharing takes place, we should not expect to see households within the same extended family growing at different rates. Furthermore, assuming that there are no frictions between the households in the extended family, the model predicts that all idiosyncratic shocks experienced by households are completely smoothed through the extended family. These two predictions form the basis for our rejection of the full risk sharing model. First, the descriptive data confirms a highly unequal consumption growth between migrants and non-migrants. Second, in section 5 we show that after controlling for extended family fixed effects, household consumption growth remains responsive to idiosyncratic income shocks.

The rejection of full risk sharing is neither novel nor surprising and emerged as an empirically established stylized fact early on within this strand of literature being valid across a variety of different contexts (Altonji, Hayashi and Kotlikoff 1992; Townsend, 1994; Grimard, 1997). Most studies, however, find that at least some degree of insurance takes place and explain this theoretically by adding additional constraints (relating to the failure of one or more of the three key assumptions above) to the full risk sharing model. We will discuss each of these constraints in turn, but point out that an important common feature across all these augmented models is that, if the risk sharing contract survives, the ratio of marginal utilities become state contingent and are therefore no longer constant over time. This could allow the share of some members (migrants in our case) to increase over time.

In the presence of enforcement problems, the better-off households have an incentive to leave the arrangement and live in autarky. The limited commitment model (e.g. Coate and Ravallion, 1993; Attanasio and Ríos-Rull, 2000; Ligon, Thomas and Worrall, 2002; Kinnan, 2012) appends the full risk sharing model with participation constraints (one for each household):

$$\sum_{t=1}^{\infty} \beta^t \sum_{s=1}^{S} \pi(y_s)\{v_1[c_{1t}(y_s)] - z_1(e_t)\} \geq \mathrm{u}_A, \tag{6}$$

where $\mathrm{u}_A$ is the expected utility received in autarky. Solving the augmented maximization problem yields a following first-order condition:

$$\frac{u'[c_1(y)]}{u'[c_2(y)]} = \frac{\omega_2 + \sum_{s=1}^{S} \mu_2(y_s)}{\omega_1 + \sum_{s=1}^{S} \mu_1(y_s)} \ . \tag{7}$$

where $\mu_1$ and $\mu_2$ are the Lagrange multipliers attached to the participation constraints. Now, as can be seen from equation (7), if the participation constraints bind, the ratio of marginal utilities becomes state contingent. In the context of migration, a growth premium has to be granted to the migrant whose autarky options have improved. As a result, risk sharing is no longer efficient: the impact of negative idiosyncratic income shocks is not equally shared within the extended family network.

The other frictions have similar analytical consequences. If households cannot monitor other network members, the problem of free riding emerges. In moral hazard models (Lim and Townsend, 1998; Kinnan, 2012), the full-risk sharing model is augmented with incentive-compatibility constraints. The *ex ante* information asymmetry leaves the extended family to balance effort and insurance; migrants are motivated to exert effort by rewarding them with higher consumption. This comes with an efficiency cost: idiosyncratic shocks are not completely smoothed within the network. Finally, if there is imperfect information about the realised incomes, households may have an incentive to misreport their incomes to avoid payments or even claim transfers from other households. In hidden income models (Townsend, 1982; Fafchamps, 1992; Kinnan, 2012), the maximization problem is augmented with truth-telling constraints that require that households will not gain from misreporting. To encourage truthful reporting, migrants are allowed to enjoy a larger share of the consumption cake. As a consequence, Pareto-efficient risk sharing is again sacrificed.

These frictions can have important implications for the degree of risk sharing. [5] Distinguishing which of the three models of constrained insurance explain our data best is beyond the scope of this paper. [6] One common feature, however, is that despite friction, reciprocity remains intact: households engage in reciprocal risk sharing but the degree of its efficiency varies.

In this paper, we contrast such reciprocity-based models with models that take into account social norms. Redistributive values may have been instilled since childhood and carefully nurtured through oral transmission, rituals and ceremonies in which the importance of the kinship group is strongly emphasised (Levi-Strauss, 1969). Remittances and other forms of assistance may also buy social prestige, political power or serve to perpetuate subordination (Platteau, 2010; Platteau and Sekeris, 2010). In risk sharing literature, social norms have been seen as the glue that keeps the risk sharing contract from breaking apart (Stark and Lucas, 1988; Fafchamps, 1999; Foster and Rosenzweig, 2001) by alleviating enforcement and information problems. Theoretically this can be modelled as subjective satisfaction that

[5] For example, Chandrasekhar, Kinnan and Larreguy (2011, 2012), using field experiments from Southern India find that limited commitment reduces transfers by 10 per cent and hidden income by 40 per cent.
[6] See Kinnan (2012) for such exercise with data from rural Thailand.

individuals receive from participation. [7] The satisfaction can stem from the fulfilment of obligations and the avoidance of social sanctions, such as guilt, shame or ridicule, or fear of witchcraft. It can also include altruism, which we do not attempt to distinguish from social norms.

A recent empirical literature relying on experimental design highlights the importance of these forces. Chandrasekhar, Kinnan and Larreguy (2011, 2012) find that in the presence of hidden income and limited commitment, social proximity between the risk sharing partners increases the amounts transferred. The field experiments of Leider et al. (2009) and Ligon and Schechter (2012) show that altruism is more important than repeated interaction in determining the size of the transfer. Furthermore, social norms could weaken the constraints to risk sharing to the extent that they never bind and allow for the existence of sustained, unreciprocated transfers. [8] Below we will find evidence of such unilateral relations and argue that this is consistent with risk sharing motivated by social norms.

## 3. Data and descriptive analysis

Kagera is a region in the north-western part of Tanzania. A large part of Lake Victoria is contained within this region and it shares a border with Burundi, Rwanda, and Uganda. The region is overwhelmingly rural and agricultural production is the most important source of income, with more than 80 per cent of the region's economically active population engaged in it (URT, 2006). Bananas, beans, maize, and cassava comprise the main food crops while coffee, tea, and cotton are important cash crops. Recent years have seen a rise in improved banana varieties and sugar for use as cash crops. At the time of the last national census in 2002, Kagera had a population of roughly two million people.

The Kagera Health and Development Survey (KHDS) was originally designed and implemented by the World Bank and the Muhimbili University College of Health Sciences. It consisted of 915 households that were interviewed up to four times from

[7] In the context of limited commitment, we can re-write the right-hand side of equation (6) as $\mathrm{u}_A - A$, where $A$ captures such satisfaction (Fafchamps, 1999; Foster and Rosenzweig, 2001; De Weerdt and Fafchamps, 2011).

[8] Schechter and Yuskavage (2011) empirically document unreciprocated relations in Paraguay.

autumn 1991 to January 1994.[9] The KHDS-2004 survey aimed to re-interview all individuals that were ever interviewed in the baseline survey and were alive in 2004. This effectively meant that the original household panel survey turned into a panel of individuals. A full household questionnaire was administered in a household where a panel respondent was found residing. Due to household dynamics, the sample size increased to more than 2,700 households.[10] The second KHDS follow-up was administered in 2010 with this time more than 3,300 households interviewed.[11]

Although KHDS is a panel of individuals and the definition of a household loses meaning after 10-19 years, it is common in panel surveys to consider re-contact rates in terms of households. Excluding households for which all previous members were deceased (17 households and 27 respondents), the KHDS 2004 field team managed to re-contact 93 per cent of the baseline households. In 2010, 92 per cent of the initial households were re-contacted. Taking into account the long, 10 or 16 year periods between surveys, the attrition rates in KHDS-2004 and KHDS-2010 are extremely low by standards of such panels (Alderman et al., 2001).

This paper exploits the fact that the survey includes all tracked split-offs from the original household and contains particularly rich information on the current links between them. The 2010 sample contains 3,314 households, originating from 816 initial households. The average baseline household spawned 4.1 households by 2010, out of which 2.4 were non-migrant and 1.7 were migrant households. Approximately three per cent of the initial households (99 households) did not have any split-offs. In what follows we will refer to these networks as extended family networks.

Figure 1 provides an overview of migration patterns. By 2010 nearly 45 per cent of the households were still residing in their original baseline community and 10 per cent were found in a neighbouring village. Covariate shocks, rainfall in particularly, are likely to be correlated between neighbouring villages. This correlation should decrease when the distance between the households increases. All else equal, risk sharing with households in the same community is less effective than risk sharing with households residing further away. Since we are mainly interested in seeing

[9] See World Bank (2004).
[10] See Beegle, De Weerdt and Dercon (2006).
[11] See De Weerdt et al (2012).

whether households exploit potential gains from spatial diversification, we define migrants as households that in 2010 are not located in the original village or in a nearby village but are found elsewhere within Kagera or outside Kagera. [12]

*[Figure 1 here]*

Remittances offer one medium for risk sharing between households. Table 1 provides a summary of the average remittance flows over the past 12 months in 2010 between the migrant households and households living in or near their baseline villages. While non-migrant households were net-receivers of remittances, Table 1 shows that transfers flow both ways. This could lead one to think – mistakenly as the analysis below reveals – that these are relationships of reciprocal risk sharing. The data in Table 1 are self-reported and it is interesting to note that migrants claim to send more home than non-migrants acknowledge. A similar discrepancy does not exist in migrant-migrant or stayer-stayer dyads [13].

*[Table 1 here]*

Table 2 provides an overview of the reasons for leaving the baseline village. More than one third of the female respondents, but none of the male respondents cited marriage as the reason for migrating, which is what one would expect in a culture with patrilocal marriages. Less than 15 per cent of the female respondents reported that they left because of work. In contrast, almost 45 per cent of the male migrants reported to have moved because they had found work or went looking for one.

*[Table 2 here]*

The consumption data originate from extensive food and non-food consumption modules in the survey, carefully designed to maintain comparability across survey rounds and controlling for seasonality. The aggregates are temporally and spatially

[12] Our results are robust to alternative migrant definitions, such as also defining households that moved to a nearby village as migrant households.
[13] By dyad we refer to a pair of households.

deflated using data from a price questionnaire included in the survey. Consumption is expressed in annual per capita terms using 2010 Tanzanian shillings. [14]

Table 3 provides the summary of the consumption and poverty developments of the panel respondents with respect to their 2010 location. On average, consumption levels in the sample almost doubled over 19 years. Individuals who stayed in their community saw their consumption increasing by more than 40 per cent. Consumption growth for migrants was much higher: those who left Kagera saw their consumption nearly triple over the same two decades. The poverty statistics tell the same story: nearly all respondents who left the region managed to escape poverty, while poverty reduction among non-migrants was more modest. These descriptive statistics reinforce the results reported in Beegle, De Weerdt and Dercon (2011): individuals who moved did considerably better than those who decided to stay.

*[Table 3 here]*

After moving, migrants remain linked to extended family members at home: 87 per cent of the migrants report that they communicated with a non-migrant network member in the 12 months preceding the survey. Migrants who maintained some form of communication experienced an average consumption growth of 123 per cent, while those who did not grew by 87 per cent. [15] This difference is statistically significant at the 1 per cent level. The severing of the most basic links does not seem to be associated with higher consumption growth; if anything, the reverse is true.

We use data from shock modules administered in 2004 and 2010. During both of these rounds, the panel respondents were asked to consider each year between the survey rounds and indicate whether a particular year was, in economic terms, 'Very good', 'Good', 'Normal', 'Bad', 'Very bad'. For each 'Very bad' response, the respondents were asked to provide the main reason for the hardship. We consider each 'Very bad' response as an economic shock. More than 60 per cent of the panel respondents reported experiencing at least one such shock between 1994 and 2009.

[14] Using adult equivalent units as the denominator instead of household size produces almost identical results across all specifications.

[15] The mean consumption growth among those who maintained contact was 441,212 TZS and among those who severed links 293,188 TZS.

Table 4 provides an overview of the shocks experienced. Most frequently reported economic shocks were death of a family member, serious illness and poor harvest due to bad weather.

*[Table 4 here]*

The shock data were collected at individual level – in particular for each person on the 2010 roster who also appears on the original 1991/94 rosters. Since our focus is to examine the role of shocks on household consumption, the data had to be reformatted from individual to household level. [16] If at least one individual in the household reported to have experienced a shock, we interpret it as a household level shock. We should also exclude shocks that occurred before the households split. Fortunately, we know the year in which the respondents moved to their 2010 location, allowing us to include only shocks that occurred one year after this move. [17]

Furthermore, some of the shock categories are problematic to our network analysis. Mortality shocks may trigger inheritance flows within extended families. As such, a negative shock in one household may actually be a positive income shock in another household. A similar problem arises with the loss of remittance shocks, if these capture the loss of transfers from a household within the same extended family. We therefore exclude these two shock categories from our final shock variable.

Finally, there are 542 households that belong to a network that contains only non-migrants or only migrants. Since we are interested in the role of migration in risk sharing, these households are dropped from the final sample. Table 5 presents the summary statistics for the final sample of 2,246 households by 2010 migration status.

*[Table 5 here]*

## 4. Econometric strategy

We begin the econometric analysis by testing the full risk sharing hypothesis for those extended family networks that contain both migrants and non-migrants. The

[16] We repeated the complete analysis of the following sections using individual level data and find it does not change the conclusions.

[17] This means that for households that remained in the baseline village we consider shocks that took place between 1994 and 2009. However, using only shocks that occurred after these household lived with *any* other network household member does not change the conclusions.

difference in logged per capita consumption between 2010 and the baseline for household $i$ in extended family $j$ ($\Delta \ln c_{ij}$) is formally modelled as:

$$\Delta \ln c_{ij} = \beta s_{ij} + x'_{ij}\gamma + \alpha_j + \varepsilon_i \tag{8}$$

where $s_{ij}$ has a value 1 if the household experienced a shock after splitting off, $x_{ij}$ is a vector of household characteristics in 2010. The latter captures the characteristics of the previous household members [18] such as the number of previous household members in the 2010 household, the age of the oldest and the education (in years) of the most educated previous household members in the household. We also include dummies capturing their relation to the 2010 household head and their marital status. [19] The term $\alpha_j$ represents the network fixed effect and $\varepsilon_i$ is the error term. The inclusion of the network fixed effects means that we compare the impact of shocks between the households originating from the same initial household. As such, the full risk sharing model presented earlier requires that β=0.

Our partial risk sharing test builds on this specification. We drop the network fixed effects and replace them with baseline village fixed effects ($\theta_v$) and network characteristics ($w_j$) comprising the number of migrants and non-migrants in the network and variables capturing characteristics of the initial household, such as its demographic composition, the household head's characteristics, including education, gender, age and the quadratic of age. We also include (logged) per capita consumption at the baseline (ln $c_{j,1991}$). This specification enables us to assess whether household per capita consumption growth is responsive to shocks in other households in the same extended family. The network shock variable, $z_{ij}$, measures the number of households affected by an income shock. The household's own shocks are excluded from this variable. The partial risk sharing specification is formulated as:

[18] Previous household member refers to a person interviewed at the baseline in 1991/94.

[19] To address concerns about some of these 2010 household characteristics variables being potentially endogenous, we run all main regressions again, but drop each of these control variable in turn. We find the shock and network shock coefficients remain stable across all specifications.

(9) $$\Delta \ln c_{ij} = \beta s_{ij} + \delta z_{ij} + x'_{ij}\gamma + w'_j\vartheta + \gamma \ln c_{j,1991} + \theta_v + \varepsilon_i$$

A negative and statistically significant $\delta$ would imply that some risk sharing takes place within the extended families. We will assess the impact of these network shocks separately for migrants and non-migrants.

The baseline per capita consumption variable in equation (9) raises a concern about endogeneity. The error term $\varepsilon_i$ could be correlated, for example due to measurement error, with the lagged consumption variable. This would then bias the estimate measuring the impact of the lagged consumption but it may also affect other coefficients. Fortunately, we can think of a credible instrument that allows us to assess this possibility. Rainfall is one of the main inputs in agricultural production in Kagera and poor rainfall (i.e. droughts) can have serious consequences for incomes. Excess rains are less of a problem due to the focus of the production on tree crops and also because the terrain is relatively undulating. The region has two rainy seasons, a short rainy season usually between March and May and a long rainy season usually between October and December. The agricultural production takes place during these seasons. Therefore, we employ average monthly z-score deviations of rainfall during the two rainy seasons preceding the interview and truncate the positive rainfall deviations to zero. [20] Rainfall during the agricultural production is expected to influence consumption through income fluctuations but is unlikely to be correlated with the potential measurement error in the per capita consumption variable. The baseline village fixed effects ($\theta_v$) in equation (9) wipe out the level effects of rainfall in the first stage regression. Therefore, exploiting the fact that rainfall shocks will affect different types of households in different ways, we interact the rainfall variable with head's gender, age and education yielding a total of three instruments.

## 5. Results

We begin by testing the full risk sharing model described above. Column 1 in Table 6 provides the results for the base specification of equation (8) with network fixed

[20] Beegle, De Weerdt and Dercon (2008) employ a similar instrumental variable approach for their lagged consumption variable in assessing the long-term impact of adult deaths on consumption growth in Kagera.

effects (NFE). [21] The control variables capture the characteristics of the previous household members, including their position within the 2010 household. The signs of the control variables are *a priori* correct. For example, education has a positive impact on consumption growth, while households with widowed or divorced previous household members experience lower consumption growth than others within the same extended family network.

The statistical significance of the shock coefficient, despite the inclusion of NFE, reveals that shocks are not insured within extended families. Households that experienced a shock had 15 percentage points lower consumption growth, on average and *ceteris paribus*, than households from the same extended family who did not experience a shock. The emergence of this wedge in the face of a shock implies a clear rejection of the full risk sharing model in the extended family networks in this study.

*[Table 6 here]*

Column 2 presents the estimation results based on equation (9). Here we drop the NFE and replace them with network characteristics, such as the number of migrant and non-migrant network members (which together control for network size and composition) and the wealth and demographics of the baseline household from which the network is formed. We also include baseline village fixed effects. The size of the shock coefficient is nearly identical to the one obtained with NFE, which gives confidence in the network level controls used.

Finally, column 3 provides the Two-Stage Least Squares results that address the potential endogeneity problem arising from the inclusion of the initial logged per capita consumption variable. The first stage regression results and the standard IV-diagnostic tests are presented in Table A1 in the Appendix. The included instruments show how households headed by older and more educated males enjoy higher baseline consumption. The excluded instruments are zero-truncated negative z-score deviations of rainfall interacted with the household head's age, education and gender.

[21] To account for heteroskedasticity, we use White (1980) adjusted standard errors for inferential purposes. These robust standard errors are reported in parenthesis in all regression tables.

They show that the positive level effects of each of these three household head characteristics are attenuated with the inclusion of negative rainfall shocks. The Cragg-Donald (1993) test yields 15.84 indicating that our instruments are relevant. Comparison with the critical values provided in Stock and Yogo (2005) implies that the bias of our IV-estimate is less than five per cent of the OLS estimate. The Hansen (1982) J-test provides a p-value of 0.394. Thus, the null hypothesis of zero correlation between the instrument and the error term is upheld at conventional levels. The shock coefficient and the standard error from the 2SLS estimates are almost identical to those from OLS, indicating that the potential endogeneity of the logged per capita baseline consumption has a negligible influence on the shock variable. In the light of this, we use the more efficient OLS method to make inferences in the remainder of the text.

The attention now shifts to testing partial risk sharing. As discussed earlier, we replace the NFE with network characteristics and baseline village fixed effects and augment the specification with the network shock variable. The first column in Table 7 reports the results for the migrant households and the second column for the non-migrant households. For migrants, the network shock coefficient is negative and highly significant. These network shocks have a sizeable impact on migrant households' consumption: on average, a shock in one household in the network resulted in a drop of six percentage points in consumption growth. As shocks are not correlated within the extended family networks (the intra-class correlation coefficient equals 0.012 with a standard error of 0.016), this finding reveals that migrants insure other households in their extended families. Non-migrant households, on the other hand, do not appear to be affected by the network shocks. The point estimate is nearly zero and highly insignificant. These results suggest that the risk sharing arrangement is not reciprocal.

*[Table 7 here]*

In order to investigate this further, we decompose the network shock variable into shocks in non-migrant and migrant households. The first variable measures the number of non-migrant households that experienced a shock in the extended family. The second network shock variable measures the number of migrant households affected by shocks. As before, household's own shocks have been excluded from these variables. Table 8 presents the regression results. Migrants are susceptible to shocks affecting other migrant and non-migrant households within their extended family network, while non-migrants are sensitive to neither. Shocks in other migrant households have a larger negative effect on consumption than shocks experienced in other stayer households. However, this difference is not statistically significant from zero at a conventional level.

*[Table 8 here]*

These regressions do not allow to say whether migration is causally responsible for the migrant taking on the role of insuring sedentary extended family network members, or whether the effect is driven by unobservables. In particular, we cannot make any statements about what would have happened if migrants had stayed home or the home-stayers had migrated. It is possible that in this parallel universe roles would have switched (migration is causally responsible) or not (it is driven by the unobserved differences between migrants and non-migrants). For the purpose of this paper it is of no consequence whether the observed unilateral insurance provision from migrants to those who stayed at home is driven by migration itself, by some unobserved characteristic of the migrants or by some interaction of the two. Our interest lies in documenting the fact that migrants provide unilateral insurance to non-migrants, while at the same time shooting ahead of them in consumption terms.

Is the price to the migrant for providing such unilateral insurance significant? From Table 8 we observe that for each shock in the extended family network at home there is a drop of 4.7 percentage points in the migrant’s consumption, which appears to be a permanent deviation from the growth curve. The average migrant has 0.54 network shocks of non-migrants, resulting in an implied overall consumption growth penalty of 2.5 percentage points, on average, over the 19-year period. Over this same period, the average consumption growth among migrants was 119 per cent, implying that insurance constituted an average annual growth penalty of around 0.063 of one percentage point (reducing average annual growth roughly, from 4.206 per cent to

4.143 per cent).[22] Put another way, migrants share about 2.1 per cent of their very substantial growth by insuring family members at their original location.[23] This is a lower-bound estimate because we cannot exclude the possibility that we are only measuring a subset of relevant shocks and a subset of extended family members. First, shocks are self-reported and it is conceivable that respondents report uninsured shocks, but not insured shocks. Second, the extended family network may well extend beyond the one we have considered in this paper.

We conclude that migrant households are partially and unilaterally insuring households that stay behind. This lack of reciprocity violates the predictions of the reciprocity-based models (without a social norms term). Because, on average, migrants are twice as rich as those who remained at home, these findings are consistent with reciprocity-based models augmented with a social norms term, which attenuates the participation, truth-telling or incentive compatibility constraints.

## 6. Other transactional insurance motives

An alternative explanation to the observed lack of reciprocity could be that migrants insure non-migrants in exchange for other benefits. By concentrating on consumption differences we have considered only current pay-offs from any risk sharing arrangement. It is quite possible that the benefits are still to accrue to the migrant in the more distant future. Lucas and Stark (1985) mention that there could be exchange motives for migration relating to the desire for non-migrants to look after local assets, the intention to return home and the aspiration to inherit. In a context that lacks technology to allow future income to be consumed now, we could confuse unilateral insurance with postponed reciprocity. Fortunately, the KHDS questionnaire is particularly rich and we are thus able to explore some of these issues. As before, the dependent variable is logged per capita consumption growth in the analysis that follows.

The questionnaire asks each migrant about asset holdings in the baseline village. As our outcome variable is consumption growth we cannot use these asset holdings as

[22] We use geometric (rather than arithmetic) means to calculate the average annual growth rates.
[23] The 95%-confidence interval for the annual growth penalty is [0.008, 0.118] and for the 'kin-tax' [0.25, 3.99].

explanatory variables: current wealth is surely endogenous to growth in wealth. We attempt to circumvent this problem by looking at the share of assets in the current portfolio that are located in the village. While it remains possible that portfolio composition is endogenous to consumption growth, we believe the results are informative enough to report.

About 12 per cent of migrants have assets in the baseline village and 10 per cent of migrants own land in the baseline village. For land we have exact area measurements, but not monetary values. If migrants engage in risk sharing with those who remain at home for the purpose of maintaining land and ensuring their continued entitlement to the land (which is important in a country with few formal land deeds), then we would expect more responsiveness to network shocks from people with a larger share of their land holdings in the baseline village. The first column of Table 9 explores this. We interact the non-migrant network shocks with a variable measuring the share of the land in the baseline village. The coefficient on this interacted variable turns out insignificant implying that the share of land in the baseline village neither increases nor decreases the insurance provision.

In the second column in Table 9 we interact the non-migrant network shock variable with the length of the migration spell. Following Dustmann and Mestres (2010), we argue this to be a measure of the permanence and success of the move and an inverse measure of the return likelihood. We find that the duration of the migration spell does not have any impact on migrant's insurance provision. This also holds when we use non-linear versions of the migration duration in the form of a piecewise linear spline.

The third column in Table 9 investigates whether the expectation to inherit is a plausible motive for unilateral insurance. Nearly 40 per cent of the migrant households have parental clan land holdings waiting for them in the baseline village. By interacting the non-migrant network shocks with a parental clan land holdings dummy, we find that that these households are no more (or less) engaged in insurance provision than households that do not expect to inherit land.

*[Table 9 here]*

A final transactional motive that could be consistent with the regression results is that non-migrants pay insurance premiums to migrants in return for their continued insurance provision. This does not seem consistent with the findings of Table 1, where we noted that migrants are net senders of transfers.

## 7. Robustness

We conduct an array of robustness checks to verify our findings. First, we find the results are robust to an alternative migrant definition where also households that moved to a nearby village are defined as migrants. Second, the results are not driven by the configuration of the data. The shock data were initially defined at individual level while our outcome variable is measured at household level. Conducting the empirical analysis at individual level does not affect our main findings. Third, defining household consumption per adult equivalent instead of per household member yields close to identical results in all specifications. Fourth, changing the way we isolate the shocks that occurred before the households split does not change our results either. Finally, we also check whether the potential endogeneity of our control variables is driving our results. However, instrumenting the lagged consumption variable does not affect the shock coefficient. In addition, when the 2010 household level control variables are omitted one-by-one, the estimated shock coefficients remain stable across all specifications. [24]

## 8. Conclusions

Starting from the household rosters of a representative household survey conducted nearly two decades ago in Kagera, we find that over half of the original household members had moved internally, while very few moved internationally. Internal migrants provide unilateral insurance to those who remain at home, which seems to be driven by social norms rather than exchange motives. The lower-bound estimate of the total, final, long-run effect of this insurance provision on the migrant's growth amounts to a 2.1 per cent sacrifice in consumption (2.5 percentage points off the 119 % total growth realised by the migrant). This is close to the results from Jakiela and Ozier (2012), who estimate that women in a laboratory setting in Kenya acted as if

[24] The results of these robustness checks are available upon request.

they were expecting to be pressured to share four per cent of their experiment winnings. [25] While our study cannot conclusively say where migrants would be without their extended family networks back home, a tax rate of 2.1 per cent seems too low to be an important brake on a migrant's growth. We do know that migrants who have severed links with home perform worse than other migrants and one should not overlook the fact that, while starting out from similar baseline welfare levels, migrants realise a total consumption growth which is three times higher than that of non-migrants.

## References


Alderman, H., Behrman, J., Kohler, H.-P., Maluccio, J., A. & Watkins, S. (2001) Attrition in Longitudinal Household Survey Data. *Demographic Research,* 5**,** 79-124.

Altonji, J. G., Hayashi, F. & Kotlikoff, L. J. (1992) Is the Extended Family Altruistically Linked - Direct Tests Using Micro Data. *American Economic Review,* 82**,** 1177-1198.

Attanasio, O. & Ríos-Rull, J. V. (2000) Consumption smoothing in island economies: Can public insurance reduce welfare? *European Economic Review,* 44**,** 1225-1258.

Baland, J., Guirkinger, C. & Mali, C. (2011) Pretending to Be Poor: Borrowing to Escape Forced Solidarity in Cameroon, *Economic Development and Cultural Change*, Vol. 60, No. 1, 1-16.

Burke, Mary A. & Young, P. (2011) "Chapter 8 - Social Norms." In *Handbook of Social Economics*, edited by Alberto Bisin, Jess Benhabib & Matthew Jackson, 311-338. North-Holland.

Beegle, K., De Weerdt, J. & Dercon, S. (2006) Kagera Health and Development Survey, 2004: Basic Information Document. mimeo.

Beegle, K., De Weerdt, J. & Dercon, S. (2008) Adult mortality and consumption growth in the age of HIV/AIDS. *Economic Development and Cultural Change,* 56**,** 299-326.

Beegle, K., De Weerdt, J. & Dercon, S. (2011) Migration and Economic Mobility in Tanzania: Evidence from a Tracking Survey. *Review of Economics and Statistics,* 93**,** 1010-1033.

Chandrasekhar, A. Kinnan, C. & Larreguy, H. (2011) Information, Networks and Informal Insurance: Evidence from a Lab Experiment in the Field. Retrieved July 10, 2012. Accessed at http://faculty.wcas.northwestern.edu/~cgk281/CKLII.pdf.

Chandrasekhar, A. Kinnan, C. & Larreguy, H. (2012) Informal Insurance, Social Networks, and Savings Access: Evidence from a Framed Field Experiment. Retrieved July 10, 2012. Accessed at http://faculty.wcas.northwestern.edu/~cgk281/SaI.pdf.


[25] It is important to note this comparison is not conceptually entirely appropriate as we focus on the tax on growth while the Kenya study reports the level effects.

Coate, S. & Ravallion, M. (1993) Reciprocity without commitment: Characterization and performance of informal insurance arrangements," *Journal of Development Economics*, Vol. 40, No.1, 1-24.

Collier, P., & S. Dercon (2009) African Agriculture in 50 Years: Smallholders in A Rapidly Changing World?. Paper presented at the 2009 Food and Agriculture Organization Expert Meeting on 'How to Feed the World in 2050'. Available at ftp://ftp.fao.org/docrep/fao/012/ak983e/ak983e00.pdf

Cox, D. & Fafchamps, M. (2008) Extended Family and Kinship Networks: Economic Insights and Evolutionary Directions, IN *Handbook of Development Economics*, Hollis Chenery & T.N. Srinivasan (eds.) edition 1, volume 4, number 5, January.

Cragg, J. & Donald, S. (1993) Testing Identifiability and Specification in Instrumental Variable Models, *Econometric Theory*, Vol. 9, No. 2, 222-240.

De Weerdt, J. & Fafchamps M. (2011) Social identity and the formation of health insurance networks. *Journal of Development Studies,* 47 (8).

De Weerdt, J., Beegle, K., Lilleør, H. B., Dercon, S., Hirvonen, K., Kirchberger, M. & Krutikov, S. (2012) Kagera Health and Development Survey 2010: Basic Information Document. *Rockwool Foundation Working Paper Series* (forthcoming).

Dustmann, C. & Mestres, J. (2010) Remittances and temporary migration. *Journal of Development Economics,* 92**,** 62-70.

Fafchamps, M. (1992) Solidarity Networks in Preindustrial Societies: Rational Peasants with a Moral Economy, *Economic Development and Cultural Change*, Vol. 41, No. 1, 147-174.

Fafchamps, M. (1999) Risk sharing and quasi-credit. *The Journal of International Trade & Economic Development*, 8 (3), 257–278.

Foster, A. D. & Rosenzweig, M. R. (2001) Imperfect Commitment, Altruism and the Family: Evidence from Transfer Behavior in Low-Income Rural Areas. *Review of Economics and Statistics*, 83(3), 389–407.

Grimard, F. (1997) Household consumption smoothing through ethnic ties: evidence from Cote d'Ivoire. *Journal of Development Economics,* 53**,** 391-422.

Hansen, L. P. (1982) Large Sample Properties of Generalized-Method of Moments Estimators. *Econometrica,* 50**,** 1029-1054.

Harris, John & Michael Todaro (1970) Migration, Unemployment and Development: A Two-Sector Analysis. *American Economic Review* 60(1), 126-142.

Hoddinott, J. (1994) A Model of Migration and Remittances Applied to Western Kenya, *Oxford Economic Papers, New Series*, Vol. 46, No. 3, 459-476.

Hoff, Karla and Arjit Sen (2006) The Kin System as a Poverty Trap? In *Poverty Traps*, Samuel Bowles, Steven Durlauf & Karla Hoff (eds.), 91-115. Princeton University Press.

Jakiela, P. & Ozier, O. (2012) Does Africa Need a Rotten Kin Theorem? Experimental Evidence from Village Economies, *World Bank Policy Research Working Paper* 6085.

Kinnan, C. (2012) Distinguishing barriers to insurance in Thai villages. Accessed at http://faculty.wcas.northwestern.edu/~cgk281/BtI.pdf on July 10, 2012.

Lewis, W. A. (1954) Economic Development with Unlimited Supplies of Labor. *The Manchester School* 22 (2), 139-91.

Levi-Strauss, H., (1969) *The Elementary Structures of Kinship*, London: Social Science Paperbacks (Revised edition).

Ligon, E. (1998) Risk-sharing and information in village economies. *Review of Economic Studies*, 65, 847–864.

Ligon, E. & Schechter L. (2012) Motives for Sharing in Social Networks. *Journal of Development Economics*, vol. 99 (1), 13-26.

Ligon, E., Thomas, J. P. & Worrall, T. (2002) Informal insurance arrangements with limited commitment: Theory and evidence from village economies. *Review of Economic Studies*, 69**,** 209-244.

Lim, Y. & Townsend, R. (1998) General Equilibrium Models of Financial Systems: Theory and Measurement in Village Economies, *Review of Economic Dynamics*, Vol. 1, No. 1, 59-118.

Leider, S., Mobius, M. M., Rosenblat, T., & Do, Q. A. (2009). Directed Altruism and Enforced Reciprocity in Social Networks. *Quarterly Journal of Economics*, 124(4), 1815-1851.

Lucas, R. E. B. & Stark, O. (1985) Motivations to Remit: Evidence from Botswana. *Journal of Political Economy*, 93**,** 901-18.

Munshi, K. (2003) Networks in the Modern Economy: Mexican Migrants in the U.S. Labor Market, *The Quarterly Journal of Economic*, No. 2, Vol. 118.

Platteau, J. (2000) *Institutions, social norms, and economic development*. The Netherlands: Harwood Academic Publishers. 384 pages.

Platteau, J. (2010) Redistributive Pressures in Sub-Saharan Africa: Causes, Consequences, and Coping Strategies. Paper prepared for the Conference "Understanding African Poverty in the Longue Durée", International Institute for the Advanced Study of Cultures, Institutions, and Economic Enterprise (IIAS), Accra, July 15-17, 2010.

Platteau, Jean & Sekeris, P. (2010) On the feasibility of power and status ranking in traditional setups, *Journal of Comparative Economics*, vol. 38(3), 267-282.

Rosenzweig, M. R. & Stark, O. (1989) Consumption Smoothing, Migration, and Marriage - Evidence from Rural India. *Journal of Political Economy*, 97, 905-926.

Schechter, L. & Yuskavage, A. (2011) Reciprocated Versus Unreciprocated Sharing in Social Networks. Mimeo. University of Wisconsin, Madison.

Stark, O. & Bloom, D. E. (1985) The New Economics of Labor Migration. *American Economic Review*, 75, 173-178.

Stark, O. & Lucas, R. (1988) Migration, Remittances, and the Family, *Economic Development and Cultural Change*, Vol. 36, No. 3, 465-481.

Stock, J. & Yogo, M. (2005) Testing for weak instruments in linear IV regression. In *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*, Andrews, D. & Stock, J. (Eds.). Cambridge University Press.

Townsend, R. (1982), Optimal Multiperiod Contracts and the Gain from Enduring Relationships under Private Information, *Journal of Political Economy*, Vol. 90, No. 6, 1166-1186.

Townsend, R. M. (1994) Risk and Insurance in Village India. *Econometrica,* 62**,** 539-591.

United Nations, Department of Economic and Social Affairs, Population Division (2012) World Urbanization Prospects: The 2009 Revision. CD-ROM Edition - Data in digital form. 2010. Accessed at http://esa.un.org/unpd/wup/index.htm on 19 January 2012.

United Nations Development Programme (UNDP) (2009) *Human Development Report 2009. Overcoming barriers: Human mobility and development*. United Nations, New York.

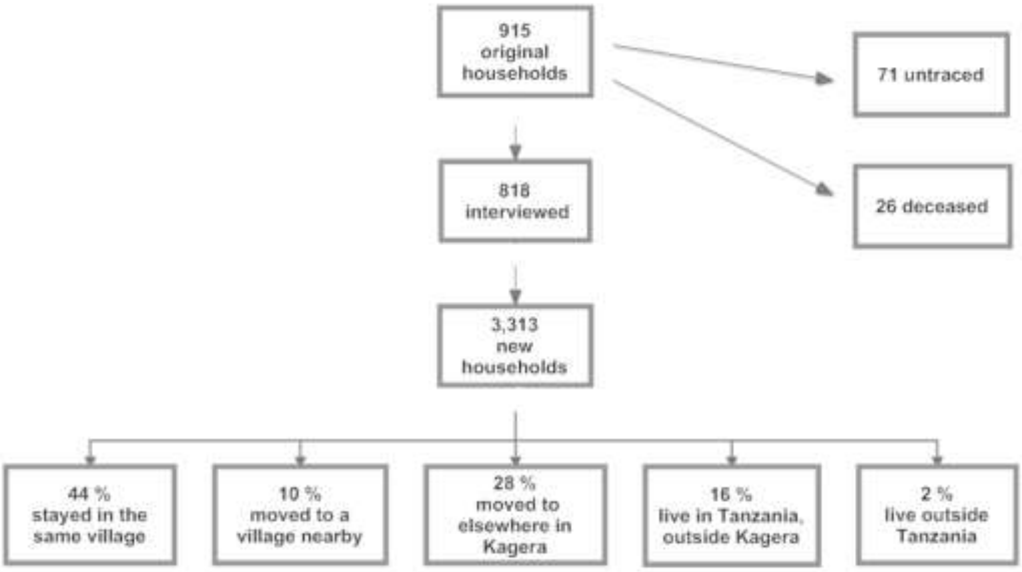
URT (United Republic of Tanzania) (2006): *Tanzania Census 2002: Analytical Report*, National Bureau of Statistics, Ministry of Planning, Economy and Empowerment, Dar es Salaam

White, H. (1980) A Heteroskedasticity-Consistent Covariance-Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica,* 48**,** 817-838.

World Bank (2004) User's Guide to the Kagera Health and Development Survey Datasets. mimeo.

## Figures

**Figure 1: KHDS-2010 – Re-contacting after 16+ years**



## Tables

**Table 1: reported remittances in and out between migrants and non-migrants, as reported by the first half of the dyad with respect to transfers to (first column) or from (second column) the second half of the dyad.** [26]

| dyad | gifts out | gifts in | net in |
|---|---|---|---|
| stayer-migrant | 9,914 | 14,440 | 4,526 |
| migrant-stayer | 20,439 | 10,392 | -10,047 |
| stayer-stayer | 8,744 | 10,022 | 1,278 |
| migrant-migrant | 18,738 | 17,281 | -1,458 |
| **Total** | **13,208** | **12,328** | **-880** |

**Table 2: Reasons for leaving the baseline village**

| Reason | males (%) | females (%) |
|---|---|---|
| To look for work | 29.8 | 7.5 |
| Own schooling | 16.0 | 10.3 |
| Found work | 15.1 | 6.7 |
| To live in a healthier environment | 10.4 | 11.7 |
| Marriage | 0.0 | 38.9 |
| Other reason | 28.8 | 24.9 |
| **Total** | **100.0** | **100.0** |

[26] This table is based on self-reported remittance flows in households in the past 12 months in 2010.

**Table 3: Consumption and Poverty Movements of the panel respondents in 1991-2010 by 2010 location**[27]

| | mean 91 | mean 2010 | difference in means | N |
|---|---|---|---|---|
| **Consumption per capita (TZS) by 2010 location** | | | | |
| Within community | 343,718 | 492,398 | 148,680*** | 2,224 |
| Nearby community | 364,099 | 569,438 | 205,339*** | 382 |
| Elsewhere in Kagera | 357,930 | 695,951 | 338,021*** | 1,007 |
| Out of Kagera | 389,379 | 1,110,827 | 721,449*** | 658 |
| Full Sample | 355,926 | 642,558 | 286,632*** | 4,271 |
| **Consumption Poverty Head Count (%) by 2010 location** | | | | |
| Within community | 31 | 19 | -13*** | 2,224 |
| Nearby community | 30 | 20 | -10*** | 382 |
| Elsewhere in Kagera | 31 | 16 | -15*** | 1,007 |
| Out of Kagera | 23 | 3 | -21*** | 658 |
| Full Sample | 30 | 16 | -14*** | 4,271 |

*Note: Significance of the difference in means using a paired t-test, *** p<0.01, ** p<0.05, * p<0.1.*

**Table 4: Shocks reported by the panel respondents 1994-2009**

| Type of shock | Freq. | Percentage |
|---|---|---|
| Death of family member | 797 | 26% |
| Poor harvest due to adverse weather | 638 | 21% |
| Serious illness | 577 | 19% |
| Loss in wage employment | 219 | 7% |
| Loss of assets | 205 | 7% |
| Eviction/resettlement | 99 | 3% |
| Poor harvest due to pests or crop diseases | 98 | 3% |
| Low crop prices | 85 | 3% |
| Loss in off-farm employment | 78 | 3% |
| Low income due to lower remittances | 43 | 1% |
| Loss of livestock | 6 | 0.2% |
| Loss of Gifts and support by organisations | 4 | 0.13% |
| Other reasons | 172 | 6% |
| **Total** | **3,021** | **100%** |

[27] All consumption values are in annual per capita terms and expressed in 2010 Tanzanian shillings.

**Table 5: Descriptive statistics**

| | Migrant households | | Non-migrant households | |
|---|---|---|---|---|
| | **mean** | **std. dev.** | **mean** | **std. dev.** |
| 1991 household per capita consumption | 355,539 | 184,744 | 354,120 | 200,839 |
| 2010 household per capita consumption | 777,748 | 642,810 | 511,348 | 410,482 |
| Per capita consumption growth between 1991-2010 | 422,210 | 653,545 | 157,228 | 394,930 |
| Natural log of per cap. consumption growth between 1991-2010 | 0.6249 | 0.798 | 0.2908 | 0.631 |
| Shock | 0.2009 | 0.401 | 0.4816 | 0.500 |
| # of hhs that reported a shock in the network | 0.7349 | 1.063 | 1.3621 | 1.336 |
| **2010 household characteristics:** | | | | |
| Age of oldest PHHM in the 2010 hh | 31.6 | 11.378 | 42.3 | 17.705 |
| A PHHM is head of this 2010 hh | 0.4484 | 0.498 | 0.7276 | 0.445 |
| A PHHM is spouse of this 2010 hh's head | 0.4121 | 0.492 | 0.3390 | 0.474 |
| A PHHM is child of this 2010 hh's head | 0.0512 | 0.220 | 0.1913 | 0.393 |
| Divorced PHHM in 2010 hh | 0.0391 | 0.194 | 0.0598 | 0.237 |
| A widowed PHHM in 2010 hh | 0.0456 | 0.209 | 0.1725 | 0.378 |
| A married PHHM in 2010 hh | 0.6316 | 0.483 | 0.6892 | 0.463 |
| Max yrs edu of PHHM in this 2010 hh | 6.8335 | 3.190 | 6.2203 | 2.960 |
| Number of PHHMs in this 2010 hh | 1.1107 | 0.438 | 1.4987 | 0.979 |
| **Initial household characteristics:** | | | | |
| HH total per capita consumption | 355,539 | 184,744 | 354,120 | 200,839 |
| Natural log value of assets in 1991 | 13.6922 | 1.095 | 13.7340 | 1.073 |
| Education of hh head | 4.3135 | 3.168 | 4.2383 | 3.071 |
| Head was male | 0.7553 | 0.430 | 0.7720 | 0.420 |
| Age of hh head | 49.1 | 15.9 | 49.0 | 15.5 |
| Males 0-5 years | 0.7684 | 0.908 | 0.7438 | 0.874 |
| Males 6-15 years | 1.3888 | 1.223 | 1.3373 | 1.138 |
| Males 16-60 years | 1.3516 | 1.023 | 1.3988 | 1.051 |
| Males 61+ years | 0.1991 | 0.399 | 0.2058 | 0.404 |
| Females 0-5 years | 0.8474 | 0.970 | 0.7839 | 0.881 |
| Females 6-15 years | 1.4493 | 1.347 | 1.4261 | 1.240 |
| Females 16-60 years | 1.9088 | 1.351 | 1.8215 | 1.200 |
| Females 61+ years | 0.2344 | 0.462 | 0.1998 | 0.417 |
| HH had a non-earth floor in 1991 | 0.1926 | 0.394 | 0.1605 | 0.367 |
| **Observations** | **1075** | | **1171** | |

*Note: 1) PHHM refers to previous household member (i.e. person interviewed at the baseline).*
*2) All consumption values are in annual per capita terms and expressed in 2010 Tanzanian shillings.*

**Table 6: The effect of shocks on consumption growth**

| Dependent variable: (logged) per capita consumption growth | 1 | 2 | 3 |
|---|---|---|---|
| | **OLS, NFE** | **OLS** | **2SLS** |
| Shock | -0.154*** | -0.157*** | -0.156*** |
| | (0.027) | (0.025) | (0.025) |
| **2010 household characteristics:** | | | |
| Age of oldest PHHM in the household | -0.001 | 0.000 | -0.000 |
| | (0.001) | (0.001) | (0.001) |
| A PHHM is head of the household | 0.175*** | 0.166*** | 0.166*** |
| | (0.048) | (0.035) | (0.042) |
| A PHHM is spouse of the household head | 0.111** | 0.087** | 0.083* |
| | (0.049) | (0.043) | (0.045) |
| A PHHM is child of the household head | -0.225*** | -0.181*** | -0.181*** |
| | (0.052) | (0.043) | (0.047) |
| A divorced PHHM in the household | -0.329*** | -0.299*** | -0.293*** |
| | (0.069) | (0.074) | (0.063) |
| A widowed PHHM in the household | -0.340*** | -0.341*** | -0.337*** |
| | (0.058) | (0.052) | (0.052) |
| A married PHHM in the household | -0.488*** | -0.463*** | -0.459*** |
| | (0.040) | (0.040) | (0.038) |
| Max years of education of PHHM in the household | 0.061*** | 0.065*** | 0.064*** |
| | (0.006) | (0.005) | (0.006) |
| Number of PHHMs in the household | -0.004 | -0.024 | -0.021 |
| | (0.023) | (0.020) | (0.024) |
| **Network characteristics:** | | | |
| Number of split-off households stayed | | -0.043*** | -0.045*** |
| | | (0.010) | (0.010) |
| Number of split-off households moved | | -0.006 | -0.007 |
| | | (0.012) | (0.011) |
| **Household characteristics at the baseline:** | | | |
| Natural log value of assets in 1991 | | 0.015 | 0.007 |
| | | (0.018) | (0.024) |
| Education of 1991 household head | | 0.002 | 0.000 |
| | | (0.006) | (0.006) |
| Head was male in 1991 | | -0.070** | -0.079** |
| | | (0.035) | (0.044) |
| Age of household head in 1991 | | 0.006 | 0.006 |
| | | (0.006) | (0.004) |

**Table 6: The effect of shocks on consumption growth**

| Dependent variable: (logged) per capita consumption growth | **1**<br>**OLS, NFE** | **2**<br>**OLS** | **3**<br>**2SLS** |
|---|---|---|---|
| Age of head squared | | -0.000 | -0.000* |
| | | (0.000) | (0.000) |
| Number of males 0-5 years in the household | | -0.004 | 0.004 |
| | | (0.017) | (0.022) |
| Number of males 6-15 years in the household | | 0.047*** | 0.051*** |
| | | (0.012) | (0.015) |
| Number of males 16-60 years in the household | | -0.002 | -0.004 |
| | | (0.016) | (0.014) |
| Number of males 61+ years in the household | | 0.139*** | 0.156*** |
| | | (0.048) | (0.065) |
| Number of females 0-5 years in the household | | 0.005 | 0.009 |
| | | (0.017) | (0.018) |
| Number of females 6-15 years in the household | | 0.030** | 0.032*** |
| | | (0.013) | (0.013) |
| Number of females 16-60 years in the household | | 0.002 | 0.003 |
| | | (0.014) | (0.013) |
| Number of females 61+ years in the household | | 0.015 | 0.019 |
| | | (0.032) | (0.033) |
| Household had a non-earth floor in 1991 | | -0.005 | -0.032 |
| | | (0.046) | (0.068) |
| (logged) household per capita consumption in 1991 (in 2010 TZS) | | -0.902*** | -0.797*** |
| | | (0.041) | (0.218) |
| Number of observations | 2,246 | 2,246 | 2,246 |
| $R^2$ | 0.215 | 0.417 | 0.414 |
| Adjusted $R^2$ | 0.212 | 0.410 | 0.393 |

*note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parenthesis. Regressions in column 1 includes NFE, regressions in columns 2 and 3 include baseline village fixed effects. PHHM refers to previous household member (i.e. person interviewed at the baseline).*

**Table 7: The effect of network shocks on consumption growth**

| Dependent variable: (logged) per capita consumption growth | **Migrant households** **1** **OLS** | **Non-migrant households** **2** **OLS** |
|---|---|---|
| Shock | -0.090** | -0.085*** |
| | (0.044) | (0.027) |
| Number of households that experienced a shock in the network | -0.061*** | -0.018 |
| | (0.014) | (0.017) |
| Number of split-off hhs stayed | -0.019 | -0.023** |
| | (0.018) | (0.010) |
| Number of split-off hhs moved | 0.002 | -0.031* |
| | (0.011) | (0.017) |
| Age of oldest PHHM in the 2010 hh | 0.003 | 0.000 |
| | (0.002) | (0.001) |
| A PHHM is head of this 2010 hh | 0.168*** | 0.180*** |
| | (0.065) | (0.060) |
| A PHHM is spouse of this 2010 hh's head | 0.015 | 0.107* |
| | (0.073) | (0.057) |
| A PHHM is child of this 2010 hh's head | -0.410*** | 0.008 |
| | (0.119) | (0.052) |
| A Divorced PHHM in 2010 hh | -0.380*** | -0.168** |
| | (0.122) | (0.076) |
| A widowed PHHM in 2010 hh | -0.313** | -0.244*** |
| | (0.124) | (0.057) |
| A married PHHM in 2010 hh | -0.442*** | -0.303*** |
| | (0.056) | (0.048) |
| Max years of education of PHHM in this 2010 hh | 0.080*** | 0.034*** |
| | (0.007) | (0.007) |
| Number of PHHMs in this 2010 hh | 0.033 | -0.057** |
| | (0.045) | (0.023) |
| (logged) hh per capita consumption in 1991 (in 2010 TZS) | -1.029*** | -0.801*** |
| | (0.049) | (0.051) |
| Number of observations | 1,075 | 1,171 |
| $R^2$ | 0.487 | 0.346 |
| Adjusted $R^2$ | 0.473 | 0.330 |

*note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parenthesis. Regressions include baseline village fixed effects and variables controlling for household characteristics at the baseline. PHHM refers to previous household member (i.e. person interviewed at the baseline).*

**Table 8: Network shocks in migrant and non-migrant households**

| Dependent variable: (logged) per capita consumption growth | **Migrant households** | **Non-migrant households** |
|---|---|---|
| | **1** | **2** |
| | **OLS** | **OLS** |
| Shock | -0.090** | -0.086*** |
| | (0.044) | (0.028) |
| Number of non-migrant hhs that experienced a shock in the network | -0.047** | -0.031 |
| | (0.021) | (0.022) |
| Number of migrant hhs that experienced a shock in the network | -0.095*** | 0.002 |
| | (0.034) | (0.026) |
| Number of split-off hhs stayed | -0.021 | -0.020 |
| | (0.018) | (0.013) |
| Number of split-off hhs moved | 0.005 | -0.035* |
| | (0.012) | (0.019) |
| Number of observations | 1,075 | 1,171 |
| $R^2$ | 0.487 | 0.347 |
| Adjusted $R^2$ | 0.473 | 0.331 |

*note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parenthesis. Regressions include baseline village fixed effects, 2010 household level variables capturing characteristics of the previous household members and variables controlling for household characteristics at the baseline.*

**Table 9: Other transactional insurance motives**

| | Migrant households | | |
|---|---|---|---|
| Dependent variable: (logged) per capita consumption growth | **1** | **2** | **3** |
| Shock | -0.081** | -0.108** | -0.090** |
| | (0.040) | (0.044) | (0.044) |
| Number of non-migrant hhs that experienced a shock in the network | -0.039* | -0.019 | -0.063* |
| | (0.023) | (0.068) | (0.036) |
| ***--- Interacted with:*** | | | |
| * Share of land in BLV in total land portfolio | -0.038 | | |
| | (0.062) | | |
| * Number of years since the last PHHM migrated into this hh | | -0.003 | |
| | | (0.005) | |
| * Hh has inheritable land in the baseline village | | | 0.031 |
| | | | (0.047) |
| * Hh member's parent lives in BLV | | | -0.011 |
| | | | (0.052) |
| Share of land in BLV in total land portfolio | 0.275*** | | |
| | (0.074) | | |
| Household does not own land | 0.236*** | | |
| | (0.039) | | |
| Number of years since the last PHHM migrated into this hh | | 0.002 | |
| | | (0.004) | |
| Hh has inheritable land in the baseline village | | | 0.011 |
| | | | (0.073) |
| Hh member's parent lives in BLV | | | 0.034 |
| | | | (0.062) |
| Hh owns land | | | -0.147*** |
| | | | (0.038) |
| Number of split-off hhs stayed | -0.020 | -0.020 | -0.019 |
| | (0.016) | (0.018) | (0.018) |
| Number of split-off hhs moved | -0.009 | -0.007 | -0.007 |
| | (0.012) | (0.012) | (0.012) |
| Number of observations | 1,075 | 1,075 | 1,075 |
| $R^2$ | 0.507 | 0.485 | 0.492 |
| Adjusted $R^2$ | 0.492 | 0.470 | 0.476 |

*note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parenthesis.*
*Regressions include baseline village fixed effects, 2010 household level variables capturing characteristics of the previous household members and variables controlling for the household characteristics at the baseline. BLV refers to baseline village, NW to network, PHHM to previous household member (i.e. person interviewed at the baseline).*

**Table A1: First-stage regression results of Column 3 in Table 6**

| Dependent variable: (logged) hh per capita consumption in 1991 | |
|---|---|
| **Included instruments:** | |
| Shock | -0.015 |
| | (0.017) |
| Number of split-off hhs stayed | 0.022*** |
| | (0.005) |
| Number of split-off hhs moved | 0.009 |
| | (0.006) |
| Age of oldest PHHM in the 2010 hh | 0.002** |
| | (0.001) |
| A PHHM is head of this 2010 hh | 0.000 |
| | (0.025) |
| A PHHM is spouse of this 2010 hh's head | 0.034 |
| | (0.028) |
| A PHHM is child of this 2010 hh's head | 0.003 |
| | (0.033) |
| A divorced PHHM in 2010 hh | -0.065 |
| | (0.041) |
| A widowed PHHM in 2010 hh | -0.028 |
| | (0.034) |
| A married PHHM in 2010 hh | -0.043* |
| | (0.023) |
| Max years of education of PHHM in this 2010 hh | 0.013*** |
| | (0.003) |
| Number of PHHMs in this 2010 hh | -0.029* |
| | (0.015) |
| Natural log value of assets in 1991 | 0.077*** |
| | (0.011) |
| Education of hh head in 1991 | 0.024*** |
| | (0.006) |
| Head was male in 1991 | 0.173*** |
| | (0.042) |
| Age of hh head in 1991 | 0.005* |
| | (0.003) |
| Age of head squared | 0.000 |
| | (0.000) |
| Males 0-5 years in 1991 | -0.075*** |
| | (0.009) |

**Table A1: First-stage regression results of Column 3 in Table 6**

| | |
|---|---|
| Males 6-15 years in 1991 | -0.041*** |
| | (0.007) |
| Males 16-60 years in 1991 | 0.018** |
| | (0.008) |
| Males 61+ years in 1991 | -0.145*** |
| | (0.035) |
| Females 0-5 years in 1991 | -0.039*** |
| | (0.010) |
| Females 6-15 years in 1991 | -0.025*** |
| | (0.007) |
| Females 16-60 years in 1991 | -0.015** |
| | (0.007) |
| Females 61+ years in 1991 | -0.032 |
| | (0.021) |
| Hh had a non-earth floor in 1991 | 0.259*** |
| | (0.024) |
| **Excluded instruments:** | |
| (Negative rainfall deviation) * (Age of hh head in 1991) | 0.005** |
| | (0.002) |
| (Negative rainfall deviation) * (Education of hh head in 1991) | 0.035** |
| | (0.015) |
| (Negative rainfall deviation) * (Head was male in 1991) | 0.294*** |
| | (0.108) |
| Number of observations | 2,246 |
| $R^2$ | 0.229 |
| Adjusted $R^2$ | 0.201 |
| *Under-identification test:* | |
| Kleibergen-Paap rk LM statistic | 49.02 |
| p-value | 0.000 |
| *Weak identification tests:* | |
| Cragg-Donald Wald F Statistic | 15.84 |
| Kleibergen-Paap rk Wald F statistic | 19.36 |
| *Over-identification test:* | |
| Hansen-J statistic | 1.862 |
| p-value | 0.394 |

*note: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors are in parenthesis. Regression includes baseline village fixed effects. PHHM refers to previous household member (i.e. person interviewed at the baseline).*