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3 Do the Poor Insure? A Synthesis of the Literature on Risk and Consumption in Developing Countries*

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1 INTRODUCTION

Income risk is a central feature of rural areas of developing countries. A major topic in development economics is how well households are able to mitigate the adverse effects of income risk. There are several sensible reasons why households will not be able to fully insure consumption against income fluctuations. The well-known problems of moral hazard, information asymmetries, and deficiencies in the ability to enforce contracts may result in incomplete or absent insurance markets. The dearth of formal insurance markets in developing countries is evidence that these problems are considerable. However, a large body of literature indicates that households in developing countries make use of a wide variety of mechanisms, often informal, to at least partially limit consumption risk. A key piece of information required to guide policy design is how, and how well, different households mitigate risk. This paper reviews various strategies for insuring consumption against income fluctuations, and examines evidence on how effectively these strategies work.

There is a wide range of possible strategies to mitigate risk. We offer two broad classifications for consideration:

**Risk management** In the absence of perfect insurance markets, households may undertake actions to reduce the variability of income. Within agriculture this might include crop and field diversification. Households might also limit income risk by choosing a diverse portfolio of occupations, or through the strategic migration of family members. The optimal amount of diversification will depend on the household's preferences towards risk, its ability to smooth consumption against income fluctuations, and the costs of diversification in the form of reduced average income.

**Risk coping** Risk-coping strategies can be classified as those that smooth consumption intertemporally, through saving behaviour, and those that smooth consumption across households, through risk-sharing. The primary distinction between these two is that intertemporal smoothing enables a household to spread the effects of income shocks on consumption forward through time. Risk-sharing, by contrast, spreads the effects of income shocks across households at any one point in time. A wide variety of mechanisms may be used for both intertemporal consumption smoothing and risk-sharing. Intertemporal smoothing may be accomplished through borrowing and lending in formal or informal markets, accumulating and selling assets, and storing goods for future consumption. Risk-sharing arrangements may be accomplished through formal institutions, such as insurance and futures markets, and forward contracts for harvests, and informal mechanisms, including state-contingent transfers and remittances between friends and neighbours. There are also a number of institutions that may offer 'disguised' insurance. For example, share tenancy, credit contracts with state-contingent repayments, and long-term labour contracts may each contain an insurance component, although none are explicitly insurance contracts.

Our primary focus in this chapter is on risk-sharing arrangements. However, it is misleading to consider this method of risk reduction in isolation from other strategies. Risk-averse individuals may choose a general risk-reducing strategy that combines portfolio diversification, saving and borrowing, and risk-sharing, depending on the relative costs and benefits of each strategy. It follows that changes in the costs and benefits of one strategy will affect how other strategies are used, and these interactions may be important for policy design. In what follows we review various mechanisms of consumption smoothing, with particular reference to how they interact, and their implications for income distribution. Sections 2 and 3 provide brief overviews of income stabilization strategies and intertemporal consumption smoothing. Section 4 presents a simple model of risk-sharing, and reviews evidence on the use of risk-sharing.
2 MANAGEMENT OF INCOME RISK

In the absence of complete insurance markets, households may choose lower average incomes in exchange for lower income variability. In rural areas, the variability of income may be reduced through a variety of mechanisms, including choosing crops whose yields or prices display low correlations, planting crops on scattered plots that are subject to different weather shocks, using a variety of production techniques, or choosing a blend of farm and non-farm occupations. The extent to which households trade-off average incomes for less variable incomes should depend, in theory, on available technology, preferences towards risk, and opportunities for smoothing consumption given income.

It is useful first to consider how much households might be willing to pay – in terms of forgone average income – to reduce income risk. A good starting point is Newbery and Stiglitz’s (1981) calculation that the money value of income stabilization as a proportion of average income, termed the relative risk premium, is approximately half of the product of the relative risk coefficient and the square of the coefficient of variation of income. For example, if the coefficient of relative risk aversion is 1.5, indicating moderate risk aversion, and the coefficient of variation of income is 0.3, a household would be willing to forgo approximately 6.75 per cent of its average income to totally eliminate income risk. It follows that the amount a household would be willing to pay to partially reduce income risk would be smaller. For example, Walker and Ryan (1990) calculate that the potential benefits of crop insurance to farmers in south India is worth only about 1 per cent of mean household income. Simple calculations of this type cast doubt on the idea that risk considerations are a major factor in the determination of allocation decisions.

These calculations are based on the assumption that households cannot smooth consumption intertemporally, and so may overstate the gains from risk reduction. If households can smooth consumption through saving and borrowing, the amount of income they will be willing to forgo to avoid income risk will be smaller. Newbery and Stiglitz (1981) provide another simple calculation that shows how the potential to save and borrow affects the risk premium. If households can save and borrow at a certain interest rate, r, the relative risk premium falls to approximately r times the relative risk premium in the case of no saving or borrowing. In other words, at an interest rate of 10 per cent, a coefficient of relative risk aversion of 1.5 and a coefficient of variation of income of 0.3, a household would only be willing to give up 0.675 per cent of its average income to totally eliminate income risk.

These examples imply that the use of portfolio diversification to limit income risk is likely to vary across households, even those that face common risks and have access to the same production technology. First, the degree of risk aversion may vary across households, and all else being equal, more risk-averse households will diversify more, and have lower average incomes. An implication is that if risk aversion declines with wealth, uninsured income risk may exacerbate income inequality. Second, households may have differing abilities to smooth consumption ex post, and this will also affect the attractiveness of using portfolio diversification to reduce income variability. For example, households that are more likely to be credit-constrained in the future will be more willing to sacrifice income for less risk (Eswaran and Kotwal, 1990; Morduch, 1990). If credit constraints are related to wealth, as seems likely, then poor households will be less willing to bear risk, even if they have risk preferences identical to those of wealthier households.

Given that preferences towards risk may affect allocation decisions, it is useful to ask how risk-averse poor households in developing countries are, and whether risk aversion varies by wealth level. There are a number of studies that use information on the allocation decisions of farmers in developing countries to measure risk preferences as, for example, Antle (1987) and Hazell (1982). The basic approach is to estimate how much observed allocation decisions diverge from what would be implied by profit maximization, and attribute any divergence to risk aversion. These studies generally support the idea of moderate amounts of risk aversion, with coefficients of relative risk aversion generally in the range of 1 to 2, although evidence of risk neutrality was found in one Indian village by Antle (1989). However, these studies are subject to several criticisms. First, there may be many reasons other than risk why farmers may choose less-than-efficient production methods, including factor market imperfections, and imperfect information about production techniques. Attributing all divergences from profit maximization to risk aversion may result in measures of risk aversion that are too high. Second, all the studies cited above implicitly assume that household consumption equals household income, that is, households do not smooth consumption. If households can smooth consumption, then measures of risk aversion are likely to be too low. As Morduch (1990) points out, a highly
risk-averse individual with very good consumption insurance may make production decisions ‘as if’ he were risk-neutral.

Measures of risk aversion have also been obtained from experimental studies, in which farmers choose among a set of gambles with non-trivial payoffs; see Binswanger (1980), Walker (1990), Binswanger and Sillers (1983) and Grisley and Kellog (1987). The results of these experiments have been used to compute measures of risk aversion, and to evaluate whether an individual’s choices are consistent with expected utility maximization versus alternative theories of decision-making under uncertainty. These experiments indicate that farmers are moderately risk-averse, but that choices do not vary systematically across wealth levels. This latter result, taken in conjunction with the observation that risk aversion appears to increase as the size of the payoff increases, has been interpreted by a number of economists including Binswanger (1981) and Binswanger and Sillers (1983) as indicating that decision-makers care only about the losses and gains in a choice rather than their final wealth position. This finding is strikingly at odds with the standard assumption underlying many economic models, that households maximize the expected utility of total consumption or wealth. Binswanger (1981) also finds that models of decision-making based on security or ‘safety-first’ principals are inconsistent with the experimental data.2

The finding of moderate amounts of risk aversion indicate that there is scope for risk factors to affect production and investment decisions, especially if individuals have few opportunities to smooth consumption given income. However, there are several reasons why it may be quite difficult to quantify the importance of risk. First, many of the methods of reducing income variability cited above, such as diversifying crops or occupations, may actually serve to increase rather than reduce expected incomes. For example, Carter (1991) finds that in the Sahel region of Burkina Faso inter-cropping results in yields that are higher but more variable than sole-cropping alone. Furthermore, given the seasonal nature of agriculture in many regions, one might expect households to undertake many different activities at different times. Simply documenting that households have a diverse set of income sources does not imply that households diversify to buffer themselves from income risk.

Second, a finding that allocation decisions are inefficient – in the sense that they do not maximize expected income – does not necessarily imply that uninsured risk is the source of the inefficiency. For example, McCloskey (1976) argues that field fragmentation in fourteenth-century England, which reduced average incomes by as much as 10 per cent, was primarily a response to uninsured risk. However, Heston and Kumar (1983) argue that field fragmentation in southern Asia may be the result of imperfections in labour markets and other institutional factors. Similarly, the common finding that poorer households adopt new agricultural technology more slowly than richer households can be explained by several factors, not all of which involve risk. The poor could be less able to smooth consumption ex post, due to credit constraints as Eswaran and Kotwal (1989) claim. Alternatively, they may face higher costs of acquiring information, as Feder, Just and Silberman (1985) suggest, or they may be less able to obtain credit to finance the advance investments that new technology requires.3

A handful of studies attempt to distinguish the effects of risk on production from the effects of other factors. For example, Morduch (1990) examines whether Indian farm households that are likely to face binding credit constraints display more crop and plot diversification than do other households. He finds that farmers likely to face borrowing constraints choose less risky portfolios of crops and plots. However, he does not provide information on the cost of risk reduction, in terms of forgone average profits. Using data from the same villages, Binswanger and Rosenzweig (1990) note that the tendency to shift to a less risky portfolio is greater among households with less inherited wealth. This study is careful to distinguish the effects of credit constraints from wealth-related patterns in risk aversion. Given that risky portfolios are also shown to yield higher returns per unit of wealth, the study concludes that limitations on ex post consumption smoothing decrease profits of the lowest wealth quintile by a third relative to the unit returns of the wealthiest farmers in the community. The wealthiest farmers in the sample do not exhibit any behaviour that can be interpreted as deviations from profit maximization due to risk aversion. A similar point is made by Carter (1991), who argues that differences in the capacity to cope with risk exacerbate income inequalities in Burkina Faso.

In summary, the few pieces of evidence that are available suggest that the effect of risk on production and investment decisions depends critically on how well households can cope with income risk. Both Rosenzweig’s and Morduch’s results imply that poorer households do choose less risky production strategies. However, it should be kept in mind that these two papers are based on data from the same household survey. Similar research must be done using data sets from other countries before these findings can be accepted as general conclusions.
3 INTERTEMPORAL CONSUMPTION SMOOTHING

Saving behaviour is one possible mechanism which can reduce consumption fluctuations despite variable incomes. Saving and dis-saving can take many forms, including transactions in formal credit and financial markets, borrowing and lending in informal markets, and the accumulation and de-accumulation of productive assets as well as consumer goods. The desirability of policies designed to buffer households from income shocks depends critically on how households use such savings to smooth consumption.

The literature on saving in developing countries falls into two categories. First, there is a body of literature that investigates how well households smooth consumption given income, but abstracts from issues of production. Gersovitz (1988) and Denton (1990) contain useful summaries of much of this literature. Second, there is a small but growing body of work that investigates the inter-linkages between saving, credit constraints and production decisions, for example Rosenzweig and Wolpin (1993) and Morduch (1991).

How well do households in developing countries smooth consumption through time, given income? Although strict versions of permanent income models are rarely accepted, the data typically reveal substantial amounts of consumption smoothing. For example, Paxson (1992) finds that shocks to the incomes of Thai rice farmers produced by transitory rainfall are largely saved, and have little effect on consumption. However, she rejects a strong version of a permanent income model which posits that propensities to consume out of permanent income are exactly one. Bhalla (1979 and 1980), using a three-year panel from India, finds evidence of consumption smoothing, but also finds that the consumption of poorer households tracks income more closely than does the consumption of wealthier households. This evidence suggests that credit constraints might be binding for poorer households.

Alderman (1992), using a three-year panel from Pakistan, also finds substantial evidence of consumption smoothing as well as differences in savings propensities between rich and poor households. Even poor households, however, use credit markets to maintain consumption in the presence of negative income shocks. Denton (1992b), using data from the Côte d’Ivoire, tested a permanent income model, with mixed results. He finds that household savings anticipate income declines in the Côte d’Ivoire, implying that individuals are forward-looking when choosing savings. However, the data are not consistent with either a strict version of the permanent income hypothesis, or with the presence of liquidity constraints.

Recent literature on saving – see, for example, Zeldes (1989a) and Kimball (1990) – has emphasized the possible importance of what has been termed ‘precautionary savings’, or prudence. Prudent consumers are defined as those with convex, rather than linear, marginal utilities of consumption. One major implication of convex marginal utility is that the variance of future consumption affects savings behaviour, and that the variance of future consumption affects savings behaviour, that the variance of future consumption affects savings behaviour. Specifically, consumers who face greater uncertainty in the future will consume less today and, on average, exhibit higher consumption growth. This is not an implication of the standard permanent income model, which assumes linear marginal utility. Furthermore, several articles have stressed the point that prudence may result in saving and consumption patterns that appear similar to those produced by borrowing constraints, even if no borrowing constraints exist. For example, Zeldes (1989a) shows that with a constant-relative-risk-aversion (CRRA) utility function, the marginal propensity to consume out of transitory income declines with wealth. In this case, prudent individuals with low wealth levels choose to dis-save (or borrow) less in response to a transitory income decline. Consumption by these individuals will track income more closely than implied by the standard permanent income model.

Several attempts have been made to distinguish, empirically, between prudent behaviour and behaviour produced by borrowing constraints. These studies include Zeldes (1989b), using US data, and Morduch (1990) for India. The test for borrowing constraints relies on the idea that binding borrowing constraints result in a violation of the first order conditions for utility maximization, whereas prudence does not. Both Zeldes and Morduch argue that the first order conditions imply that the growth in consumption between two periods \((t + t + 1)\) should be orthogonal to information known by the household at time \(t\). A finding that income at \(t\) predicts consumption growth between \(t\) and \(t + 1\) is taken as evidence of borrowing constraints.

Intuitively, households that want to borrow due to low current income, but cannot do so, will have low current consumption and, on average, high consumption growth between the current period and the next. Both papers report a negative relationship between lagged income and consumption growth, and conclude that borrowing constraints may be operative in the USA and India, respectively. Morduch, however, also notes that when the sample is disaggregated by village and by land wealth, the permanent income model cannot be rejected for all groups. In particular, the hypothesis of borrowing constraints cannot be rejected for landless labourers and small farmers in most
villages, but can be consistently rejected for medium and large farmers. There is reason to be cautious when interpreting these results. Carroll (1991) points out that, for prudent consumers, it may not be the case that consumption growth is orthogonal to income at time \( t \). As noted above, prudence implies that consumers for whom future consumption is more uncertain will display higher consumption growth. If consumption uncertainty is negatively correlated with current income, then current income will be negatively correlated with consumption growth even in the absence of borrowing constraints. Although the evidence indicates that poorer households have consumption that more closely tracks income, the empirical work done to date does not provide clear evidence of whether this is due to prudence or to borrowing constraints.

Assuming that borrowing constraints are operative for at least some households at some times, it is useful to consider how borrowing constraints might affect consumption patterns. As Deaton (1990) notes, even if households are precluded from doing any borrowing at all, households may still be able to do a substantial amount of consumption smoothing through the accumulation and de-accumulation of either financial or physical assets. Deaton's simulations indicate that households that can never be net borrowers may have consumption patterns that are generally smooth. However, when large negative shocks in income coincide with low levels of assets or stocks, consumption declines sharply. The implication is that the effects of negative shocks to income on consumption will depend critically on the initial asset position of households. For example, a negative shock to income may produce little effect on consumption, but two consecutive negative shocks may have a large effect, since assets were drawn down in response to the first shock. This is consistent with Webb and Reardon's (1991) observation that famine conditions were observed in Burkina Faso and Ethiopia only after two successive droughts. The ability of credit-constrained households to buffer consumption may also depend on the degree of auto-correlation in incomes. Deaton (1991) shows that stocks will buffer consumption less effectively if income shocks display positive serial correlation. Conversely, households whose incomes are negatively auto-correlated will be able to maintain consumption patterns that are quite smooth relative to income.

As noted above, borrowing constraints have implications for production and investment decisions of farm households. If credit markets for consumption do not operate perfectly, then farmers may sell or buy productive assets to smooth consumption. This idea is explored by Rosenzweig and Wolpin (1993), who argue that bullock sales and purchases are a major source of consumption smoothing in rural India, with implications for the efficiency of agricultural production. Furthermore, as discussed by Morduch (1990), farm households with a positive probability of facing binding borrowing constraints may be less likely to undertake risky production activities at the cost of greater expected profits.

4 RISK-SHARING

4.1 General Framework

The presence of insurance markets, formal or informal, implies that random variation in a household's income need not result in consumption variation. It is well known, however, that the problems of moral hazard, asymmetric information and high enforcement costs may produce inefficiencies in insurance markets. The dearth of formal insurance institutions in developing countries seems to indicate that these problems are substantial. A relevant question is whether informal insurance markets, built around community or family relationships, are able to overcome the problems that hinder the development of formal insurance markets.

One perspective of social insurance in traditional economies is based on shared norms and moral values (Platteau, 1991; Scott, 1976). Without denying this possibility, one can show that more narrow concepts of self-interest can generate institutions which pool income risk. Arrow and Hahn (1971) present a general equilibrium framework with trade between risk-averse individuals that produces perfect risk-sharing. Although a set of strong assumptions support this particular model, a number of simpler markets can do as well (Fafchamps, 1991). Similarly, risk-sharing does not necessarily require an arbitrator or planner; if interactions are repeated, then mutual assistance may be self-enforcing (Coate and Ravallion, 1993; Posner, 1980). This implies that the short-term gains of not co-operating when it is one's turn to remit rather than receive may not outweigh the expected costs of forgoing future co-operation.

There is a growing body of literature that tests whether households within villages, regions, and even countries fully share risk. The hypothesis of full risk-sharing is extreme, requiring the absence of moral hazard, asymmetric information and enforcement costs. However, it
is still useful to consider whether observed consumption patterns are broadly consistent with patterns predicted by insurance models. In what follows, we sketch out a simple model of full risk-sharing, discuss the empirical implications of this model, and contrast the model's implications with alternative models of consumption smoothing. Our presentation follows MacC (1991) and Townsend (1991). We do not explicitly model production decisions, although these can be easily incorporated. For purposes of exposition, we also assume that the basic unit through which insurance operates is the village. However, the basic model can be, and has been, applied to many types of insurance 'groups', ranging from families to countries.

To depict the basic model of risk-sharing, let $Y_{it}^*$ be the true income of household $i$ in village $v$ at time $t$ (measured net of insurance premiums or receipts). Assume that $Y_{it}^*$ consists of several different orthogonal components: an individual-specific fixed effect $\mu_i$, a time-varying village-specific shock $\mu_{vt}$ that is common to all villagers, and an idiosyncratic shock $\epsilon_{it}$:

$$Y_{it}^* = \mu_i + \mu_{vt} + \epsilon_{it}. \hspace{1cm} (1)$$

The term $\mu_i$ captures the effects of factors -- such as weather or prices -- that may affect the incomes of all people in the village. The actual effects of these common factors on incomes may, in reality, vary from household to household. The assumption of identical village effects in incomes is made here to simplify notation. The idiosyncratic component $\epsilon_{it}$ is not correlated across individuals within a village.

Full insurance within a village implies that total village resources in any time period are distributed across households so as to equate the weighted marginal utility of consumption across households:

$$\lambda_i U'(c_{it}^*, z_{iit}) = \lambda_j U'(c_{jt}^*, z_{jtt}) \forall i, j. \hspace{1cm} (2)$$

where $c_{it}^*$ is the consumption of household $i$ in village $v$ at time $t$. The term $\lambda_i$ can be interpreted as the weight a social planner gives to household $i$. Alternatively, in a decentralized market system, $\lambda_i$ will reflect the initial endowment of household $i$, and would be a (non-linear) function of $\mu_i$. The variable $z_{iit}$ measures household $i$'s preferences for consumption at time $t$, and reflects factors such as the number of people in a household, which affect the marginal value of consumption and may change over time.

An important property of equation (2) is that the household-specific weight, $\lambda_i$, is constant over time and does not depend on the household's income draw in time $t$. The portion of total village resources a household receives in any year depends only on its initial endowment relative to the initial endowments of other villagers, and its preferences for consumption relative to the preferences of other villagers in that year. For example, if all households had identical initial endowments and identical preferences, their consumption levels would be equated in each year, no matter what the distribution of realized incomes across households.

The exact relationship between an individual's consumption and village consumption depends on the form of the utility function. Both MacC and Townsend develop a full insurance model using both constant-absolute-risk-aversion (CARA) and constant-relative-risk-aversion (CRRA) utility functions. In what follows, we use the CARA utility function, since it results in slightly more straightforward consumption equations. The utility function is:

$$U(c_{it}^*) = -e^{-\alpha(c_{it}^* - z_{iit})}, \hspace{1cm} (3)$$

where $\alpha$ is the coefficient of absolute risk aversion. Equations (2) and (3) can be combined to yield the following consumption equation for household $i$ at time $t$:

$$c_{it}^* = \bar{c}_v^* + (z_{iit} - \bar{z}_v) + \theta_i, \hspace{1cm} (4)$$

where $\bar{c}_v^*$ is average village consumption, that is, total village consumption divided by the number of village members; $\bar{z}_v$ is the village mean of $z_{iit}$ and $\theta_i$ is an individual-specific consumption shifter that sums to zero across village members and is a non-linear function of the $\lambda$s of all village members. The CRRA utility function results in a similar consumption function, with individual consumption replaced by its logarithm, and average village consumption replaced by the average of the logarithm of consumption.

There are several important implications of the full-insurance model. First, a household's consumption is determined solely by average village consumption and preferences. Household income affects consumption only insofar as it affects total village resources and village consumption. In fact, if preferences; that is, $\theta_i$ did not vary over time, all households within a village would have identical consumption changes between any two periods. A related implication of the full insurance model is that an individual who receives an idiosyncratic shock that
permanently increases his income will continue to receive only his pre-specified portion of total village income. Similarly, individuals who become permanently poor will have their consumption maintained by the community for life. Obviously, the incentives to renege on risk-sharing contracts in these instances may be high, and the assumption that contracts are fully enforceable is critical.

Another point is that full risk-sharing only protects individuals against idiosyncratic, rather than aggregate, risk. As the number of individuals in the insurance pool becomes large, the effect of idiosyncratic income shocks, the \( e_{it} \) in equation 1, on village consumption goes to zero. However, aggregate shocks, the \( u_{it} \), are left uninsured. This does not imply that village consumption necessarily tracks village income. Villages potentially may borrow and lend from each other to smooth consumption against aggregate shocks, and the full insurance model can easily take this possibility into account. For example, a model of full insurance within villages can be nested together with a model of permanent income saving and borrowing between villages, implying a low response of village consumption to transitory movements in village income. Furthermore, stocking behaviour may be used to smooth consumption over time within villages, even in the absence of inter-village credit markets.

Although inter-temporal smoothing mechanisms may be used to mitigate the effects of aggregate risk on consumption, it is still true that the effectiveness of risk-sharing as a tool for consumption smoothing will be limited by the importance of aggregate risk relative to idiosyncratic risk within an insurance ‘group’.

The next section examines the evidence on income covariation. The subsequent sections turn to evidence on risk-sharing.

### 4.2 Income Covariation within Communities

As described above, complete risk-sharing can only protect households from the effects of idiosyncratic shocks to income. Even if risk-sharing arrangements function efficiently within communities, they will produce little in the way of consumption smoothing if only a small part of total income risk is idiosyncratic. Covariate income risk may also limit the usefulness of credit markets as a tool for consumption smoothing, if credit markets are regionally segmented.

There are several problems associated with measuring the amount of aggregate risk a community faces. The first is conceptual: what is the appropriate community? To find out how effective informal insur-
from Senegal to show not only that yields of groundnuts, millet and rice are highly responsive to rainfall, but that cross-crop correlations between rainfall-induced yield fluctuations are quite high (0.82 or higher for each pair of crops). Webb, von Braun and Yohannes (1991) obtained similar results for Ethiopia. These two studies, then, support the view that there may be little scope for co-insurance at the village level.

For weather to induce strong correlations of income within a community, however, different households should face the same weather. Townsend’s observation that rainfall measured at opposite ends of a single ICRI SAT village are not highly correlated may imply that weather can produce idiosyncratic changes in income even for neighbouring farmers who produce the same crops. If individual farmers, however, all exploit this heterogeneity with plot diversification, then individual farm variability would be reduced while correlations between farms increased.

There may be substantial scope for co-insurance within villages even if within-crop risk is highly correlated across neighbouring farms if households within villages are engaged in different activities, and if risk is not highly correlated across activities. Diversification within villages may also imply that movements in input or output prices need not result in large village-level movements in incomes. This possibility is supported by a fair amount of evidence from panel data. For example, Morduch (1991), finds that idiosyncratic risk (inclusive of measurement error) accounts for 75 to 96 per cent of the total variance in household income in South India. Similar magnitudes of idiosyncratic risk have been implied for Burkina Faso (Carter, 1991) and northern Nigeria (Udry, 1990).

Other studies use samples with numerous clusters (villages) to examine whether incomes covary more within than across villages. Deaton (1992a), for example, tests whether there are village-specific effects in household income changes within regions of the Côte d’Ivoire. F-tests indicate that changes in household income do not covary significantly more within villages than across villages. These results imply either that the covariance of household incomes within villages is low, or that villages within regions experience common income shocks. Another possibility is that the two survey years over which income changes were computed happened to have no large village-level shocks. Longer time series of data might reveal more within-village covariance in incomes. Alderman and Garcia (1993) using a similar methodology, provide evidence that village income covariance in Pakistan, though only around half of explained income fluctuations, (less than a quarter of all observed inter-annual movement in incomes) is larger than provincial covariance.

One difficulty in interpreting evidence on the relative magnitudes of idiosyncratic versus village-level risk is that ‘idiosyncratic risk’, as measured, captures both true idiosyncratic variation as well as measurement error in incomes. There is no direct evidence on the size of measurement error in incomes in developing countries. However, evidence from the USA indicates that measurement error may account for a substantial fraction of the total variance in reported income. For example, Duncan and Hill (1984) compare employees’ reports of income with records from their employer, and find that measurement error accounts for 16 per cent of the variation in reported labour income. One might expect that measurement error is a much more serious problem for self-employed agricultural households than for US employees. Furthermore, in many data sets from developing countries, the value of home-produced food (as well as in-kind payments of wages and rent) is included in both income and consumption, so measurement errors in consumption and income are likely to be positively correlated. This positive correlation in measurement errors exaggerates the co-movement of income and consumption; that is, it may appear that households buffer consumption from income risk less than they actually do.

Two additional points must be stressed when interpreting evidence on the covariance of incomes across households within villages. First, a finding that incomes within villages do not covary necessarily imply that households cannot buffer consumption against village shocks to income. Income-sharing between family members that live in different locations, for example, can ameliorate the effects of village movements in income on consumption. Furthermore, if villages are linked to a larger economy by credit markets then shocks to income that are correlated across village members need not produce large consumption changes.

Second, the degree of diversification of risk within and across households may be a response to the viability of insurance markets. If insurance markets work well within villages, then one might expect individual households to specialize in production, but the village as a whole to diversify risk. As Udry (1991) states, perfect insurance markets within villages imply that ‘investment in agricultural production is directed to plots on which output is less correlated with overall community income and that this diversification is carried out at the
community level, not the household level'. Conversely, if insurance markets (and credit markets) do not work well within villages, because of problems of moral hazard, asymmetric information or a lack of effective enforcement mechanisms, then one might expect risk to be diversified within, but not across, households. In the extreme, each household might produce a similar diversified crop mix, resulting in co-movements in incomes across households. If this is the case, it would be a mistake to conclude that income co-variation hinders the effectiveness of village-level insurance markets. Rather, it is the inefficiency of insurance markets that produces income co-variation.

4.3 Tests of Complete Risk-Sharing

A strong empirical implication of the full risk-sharing model is that, controlling for village changes in consumption and individual preferences, the consumption and income changes of a given individual will not be correlated. This empirical implication of a full insurance model is not an obvious implication of other models of consumption determination. For example, one simple model would be that consumption tracks income; households neither insure one another, nor borrow and save so as to smooth consumption. If this simple model were correct, movements in an individual's consumption would be correlated with movements in village consumption only to the degree that the incomes of individuals within villages are correlated. The consumption-tracks-income model has empirical implications that are precisely the opposite of the full-insurance model. Without controlling for individual income, individual and village consumption will be correlated. However, once individual income is controlled for, this correlation will vanish.

A permanent income model of saving and borrowing is another alternative to both the full insurance and the consumption-tracks-income model. Under a standard permanent income model, consumption responds to changes in the expected annuity value of current and future income. Like the consumption-tracks-income model, the permanent income model implies that changes in the consumption of individuals within a village will be correlated only because current and expected future incomes are correlated across village members. However, unlike the consumption-tracks-income model, the effect of a change in an individual's income on consumption may in theory be quite small. For example, a shock to income that is not expected to persist - for example, an increase in income due to good weather - would increase consumption only by the annuity value of the shock.

The empirical implications of full risk-sharing and other models of consumption determination differ sharply. However, in practice, distinguishing between these models may be difficult, for several reasons. First, both the permanent income and complete risk-sharing models are consistent with small effects of household income on consumption. A finding that household income has little effect on consumption does not distinguish between the two models. Second, household income is likely to be measured with a great deal of error, especially for farm households. If there are strong village effects in income, village consumption may serve as a better measure of true household income than measured household income. It is demonstrated below that if this is the case, permanent income and full risk-sharing models of consumption can yield extremely similar empirical results. Third, if credit markets are regionally segmented, household consumption may co-move with aggregate village consumption even in the absence of risk-sharing. Region-wide shocks to incomes may produce movements in regional interest rates, which could result in consumption changes even for households who have not experienced a change in income. The result would be the appearance of risk-sharing when none actually exists.

A spate of recent papers test the full insurance model. Mace (1991) as well as Cochrane (1991) do so using US data. Tests using data from developing countries include Townsend (1991) and Morduch (1991) for India; Rashid (1990) and Alderman and Garcia (1993) for Pakistan; Deaton (1992b) for Côte d'Ivoire; and Udry (1990) for Nigeria. Other relevant papers include Altonji, Hayashi and Kotlikoff (1989) and Hayashi, Altonji and Kotlikoff (1991), which use US data to test models of altruism within extended families.

Most of these papers test for full insurance by estimating consumption equations, and testing whether household income affects household consumption, given 'community' consumption. The community is defined either as the village, as in Deaton; Townsend; Morduch and Udry; the extended family, as in Altonji, Hayashi and Kotlikoff; or the whole USA, as in Mace (1991). The basic form of the consumption equation is:

$$c_{it} = \beta_1 z_{it} + \beta_2 \bar{z}_{it} + \beta_3 y_{it} + e_{it}$$

(5)

c_{it}, \bar{z}_{it}, and y_{it} represent measured values of c_{it}, \bar{z}_{it}, and y_{it}. Variables meant to control for household preferences, that is, the $e_{it}$ in
equation (4) are typically included as well. The household-specific intercept \( \beta \) represents \( \xi \). A minimum data requirement for estimating equation (5) is that each household is observed for at least two time periods. The household-specific fixed effect \( \beta \) cannot be properly accounted for without panel data. The null hypothesis of full insurance implies that \( \beta_1 \) equals 0 and \( \beta_2 \) equals 0: controlling for village consumption, individual incomes will not affect consumption. Some studies yield additional information on the full insurance model by examining whether the coefficients on the preference-shifters \( \gamma \) are significant. For example, Cochrane (1991) tests whether illness adversely affects consumption growth, which should not happen if illness were fully insured.

There are several general methods of estimating equation (5), and the choice of method depends on the nature of the data available. One approach is to estimate equation (5), for each village, in first differences. The change in community consumption can then be proxied by the change in the sample mean of consumption or, if the data span a number of years, by a set of time-varying intercepts. Another approach, which is useful with long panels of data, is to estimate equation (5) for each household, thereby letting the parameters \( \beta \) and \( \gamma \) vary across households. Townsend, who uses 10-year panels of information on the incomes and consumption of 102 households spread over three Indian villages, adopts this approach (among others). Deaton, as well as Alderman and Garcia, exploit cross-village rather than cross-time variation in consumption to test the insurance model. These tests rely on the idea that under full risk-sharing within - but not across - villages, year-to-year changes in household consumption should be fully explained by a set of village-specific intercepts.

Despite the variety in methodology and data sources, each of these papers provides some evidence against the full insurance model. However, their results do differ. Townsend and Mace are the most supportive of risk-sharing. Both their papers find that:

i) movements in individual consumption are strongly correlated with movements in average community consumption; and

ii) household incomes appear to exert only small, although sometimes significant, effects on consumption, once community consumption is controlled for.

For example, Townsend first estimates variants of equation (5) for each household that do not include household income. The hypoth-

esis that \( \beta \) equals 1 can be rejected for only three households per village. He then includes individual income measures, and finds that incomes are statistically significant for only a few households per village. Townsend also estimates variants of equation (5) in which \( \beta \) is constrained to be identical for all households within villages. These results are somewhat less supportive of full insurance; some income measures affect consumption but the effects of different types of income differ across villages. Furthermore, lagged income values tend to have more consistently significant effects on consumption, although these effects are still small, that is, estimates of \( \beta \) range from 0.06 to 0.1. Similarly, Mace finds that individual income changes have extremely small (though in some specifications significant) effects on consumption changes.

The results of the other studies cited are less supportive of full risk-sharing. Cochrane, for example, finds that long illnesses and involuntary job loss are associated with consumption declines, thus rejecting the full insurance model. Altonji, Hayashi and Kotlikoff (1989) find that household consumption changes respond to household income changes, even controlling for changes in the incomes of extended family members, thus rejecting a model of family-based insurance. Deaton rejects full village risk-sharing in the Côte d'Ivoire. Although consumption co-moves more within than across villages, household incomes do affect consumption, even controlling for village fixed effects. Further evidence against the model of full village risk-sharing is provided by both Morduch (1991) and Rosenzweig (1988), both of whom use the same data set as Townsend and Udry (1991) who uses data from northern Nigerian villages.

The evidence on the risk-sharing model is somewhat mixed. All papers statistically reject full risk-sharing for at least some specifications. However, most results do indicate that there are large co-movements in consumption within villages, and that the effect of individual income on consumption is small. Do these results indicate, as Townsend claims, that the full insurance model represents 'a surprisingly good benchmark'?

To answer this question, one must ask whether these tests of full insurance have much power against reasonable alternative hypotheses. One alternative hypothesis is that households do not insure one another, but do act as permanent income savers. As discussed above, permanent income models are consistent with a small effect of income changes on consumption changes, if income changes are largely transitory. A finding that \( \beta \) is small is not evidence of risk-sharing. Furthermore,
there are several reasons why consumption may track village consumption, even in the absence of risk-sharing. Suppose, for example, that village-level shocks to income are largely permanent, due to permanent changes in technology, prices, etc., and that idiosyncratic shocks to income are largely transitory; in this case, a permanent income model of saving would imply that $\beta_1$ is close to one and $\beta_2$ is close to 0, even if risk is not pooled.

The likely presence of measurement error makes the results even more difficult to interpret. If risk is not fully pooled, and if there is measurement error in household income, estimates of $\beta_2$ will suffer from attenuation bias. Furthermore, measurement errors in income and consumption will be positively correlated if home-grown food is counted in both income and consumption. This correlation will produce an upward bias in $\beta_2$ that counteracts the downward attenuation bias, and it is not possible to determine, a priori, which effect will predominate. Deaton estimates $\beta_2$ using an instrumental variables approach to take into account correlated measurement errors, and finds that instrumental variables estimates of $\beta_2$ are generally lower than ordinary least squares estimates. However, his methods do not handle attenuation bias due to mismeasured income, and may therefore produce estimates of $\beta_2$ that are too low.

A final problem is that the failure to control properly for the factors that shift preferences, that is, the $z_{it}$, could result in an incorrect rejection of the full insurance model. Many of the factors that affect preferences for consumption may also affect a household's income. For example, poor health may result in an increase in the marginal value of consumption as well as a reduction in income. If the factors that shift preferences are observed by the researcher, and so omitted from the model, the parameter estimate $\beta_2$ may be biased away from 0, and the bias could go in either direction. For example, if unobserved health shocks are fully insured, the consumption of a household that experiences an adverse health shock might rise, since the community will compensate the household both for its decline in income and for its increased need for consumption. In this particular example, the estimate of $\beta_2$ would be biased to something less than zero.

In summary, the tests of insurance models discussed above appear to indicate that full risk-sharing is generally rejected. Given that full risk-sharing hinges on the complete absence of moral hazard, private information and on the perfect ability to enforce insurance contracts, this result is not very surprising. While many of the results are consistent with some risk-sharing, they are also consistent with other models of consumption determination. Although household consumption does not track household income, it is difficult to determine how much of this consumption-smoothing behaviour represents inter-temporal smoothing, through saving and borrowing; how much represents inter-household consumption smoothing, through insurance, or how much is the spurious result of measurement error bias.

4.4 Evidence on Partial Risk-sharing

Even if risk is not fully pooled between households within villages, expanded families, or countries, it is still possible that partial risk-sharing is an important method of consumption smoothing. One way to assess the importance of risk-sharing is to look directly at the methods that households use to smooth consumption. If groups of households share risk, then one should in principle be able to observe transfers or remittances between households. Furthermore, these transfers should be state-contingent, with households who experience high-income draws providing transfers to those with low-income draws.

There are several reasons why one must be cautious about inferring too much about the importance of risk-sharing by looking at data on transfers. First, many types of risk-sharing arrangements will result in 'transfers' that are quite difficult to measure. Udny's research on Nigeria (1990, 1991), for example, highlights the idea that partial risk-sharing may be accomplished through credit contracts with state-contingent repayment terms. Discerning the insurance component of a credit contract is difficult without data on the economic circumstances of both the borrower and lender as well as the actual loan repayments made. Transfers may also take the form of donated labour or other productive assets. Another possibility is that extended families share risk by transferring people rather than money between households. For example, households with high-income draws may take in relatives from households with low-income draws. Furthermore, both long-term labour contracts and land rent contracts may contain insurance components. In all these cases, the implicit transfers generated by risk-sharing will not appear as measured transfers in standard data sources. Another problem is that partial risk-sharing may generate very infrequent transfers between households. For example, households may collect transfers from family members only in the event of extreme disasters that rarely occur. In this case, few transfers might be recorded in the data in any given year, even if partial risk-sharing plays an important role in buffering consumption.
A second important point is that the transfers and remittances that are observed need not be the result of risk-sharing. Lucas and Stark (1985) discuss a range of motives for family members who have migrated to send remittances to their families. For example, migrants may send remittances to increase their chances of inheriting family assets, or to pay families back for the costs of education. A related point is made by Cox (1987), who argues that transfers between generations actually represent payments for services exchanged between family members. It could also be the case that loans between family members may masquerade as ‘gifts’. Simply documenting that transfers exist does not necessarily imply risk-sharing.

Remittances may also be made for purely altruistic reasons, possibly with no expectation (on the part of the remitter) that the transfers will ever be reciprocated. Furthermore, a finding that transfers depend on the realized economic circumstances of both the giving and receiving household, that is, are state-contingent, need not imply that transfers are the result of risk-sharing. For example, Becker (1974) shows that even one-sided altruism – where one person cares about the welfare of another, but not vice versa – may result in state contingent transfers, with the donor household giving more the higher its own income and the lower the recipient household’s income. Similarly, Ravallion and Dearden’s (1988) study of ‘moral economy’ in Java, which focuses primarily on the redistributive role of transfers includes results that are compatible with risk-sharing as well. In general, it is difficult to distinguish between altruism and (selfish) risk-sharing.

Despite the problems in interpreting data on transfers and remittances, there is some evidence to suggest that households use transfers and remittances to partially share risk. For example, Udry (1990) finds that loan repayments are sensitive to shocks received by the lending household, indicating that credit contracts are used to make state-contingent transfers. However, because Udry does not have explicit measures of the size of income shocks (but only discrete variables that indicate whether a shock occurred), it is difficult to determine whether these transfers play a large role in buffering consumption. Ravallion and Dearden (1988) find that in rural, but not urban, areas of Java, households that experience ill-health receive greater transfers, even controlling for income. However, it is not known how much of the costs of illness are covered by these transfers. Rosenzweig (1988) finds that the net transfers a family receives increase when household income falls (relative to its average value). Furthermore, households with more kinship connections to other households, in the same and different villages, have transfers that are more responsive to income shocks. Although this evidence supports the idea that transfers are a source of consumption smoothing, the results also indicate that the size of these transfers is quite small relative to the size of income shocks: transfers make up for roughly 2 per cent of an income decline. Other evidence in support of partial risk-pooling is provided by Lucas and Stark (1985). Their results indicate that the receipt of remittances by rural households in Botswana depends on an interaction between the severity of droughts and ownership of drought-sensitive assets, such as cattle. However, the question of how much insurance these transfers provide is not answered.

If family members who live in distant locations provide insurance, a logical question is whether migration decisions are made in order to diversify risk, as implied in Reardon, Delgado and Matlon (1988). This question is explored by Rosenzweig and Stark (1989), who observe that most migration in rural India is not by males seeking employment, but by females entering into marriage. These marriages may mitigate the effects of income risk by establishing ties to households in distant locations with income shocks less correlated than those of local families.

These few pieces of evidence support the idea that transfers among households have an insurance component; although Rosenzweig (1988) indicates that these transfers buffer consumption from income shocks by only a small amount. There is simply not enough literature from enough countries to draw general conclusions about the scope and importance of household risk-sharing. And, it is unlikely that any firm conclusions can be reached until more comprehensive household-level data become available from a wider range of countries.

5 CONCLUSION

Formal tests of perfect consumption smoothing, either inter-temporally through savings or spatially through sharing of idiosyncratic income shocks, do not provide convincing evidence that such patterns are prevalent in village economies. Nor is it hard to picture why this would be the case. Even in a small community information is asymmetric, and monitoring of states of nature and of individual efforts make complete sharing unlikely. Similarly, there is often a restricted menu of savings instruments available in a community. The consumption tracks income alternative is, however, no more likely. Most individuals
appear to have appreciable ability to mitigate income fluctuations.

Beyond the rejection of polar cases, what can be generalized about the diverse and often effective consumption smoothing institutions that have been recorded? Clearly, one would like to know the costs of risk-reduction. In particular, does the desire for consumption smoothing lead to a poverty trap for communities at large? That is, do the prevalent types of risk-reducing strategies imply a high premium? This could be in terms of production strategies which are low-risk-low-return, or in terms of asymmetries in asset sales and purchase prices, or other fairly costly means used to stabilize consumption. Bencivenga and Smith (1991) argue that in the absence of financial intermediation, consumers may self-insure by investing excessively in unproductive liquid investments rather than productive illiquid investments, yielding slower growth for the economy.

While there is not a single risk premium which summarizes the cost of risk aversion in developing countries, available evidence indicates that there is some relationship between ex post consumption smoothing possibilities and production decisions. Moreover, the poor appear to be less able to bear risk. As such, there is a convergence of efficiency and equity issues. For example, Binswanger and Rosenzweig (1990) find that the poor have a return for every rupee invested that is 30 per cent below that earned with a profit-maximizing portfolio similar to that held by the wealthiest households. As restricted access to consumption credit is often inferred to be a primary explanation for such patterns, it is plausible — but to date not indicated — that interventions which improve access to credit markets can raise producer efficiency. For a variety of reasons, effective instruments to achieve such ends are difficult to identify (Besley, 1992), although the benefits of such programmes may be underestimated to the degree that the efficiency gains due to risk diffusion are not considered.

The fact that the absence of insurance possibilities limits households’ ability to reduce consumption fluctuations does not necessarily imply that the most effective intervention would be to set up insurance programmes. Are there other ways that governments or other institutions can provide missing markets if co-insurance is either imperfect (missing for some groups or incomplete under covariate risks) or costly? If imperfections are due to factors for which scale is important, such as the need for reinsurance or information processing, such interventions may be possible. Conversely, if imperfections are due to asymmetries in information and moral hazard, outside agencies offer no particular advantage. A related consideration is that interventions might merely substitute for existing institutions with little welfare gain (Cox and Jimenez, 1990).

A number of studies have suggested programmes to reduce the riskiness of income, as opposed to consumption, streams — for example, through employment guarantee or similar public work schemes. Often such programmes are evaluated in terms of income transfers and of assets created; the stream of benefits may, however, also include increased farm efficiency due to indirect effects on portfolios and input allocation. Moreover, in addition to the first-round effect of reduced income risk, such programmes may have a secondary effect by increasing access to consumption credit as they may reduce the risk of default. Little evidence is currently available, however, to support (or refute) this hypothesis.

There is a wide class of other policies that may be used to reduce the riskiness of income streams. For example, countries may, and often do, stabilize the prices that producers receive for their crops. In some cases, prices are fixed and enforced by marketing boards. In other cases, countries impose export taxes that cushion farmers from fluctuations in world prices. Although such policies create inefficiencies in production decisions, Hoff (1991) and Skinner (1991) suggest that these losses may be counterbalanced by the welfare gains of risk reduction. Evaluation of the benefits of such policies depends critically on how effectively households insure themselves against price risk in the absence of the policy, and the importance of price risk in overall risk. In general, more research is needed to establish the importance of different types of risk in total income risk, and on how effectively households are insured against each type of risk.

As mentioned, despite some equity implications, a number of mechanisms are shown to smooth consumption effectively over a range of income fluctuations. However, there is also some evidence that types of co-insurance and self-insurance (savings) which work under a certain range of risks may break down under others. In particular, although a single bad year seldom results in a famine, successive bad years may have severe consequences as individual savings prove insufficient, and informal — and localized — credit becomes increasingly expensive. Although the case for or against intervention in such situations is conceptually similar to that under more limited income shocks, the costs and benefits may be sufficiently different to justify a wider set of programmes. As such, additional information on existing coping mechanisms accuizes, it may be possible to identify a range of cost-effective interventions suitable to local conditions.
example, if there is no risk-pooling but there are common shocks to income, individual and village consumption will co-move. It is easily shown that both the consumption-tracks-income model or the permanent income model will yield values of $\beta$ that go to 1 as the number of households and time periods go to infinity.

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