Chop Time, No Friends
Intrahousehold and Individual Insurance Mechanisms in Southern Ghana

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Abstract

Poor people in the rural areas of developing countries face a risky environment that increases their vulnerability to poverty. This paper follows the existing literature on consumption smoothing and risk-sharing and tests whether the household as a unit is fully insured within the village. I find that whether or not the hypothesis of full insurance is rejected depends on whose reports of total household expenditure I use. However, given the nature of relations between husbands and wives in these households the household may not be the appropriate unit of analysis. I test for, and reject, risk pooling within the household. I then identify the appropriate risk sharing group for the individual. Women pool their risk with other women in the village while men have a wider and less defined risk pool. These tests for insurance show consumption for these households and individuals to be fairly insensitive to shocks and I investigate how this is achieved. Results from transfer data show that transfers from the spouse and the extended family are not responsive to shocks, while those from non-family friends are.

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The fact that West African marriage bears so little resemblance to European marriage, in terms both of the domestic economy of the household, and of day to day social activities, receives insufficient emphasis in the literature. Spouses usually enjoy little everyday companionship except, perhaps, when they grow old: they rarely sit and converse; they eat separately; they tend to have separate ceremonial and recreational activities. Considering that they are rarely seen walking down a path together, it is no wonder that they seldom work jointly to produce crops which either party may sell, or toil alongside each other on the fields. Hill, 1975, p.124

Introduction

The title of this paper comes from a sign painted on the front of a lorry that plies the road between Accra and Nsawam in Southern Ghana. The most common interpretation of the statement is that when it is “chop time”, i.e. time to eat, one wishes friends were not around to share in the food. This paper examines this assertion through a test for mutual insurance at a number of levels using data from a two year rural survey in Ghana. Using measures of expenditures and shocks at the household level I find that which household member is reporting the total household expenditure determines whether or not I can reject the hypothesis of full insurance. Using women’s reports of total household expenditure, I cannot reject this hypothesis, but the sum of the husband’s and wife’s own reports results in a rejection. In an effort to provide further evidence as to whether or not households act as a single unit, I also test for risk pooling within the household. This is rejected and shown to be robust to measurement error bias. I then seek to identify the appropriate risk pooling group(s) for individuals. Evidence is mixed, but it appears that women insure with their own gender group while men have a number of potential groups where full insurance cannot be rejected.

These tests for insurance show consumption to be fairly well insulated from unexpected shocks. In order to identify the mechanisms by which this is achieved, I test the responsiveness of transfers to shocks. Spouse to spouse transfers do not respond to shocks, confirming my results from the test for insurance. Transfers from extended family members also do not respond to shocks. However, transfers from non-relatives do respond to shocks, albeit at a low level relative to the magnitude of the shock. I also provide some preliminary evidence that assets may be used to smooth consumption, but only in the case of very large shocks.

The paper is structured as follows. Section one reviews the relevant literatures exploring mutual insurance and the modeling of household allocation. Section two describes the model that will be used to test for insurance and to identify the mechanisms used to smooth consumption. Section three discusses the data that is used in estimation. Section four discusses the estimation strategy and presents results. Section five concludes and provides some policy implications.

I. Relevant Literature

Rural people in developing countries face not only the dilemma of poverty but poverty that is exacerbated by risk. Often starting from an income level close to subsistence, farmers face unexpected variations in income that can come from a variety of factors endemic to the environment. Their income is affected by variations in weather, pests, plant disease, theft, and other unforseen events. This environment can also affect their livelihood more directly though the prevalence of diseases and illness that are associated with inadequate access to clean water and basic health care. The ability of these households to cope with these risks is critical not only to their continued productivity but sometimes to their very survival.

A large literature in economics has evolved to examine how households cope with risk. The first stage in this examination is to examine how significantly risk affects consumption. The initial theoretical work was provided by Diamond (1967) and Wilson (1968). Based on this work, Mace (1991), Cochrane (1991), and Townsend (1994) develop a test for the Pareto efficient allocation of risk. Their test, simply put, is to see if household consumption varies with idiosyncratic shocks while also co-moving with average consumption (my model, developed in section II, will use a similar test and expand it to cover allocation within the household). Mace (1991) and Cochrane (1991), using data from the United States, find evidence that many subsets of consumption show evidence of efficient risk sharing, although Mace (1991) rejects this hypothesis for certain categories of consumption and preference specifications. Using data from rural India, Townsend (1994) rejects the hypothesis of perfect insurance but finds that own income does not have a large effect on consumption. After correcting for measurement error and other possible sources of bias, Ravallion and Chaudhuri (1997) find similar results for the same area. Deaton (1992a) also finds an absence of complete risk pooling in villages in Cote d'Ivoire. Grimard (1997) studies the same area as Deaton and uses similar techniques. However Grimard posits, based on anthropological evidence, that the correct risk pool is not the village but rather the ethnic group. He finds more risk pooling than Deaton but still does not find perfect risk pooling. In another approach to examining diverse patterns of risk pooling, Jalan and Ravallion (1999) show that in China the effect of shocks on consumption varies with wealth and that poorer households show greater variance in consumption. However, no group in their sample shows perfect insurance. Another body of literature that examines the question of consumption smoothing centers around testing the permanent income hypothesis in both developed and developing countries. Alderman and Paxson (1992) discuss ways to distinguish between perfect insurance and the permanent income hypothesis, and Ligon (1998) provides a nested test of these two regimes as well as a private information regime including moral hazard.

How is this partial risk sharing achieved? A much more extensive literature examines the individual mechanisms that households use and I will only discuss selected papers here (Alderman and Paxson (1992) and Besley (1995) provide more comprehensive reviews). Transfers from relatives provide a likely candidate, particularly given the importance of extended family structures in developing countries and in West Africa in particular. Rosenzweig (1988) provides evidence that rural households in India use transfers to smooth consumption and that they prefer to use this mechanism instead of credit. Morduch (1991) also uses data from India and shows that transfers may reduce risk by forty to ninety percent. Rosenzweig and Stark (1989) show that the formation of insurance networks may affect the process of household formation. Using data from India, they show that spouses are often selected from other communities in order to provide a non-covariate risk pool.

Credit markets might provide another risk sharing mechanism. Udry (1994) uses data from Nigeria that shows state contingent repayment loans are used as an insurance mechanism. While this provides a significant buffer against consumption variation, Udry also rejects the hypothesis of perfect insurance. If we broaden the notion of credit to include precautionary savings or the use of savings as a self-insurance mechanism, we cross over to the case where behavior may be better characterized by the permanent income hypothesis. Deaton (1992b) uses this framework to examine savings patterns in Cote d'Ivoire. He concludes that savings may be used by farmers to smooth income over time but this is behavior more likely due to farmers having private information about their future than indicative of behavior in line with the permanent income hypothesis. Paxson (1992) shows that farmers in Thailand save more out of their transitory income in order to secure a smooth consumption path. Beyond credit, households could choose other options for dealing with risk. Rose (1995) and Kochar (1999) show that labor supply is used by farmers in India to smooth consumption in the face of agricultural shocks.

All of these analyses are conducted at the household level. If we believe that households act as a single unit (as in Becker (1993)), then it does not matter whether we analyze consumption and risk at the individual or the household level. However, a growing literature in economics questions and tests this assumption in both the less and more developed countries. Most of the alternatives that have developed to the unitary approach fall under the general rubric of collective household models. Bourguignon and Chiappori (1992) offer a succinct explanation: "the various contributions that follow the collective line share a fundamental option, namely that a household should be described as a group of individuals, each of whom is characterized by particular preferences, and among whom a collective decision process takes place." This class of models contains a wide range of possible decision process within the household, and makes only the assumption that the allocation process is Pareto efficient (Browning, et. al. (1994), Browning and Chiappori (1994), Chiappori (1992), and Chiappori (1988)). Note that the broad class of collective models includes the unitary model as a particular case. While this general framework does not assume a particular form of preferences nor any prior hypotheses on the sharing rule, the theory does yield a testable result, i.e. that the Slutsky matrix need not be symmetric (as it would be for individuals).

A more restrictive class of collective models is comprised of those that represent intrahousehold allocation as the outcome of a cooperative bargaining process (Manser and Brown (1980), McElroy and Horney (1981), and McElroy (1990)). This approach begins to provide a more concrete framework for the analysis of power -- as McElroy (1990) notes: "a key issue that separates bargaining from neoclassical models is the treatment of income: in neoclassical models only pooled family income matters; in the bargaining approach who has control over the various income sources matters." In this approach, individuals form a household when their utility from doing so is greater than their utility in isolation. To determine the distribution of the gains from union, individuals engage in a process of Nash bargaining. The opportunity cost of family membership, or threat point, determines the relative strength of a household member in the bargaining process. These threat points are determined by the extra environmental parameters (EEPs) which determine the utility attainable outside of marriage.

An alterative approach is provided by non-cooperative game theory. The non-cooperative approach is similar to the collective approach in that it also does not presuppose income pooling (Carter and Katz (1997), Lundberg and Pollak (1993, 1994, 1995)). It treats individuals as "autonomous subeconomies" who exchange transfers and also have a vector of commonly consumed goods. Individuals' actions are conditioned on the actions of the other household member and thus a Nash equilibrium is used as the solution concept. These models do not necessarily imply a Pareto optimal outcome (although it can be one possible equilibrium). Lundberg and Pollak (1993) use this literature to make an adjustment to the bargaining models. They note that the use of divorce as a threat point is an extreme and unrealistic argument. Instead they propose that the failure of a cooperative outcome will lead to one of a variety of non-cooperative equilibria.

The major way to empirically distinguish the unitary from other collective models of allocation is to use non-labor income. Most of the work in this area tends to reject the income pooling predicted by the unitary model. For example, using data from Brazil, Thomas (1990) shows that mother's and father's income do not have equal effects regarding nutrient intake, fertility, child survival, and child weight for height. In similar on-going work on Taiwan, Thomas and a co-author also reject the unitary model based on consumption patterns. Early tests for Pareto efficiency, however, do not reject the hypothesis that intrahousehold allocations are efficient. Another rejection of the unitary model based on expenditures in Cote d'Ivoire can be found in Hoddinott and Haddad (1995). Lundberg, et. al. (1995) use a natural experiment -- the shift of child benefit payments from father to mother -- to examine the income pooling hypothesis in the United Kingdom. They reject the unitary model as evidence shows that the shift in recipient led to greater expenditure on women's and children's goods. Using consumption data, a number of papers have found grounds to reject the unitary model. Browning and Chiappori (1994) test household demands for symmetry in the Slutsky matrix. They find that this condition does not hold for two member households but does hold, as it should, for single member households. Browning, et. al. (1994) also reject the unitary model of the household with evidence that intrahousehold allocation is affected by relative ages, incomes, and the total expenditure of the household.

When the examination of intrahousehold models turns to production, it is easier to examine Pareto efficiency. Pareto efficient production implies that there would be no gains from redistributing household resources say, from men's fields to women's fields. Using data from Burkina Faso, and controlling for possible reallocations due to risk as well as measurement error, Udry (1996) and Alderman, et. al. (1995) find that allocations are not Pareto efficient and that the value of household output could be increased some 10 to 20 percent by reallocating existing inputs. This result provides for a rejection of not only the unitary model, but many of the collective models. More recent work has sought to test the efficiency of households by focusing on how risk is allocated. Dercon and Krishnan (1998) use data from Ethiopia to estimate the effects of health shocks on nutritional status. They reject full insurance at the household level. Doss (1998) uses rainfall data from Ghana to estimate transitory income and shows that these shocks affect household expenditures differentially based on who within the household sustains the shock.

The notion of a unitary household has long been questioned outside of economics. Papers such as Guyer and Peters (1987) indicate a number of ways in which to challenge the unitary model. Studying the particular case of rice farming in the Gambia, Carney and Watts (1990) provide a case study of the dynamics of intrahousehold bargaining and power. Much of the literature on West Africa indicates that men and women keep separate accounts and even operate in separate economies (see Hill (1975) for an overview). Zwarteveen's work in Burkina Faso (1996) documents separate asset streams and income areas for men and women. Karanja-Diejomaoh (1978) provides extensive detail on couples in Lagos, Nigeria and shows that they maintain separate bank accounts about which the spouse is almost always unaware, have incomes (often in the formal sector) that the spouse cannot estimate, and that males have little idea about the extent of their wives' contribution to household expenditures. The reasons for this often mutual ignorance seems to be to protect their own income from the demands of the spouse. Oppong (1971) indicates that the separation of economic activities and ignorance of each other's income is also a characteristic of households in Accra. She (in this and subsequent work) argues that: "...the financial aspect of the conjugal relationship exhibited two characteristics, *jointness* as regards husbands' and wives' financial provision for their households and *segregation* with regard to spouses' financial management and ownership of property" (184).

With whom then do men and women share information and economic activities with? The kin, especially the clan or lineage, is the oft-cited example. Indeed, this serves as the basis for Grimard's (1997) work and this explanation is cited by a number of non-economists who have worked directly on Ghana (see for example, Fortes (1950) and Feldman and Feldman (1978)). However, others such as Addai-Sundiata (1996) cite economic change as an important factor in the breakdown of some important aspects of the traditional kinship network. Economists who have considered transfers as insurance in the context of the dynamics of agricultural change also warn that we might see results like this. Rosenzweig (1988) in his work on India argues that technical change may change the distribution of risks. This would drive a wedge between family members who are farming different crops, while allowing for more robust contracting between members of the same farming (or income generating activity) cohort. In our area, the recent surge in pineapple production, with its vastly different production technology, could be generating this type of effect.

Organizations consisting of members of the same gender may provide the needed alternative to the clan in these times of economic change (see Wipper (1984) for a discussion of women's voluntary groups in Sub-Saharan Africa). Aryeetey's (1995) work on seed technology diffusion in the Ada area of Ghana provides a case where men transmit information mainly to each other and seem to have a separate and distinct network from women. In the area this paper studies there are a number of gender based organizations around production (for example a male farmers cooperative). Many of the women (but few of the men) generate off-farm income through marketing activities and the market provides an important social and economic locus for the women. These joint activities can spawn insurance networks. One example is an organization called the Women's Committee. Consisting of 120 members, one of its chief functions was to provide assistance to a member if a relative passed away (note that a funeral is a significant expense in Ghanian culture). In the end, though, such organizations are only indicative. Recall Hill's words (above), a woman is more likely to spend more of her time and activities with fellow women than her spouse or other men and the same is true for her husband, and so structured organizations may be unnecessary.

This section has discussed how a critical component in individual welfare might be measured and examined. Informal insurance provides a critical buffer for poor households in the risky agricultural environment of developing countries. What this paper will do is look behind the household door to see how individuals cope with risk. Households in West Africa are divided into male and female spheres and in order to better understand the welfare of their members it is necessary to understand to what degree they share risk. When I find that they do not share it with each other, I turn to the institutions and social networks that exist outside of the house — particularly those based in gender and the abusua (clan).

II. The Model

II.A. Households

I begin with a model similar to that of Townsend (1994) in order to examine the Pareto efficient allocation of risk at the village level. There are H households in the economy with I members in each household. I will define the household as the marital union so that there are two members: i and j. We can represent their consumption as:

$$C_{hst} = c_{hist} + c_{hjst} \tag{1}$$

Household income is:

$$Y_{hst} = y_{hist} + y_{hjst} \tag{2}$$

There are S possible states of the world that occur with probability π_s. Over time, households discount consumption at a discount rate of β. A Pareto efficient allocation of risk can be characterized by the following problem:

$$\max_{C_{hst}} \sum_{h=1}^{H} \lambda_h \sum_{t=1}^{T} \beta^t \sum_{s=1}^{S} \pi_s U(C_{hst}) \tag{3}$$

subject to:

$$\sum_{h=1}^{H} C_{hst} = \sum_{h=1}^{H} Y_{hst} \tag{4}$$

and

$$0 < \lambda_h < 1, \quad \sum_{h=1}^{H} \lambda_h = 1 \tag{5}$$

where λ_h is the programming weight assigned to household h. The solution yields:

$$\lambda_h U^{/}(C_{hst}) = \lambda_l U^{/}(C_{lst}) \tag{6}$$

across all households. Now let us assume that households have the exponential utility function (where preferences are separable over time and state):

$$U(C_{hst}) = -\frac{1}{\sigma} e^{-\sigma C_{hst}} \tag{7}$$

We can rewrite equation (6) as:

$$C_{hst} = C_{lst} - \frac{1}{\sigma} \ln(\frac{\lambda_l}{\lambda_h}) \quad \forall \; h,l \tag{8}$$

Summing across households we get:

$$C_{hst} = \frac{1}{H}\sum_{l=1}^{H} C_{lst} + K_h \quad \forall \; l \neq h \tag{9}$$

where K_h is the average sum of the differences in programming weights. Equations (8) and (9) indicate income should not matter for current consumption. Now suppose income is defined as:

$$Y_{hst} = \overline{y}_h + x_{hst} \tag{10}$$

where x represents an i.i.d shock of mean zero, representing the transitory shocks that these rural Ghanaian households experience. As a test of perfect insurance I add current income as an exclusion restriction to equation (9):

$$C_{hst} = \beta(\overline{y}_h + x_{hst}) + \alpha\frac{1}{H}(\sum_{h=1}^{H} C_{lst}) + \Phi K_h \quad \forall \; l \neq h \tag{11}$$

Taking the difference over time yields:

$$C_{hst} - C_{hst-1} = \beta(x_{hst} - x_{hst-1}) + \alpha(\bar{C}_{st} - \bar{C}_{st-1}) + \varepsilon \qquad (12)$$

where $\bar{C}_{st}$ is the village mean consumption at time t in state s and ε is i.i.d. measurement error.

If households are perfectly insured, individual shocks will not affect their consumption. Rather, their consumption will move with the village average. Hence, full insurance implies that $\beta=0$ and $\alpha=1$. This is the equation to be estimated. Note that α will be one in any sample, regardless of risk sharing. I will use the "left-out" mean, i.e. the mean will be calculated separately for each household and not include that household. With perfect insurance, α will remain one, but if households are imperfectly insured α will be less than one.

II. B. The Individual Problem

It may be that there are issues of inefficient resource (or risk) allocation within the household. Hence, we can break this analysis down to look at the individual level problem; both within and beyond the household.

II. B. 1. The individual in the household.

We have two individuals, i and j, living in the same household. Again, there are S possible states of the world that occur with probability π_s. Over time, with a discount rate of β, we can write the individual's expected utility from consuming a vector of goods, c_{ist}, as:

$$\sum \beta^t \sum \pi_s U(c_{ist}) \qquad (13)$$

Let λ_{hi} be the programming weight assigned to individual i in household h. If we denote the other member of the household as j, then a Pareto efficient allocation of risk within the household can be characterized by:

$$\max_{c_{hist} c_{hjst}} \lambda_{hi}\left(\sum_{t=1}^{T} \beta^t \sum_{s=1}^{S} \pi_s U(c_{hist})\right) + (1-\lambda_{hi})\left(\sum_{t=1}^{T} \beta^t \sum_{s=1}^{S} \pi_s U(c_{hjst})\right) \qquad (14)$$

subject to the following constraint:

$$y_{hist}+y_{hjst}=c_{hist}+c_{hjst} \quad \forall s,t \tag{15}$$

This program yields the first order condition:

$$\lambda_{hi}U^{/}(c_{hist})=(1-\lambda_{hi})U^{/}(c_{hjst}) \quad \forall s,t \tag{16}$$

If we assume that each consumer has the following exponential utility function:

$$U(c_{hist})=-\frac{1}{\sigma}e^{-\sigma c_{hist}} \tag{17}$$

Then the optimal consumption of both husband and wife at a given time is:

$$c_{hist}=c_{hjst}-\frac{1}{\sigma}\ln(\frac{1-\lambda_{hi}}{\lambda_{hi}}) \quad \forall s \tag{18}$$

Thus consumption in the household should move directly together. We can represent their income at a given point in time as the sum of an average component and a shock, x, which is i.i.d. and has a mean of zero:

$$y_{hist}=\overline{y}_{hi}+x_{hist} \tag{19}$$

Equation (18) indicates that the value of this shock should not matter to the consumption of person i in state s. In order to test for perfect insurance, we can add this as an exclusion restriction to equation (18) which can now be written as:

$$c_{hist}=\alpha c_{hjst}+\beta(\overline{y}_{his}+x_{hist})+\varphi\frac{1}{\sigma}\ln(\frac{1-\lambda_{hi}}{\lambda_{hi}}) \tag{20}$$

Taking the difference of consumption over time, we have:

$$c_{hist} - c_{hist-1} = \alpha(c_{hjst} - c_{hjst-1}) + \beta(x_{hist} - x_{hist-1}) + \varepsilon \qquad (21)$$

where ε is i.i.d measurement error. Given our theoretical results, the coefficient on the idiosyncratic shocks, β, should be zero if the individual has perfect insurance.

II. B. 2. The individual within the village

Suppose that individuals instead pool risk at the village level, with individuals other than (or in

$$\max_{c_{hist}} \sum_{h=1}^{H} \sum_{i=1}^{I} \lambda_{hi} (\sum_{t=1}^{T} \beta^t \sum_{s=1}^{S} \pi_s U(c_{hist}) \qquad (22)$$

addition to) their spouse. We can rewrite their optimization problem (equation (14)) as:

subject to:

$$\sum_{h=1}^{H} \sum_{i=1}^{I} y_{hist} = \sum_{h=1}^{H} \sum_{i=1}^{I} c_{hist} \qquad (23)$$

Solving and taking the difference over time, yields:

$$c_{hist} - c_{hist-1} = \alpha(\overline{c}_{st} - \overline{c}_{st-1}) + \beta(x_{ist} - x_{ist-1}) + \varepsilon \qquad (24)$$

where $\overline{c}_{st}$ is the village average consumption.

II. b. 3 The individual in the gender group and the clan

Suppose all i's belong to group 1, and the j's to group 2. The problem is now:

$$\max_{c_{hist}} \sum_{h=1}^{H} \lambda_{hi} (\sum_{t=0}^{T} \beta^t \sum_{s=1}^{S} \pi_s U(c_{hist}) \quad for\ i = 1,2 \qquad (25)$$

subject to:

$$\sum_{h=1}^{H} y_{hist} = \sum_{h=1}^{H} c_{hist} \tag{26}$$

and

$$0 < \lambda_{hi} < 1, \quad \sum_{h=1}^{H} \lambda_{hi} = 1 \tag{27}$$

Using the exponential utility function, the optimal consumption for individual i is:

$$c_{hist} = \frac{1}{H}\sum_{h=1}^{H} c_{hjst} + \frac{1}{\sigma}(\ln\lambda_{hi} - \sum_{h=1}^{H} \ln\lambda_{hj}) \tag{28}$$

As before, we can add the restriction of income, and take the difference over time to arrive at:

$$c_{hist} - c_{hist-1} = \alpha(\bar{c}_{st} - \bar{c}_{st-1}) + \beta(x_{ist} - x_{ist-1}) + \varepsilon \tag{29}$$

where $\bar{c}_{st}$ is the average consumption for each separate gender group. The extension to clans is straightforward. Instead of allowing for only two groups, we allow the number of groups to equal the number of clans. The results indicate that consumption should be unaffected by idiosyncratic shocks and vary with average clan consumption.

II. C. Coping Mechanisms

The most likely mechanism for coping with risks across states at a given time is transfers[1]. Future sections in this work will directly incorporate credit and assets.

II. C. 1. Transfers within the household

In order to incorporate transfers into the model, we can rewrite (19) as:

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[1] Udry (1990, 1994) indicates that credit may provide a valuable contemporaneous insurance mechanism in the West African village setting. Future versions of this paper will examine this.

$$y_{hist} = \bar{y}_{hi} + x_{hist} + \tau_{hist} \qquad (30)$$

where τ_{is} is person i's net transfer to his or her spouse in state s. Solving the optimization problem as before, the optimal level of transfers within the household is

$$\tau_{hist} = \frac{1}{2}(y_{hjst} - y_{hist}) + \frac{1}{2}\sigma \ln\left(\frac{\lambda_{hi}}{1-\lambda_{hi}}\right) \quad \forall s,t \qquad (31)$$

where y includes both the transitory (x) and permanent parts of income. We can see then that transfers should compensate directly for any idiosyncratic shocks to income (in this case at ½ of the shock). Taking the difference of this equation over time gives the equation to be estimated:

$$\tau_{hist} - \tau_{hist-1} = \frac{1}{2}(x_{hjst} - x_{hjst-1}) - \frac{1}{2}(x_{hist} - x_{hist-1}) \quad \forall\ s \qquad (32)$$

II. C. 2. Transfers within the community

We can rewrite (19) as:

$$y_{hist} = \bar{y}_{hi} + x_{hist} + \omega_{hist} + \tau_{hist} \qquad (33)$$

Where ω represents transfers from persons outside of the household. Adding up across households and solving for the optimal level of transfers we have:

$$IH \cdot (\tau_{hist} + \omega_{hist} + \bar{y}_{hi} + x_{hist}) = \sum_{l=1}^{H} \sum_{j=1}^{I} \tau_{jlst} + \omega_{jlst} + \bar{y}_{jl} + x_{jlst} + K_{jk} \qquad (34)$$

where K is again the difference in programming weights. We can rewrite this as:

$$(\tau_{hist} + \omega_{hist}) = \frac{1}{IH}\left(\sum_{l=1}^{H} \sum_{j=1}^{I} \tau_{jlst} + \omega_{jlst} + \bar{y}_{jl} + x_{jlst} + K_{jk}\right) - \bar{y}_{hi} - x_{hist} \qquad (35)$$

which indicates that the transfers that one receives are a function of the difference of the individual shock from the average.

Taking the difference over time we have:

$$(\omega_{hist}-\omega_{hist-1})+(\tau_{hist}-\tau_{hist-1})=\beta(x_{hist}-x_{hist-1})+\alpha(\bar{x}_{st}-\bar{x}_{st-1})+\varepsilon \qquad (36)$$

where $\bar{x}_{st}$ is the group mean. This is the equation to be estimated.

III. The Data

In order to estimate the changes in consumption and transfers as a result of shocks, we need data on these over time. All the data used in this paper comes from a two year rural household survey in southern Ghana supervised by Christopher Udry and myself. Before discussing the data that I will use in estimation, it is worth discussing the study area and the broader design of the survey.

The survey was carried out from November 1996 to October 1998 in the Aukapim South District of the Eastern Region of Ghana. This area is a dynamic agricultural region. In addition to the staple maize and cassava crops that make up the bulk of agricultural production, many farmers have started to grow pineapple for export and domestic processing. The staple crop agricultural system is based on two seasons, a major season, stretching from March to July, and a minor season from September to December. Pineapple does not need to adhere to this growing season, and hence it shows a less pronounced seasonal variation.

Within this area, we identified four village clusters with a variety of market conditions and cropping patterns. Within each village, we randomly selected 60 married couples (or triples) to be interviewed (in those villages where there was more than 60 resident couples). Enumerators then interviewed the male and female respondents separately. Each person was interviewed 15 times during the course of 2 years. A list of the rounds, their dates, and the questionnaires administered is in Appendix 1.

III. A. Consumption

In order to estimate consumption, I use data from 3 expenditure questionnaires administered thrice during the two years of survey work. These questionnaires covered food consumed from own farms, purchased food, and other (family) expenses. This provides expenditure information but not assigned consumption. However, a number of goods are clearly assignable in that their consumption is private. These are alcoholic beverages, non-alcoholic pre-packaged beverages, prepared food (from kiosks), personal care products, hair cuts, public transport, petrol, car repairs, books, newspapers, entertainment, lottery tickets, and kola nuts. Table 1 presents summary statistics on total expenditure on these goods, by village. These data do not include Village 1 because I discovered that the enumerator conducting the interviews for round 4 and round 8 consistently under-covered certain expenditure categories.

Table 2a provides total monthly household expenditure. This includes all expenditures as well as food harvested from the household farms[2]. Given an average household size of 5.6 and an exchange rate of approximately 2100 cedis to one dollar, annual expenditure per capita is around $600. Table 2b contains estimates of total household food expenditure (again including own harvests). Food expenditure accounts for about 65 percent of total expenditure.

In an effort to capture information flows within the household, we asked both spouses to provide not only their own expenditure but also estimates of their spouses' expenditure. The male enumerators initially encountered problems implementing this, so coverage is not complete. Nonetheless, we have at least two (own and female) and sometimes three estimates of each expenditure. Thus, Tables 2a and 2b also provide estimates of total and food expenditure constructed using only the women's reports. Note that the female reports are much lower, which seems to be because they were reporting only the expenditure they knew about. This may be indicative of the level of private information within the household[3].

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[2]This includes harvest and expenditure from household members other than the husband and wife — which is quite small.

[3] We can rule out the hypothesis that the higher own report totals are caused by double counting as men and women report significantly different structures to expenditure.

III. B. Shocks

I have two different measures of shocks. First, there are illnesses. We asked respondents to recall major illnesses[4] and the cost of any related treatments. We asked for this information at two points: first in March 1998 (round 11) and then again in August-September 1998 (round 15). The second measure of shocks is unexpected agricultural shocks. These include pests, plant diseases, theft, and other events. We asked the respondents about these at three different times during the survey; two of these corresponded with the questions on illness, the third was in July 1997 (round 6). Thus, I construct the two periods of shocks to roughly correspond to the administration of the expenditure questionnaires. I use illness in the period spanned by rounds 1 to 4 and rounds 8 to 12. I use agricultural shocks in the period from round 1 to 6[5] and from round 8 to 12.

In rounds 11 and 15, we asked respondents to describe the shock, its severity (ranked from 1 to 5), the proportion of the plot affected and the estimated value of the damage. The value of the damage provides the needed monetary measure of a shock to compare to the change in consumption. Unfortunately, we did not ask for the value of the shock in the period up to round 6. Thus, in terms of the model, I have the value of x_{it} but not the value of x_{it-1}. However, I can use the data from the later rounds to estimate the value of the shocks. In order to do this, I posit that the value of the damage is a function of the severity of the shock, the village where it occurred, the primary crop on the field, the toposequence of the field affected, and the soil type. I estimate this value damage function using the plots which reported a shock in either the round 11 or round 15 questionnaires. The results of this estimation are in Table 3. Using these results, I can create an estimated value of the shock for x_{it-1}. Using the coefficients provided by the first stage estimation, we have the estimated value of damage due to agricultural shocks to round 6.

[4]We defined major illnesses as those that resulted in medical expenses and/or resulted in missed work.

[5]This leads to the inclusion of shocks beyond the consumption period, which may create noise and lower the reliability of the results.

This, as well as reported values for the other shocks is in table 4[6]. As we can see from the statistics, mean shocks can represent a significant proportion of the mean household expenditure. Moreover, if we add one standard deviation to the mean, shocks can represent in excess of one month's total household expenditure in the first six rounds, and approximately 80 percent of expenditure in the round 8 to 12 period.

The estimation of the early shocks leads to the problem that x_{it-1} is now measured with error. I can treat this as a problem of errors in variables and calculate the reliability ratio from the first stage to adjust the standard errors in the second stage. However, since the regressions I estimate use a differenced regressor, the standard reliability ratio does not apply. Appendix 2 explains how I derive the reliability ratios for these differenced regressors for use in multivariate regressions.

III. C. Transfers

We collected an extensive panel of data on spouse to spouse transfers. The major transfer between husband and wife is "chop money." This is almost always a male to female transfer that is meant for household food and expenses. The amount is usually determined by the husband, although some of them did indicate that they consulted their wives. Another (more indirect) source of transfers is when the respondent sells produce from their spouse's farm. We collected this data from the respondents over the course of 7 rounds, spaced about six weeks apart. Table 5 shows the mean value of these transfers by round. As we can see, chop money accounts for approximately one tenth of monthly household expenditure. Note though, that as with expenditures, we received different accounts of the amount depending on whom we asked. Men indicated the amount was higher.

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[6]While the round 1 to 6 and 8 to 12 shocks seem to have vastly different values, a large part of the differences seems to be driven by different levels of incidence. There was a much higher number of overall shocks reported in round 6 (289 to 171), and much a higher proportion of these were reported by men.

Unfortunately, we did not collect data on inter-household transfers as frequently. We can use the gifts and transfer questionnaire from rounds 5 and 11 to compare with our shock panel. Recall that our shock data extends from round 1 to 6 and from 8 to 12. This will yield four rounds of shock data preceding each measure of transfers (with two additional rounds in the first period). The gifts data allows us to distinguish between family and non-family transfers but the earlier gifts data does not have a complete listing of the gender of the giver. Table 6 shows the mean values of the transfers for the week preceding the interview. Relative to the monthly spouse to spouse transfers these are small. However, they do have a large range as the maximum and minimum values indicate.

IV. Estimation and Results

In this section I test for perfect insurance in these villages at both the household and individual level. I begin with the test used in almost all of the literature — the household as an insurance unit within the community. I will then examine the intrahousehold dimension of insurance. Since risk pooling is not found within the household, I will examine the possibilities that men and women insure with other individuals in the village at large, or with their gender group or clan. Finally, I examine how responsive transfers are to shocks.

IV. A. The household in the village

In order to examine household consumption insurance, I estimate equation (12). This estimation requires the construction of village average household consumption (through my proxy of expenditure). I do this by calculating the "left-out" mean for each household. That is, the mean on the right hand side for each household is the village mean calculated without the inclusion of the household whose change in consumption I am using. In order to compute household shocks, I sum the male and female reports of their own shocks.

Table 7a reports the results using the female reports of total household food expenditure. Most household surveys in developing countries identify one person (usually the chief shopper who is usually the wife) and ask that person to provide detailed consumption data. Thus, this measure is comparable to most existing data. Table 7a indicates that agricultural shocks (the larger of the two shock measures I use) have, at worst, a small effect on income. Using the confidence interval results, household consumption does not fall by more than 13 percent of the value of an agricultural shock. The results on illness are less precise, and at the 95 percent confidence level, I cannot rule out the hypothesis that consumption falls by the full value of the shock. Table 7a also presents an F-test of the full insurance coefficients (coefficients on shocks should be zero and that of village average consumption should be 1). These results indicate that I cannot reject the hypothesis that households within a village are fully insured.

Results using the sum of husbands' and wives' own reports of food expenditure for household consumption tell a different story. Table 7b provides these results. As before, consumption is fairly unresponsive to agricultural shocks. At the lower bound of the 95 percent confidence interval, consumption will only fall by 5 percent of the value of an agricultural shock. However, a joint test of the perfect insurance model is rejected at the 5 percent level. The only factor driving this result is that there is low comovement in village household consumption, as measured through these own-report totals. Thus, using what may be a more robust measure of household expenditure/consumption produces a qualitatively different result[7].

We can also examine the co-movement of consumption in isolation using the round 8 data, as well as the round 4 and round 12 data used in the test for full insurance. Table 8 provides a household fixed effect estimation of own and female reports of total household consumption on village (left out) mean consumption. These results indicate that both reports move well with the village mean over time. Thus, with a broader sample we might reject this result. Nevertheless, the fact remains that in the period for which I have sufficiently detailed shock data, the own and female reports generate a qualitatively different result.

[7]The varying household differences in information between spouses may be at the heart of the differences in these two results. As spouses conceal additional information from each other, the probability of double-counting in the own reports and under-reporting in the female reports changes. This will be the subject of additional work.

IV. B. Do husbands and wives pool risk?

One way in which we can examine the usefulness of the household as a unit of analysis is to estimate equation (21). This allows us to test the hypothesis that husbands and wives insure each other. In order to estimate (21), I will use private consumption, as defined earlier. The results are in Table 9. These estimates show that individual private consumption is fairly smooth. Agricultural shocks have a negligible effect — at most private consumption falls by 2 percent of the value of the shock. Illness has a larger potential effect. The 95 percent confidence interval indicates that, at worst, 43 percent of the illness shock is passed through to consumption. The results for agricultural shocks seem to hold across genders when I estimate equation (21) separately for men and women (Table 9a). Illness shocks show some difference, with men having a wider confidence interval and a lower coefficient.

Co-movement with the spouse's consumption, however, is rejected in all versions of this estimation. A joint test of the coefficients predicted by the model results in a rejection of the hypothesis of perfect insurance at better than the 5 percent significance level. This leads to the conclusion that the household is the wrong unit of analysis for risk pooling. Despite the fact that husbands and wives farm separate plots and engage in separate economic activities and thus could provide very efficient risk diversification, they do not insure each other. This conclusion may well reach beyond risk. Given the absence of a Pareto efficient pooling of risk within the household, there may be inefficiencies in other areas of household consumption and production.

Before moving to additional analysis, it is worth examining this finding of non-pooling further. The model predicts that the coefficient on spouse's consumption should be one. The results indicate that this coefficient appears to be significantly different from one at the 95 percent level. This result could be caused by measurement error. Suppose that consumption was reported with error so that the consumption observed here is true consumption plus some error, u:

$$c = c* + u, \quad u \sim N(0, \sigma_u^2) \qquad (37)$$

As a result of this error, the estimate of α will be biased towards zero when there are no covariates as follows (Judge, et. al. 1988):

$$plim\,\hat{\alpha}=\frac{\alpha\sigma_{c*}^{2}}{\sigma_{c*}^{2}+\sigma_{u}^{2}} \tag{38}$$

We also know that:

$$\sigma_{c}^{2}=\sigma_{c*}^{2}+\sigma_{u}^{2} \tag{39}$$

where σ_c^2 is the variance of the observed consumption. In order to estimate the extent of the measurement error needed to obtain the result in table 9, I use a univariate version of equation (21) (consumption on consumption) to estimate the variance of the measurement error relative to the observed variance. Without the inclusion of shocks, the estimate of α is -0.06 (t=-0.89), and the model predicts that α should be 1. Substituting these values in for $\hat{\alpha}$ and α, respectively, I can solve for σ^2_{u}:

$$\sigma_{u}^{2}=1.06\sigma_{c}^{2} \tag{40}$$

which is impossible. Thus, I rule out the hypothesis that these results are due to measurement error. So if husbands and wives are not sharing risk with one and another, then with whom are they pooling? The following section examines alternate configurations of the risk pool.

IV. C. Risk pooling between the individual and the community

The most obvious risk pool would be all individuals within the village. Townsend (1994) and others argue that the village provides a natural economic unit; allowing for communication, enforcement, and observability while providing a pool with sufficient variation in idiosyncratic risk. In an effort to test this hypothesis at the individual level, I estimate equation (24). The results are in Table 10. Consumption again appears to be quite smooth, and the confidence interval on the illness shocks is smaller relative to the intra-household and household level test. In a test of the perfect insurance model, I cannot reject the hypothesis of perfect insurance at either the 5 or 10 percent level of significance.

However, there does appear to be some difference in this result by gender. Tables 10a and 10b provide estimates of equation (24) separately by gender. In the case of the male respondents, I can not reject the model of full insurance. Estimates of female consumption provide us with a weak rejection of the model of the full insurance, I can reject the coefficients at the 10 percent level of significance but not a the 5 percent level. We can explore these results through an examination of the co-movement of consumption without considering shocks. Table 11 provides these results for each gender. The male estimates are quite noisy; the confidence interval encompasses both zero and one. The female estimates provide a tighter confidence interval, and it does not include one. Thus, this provides some additional support for the rejection of the hypothesis that women insure with all village individuals.

Given that husbands and wives do not insure each other, that men and women operate in distinct economic activities, and that there are a number of gender-based organizations in these villages, one candidate for the risk pool that I can examine is the own gender group. Table 12 provides an estimate of the change in the respondent's consumption against the left-out mean of his or her own gender group as specified by equation (29). The resulting coefficients and F-test reject the hypothesis of full insurance. However, if we separate men and women, the results are different. Table 12a indicates that I can reject the hypothesis that men fully insure with other men at a 5 percent level of significance. Table 12b shows the opposite to be true for women, I cannot reject the hypothesis of full insurance for women with their own gender group.

I can test respondent's consumption against the village average of the opposite gender group in an attempt to distinguish between the gender group and all village individuals as the insurance group. Tables 13, 13a, and 13b present the results of estimating equation (29) using the opposite gender group average as the mean consumption. In a test of the pooled sample, I cannot reject the hypothesis that there is full insurance with the opposite gender group. However, if I separate men and women, we again get two different stories. The male results fail to reject the hypothesis of perfect insurance with women, largely because the confidence interval on women's average consumption is huge, testimony to the more noisy data from men. The women's result rejects the hypothesis of perfect insurance with the men.

We can draw some tentative conclusions from these results. The regressions for male's insurance fail to reject full insurance with all village individuals but do reject full insurance with their own gender group. The female results reject full insurance with all village individuals (at the 10 percent significance level), cannot reject full insurance among all women, and can reject full insurance with all men. Both of these results could not be true at once — if men are insuring with all village individuals they are insuring with women. One of the implications of the test for village level individual insurance is that individuals insure with all village individuals, they insure with any sub-group of this population. Since I can reject the hypothesis that women insure with men, by extension, we can reject the hypothesis that men insure with all village individuals.

These results, however, do not consider another logical choice for the insurance group: the clan. As noted earlier, the Ghanaian abusua, or clan, provides an important locus for resource sharing and support. The abusua is also not confined to the village, in fact there is significant overlap of the major abusuas between our three villages. We can now estimate equation (29) using this feature of the data. Table 14 presents the results of this estimation using the cross-village abusua average consumption. At first glance, the abusua across villages seems like a good candidate for the risk pooling unit. The results fail to reject the hypothesis that all individuals share risk with their clan. If we separate the regression and run each gender separately, a distinction appears (Tables 14a and 14b). In the case of males, I cannot reject the abusua as the risk sharing unit. However, women do not share their risk with their extended clan. In their case I can reject the hypothesis of perfect insurance at better than 5 percent significance.

I can also combine potential risk pools and examine the possibility that individuals insure with abusua members in their home village only. Tables 15, 15a, and 15b report the results of estimating equation (29) using the village abusua[8] average consumption. In this case I cannot reject full insurance for the pooled sample at the 5 percent significance level. The male result (Table 15a) is less precise, and I again cannot reject that males insure with the abusua. The results for women (Table 15b) indicate a rejection of full insurance with village abusua members at better than 5 percent significance.

Table 16 summarizes the results of this section. There are definite conclusions about how women insure. We cannot reject the hypothesis that they insure with their own gender group within the village, but we can reject the hypothesis that they insure through their abusua either across villages or within their home village. men's results are less conclusive because the data is more noisy. Men may insure with all individuals within the village, however, their rejection of their own gender group makes this unlikely. Men most probably insure with their clan, either across villages or within their home village.

IV. D. Coping through transfers

How do the households cushion their consumption against these shocks? This section looks at the most likely mechanism: transfers. I also provide some exploratory analysis of the possibility that assets are used to smooth consumption along the lines of Paxson (1992) and Udry (1995). Future work will look for insurance through state contingent credit repayment along the lines of the work of Udry (1994).

IV. D. 1. Intrahousehold transfers

Transfers between spouses are much more frequent and, on average, much larger than any other transfers individuals in these villages receive. Thus, these might provide a likely vehicle for insurance. However, as shown earlier, there seems to be no insurance at the intra-household

[8] In this specification, I include all those listing an outside abusua as one group. This makes no difference in the qualitative results.

level. I examine this question using an estimation of equation (32). The data I use includes round by round spouse to spouse transfers (reported separately by the husband and wife) as well as the agricultural shocks reported by each respondent for each round. For this panel of agricultural shocks, values were provided directly by the respondent, so there is no need to use the errors-in-variables correction.

Table 17 provides the results of estimating equation (32) using this panel data. The left side of the table uses the male reports of the net transfers received from the wife and so the shocks refers to male own-shocks, and spouse shocks refer to female reported shocks. The opposite is true for the right side of the table, which uses female reports of net transfers received. None of the coefficients are significant at 5 percent[9] (although lagged male shocks are close), confirming the conclusion that household members do not insure each other. Tables 17a and 17b decompose these transfers into chop money (the principal constituent) and net produce transfers. The only significant coefficient in these tables is on women's reports of produce transfers response to their spouses shocks. Given that these are agricultural shocks, this result is to be expected: the shocks have reduced output. The fact that the male report is not sensitive to this is indicative of their ignorance of the true magnitude of this transfer (as many of the respondents told us). The lack of significant results for chop money is not surprising. When asked what were the factors determining this amount, many of the men cited household demographics and more fixed rules than those we would expect in the presence of insurance.

It is also possible that household members insure each other through shifting expenditures within the household. This is unlikely given the smoothness of own private consumption combined with the results on transfers. I will deal with this more fully in future work, but preliminary analysis of expenditures on children shows them to be equally invariant to male and female shocks.

[9]These results are robust to a specification without lagged shocks.

IV. D. 2. Transfers from outside of the household

In order to estimate the insurance that individuals receive in the form of transfers from outside of the household, I use data from the two transfer questionnaires and combine this with the shock data used to estimate equation (36). Table 18 presents the results using total non-spouse transfers. It appears that there is no insurance provided through transfers for illness from members of the community outside of the household. Agricultural shocks, on the other hand, elicit a significant response as the transfers for the week preceding the interview show an increase equivalent to 1 percent of the value of the shock. Keep in mind that this is a one week recall of transfers against five months of shocks (since the round 6 data does not allow us to identify the date of the shock). As expected, the village individual mean shock has close to an opposite effect to the idiosyncratic shock.

The African family is oft-touted as a strong informal social safety net. I can decompose transfers into family and non-family components in order to examine this assertion. Table 18a presents the results for transfers from all family members. There is weak evidence of support in the case of illness, but neither of the shock coefficients are significant. Table 18b provides the same estimates for transfers from non-relatives. The transfers from non-family respond significantly to agricultural shocks, albeit at a low level. Thus, we can conclude that transfers from not only outside of the household, but outside of the extended family play a significant yet small role in insuring individuals in these villages. In order to determine what makes up for the remaining value of the shock in keeping consumption smooth, I turn to assets.

IV. E. Assets as a Consumption Smoothing Mechanism

These individuals may be using their assets to achieve the smooth consumption observed in the estimates of the insurance equations. In order to provide a preliminary test of this, I estimate an equation similar to that of Paxson (1992). This equation is:

$$A_t - A_{t-1} = \alpha + \beta X_t + \varepsilon \qquad (41)$$

That is, the change in assets is a function of these transitory shocks. This result can be produced through maximizing a quadratic or constant absolute risk aversion utility function over the life of the individual. Note that I assume that permanent income is stationary over this period and that I neglect to control for the life cycle stage of the household[10].

In order to measure assets, I use data from a thrice administered asset questionnaire. This questionnaire asked for all non-land based individual held assets including farm equipment, cloth, stored crops and the like[11]. Table 19 presents summary statistics on these figures for men and women. As we can see, individual assets are quite large. In the estimation of equation (41) I use the change in assets from round 9 to 15. I will also use the shocks reported over the interval from round 8 to round 12 as the dependent variable. The initial estimate of (41) can be found in Table 20. This result indicates that assets may play a significant role. Figure 1 presents the same data used to calculate a nonparametric regression by means of the Nadaraya-Watson estimator using a Epanechnikow kernel[12]. The dispersion between the upper and lower confidence intervals indicates that there is a considerable amount of heteroskedasticity in these data. Table 20a presents a linear regression estimate of equation (41) using White corrected standard errors. Note that the coefficient on agricultural shocks is now insignificant. Thus, the tentative conclusion we can draw from these data is that if assets are used as a smoothing mechanism, it is only at extreme level of shocks (based on a few respondents).

V. Conclusion and Policy Implications

This paper started at the level of the existing literature on insurance in developing countries. Looking at the household's insurance within the village, I initially cannot reject perfect insurance using total expenditure as reported by one member of the household. However, when I use a total calculated from the husband's and wife's reports of their own expenditure for household

[10]Later versions will deal with these issues more explicitly.

[11]We asked for cash holdings, but these data were not reliable data enough to be worth including.

[12]Calculations are based on the algorithm described by Haerdle (1991), Chapter 5.

consumption we can reject full insurance. I then tested the hypothesis that there is full insurance within the household and that households represent an efficient consumption unit. This assumption is used in a wide range of the economics literature including tax policy, education, and welfare analysis, literature well beyond that which deals only with the dynamics of the household. One way to test this hypothesis is to look for risk pooling within the household. My results reject the hypothesis of Pareto efficient pooling within the household, and this conclusion is robust with respect to measurement error. I then searched for the individual's risk pooling group beyond the household. This investigation led to the broad conclusion that men and women exhibit different insurance patterns. Women seem to insure with their own gender group. Men may insure with individuals in the village or, more likely, their clan members within and across villages.

These tests of perfect insurance also show household and individual consumption to be non-responsive to significant agricultural shocks. In an effort to identify the mechanisms by which consumption is smoothed, I examined transfers and assets. Intrahousehold transfers appear to not at all respond to shocks, confirming the results that husbands and wives do not pool risk within the household. Transfers from outside of the household show a small but significant level of response to shocks. Contrary to the conventional wisdom regarding family-based safety nets in Africa, the transfers that respond to shocks come not from the extended family but from non-relatives. Given that transfers can only account for a small percentage of the shock, I also examined the role assets have in smoothing consumption. Preliminary analysis of these data indicate that assets may be used to smooth consumption only in the case of large shocks. Future sections of this work will look at the role other insurance or smoothing mechanisms such as credit and labor exchange play in reducing the variability of consumption.

This work has a number of varied policy implications. First, the fact that qualitatively different results are produced based on whose report of total expenditure is used sounds a note of caution with regard to analysis (and the resulting policies) based on a single household member's report. These households have a high and varied degree of private information, and drawing conclusions that do not take account of this fact can result in biased and incorrect policy. This includes not only the risk faced by the household (or its members) and how well they cope, but also extends to areas such as measuring poverty and designing appropriately targeted education, health, and nutrition programs..

Second, this paper provides evidence that the household is the wrong unit of analysis for risk sharing. Since households do not provide a Pareto-efficient pooling of risk, I can rule out the hypothesis that households act as a single unit. This means that the household is the wrong unit of targeting for many policies. Instead, policy makers would do better to target individuals and treat the household as a locus of many of their consumption and productive activities but not assume that these are efficient (as a household) or flexible. Given these results, a policy such as providing credit or insurance to the "household head" during a risky agricultural season might not filter through to his spouse should she face unexpected events in her own endeavors.

Third, the result that men and women seem to insure in different groups highlights the importance of understanding the separate economies of both genders. In order to reach females, policies targeted at women's groups may be more effective than those aimed at the household. Men may be better reached through their family networks. Further work needs to be done to better define and identify these gender specific groups and what consumption and production activities they involve.

Related to this is the fourth major policy implication. The analysis of transfers shows the importance of social networks and the lack of family support. Support, in times of unexpected financial hardship, comes from outside of the extended family and not from family members. Thus, we need to reconsider the notion of the African family as the traditional safety net and better understand what constitutes this network — be it the gender group, the clan, or some other group.

Finally, both household and individual consumption appear to be fairly unresponsive to shocks.

We need to understand how these households avoid the affects of these shocks on consumption and what the attendant costs (or benefits) may be. For example, if productive assets are sold to avoid a precipitous drop in consumption, what are the long term impacts on individual income and consumption? My future work will identify the consumption smoothing mechanisms used by these villagers. This will have direct implications as to whether or not intervention into the informal insurance market would provide direct welfare benefits.

Appendix 1
Schedule of Surveys
1996-1998

	round														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
date started	11/25	1/27	3/3	4/14	6/2	7/7	8/18	9/29	12/2	1/20	3/16	4/20	6/1	7/6	8/10
	1996	1997								1998					
Questionnaire															
HH roster	ver. 1						ver. 2								
Plot List					ver. 1				ver. 2						
Soil test	quest.								no quest.						
Assets	ver.1								ver. 2						ver. 3
Trading stocks															
Sale of Farm Output		ver. 1						ver. 2		ver. 3					
Sale from spouse's plot															
Plot activities		ver.1								ver. 2					
Work on spouse's plot															
Lending															
Borrowing															
Farm Info			ver. 1			ver. 2									
Non-farm income			ver. 1				ver. 2								
Time allocation															
Plot mapping	ver. 1								ver. 2						
Gifts		ver. 0			ver.1						ver. 2			ver. 3	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Food expenditure				ver. 1								ver. 2			
Own farm food				ver. 1								ver. 2			
Family expenses				ver. 1								ver. 2			
Family background															
Plot ranking								ver. 1		ver. 2					
Marital attitudes										ver. 1			ver. 2		
Learning										ver. 1				ver. 2	
Individual Roster															
Plot status															ver. 2
Events (includes plots)						ver.1					ver. 2				
Added Plot															
Discontinued Plot															
Permanent Labor															
Marital Transfers															
Plot Wrap Up															

Appendix 2
Constructing a reliability ratio for the difference measure of shocks

For the purpose of this discussion, let me disaggregate the shock vector (X) into agricultural shocks (S) and illness shocks (L). Recall that the value of agricultural shocks is reported in period t (S_t) and is estimated in period t-1 (S_{t-1}). In a non-differenced, univariate case, we could construct the reliability ratio from the r-squared of the regression of the estimated damage on the reported damage in period t.

However, I use the following variable for estimation:

$$\Delta S_t = S_t - S_{t-1} \tag{1}$$

Where shocks at t are measured without additional error and shocks at time t-1 are measured with an additional, estimable error component (v_{t-1}) so, given that $S_t \equiv S^*_{t-1}$:

$$S_{t-1} = S^*_{t-1} + v_{t-1} \tag{2}$$

:Thus Δ_t is:

$$\Delta S_t = S_t^* - S^*_{t-1} - v_{t-1} \tag{3}$$

and the variance is:

$$\sigma_x^2 = \sigma_{S_t}^2 + \sigma_{S_{t-1}}^2 - 2cov(S_t^*, S_{t-1}^*) + \sigma_v^2$$

assuming that the variance in true reported shocks is constant over time, the true variance of X is:

$$\sigma_{X^*}^2 = \sigma^2(S_t^* - S_{t-1}^*) = 2\sigma_S^2 - 2cov(S_t^*, S_{t-1}^*) \tag{4}$$

Thus, the reliability ratio of ΔS_t is:

$$RR \ \Delta S_t = \frac{\sigma_{X^*}^2}{\sigma_x^2} \equiv \lambda \tag{5}$$

Now,

$$let \;\; \rho \equiv \frac{cov(S_t^*, S_{t-1}^*)}{\sigma_S^2} \tag{6}$$

So

$$\lambda = \frac{2(1-\rho)\sigma_{S^*}^2}{2(1-\rho)\sigma^{S^{*2}} + \sigma_v^2} \tag{7}$$

and

$$\lambda^{-1} = 1 + \frac{\sigma_v^2}{\sigma_{S^*}^2 2(1-\rho)} \tag{8}$$

Let us define λ_0 as:

$$\lambda_0 \equiv \frac{\sigma_{S^*}^2}{\sigma_{S^*}^2 + \sigma_v^2} \tag{9}$$

which we can also write as:

$$1 - \lambda_0 = \frac{\sigma_v^2}{\sigma_{S^*}^2 + \sigma_v^2} \tag{10}$$

We can now rewrite (8) as:

$$\lambda^{-1} = 1 + \frac{1-\lambda_0}{2\lambda_0(1-\rho)} = \frac{2\lambda_0 - 2\lambda_0\rho + 1 - \lambda_0}{2\lambda_0(1-\rho)} \tag{11}$$

Which reduces to:

$$\hat{\lambda} = \frac{2\hat{\lambda}_0(1-\tilde{\rho})}{1 + \hat{\lambda}_0 - 2\hat{\lambda}_0\tilde{\rho}} \tag{12}$$

We can estimate the various variables in (12) through univariate regressions as follows:

$$S_t^* = \hat{\rho}\hat{S}_{t-1} \tag{13}$$

and

$$S_t^* = \hat{\lambda}_0\hat{S}_t \tag{14}$$

We can then insert these into (12) and then control for the multivariate nature of the regression as follows:

$$\lambda_1 = \frac{\hat{\lambda} - R^2}{1 - R^2} \tag{15}$$

Where R^2 is the r-squared statistic from the following regression:

$$S_t - S_{t-1} = \alpha(L_t - L_{t-1}) + \beta(\overline{c}_t - \overline{c}_{t-1}) \tag{16}$$

Table 1: Private Expenditure (nominal cedis per month)						
	Male			Female		
	Mean	Median	number	Mean	Median	number
Round 4 (4/97)	51,220	20,488	140	24,687	17,221	152
Round 8 (10/97)	49,717	32,481	140	24,053	16,263	143
Round 12 (4/98)	61,049	35,337	136	26,321	22,266	148

(ref: conshok.do 1.3a)

Table 2a: Monthly Total Household Expenditure: Own Reports and Female Report (nominal cedis)						
	Own Reports			Female Reports		
	mean	median	number	mean	median	number
Round 4	595,885	513,134	107	342,254	279,412	147
Round 8	571,649	431,174	113	390,721	310,635	142
Round 12	620,850	526,087	110	461,175	357,989	146
own report is sum of male reports of male exp + female reports of female exp, female report is female reported female + female reported male exp						

(ref conshok 11.0a)

Table 2b: Monthly Household Food Expenditure: Own Report and Female Report (nominal cedis)						
	Own Reports			Female Reports		
	mean	median	number	mean	median	number
Round 4	428,676	353,827	109	258,743	205,091	150
Round 8	325,120	275,561	115	223,259	210,559	145
Round 12	392,671	327,492	112	328,007	255,385	147

(ref conshok 11.0a)

Table 3: Estimating the value of damage (Linear regression with White corrected standard errors) R^2 = .35, n=112		
variable	coefficient	t-statistic
village 2	714,727	1.23
village 3	206,857	1.57
village 4	203,696	1.64
crop=maize	-142,793	-0.57
crop=maize/cassava/cocoyam	11,869	0.05
crop=maize/cassava	193,167	0.73
crop=maize/cocoyam	243,599	0.41
crop=pineapple	396,665	1.42
crop=tree	445,813	1.30
soil type=loam	140,221	1.29
soil type=clay	372,114	1.89
slope	-82,484	-0.78
steep slope	-236,706	-1.58
severity	163,201	2.335
constant	-607,014	-1.54

(ref shokval2.do 6.0)

Table 4: Shocks Received (cedis)						
type of shock	Male			Female		
	mean*	st. dev.	number	mean*	st. dev.	number
Agric. to round 6	138,948	416,263	220	16,954	156,305	179
Agric, round 8 to 12	47,711	208,788	220	23,190	81,461	179
Illness to round 4	5,619	27,560	185	4,270	17,553	205
Illness round 8 to 12	5,340	27,890	185	4,713	15,982	205
* for all shocks, the median value was zero						

Table 5: Mean Net Monthly Spouse Transfers Received sample of married couples, value in cedis						
	Male report			Female Report		
Round	Chop money	Produce	n*	Chop money	Produce	n
15	-54,417	-1,908	156	40,665	99	155
14	-52,242	-4,668	155	38,397	1,084	154
13	-54,692	-6,899	158	35,503	2,726	157
12	-68,661	-11,783	156	50,579	4,271	156
11	-62,033	--	152	--	--	--
10	-61,196	--	160	--	--	--
8	-56,989	-13,918	164	51,171	3,928	163
* in some cases the male resp replied don't know for produce, n is the number of chop money responses						

(ref spoutest sect 2.5)

Table 6: Net Non-Spouse Transfers Received Rounds 5 & 11, cedis during previous week								
	Male				Female			
	mean	min	max	n	mean	min	max	n
R 5, all sources	1,171	-50,000	115,00	140	433	-20,000	98,500	133
family only	27	-50,000	115,000	140	-67	-20,000	10,000	133
non-family	1,144	-20,000	50,000	140	500	-12,000	98,500	133
R11, all sources	-1,959	-90,000	20,000	133	-398	-72,000	55,000	147
family only	-1,331	-50,000	60,000	133	-414	-70,000	55,000	147
non-family	-628	-40,000	50,000	133	16	-16,000	40,000	147

ref conshok 7.2

Table 7a: Regression Results Household Change in Expenditure: Female Reports (errors in variable regression, conditional reliability of ag. shocks=0.8) n=101				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-.30	-0.50	-1.48	0.88
change in agric. shock	0	-0.07	-0.13	0.12
village avg consumption	0.76	2.54	0.17	1.36
constant	4,334	0.11	-71,951	80,619
Joint test of perfect insurance parameters: F(3, 82)=0.32, Prob > F 0.88				

Table 7b: Regression Results Household Change in Expenditure: Own Reports (errors in variable regression, conditional reliability of ag. shocks=0.8) n=86				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.19	-0.34	-1.33	-0.94
change in agric. shock	0.06	1.16	-0.05	0.17
village avg consumption	-2.25	-1.90	-4.61	0.11
constant	-86,982	-1.84	-180,796	6,832
Joint test of perfect insurance parameters: F(3, 82)=2.69, Prob > F 0.05				

Table 8: Fixed Effect Estimation of Consumption Co-Movement with Village Average Rounds 4, 8, and 12 panel				
	coefficient	t-statistic	95% confidence interval	
Female reports (n=336)				
village avg consumption	0.95	9.50	0.75	1.14
Own reports (n=442)				
village avg consumption	0.78	3.56	0.35	1.22

Table 9: Regression Results Individual Change in Private Consumption (errors in variable regression, reliability of ag. shocks=0.81, n=167)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	0	0.01	-0.43	0.43
change in agric. shock	0.02	1.12	-0.02	0.06
change in spouse's private consumption	-0.15	-0.71	-0.55	0.26
constant	4,157	0.58	-9,976	18,291
F(3,163)=11.15, Prob > F=0.00				

Table 9a: Gender Separated Regression Results Change in Expenditure (errors in variable regression, reliability of ag. shocks=0.24)				
	Male (n=89)		Female (n=78)	
	95% confidence interval		95% confidence interval	
change in illness cost	-0.82	0.65	-0.21	0.13
change in agric. shock	-0.04	0.08	-0.03	0.03
spouse's private consumption	-2.08	0.17	-0.01	0.21
constant	-21,987	31,289	-666	8,912
test of perf insurance coeff.	F(3,85)=4.38, Prob>F=0.01		F(3, 74)=90.78, Prob>F=0.00	

Table 10: Regression Results Change in Expenditure, all village individuals as reference group (errors in variable regression, reliability of ag. shocks=0.81, n=203)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.01	-0.05	-0.36	0.34
change in agric. shock	0.02	1.04	-0.02	0.05
change in village avg private consumption	-0.57	-0.79	-2.06	0.93
constant	5,214	0.71	-9,303	19,732
F(3, 199)=1.96 Prob>F=0.12				

Table 10a: Regression Results Change in Male Expenditure, all village individuals as reference group (errors in variable regression, reliability of ag. shocks=0.81, n=102)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.01	0.04	-0.66	0.68
change in agric. shock	0.02	0.69	-0.03	0.07
change in village avg private consumption	-1.34	-0.89	-4.37	1.67
constant	8,919	0.63	-19,370	37,208
F(3, 98)=1.11 Prob>F=0.35				

Table 10b: Regression Results Change in Female Expenditure, all village individuals as reference group (errors in variable regression, reliability of ag. shocks=0.81, n=101)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.04	-0.48	-0.21	0.13
change in agric. shock	0	-0.10	-0.04	0.03
change in village avg private consumption	0.15	0.45	-0.52	0.82
constant	1,459	0.43	-5,333	8,251
F(3, 97)=2.22 Prob>F=0.09				

Table 11:
Individual Fixed Effect Estimation of Consumption Co-Movement with Village Average
Rounds 4, 8, and 12 panel

	coefficient	t-statistic	95% confidence interval	
Male (n=379)				
village avg consumption	-0.22	-0.28	-1.77	1.33
constant	63,513	2.04	2,242	124,783
fixed individual effect		2.76		
Female (n=401)				
village avg consumption	0.13	0.61	-0.28	0.53
constant	19,994	2.41	3,649	36,339
fixed individual effect		2.96		

Table 12: Regression Results Own Gender Reference Group (errors in variable regression, reliability of ag. shocks=0.8, n=203)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.01	-0.08	-0.36	0.33
change in agric. shock	0.01	0.62	-0.02	0.05
Δ in gender group avg private consumption	-1.27	-2.05	-2.49	-0.05
constant	8,745	1.30	-4,478	21,698
F(3,98)=5.45 Prob>F=0.00				

Table 12a: Regression Results Male Change in Expenditure, Own Gender Reference Group (errors in variable regression, reliability of ag. shocks=0.8, n=102)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.02	0.07	-0.64	0.68
change in agric. shock	0.01	0.54	-0.04	0.07
male avg private consumption	-1.54	-1.59	-3.45	0.38
constant	16,277	1.10	-13,121	45,674
F(3,98)=2.72 Prob>F=0.05				

Table 12b: Regression Results Female Change in Expenditure, Own Gender Reference Group (errors in variable regression, reliability of ag. shocks=0.8, n=101)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.04	0.42	-0.20	0.13
change in agric. shock	0	-0.10	-0.04	0.03
female avg private consumption	-0.78	0.90	-2.50	0.94
constant	3,694	1.24	-2,237	9,625
F(3, 97)=1.50 Prob>F=0.22				

Table 13: Regression Results Change in Consumption, private consumption of opposite gender group as reference (errors in variable regression, reliability of ag. shocks=0.8, n=203)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.02	-0.10	-0.37	0.33
change in agric. shock	0.02	1.06	-0.02	0.05
opp gender avg private consumption	0.27	0.47	-0.88	1.42
constant	130	0.02	-13,855	14,115
F(3, 199)=0.82 Prob>F=0.48				

Table 13a: Regression Results Change in Male Consumption, private consumption of opposite gender group as reference (errors in variable regression, reliability of ag. shocks=0.8, n=102)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.02	0.06	-0.65	0.69
change in agric. shock	0.02	0.83	-0.03	0.07
change in female avg private consumption	3.04	0.80	-4.56	10.74
constant	-2,501	-0.19	-28,919	23, 917
F(3, 98)=0.33 Prob>F=0.81				

Table 13b: Regression Results Change in Female Consumption, private consumption of opposite gender group as reference (errors in variable regression, reliability of ag. shocks=0.8, n=101)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.04	-0.50	-0.21	0.13
change in agric. shock	0	-0.08	-0.04	0.03
change in male avg private consumption	0.16	0.73	-0.28	0.60
constant	586	0.16	-6,670	7,842
F(3, 97)=4.96 Prob>F=0.00				

Table 14: Regression Results
Change in Expenditure, private consumption of abusua across villages as reference group
(errors in variable regression, reliability of ag. shocks=0.81, n=186)

	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.04	0.19	-0.36	0.43
change in agric. shock	0.02	0.96	-0.02	0.06
change in abusua avg private consumption	0.41	0.90	-0.48	1.30
constant	756	0.11	-12,465	13,978
F(3, 182)=0.88 Prob>F=0.45				

Table 14a: Regression Results
Change in Male Expenditure, private consumption of abusua across villages as reference group
(errors in variable regression, reliability of ag. shocks=0.81, n=96)

	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.07	0.19	-0.70	0.84
change in agric. shock	0.02	0.64	-0.04	0.07
change in abusua avg private consumption	0.54	0.78	-0.98	2.27
constant	-1,416	-0.10	-28,443	25,611
F(3, 92)=0.19 Prob>F=0.90				

Table 14b: Regression Results
Change in Male Expenditure, private consumption of abusua across villages as reference group
(errors in variable regression, reliability of ag. shocks=0.81, n=90)

	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.03	-0.27	-0.21	0.16
change in agric. shock	0	-0.10	-0.04	0.04
change in abusua avg private consumption	0.04	0.19	-0.41	0.50
constant	3,059	1.02	-2,933	9,054
F(3, 86)=6.08 Prob>F=0.00				

Table 15: Regression Results Change in Expenditure, private consumption of abusua within villages as reference group (errors in variable regression, reliability of ag. shocks=0.8, n=193)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.04	0.21	-0.35	0.43
change in agric. shock	0.02	0.97	-0.02	0.05
change in abusua avg private consumption	0.30	1.18	-0.20	0.80
constant	899	0.14	-11,566	13,365
F(3, 189)=2.83 Prob>F=0.04				

Table 15a: Regression Results Change in Male Expenditure, private consumption of abusua within villages as reference group (errors in variable regression, reliability of ag. shocks=0.8, n=99)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	0.08	0.23	-0.67	0.84
change in agric. shock	0.02	0.69	-0.04	0.07
change in abusua avg private consumption	0.47	0.99	-0.48	1.42
constant	409	0.03	-24,462	25,279
F(3, 95)=0.54 Prob>F=0.65				

Table 15b: Regression Results Change in Female Expenditure, private consumption of abusua within villages as ref. group (errors in variable regression, reliability of ag. shocks=0.8, n=94)				
	coefficient	t-statistic	95% confidence interval	
change in illness cost	-0.02	-0.18	-0.20	0.16
change in agric. shock	0	-0.16	-0.04	0.04
change in abusua avg private consumption	0.10	0.82	-0.14	0.34
constant	2,242	0.78	-3,478	7,962
F(3, 95)=19.43 Prob>F=0.00				

Table 16 Results of Tests for Individual Insurance Pool Joint F-Tests of Perfect Insurance Coefficients			
Group	Pooled	Men	Women
All village individuals	Not rejected	Not rejected	Rejected at 10%
Own gender group	Rejected at 5%	Rejected at 5%	Not rejected
Opp. gender group	Not rejected	Not rejected	Rejected at <5%
Cross-village abusua	Not rejected	Not rejected	Rejected at <5%
Within village abusua	Rejected at 5%	Not rejected	Rejected at 5%

Table 17: Panel Regression Results Change in Total Net Spouse Transfers Received and Agricultural Shocks								
	Male Reported Transfers (n=384)				Female Reported Transfers (n=386)			
	coeff.	t	95% conf interval		coeff	t	95% conf interval	
Δ shocks	0.03	0.22	-0.25	0.31	-0.27	-1.03	0.78	0.24
Δ lag shocks	0.09	1.90	0	0.18	0.09	1.46	-0.03	0.21
Δ spouse shocks	0.15	0.27	-0.99	1.30	-0.11	-1.11	-0.30	0.08
Δ lag spouse shocks	-0.11	-1.19	-0.28	0.07	-0.01	-0.39	-0.08	0.06
constant	6,449	2.75	1,843	11,054	-4,363	-2.48	-7,815	-910

Table 17a: Panel Regression Results Change in Net Chop Money Transfers Received and Agricultural Shocks								
	Male Reported Transfers (n=639)				Female Reported Transfers (n=386)			
	coeff.	t	95% conf interval		coeff	t	95% conf interval	
Δ shocks	-0.07	-1.67	-0.16	0.01	-0.27	-1.10	-0.76	0.22
Δ lag shocks	-0.01	-0.61	-0.05	0.03	0.10	1.67	0.02	0.21
Δ spouse shocks	0.03	0.42	-0.10	0.15	0.04	0.41	-0.14	0.22
Δ lag spouse shocks	-0.03	-0.45	-0.16	0.10	-0.03	-0.87	-0.10	0.04
constant	1,126	0.60	-2,559	4,810	-2,875	-1.71	-6,178	428

Table 17b: Panel Regression Results Change in Net Produce Transfers and Agricultural Shocks								
	Male Reported Transfers (n=389)				Female Reported Transfers (n=386)			
	coeff.	t	95% conf interval		coeff	t	95% conf interval	
Δ shocks	-0.01	-0.12	-0.17	0.15	0.01	0.07	-0.17	0.18
Δ lag shocks	0.01	0.23	-0.05	0.06	-0.01	-0.40	-0.05	0.03
Δ spouse shocks	0.23	-0.69	-0.89	0.43	-0.14	-4.42	-0.21	-0.08
Δ lag spouse shocks	-0.06	-1.17	0.16	0.04	0.02	1.31	-0.01	0.04
constant	2,906	2.15	252	5,562	-1,488	-2.49	-2,661	-314

(ref spoutest 15)

Table 18: Error in Variables Regression: Change in Total Non-Spouse Transfers and Shocks (reliability of ag shocks=.8, n=192)				
	coefficient	t	95% confidence interval	
Δ illness shocks	0.02	0.61	-0.03	0.07
Δ agric. shocks	0.01	3.67	0	0.02
Δ village avg illness shock	-2.03	-1.32	-5.06	1.00
Δ village avg agric shock	-0.03	-1.35	-0.08	0.02
constant	-7,475	-1.27	-19,101	4,151

Table 18a: Error in Variables Regression: Change in Family Transfers and Shocks (reliability of ag shocks=.8, n=192)				
	coefficient	t	95% confidence interval	
Δ illness shocks	.01	0.43	-0.04	0.05
Δ agric. shocks	0	1.09	0	0
Δ village avg illness shocks	-1.38	-1.00	-4.09	1.34
Δ village avg agric shocks	-0.02	-0.76	-0.06	0.03
constant	-4,103	-0.78	-14,510	6,304

Table 18b: Error in Variables Regression: Change in Non-Family Transfers and Shocks (reliability of ag shocks=.8, n=192)				
	coefficient	t	95% confidence interval	
Δ illness shocks	0.01	0.36	-0.03	0.04
Δ agric. shocks	0.01	4.20	0	0.01
Δ village avg illness shocks	-0.66	-0.67	-2.60	1.29
Δ village avg agric shocks	-0.02	-1.04	-0.05	0.01
constant	-3,372	-0.89	-10,823	4,079

Table 19: Summary Statistics of Asset Holdings (nominal cedis)						
	Male			Female		
Round	Mean	Median	Number	Mean	Median	Number
1 (12/96)	966,891	436,500	186	396,960	180,000	197
9 (12/97)	1,034,464	484,500	177	345,827	250,500	186
15 (9/98)	1,259,736	630,000	169	449,835	323,000	183

Table 20: Regression Results Change in Personal Assets Round 15-Round 9 (n=308)				
	coefficient	t-statistic	95 % confidence interval	
change in shocks	-1.48	-3.31	-2.35	-0.60
constant	234,570	2.74	66,144	402,997

Table 20a: Regression Results with White Corrected Standard Errors Change in Personal Assets Round 15-Round 9 (n=308)				
	coefficient	t-statistic	95 % confidence interval	
change in shocks	-1.48	-1.12	-4.07	-1.12
constant	234,570	2.66	61,186	407,954

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