

Income risk, coping strategies and safety nets

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Summary

Rural and urban households in developing countries face substantial idiosyncratic and common risk, resulting in high income variability. Households in risky environments have developed sophisticated (ex-ante) risk-management and (ex-post) risk-coping strategies, including self-insurance via savings and informal insurance mechanisms to do so while formal credit and insurance markets appear to contribute only little to reducing income risk and its consequences. Informal credit and insurance, however incomplete, helps to cope with risky incomes. Despite these strategies, vulnerability remains high, and is reflected in fluctuations in consumption. It is clear therefore, that further development of safety nets will be necessary. In this paper, we focus on the opportunities available to households to use risk-management and risk-coping strategies, and on the constraints on their effectiveness.

Fluctuations in consumption usually imply relatively high levels of transient poverty. High income risk may also be a cause of persistent poverty. The failure to cope with income risk is not only reflected in household consumption fluctuations but affect nutrition, health and education and contribute to inefficient and unequal intra-household allocations.

Deaton's model provides a useful description of the advantages of self-insurance. Policy conclusions may be limited however. In practice, assets are risky, not safe. The covariance of asset values and income due to common shocks makes self-insurance a far less useful strategy than it seems. We quantify the consequences of holding risky assets that are covariate with incomes, using simulations.

Access to relatively safe and profitable assets, which might be useful for consumption smoothing, may also be limited. Lumpiness in assets may be a reason why the poor cannot protect themselves easily via assets.

Policies that influence asset market risks could be beneficial to households attempting to deal with shocks. Policies could include providing more attractive and diversified savings instruments. Microfinance initiatives should put savings for self-insurance on the agenda. Macroeconomic stability during income downturns would also allow self-insurance to function better.

Income smoothing can be achieved by income portfolio adjustments. In practice relatively little income smoothing (even via income portfolio adjustments) is achieved by poorer households. Income diversification for effective risk-reduction appears limited. Observed diversification patterns are often not aimed at reducing risk. Households face entry constraints to enter into profitable activities.

Income risk reduction often comes at a cost. Income skewing is likely if less protection is offered by investing in assets. The long-term consequences for the asset-poor are lower average incomes and a higher income gap relative to asset-rich households.

Observing specialisation does not necessarily imply that the household follows a high-risk strategy. Also, entry constraints may limit the diversification that can be achieved, leaving only low-return activities free to the poor. Income portfolios must be seen in relation to the asset portfolio and other options available: a risky, specialised portfolio may mean lower consumption risk than a diversified portfolio, depending on the asset position. Finally, several income-based strategies are only be invoked when a crisis looms. These (income) 'coping' or 'survival' strategies are especially important when the shock is economy-wide.

There has been increasing interest in the empirical analysis of informal risk-sharing and theoretical modelling on the sustainability and consequences of these arrangements. Risk-sharing can be viewed as the cross-sectional equivalent of consumption smoothing over time.

In the absence of enforcement problems, the existence of better savings opportunities and a public safety net providing transfers when common shocks occur, could improve welfare without crowding out the informal insurance arrangement. A transfer-based safety net is, however, likely to crowd out private (precautionary) savings.

Informal insurance arrangements are likely to have to be self-enforcing, imposing sustainability constraints. Circumstances in which risk-sharing arrangements may be sustained are, inter alia: a low discount rate of the future, high frequency of interactions, situations in which idiosyncratic shocks are more frequent relative to other shocks.

Evaluating the effects of alternative coping mechanisms such as savings, or of policy interventions such as providing better savings instruments or public safety nets, needs to take into account their effect on incentives to sustain the agreement rather than to go it alone. It is possible that opportunities for precautionary savings or a public safety net would actually be welfare reducing and displace the informal insurance arrangement by more than one to one.

Any policy intervention that improves an individual's position outside a private group-based informal risk-sharing arrangement may provide incentives to break down the informal arrangement. Targeted interventions that target only some members of communities or groups could be particularly counterproductive. Group-based savings schemes could provide a useful alternative or complement if one is concerned about crowding-out. The possibly negative welfare effects can be avoided.

Whether the crowding-out and potential negative welfare effects of interventions on informal insurance mechanisms are significant is an empirical question. If common shocks are dominant and if groups and communities rather than just individuals are targeted, these negative effects are likely to be less significant.

Standard quantitative poverty analysis assumes that consumption is smooth. If smoothing is not possible, especially when large negative shocks occur, then alternative measures of poverty and vulnerability need to be explored. If inter-

temporal data are available, broader definitions can be used to describe vulnerability. Aggregate measures of 'vulnerability' can be obtained.

Targeting assistance to the vulnerable population requires specific kinds of information. Analysing the characteristics of households experiencing chronic or transient poverty, or in general, their consumption fluctuations, can provide this information. Panel data are required for this analysis.

If policies are exogenous to the risk management and coping strategies, then information on how households handle income risk is irrelevant. However, policies may affect household opportunities to cope with risk (e.g. by changing exit options from informal insurance). In that case, how households cope with risk is relevant for the design of policies, in turn increasing data requirements.

If effective safety nets and other consumption risk-reducing policies require detailed knowledge of existing risk-reducing actions by households, then surveys need information on physical, human and social capital, on shocks, as well as on opportunities in labour, product and asset markets. Panel and cross-section surveys could be used to collect relevant information.

The complexity of consumption-risk reducing strategies implies that a simple indicator is unlikely to be available. Measures of vulnerability would typically require detailed data, including from panels. Some indicators that aim to describe vulnerability are typically flawed.

The emphasis on the ability to cope with risk via assets, human capital and informal insurance and on the opportunities available, marks a convergence of different disciplines, bridging gaps with more qualitative approaches.

Income risk, coping strategies and safety nets¹

1. Introduction

- *Rural and urban households in developing countries face substantial idiosyncratic and common risk, resulting in high income variability.*

High income risk is a part of life in developing countries. Climatic risks, economic fluctuations, but also a large number of idiosyncratic shocks make these households vulnerable to serious hardship. For example, table 1 gives details on the various shocks causing serious hardship to rural households in Ethiopia in the last twenty years. Not surprisingly for Ethiopia, climatic events are the most common cause of shocks, but many households suffer from other common or idiosyncratic shocks related to economic policy, labour or livestock.

Table 1 Shocks faced by rural households in Ethiopia

Events causing of hardship	Percentage of households reporting hardship episode in last 20 years
Harvest failure (drought, flooding, frost, etc.)	78
Policy shock (taxation, forced labour, ban on migration, ...)	42
Labour problems (illness or deaths)	40
Oxen problems (diseases, deaths)	39
Other livestock (diseases, deaths)	35
Land problems (villagisation, land reform)	17
Assets losses (fire, loss)	16
War	7
Crime/banditry (theft, violence)	3

Source: own calculations based on Ethiopian Rural Panel Data Survey (1994-1997)

Many other studies have reported high income variability related to risks of various forms. Using the 10-year panel data for one of three ICRISAT villages in India, Townsend (1994, p.544) reports high yearly fluctuations yields (in monetary terms) per unit of land for the dominant crops. The coefficient of variation for castor was found to be 1.01, for paddy 0.70 and for a sorghum/millet/pea intercrop 0.51. Kinsey et al. (1998) report a high frequency of harvest failures in a 23-year panel of rural households in a resettlement area in Zimbabwe. Bliss and Stern (1982) provide an estimate for Palanpur, India: if the onset of production is delayed by two weeks, then yields decline by 20 percent. Morduch (1995) provides other examples.

¹ Background Paper for the World Development Report 2000/01. The author is Oxford University. An early draft of the parts dealing with informal insurance was presented at the Annual Bank Conference in Development Economics in Europe, in Paris in May 1999. E-mail: stefan.dercon@econ.kuleuven.ac.be

- *Shocks can be idiosyncratic or common. But other characteristics matter as well in causing hardship or exacerbating the effect of shocks to income. The nature of the shock has implications for the ability to cope with its consequences.*

Income risk is caused by a variety of factors. Typically, common (aggregate, economy-wide, covariate) risk is distinguished from individual (idiosyncratic) risk: the former affects everybody in a particular community or region; the latter only affects a particular individual in this community. In practice, even within well-defined rural communities, few risks are purely idiosyncratic or common. Table 2 gives details on different events and shocks experienced by households in a 3-period panel data set on Ethiopia in a data set. A large number of different shocks affecting income happen; most shocks have a large idiosyncratic part. (In the last column, the table gives a measure of the extent to which the shock ‘common’ is to the households in the community. The lower the contribution of the village level variance to total variance, the more idiosyncratic the shock.)

Table 2 Shocks affecting income 1994-1995 (n=1450, 15 communities)

	1994a	1994b	1995	village level variance as % total variance *
village rainfall (% above long-run mean)	0.06	0.12	0.12	100
rain index (individual, 1 is best) [§]	0.57	0.57	0.63	77.0
non-rain shock index (1 is best), total index [§]	0.65	n.a.	0.80	24.2
non-rain shock : low temperature, frost, storm, etc. [§]	0.71	n.a.	0.82	35.4
non-rain shock: pests and diseases on crops [§]	0.59	n.a.	0.77	26.4
non-rain shock: animal damage, trampling,... [§]	0.68	n.a.	0.85	29.1
non-rain shock: weed damage [§]	0.29	n.a.	0.14	13.1
crop index (best=1, 0 worst) [§]	0.33	0.65	0.43	35.1
Livestock affected by animal disease (1 is best) [§]	0.72	0.86	0.89	21.1
Livestock affected by lack of water and grazing land (1 is best) [§]	0.71	0.78	0.78	22.3
Number of days lost by adults in last month per adult	0.66	0.45	0.39	3.1
Adults died in last six months	n.a.	0.04	0.02	4.1
Lower harvest linked to not having labour due to illness	0.19	n.a.	0.13	14.6
Lower harvest due to not finding labour when needed	0.18	n.a.	0.13	13.8
Lower harvest due to not finding oxen at right time	0.40	n.a.	0.27	29.6

[§]index based on reported problems. 1 means no problems reported. 0 means all possible problems occur. Rain index (individual) is based on problems for own activities from rainfall, including whether it rained during harvest, irregularly for own crops, etc. Crop index is based on reported moderate or serious crop failures.

*The results on the variance-decomposition are obtained allowing for time-varying village level means on the pooled data set across rounds. In practice, this village-level variance is the R² of a regression on a full set of time-varying village level dummies.

**Figure for consumption refers to the variance of the log of real consumption per adult.

n.a.=not available

Source: Dercon and Krishnan (1999b).

Other studies also find that the idiosyncratic part of income risk is relatively large. Deaton (1997) finds that common components for particular villages explain very little of the variation of household income changes within villages in the Côte d’Ivoire LSMS data for 1985-86. Townsend (1995) reports evidence from a Thai household

data set, suggesting that there are few common regional components in income growth. The Indian ICRISAT-data suggest also relatively limited co-movement in incomes within the villages (Townsend (1995)). Murdoch (1991) suggests that idiosyncratic risk (inclusive of measurement error) accounts for 75 to 96 percent of the total variance in income in these villages. Udry (1991) reports similar magnitudes for Northern Nigeria.

Other characteristics of income risk include the frequency of shocks and the repeated nature (see also Murdoch (1997)). Relatively small but frequent shocks are more easily to deal with than large, infrequent negative shocks. Examples of the latter are disability or chronic illness; the former are events such as transient illness. Gertler and Gruber (1997) find that, in terms of consumption levels, households in their sample from Indonesia can only protect 30 percent of the low-frequency health shocks with serious long term effects, but about 70 percent of the high-frequency smaller health shocks.

If shocks come together, i.e. bad shocks are repeated over time, then coping is more difficult. Theoretically, the effects of autocorrelation on buffer stock behaviour are explored by Deaton (1991). Using panel data from Pakistan, Alderman (1998) finds that with successive shocks, consumption smoothing is more difficult than with a single shocks.

The nature of the shock is important to understand the possibilities to deal with its consequences. Idiosyncratic shocks can be insured within a community, but common shocks cannot: if everybody is affected, the risk cannot be shared. Formal or informal insurance transfers (credit or insurance) from outside the community are necessary; intertemporal transfers (e.g. depletion of individual or community-level savings) are also possible.

- *Households in risky environments have developed sophisticated (ex-ante) risk-management and (ex-post) risk-coping strategies, including self-insurance via savings and informal insurance mechanisms.*

Households do not just undergo the consequences of high risk. Livelihood systems have developed that focus on long-term survival and well-being. There are different ways to characterise these systems. Alderman and Paxson (1994) distinguish risk-management from risk-coping strategies. The former attempt to affect *ex-ante* the riskiness of the income process ('income smoothing'). Examples are income diversification, through combining activities with low positive covariance and income-skewing, i.e. taking up low risk activities even at the cost of low return. In practice, this implies that households are usually involved in a variety of activities, including farm and off-farm activities, use seasonal migration to diversify, etc. (Rosenzweig and Binswanger (1993), Murdoch (1990), Alderman and Paxson (1994) give more references). They are usually household or individually based but may also involve neighbours, relatives or kingroups (Fafchamps (1992)) (see also section 3).

Risk-coping strategies involve self-insurance (through precautionary savings) and informal group-based risk-sharing. They deal with the consequences (*ex-post*) of income risk ('consumption smoothing'). Households can insure themselves, by

building up assets in ‘good’ years, to deplete these stocks in ‘bad’ years. Deaton (1991) has shown that precautionary savings can provide quite an effective, even though imperfect strategy for households in dealing with income risk. Rosenzweig and Wolpin (1993) report the use of bullocks in India to smooth consumption. Czukas et al. (1998), however, find little evidence of smoothing through sales of livestock (for a further discussion, see section 2).

Alternatively, informal arrangements can develop between members of a group or village to support each other in case of hardship. These mechanisms are often observed operating within extended families, ethnic groups, neighbourhood groups and professional networks. In recent years, these mechanisms have been studied theoretically and empirically in variety of settings (even though mainly in a few villages in India) (theoretically by Coate and Ravallion (1993), in ICRISAT-villages by Townsend (1994) and Ligon et al. (1997); empirically in the Philippines by Lund and Fafchamps (1997)) (see also section 4).

Risk-coping strategies may also involve attempting to earn extra income when hardship occurs. Kochar (1995) reports increased labour supply as the key response in the ICRISAT villages. The literature on coping strategies when famine strikes also regularly report attempts to earn additional income through a reallocation of labour, including temporary migration, earning income from collecting wild foods (also for own consumption), gathering activities (such as increased firewood collection), etc. Dessalegn Rahmato (1991) reports all these responses during the famine in Wollo in Ethiopia in 1984-85; similar responses were noticed in Sudan (De Waal (1987)). Other examples are in Corbett (1988)² (for more details, see section 3).

Group-based insurance mechanisms are geared towards insuring idiosyncratic shocks, affecting some members but not to all. They obviously cannot provide insurance to deal with shocks common to all members. Self-insurance can, in principle, deal with any type of shock, as long as ex-ante sufficiently large resources have been built up. Recent work has highlighted the links between informal insurance and self-insurance (e.g. Ligon et al. (1998)) and below we discuss this in more detail (section 4), since this has important implications for policy design.

- *Formal credit and insurance markets appear to contribute only little to reducing income risk and its consequences. Informal credit and insurance, however incomplete, helps to cope with risky incomes.*

²The social sciences literature on household strategies dealing with shocks often uses a different terminology. For example, Davies (1996) uses ‘coping strategies’ to describe strategies employed during crises, where coping suggests success in dealing with the crisis, while ‘adaption’ is a characteristic of a ‘vulnerable’ household, using ‘coping’ strategies as part of standard behaviour. Adaptive strategies are then defined as a permanent change in the mix of ways in which households make a living, irrespective of the year in question. For a good review, see Moser (1998). In this paper, we consider a framework in which households develop strategies to deal with contingencies. A distinction between adaption and coping seems less relevant. Any coping strategies will need ex-ante actions, such as forming informal networks, or building up savings. Consequently, all households will have adapted their livelihood to serve their own objectives as good as possible – and whether this includes more or less ‘traditional’ coping strategies is *conceptually* irrelevant, although as will be seen, it has analytical and policy implications, e.g. regarding long-term incomes.

These high risks are not easily insured via formal market mechanisms. Credit and insurance markets are typically absent or incomplete for good theoretical reasons or linked to bad policy (for surveys, see Bell (1988) or Besley (1994)). Consumption loans are rare. Nevertheless, traditional credit systems (Roscas, Susu, Tontines) often include a lending possibility, which may be used for consumption purposes. Formal loans or loans in microfinance programmes also often serve consumption purposes via their fungibility. Informal credit markets also appears to adjust to high-risk environments. Udry (1994) reports that informal loans in rural Nigeria appear to take the form of state contingent loans. Repayment is conditional on income outcomes of both borrowers and lenders: negative shocks are translated into more favourable terms for the agent experiencing them.

- *Despite these strategies, vulnerability remains high and is reflected in fluctuations in consumption. It is therefore clear that further development of safety nets will be necessary.*

Despite the existence of these systems, high variability in consumption outcomes remains. Townsend (1995) noted that income variability remains high in the ICRISAT data for India: diversification and other income strategies are only used to a limited extent and in any case insufficient. Risk coping strategies are also typically insufficient. Work on India estimates that transfers amount to less than 10 percent of the typical income shocks (Rosenzweig (1988)). Townsend (1994) reports strong evidence of insurance (risk-sharing) in the ICRISAT villages, even though it is still only partial insurance, not full insurance³. Other studies also suggested imperfect risk-sharing or consumption smoothing (Paxson (1993), Chaudhuri and Paxson (1994), Deaton (1992), Deaton (1991), Morduch (1991), see also Deaton (1997) for several examples).

The experiences during the large famines in the Horn in the mid-1980s also illustrated the limitations of these coping strategies. Dessalegn Rahmato (1991) has documented in detail the complexity of these strategies, but the results were still dramatic. Reardon et al. (1988) report that transfers in the aftermath of the 1984 drought were only equivalent to 3 percent of the losses for the poorest households in the Sahel. Recent events in East-Asia during the recent crisis also exposed the limitations of informal insurance and self-insurance. Large increases in consumption poverty have been reported, especially for rural households in remote areas or those dependent on transfers from urban areas, households relying on seasonal migration, and those households who also experienced the El-Niño related drought in the same period.

³ Risk-sharing in this sample could be due to inter-household relationships but also due to self-insurance. Rosenzweig and Wolpin (1993) find that bullocks sales and purchases contribute to consumption smoothing in these villages (at the cost of higher returns). The evidence from Townsend (1994) has also been questioned by Chaudhuri and Ravallion (1996) on econometric and other grounds. They suggest only limited insurance.

- *Fluctuations in consumption usually imply relatively high levels of transient poverty. High income risk may also be a cause of persistent poverty.*

The resulting consumption fluctuations can be expressed in terms of vulnerability to fall below a particular minimum consumption level, either temporary or in a permanent way. Different operational definitions of this idea exist in the literature. Ravallion (1988) considers transient versus chronic poverty. The chronically poor are defined as those with average consumption below the poverty line. Chronic poverty for an individual can then be measured using average consumption as the welfare indicator. Transient poverty for an individual is the average poverty over time minus chronic poverty. Aggregation using procedures as in standard poverty measures provides an overall measure of transient poverty. Using these definitions, Ravallion (1988) finds that about half of total poverty is transient in the ICRISAT-sample; Jalan and Ravallion (1996) find high transient poverty in panel data from rural China: half of the mean squared poverty gap is transient. Other definitions of chronic and transient poverty are possible; the outcomes are similar. For example, using income data over 9 years from the ICRISAT panel in India, Gaiha and Deolalikar (1993) report that about a fifth of households were poor in each year, but that only 12 percent were never poor – most households were poor for some time.

The poorest households are typically least insured against shocks. For example, Ravallion and Jalan (1997) report that for the poorest wealth decile, 40 percent of an income shock is being passed onto current consumption. By contrast, consumption by the richest third of households is protected from almost 90 percent of an income shock.

However, high income risk and the need to cope with its consequences may have implications for chronic poverty: households may be forced to forgo higher returns for more stable consumption, even at low levels. The theory is developed in Eswaran and Kotwal (1989); empirical examples include Rosenzweig and Binswanger (1993), Morduch (1990), Dasgupta (1993), Dercon (1996) and (with some dissent) Jalan and Ravallion (1998). These are discussed in more detail in section 3.

- *The failure to cope with income risk is not only reflected in household consumption fluctuations. Effects on nutrition, health and education are also observed, as are intra-household consequences.*

Rose (1994) finds that in rural India negative rainfall shocks are associated with higher boy and girl mortality rates in landless households, but not in households with lots of land. Jacoby and Skoufias (1997) find that in South India (ICRISAT-villages) children are often taken out of school in response to adverse income shocks; the result is lower accumulation of human capital. Foster (1995) shows that child growth was affected during and after the severe floods in Bangladesh in 1988. He does not find evidence of a sex bias. But other studies find such a bias. Using ICRISAT-data, Behrman (1988) shows that the inability to smooth consumption implies that child health suffers in the period before the major harvest; girls are most affected. Behrman and Deolalikar (1990), using data on individual nutrient intakes from India, report that estimated price and wage elasticities of intakes are substantially and significantly

higher for females than for males, suggesting that women and girls share a disproportionate burden of rising food prices.

Dercon and Krishnan (1999) test risk-sharing within rural households in Ethiopia. Adult nutrition is used to investigate whether individuals are able to smooth their consumption and within the household over the seasons. Within poor households in the southern part of the country, households do not engage in complete risk-sharing between husbands and wives; women in these households bear the brunt of adverse shocks. An average loss of labour due to illness for a female in a poor, southern Ethiopian household results in a loss of 1.6 to 2.3 percent of body weight due to the lack of risk-sharing.

- *In this paper, we focus on the opportunities available to households to use risk-management and risk-coping strategies, and on the constraints on their effectiveness.*

In the next section, we focus on self-insurance via savings. The advantages of savings for consumption smoothing are well understood. What is less discussed is the factors that may cause households not to be able to use this strategy effectively. Consequently, we will focus on these issues. In section 3, we will focus on the risk management strategies: income-smoothing strategies, such as diversification of activities or skewing the income portfolio towards low risk activities. We will also discuss the link with assets. In section 4, we discuss risk-coping strategies via informal insurance. In section 5, we discuss the possibilities to inform policy by monitoring vulnerability and consumption-risk reducing strategies. In section 6, we conclude.

2. Asset strategies

- *Deaton's model provides a useful description of the advantages of self-insurance. Policy conclusions may be limited however.*

Deaton (1991) sets out clearly the benefits of self-insurance via savings when credit markets are imperfect. In his model, the household maximises intertemporal expected utility. Instantaneous utility is concave and the individual has a precautionary motive (convex marginal utility). It can save, receiving a safe return r on the asset. Income is stationary and risky⁴. Households are impatient, in that their rate of time preference δ is large. The result is that $r < \delta$. Deaton shows that if households are infinitely lived (a 'dynasty') then households will build up assets in good years to deplete in bad years. Assets will not be systematically accumulated to very large levels due to impatience. We observe high frequency fluctuations in savings, consumption smoother than income, even though it is still possible that, after bad luck in the form of sequence of bad draws, consumption is very low, i.e. a deep crisis is not easily insured. Deaton plausibly argues that for many developing countries, this model fits well with some of the stylised facts of occasional low consumption, low asset holdings and high frequency of asset transactions.

⁴ In the basic model it is also i.i.d., but this assumption is relaxed in further simulations.

However, it is not easy to draw policy conclusions from this work, except for developing credit and insurance markets, which, as is well known, face inherent problems not easily addressed by interventions (Besley (1994)). In many ways the result follows largely from the impatience of households: if only they were patient, they would build up sufficient assets to cope with future stress.

- *In practice, assets are risky, not safe. The covariance of asset values and income due to common shocks makes self-insurance a far less useful strategy than it seems.*

Deaton's model assumes that savings can occur in a safe form with a positive rate of return. In practice, this may not be possible. The lack of integration of asset markets and difficulties that face the poor in obtaining access to the better (internationally traded) assets and securities means that the portfolio of assets available to the poor is far from ideal. When a common negative shock occurs, incomes are low and returns to different assets are also low – often even negative. As a consequence, just when assets are needed, net stocks could be low as well. For example, if assets are kept in the form of livestock (as they are commonly throughout most of the developing world!), then during a drought not just are crop incomes low, but some livestock may die as well and fertility will be low. The consequence is a smaller herd or even loss of all livestock, just when needed as part of the self-insurance scheme⁵. Similarly, stock market returns may be low when crisis hits an economy - as recent experience in Asia has shown. To the extent that some of these stocks are kept for precautionary motives, similar effects occur.

Another form of risk related to assets is not so much related to the return per se, but to the terms of trade of assets relative to consumption. If a negative common shock occurs, households would like to sell some of their assets. However, if everybody wants to sell their assets, asset prices will collapse and the consumption that can be purchased with the sale of assets will be lower. Similarly, when a positive shock occurs, all will want to buy assets for future protection, but then prices will be pushed up. In all, self-insurance becomes far more expensive as a strategy.

There is a lot of evidence, albeit some of it anecdotal, that this is indeed common occurrence. During the famine in Ethiopia in 1984-85, terms of trade between livestock and food collapsed – relative food prices became three times higher than usual, reducing the purchasing power of assets by two-thirds. In recent times, house prices in Indonesia and other Asian economies have collapsed after a boom during the early 1990s.

Note that the same occurs during positive shocks. Bevan et al. (1991) reported on the construction boom taking place during the coffee boom in the mid-1970s in Kenya: prices for construction materials and other durables increased considerably. Households tried to put some of their positive windfalls into more assets, but their choice set was strongly restricted due to the macroeconomic policies.

⁵ Note that this type of risk in returns to assets are not limited to commodity-based assets. The risk of bank bankruptcy and a run to withdraw deposits during economic crisis means that seemingly safe assets are in fact also risky with covariate returns with incomes.

- *We can quantify the consequences of holding risky assets that are covariate with incomes, using simulations.*

Using a simple model and some simulations, we can illustrate some of the problems arising from asset market imperfections in this context. Let the household maximise a standard intertemporally separable utility function u . Instantaneous utility v is defined over consumption c and strictly concave. Let δ be the rate of time preference. So at t , the household maximises:

$$u_t = E_t \left[\sum_{\tau=t}^T (1 + \delta)^{t-\tau} v(c_\tau) \right] \quad (1)$$

Let y_t be risky income and A_t , the stock of assets. Assets have a risky return r_t . However, we also introduce the complication that assets are kept in another form than consumption units. With consumption prices as the numéraire, transforming consumption into assets is at a price p_t per unit of the asset. We can think of p_t as the terms of trade or the exchange rate between the asset and consumption, or equivalently, a measure of the purchasing power of assets at t . See above for some examples where this may be relevant.

The asset equation linking period t and $t+1$ can be written as

$$p_{t+1}A_{t+1} = \frac{p_{t+1}}{p_t} (p_t A_t + y_t - c_t)(1 + r_{t+1}) \quad (2)$$

We introduce credit constraints in a simple way, stating that assets can never be non-negative, or

$$A_t \geq 0, \forall t \quad (3)$$

Restricting c_t , y_t , p_t and $(1+r_t)$ to non-negative values only, we can write the optimal decision rule for consumption and savings between t and $t+1$ as:

$$v'(c_t) = \max \left[v'(p_t A_t + y_t), E_t \left[\frac{p_{t+1}}{p_t} \frac{(1 + r_{t+1})}{(1 + \delta)} v'(c_{t+1}) \right] \right] \quad (4)$$

Households will consume and not save until intertemporally, appropriately discounted and valued expected marginal utility is equated to current marginal utility (second term on the right-hand side); however, if liquidity constraints bind, then the first term will be higher, so that all assets and income are used for consumption. Equation (4) is standard, except for the relative prices of assets. Note that in this formulation, the path of prices (p_{t+1}/p_t) is relevant for evaluating expected future utility relative to current marginal utility, while only r_{t+1} matters, not r_t ⁶. This allows us to consider different ways risk can enter into asset values over time.

⁶Formally, this means that current prices p_t are a state variable in the dynamic programming problem, besides the current value of assets plus income. When evaluating the future value of our assets, we need to take into account the current rate of exchange (terms of trade) between assets and consumption. The reason is that any reduction in consumption today needs to be transformed into assets using p_t , so that assets can be carried over to the future; in the future, to consume the asset, it should be transformed again into consumption units using p_{t+1} . Consequently, the current state at t is not fully described by the current means on hand, but we also need to consider the current price p_t .

Further analytical results on the consequences of risk in asset values are not obviously obtained. Using (4), we can however conduct some numerical simulations using different assumptions about risk. We consider a finite life-cycle with $T=20$ and assume that at the beginning of the first year, assets are equal to zero. Utility is logarithmic in consumption ($v(c_t) = \ln c_t$). Income is risky and we assume that income is approximately normally distributed with mean 50 and a standard deviation of 10^7 . We use a rate of time preference of 5 percent per period t . We can deploy different assumptions about the risk related to assets; however, in all cases, households know the distributions and moments of the random variables, but not the actual draw when making decisions (rational expectations). We also use different assumptions about the covariance between the risk in assets and the income risk.

To evaluate the consequences of different risk processes and their covariance, we simply calculate a *risk premium*. We define this as the consumption the household is willing to give up in the first year to obtain the optimal path of consumption without liquidity constraints (i.e. with perfect credit and insurance markets)⁸. If the household did not have access to any form of savings or credit, i.e. consumption and income are equal in each period, then we find that, under our assumptions, the risk premium implied by our assumption is 19.8 percent. Obviously, access to savings instruments, however imperfect, could improve on this percentage. The success of self-insurance can be measured by the reduction in the risk-premium via savings and assets. We therefore also give the percentage of the total risk premium (i.e. of 19.8 percent) that is *recovered* through using self-insurance.

We need to specify the different possible risk processes of assets and the covariance with income. Table 3 summarises the cases considered. In general we assume approximately normally distributed risk processes, using power points⁶. We distinguish three cases. Case 1 considers a safe asset – no risk in terms of trade or in return. Case 2 considers a risky return to the asset, although no risk in the terms of trade. We assume an (approximately) bivariate normal distribution with correlation coefficient ρ_{yr} taking on different values to allow for different forms of covariance. For simplicity, all variables are independently and identically distributed over time⁹. Note that the values chosen imply a coefficient of variation in asset returns and in income of 0.20. Case 3 considers a safe return to the asset, but risk in the terms of trade. Again, an (approximately) bivariate normal distribution with correlation coefficient ρ_{yp} is assumed. All variables are independently and identically distributed over time. The coefficient of variation of the terms of trade is also assumed to be 0.20. (Case 4 and 5 are discussed below.)

⁷In particular, we approximate the normal distribution using 10 power points taken as mean values for each of the corresponding deciles of the distribution. In this way, we allow the computations to converge rather faster, but also avoid the problem of negative incomes, inherent if we assume the normal distribution.

⁸It is evaluated at zero assets and with income and asset prices equal to mean values.

⁹ Deaton (1992) introduces another complication: autocorrelation in income over time. In general, he finds that this makes self-insurance via savings far more costly, since much higher asset holdings have to be kept to obtain the same insurance (since bad years will come in sequence). We can expect that introducing autocorrelation in our simulations would have given exactly this effect, increasing the risk premium that remains after self-insurance.

Table 3 Values for simulations used

<i>Case</i>	<i>Assumptions used</i>	<i>Description</i>
<i>Case 1: safe asset</i>	$y_t \sim N(\mu_y, \sigma_y) = N(50, 10)$ $p_t \equiv 1, \forall t=1, \dots, 20.$ $r_t \equiv 0.05, \forall t$	<i>Safe assets, with constant exchange rate between consumption and assets.</i>
<i>Case 2: Covariate risk in asset returns</i>	$((1+r_t), y_t) \sim \text{i.i.d. } N_2(\mu_r, \mu_y, \sigma_r, \sigma_y, \rho_{yr})$ $= N_2(1.05, 50, 0.21, 10, \rho_{yr})$ $\rho_{yr} \in \{-1, -0.5, 0, 0.5, 1\}$ $p_t \equiv 1, \forall t=1, \dots, 20.$	<i>Bivariate normally distributed asset returns r_t and income y_t. Asset terms of trade p_t constant. Covariance between income and asset returns possible.</i>
<i>Case 3: Covariate terms of trade risk</i>	$(p_t, y_t) \sim \text{i.i.d. } N_2(\mu_p, \mu_y, \sigma_p, \sigma_y, \rho_{yp})$ $= N_2(1.00, 50, 0.20, 10, \rho_{yp})$ $\rho_{yp} \in \{-1, -0.5, 0, 0.5, 1\}$ $r_t \equiv 0.05, \forall t=1, \dots, 20.$	<i>Bivariate normally distributed asset terms of trade p_t and income y_t. Asset return r_t safe. Covariance between terms of trade and income possible.</i>
<i>Case 4: Covariate risk in asset returns, lumpy assets</i>	As in 2 but $A_t \in \mathbb{N}, p_t=10$	<i>Case 2 but lumpy asset to be bought and sold in units of 10 (1/5 of mean income)</i>
<i>Case 5: Covariate terms of trade risk, lumpy assets</i>	As in 3 but $A_t \in \mathbb{N}, \mu_p=10$	<i>Case 3 but lumpy asset to be bought and sold in lumpy units with mean price of 10</i>

Table 4 Risk premia with imperfect assets under liquidity constraints

Case	Correlation coefficient between the asset and income risk process (ρ)	Risk premium as a percentage of the mean of the income process y . ^a	One minus the risk premium, as a percentage of risk premium of the benchmark. ^b
<i>Benchmark:</i> <i>Income risk, $y_t = c_t$</i> <i>(no assets)</i>	n.a.	19.8	0.0
<i>Case 1:</i> <i>safe asset</i>	None	6.4	67.6
<i>Case 2:</i> <i>Covariate risk in</i> <i>asset returns</i>	-0.5	5.7	71.3
	0	7.0	64.7
	0.5	8.2	58.5
	1	9.4	52.5
<i>Case 3:</i> <i>Covariate terms of</i> <i>trade risk</i>	-0.5	-0.7	103.7
	0	9.9	49.9
	0.5	16.7	15.7
	1	19.8	0.1
<i>Case 4:</i> <i>Case 2 with</i> <i>lumpy asset</i>	0	9.6	51.4
	0.5	10.6	46.7
	1	11.5	41.9
<i>Case 5:</i> <i>Case 3 with</i> <i>lumpy asset</i>	-0.5	1.7	91.5
	0	12.5	36.8
	0.5	19.0	4.1
	1	19.8	0

Simulations using equation (4), (backward solution) with logarithmic utility, $T=20$, $\delta=0.05$.

^a = the amount the household is willing to give up in the first period to get rid of all uncertainty.

^b = the percentage of the risk premium that is recovered by savings, i.e. the value in column (3) divided by 19.8 percent.

The results of the numerical simulations using these assumptions are given in table 4. In each period, there is a draw of income and if applicable, of the terms of trade of assets and of the rate of return. On the basis of this information and assets carried over from last period, the household will decide its optimal consumption and asset holding. The algorithm uses the optimal program, based on the backward solution of condition (4). The results show the consequences of risk in assets and covariance with income. First, comparing the benchmark with the case of a safe asset, we notice that two-thirds of the risk premium is recovered through self-insurance. However, if we introduce risk in the returns to assets, then this risk premium goes up, unless income and asset returns are negatively correlated. Negative correlation ($\rho_{yr} < 0$) simply means that whenever one wants to sell assets to smooth consumption due to a bad income draw, asset returns happen to be higher, so they are obviously more attractive and useful. Positive covariance gradually reduces the effectiveness of the asset as a buffer for consumption. When income and asset returns are perfectly correlated ($\rho_{yr} = 1$), the risk

premium has increased by almost half. Self-insurance is still useful – the risk premium is still less than half than in the benchmark.

The situation changes when the risk is in the terms of trade or exchange rate between assets and consumption or income. Recall that positive covariance means pricy assets whenever income is high (and households want to buy), and very low exchange rates when income is low (and households want to sell). It is clear that terms of trade risk reduces the ability to smooth consumption via self-insurance. Even without covariate income and asset prices, this source of risk is very costly, increasing the risk-premium by half relative to the case of a safe asset: the non-zero probability that you may need to sell cheap and buy at high prices is causing this. Also, with a positive covariance between income and the asset terms of trade, self-insurance quickly loses its attractiveness – even with a correlation coefficient ρ_{py} of 0.5, very little benefit can be obtained from savings in this form. Although these are results based on numerical solutions, the difference is between risk in the returns to assets and in the terms of trade of assets is intrinsic, and not just dependent on the numerical example used. In the latter case, with positive covariance, not only results a bad draw for low asset values when you would want to sell them (this is also the case when there is a bad draw in asset returns). Also, when income is high, windfall income is transformed into assets only at a high price, when terms of trade risk is present (which is not the case when we have risk in asset returns). In other words, the current asset terms of trade affect the effectiveness of transforming income into assets.

There is some evidence of household behaviour consistent with these predictions. During the 1984-85 famine, households in Ethiopia were observed rather to cut their consumption to dangerously low levels rather than sell their assets, when asset terms of trade had totally collapsed. This is consistent with the model described above: the return in terms of consumption of keeping on to their assets is very high, since at present very little consumption can be obtained. Also, Czukas et al. (1998) present evidence, consistent with this model. They find that livestock sales (both cattle and small stock) combined offset at most thirty percent, and probably closer to only fifteen percent of the crop income shortfall endured during severe drought.

- *Access to relatively safe and profitable assets, which might be useful for consumption smoothing, may also be limited. Lumpiness in assets may be a reason why the poor cannot protect themselves easily via assets.*

While risk in returns and terms of trade may limit in certain circumstances the use of assets to smooth consumption, there are examples where assets contribute to consumption smoothing. Rosenzweig and Wolpin (1993) have shown that bullock sales contribute to consumption smoothing in the South Indian ICRISAT villages, although Lim and Townsend (1994) argue that crop inventory appears to be the main strategy. Access to assets for smoothing may however not be self-evident. For example, buying and selling cattle is generally recognised a common strategy to cope with income fluctuations in many rural areas (Binswanger and McIntire (1987), Davies (1996)). However, a relatively large proportion of households often do not own any. Dercon (1998) finds that only half the households in a sample in Western Tanzania own cattle, even though cattle are important in the farming system and in their culture. The explanation is not that the others simply choose to enter into other

activities; rather, investing into livestock requires a sizeable surplus: livestock are lumpy. A cow, for example, costs about a fifth of mean crop income. Cattle ownership is generally determined by endowments in male labour and land, suggesting that those with a poorer endowment cannot generate sufficient means to enter into cattle rearing, leaving them relatively more exposed to income risk.

The consequences of lumpy assets are easily illustrated via simulations. In table 3 and 4 we have added two more simulations: case 2 and case 3 are repeated but with lumpy assets, so that they cost (on average) one-fifth of mean income. One can see that the risk premium increases quite significantly, and that the effectiveness of using the asset is reduced, especially if positive covariance is present. Dercon (1998) present other simulations, such as on the number of periods that a poor household may have no assets left to use as a buffer stock, exposing it to the consequences of bad shocks.

- *Risk in returns to assets and especially in the terms of trade between assets and consumption, covariate with household income, and assets that are lumpy, affect the possibilities for self-insurance. Consequently, policies that influence asset market risks could be beneficial to households attempting to deal with shocks.*

Despite the fact that the simulations are numerical, and partly dependent on the actual values used, we can definitely conclude that risk in asset values, whether in the returns or in their terms of trade, affects the ability to self-insure. Furthermore, the largest effects stem not from risk per se, but from the covariance between asset values and income. Positive covariance is not unrealistic: when an economy-wide shock occurs incomes are likely to decline but so also will asset values. From these simulations, we find a large reduction in the opportunity to effectively self-insure.

- *Policies could include providing more attractive and diversified savings instruments. Microfinance initiatives should put savings for self-insurance on the agenda. Macroeconomic stability during income downturns would also allow self-insurance to function better.*

Providing households access to better, a larger set and less risky assets should avoid some of these problems. Integrating asset markets with the wider economy could avoid much of the often-observed covariate movements in asset prices and incomes. For example, if in rural Africa or India, holding other assets, such as low cost financial savings via post-office accounts etc. could be facilitated, then communities could use alternatives to animals to store wealth. Introducing a focus on savings for self-insurance in the booming number of initiatives related to microfinance operations could be of help.

The terms of trade risk between assets and consumption is of particular concern. This has partly to do with macroeconomic stability. For example, terms of trade declines often coincide with consumer price increases relative to asset prices (e.g. in the famines in Bangladesh in 1974, in Ethiopia in 1985). Low inflation and exchange rate stability could reduce these large shocks in relative prices when incomes are low. Policies that limit the macroeconomic effects of common shocks would enhance self-insurance.

3. Income smoothing strategies

- *Income smoothing can be achieved by income portfolio adjustments.*

In this section, we consider income smoothing, i.e. strategies which reduce the risk in the income process. Often, the strategy considered is diversification of income sources. Theoretically, as long as the different income sources are not perfectly covariate (i.e. they have a correlation coefficient below 1), then there will be a reduction in total income risk from combining two income sources with the same mean and variance. Stated like this, there appear to be no costs involved: mean income is the same. It is useful therefore to consider also another income-based strategy, in which mean income is reduced to obtain lower risk. One could refer to this as income-skewing: resources are allocated towards low risk-low return activities. In the extreme, this will not show up as diversification: as Collier and Gunning (1999) argue, the poor may well be more specialised in a low risk-low return activity. In this section we will discuss how effective income smoothing is, the limitations to using of (mean preserving) diversification, and the determinants and costs of diversification and income skewing.

- *In practice relatively little income smoothing (via income portfolio adjustments) is achieved by poorer households.*

Many studies have emphasised the extent to which households diversify income sources. Across the developing world, farm households achieve a substantial share of income from non-farm activities (Reardon et al. (1994), and the many references in the study, Collier and Lal (1986), Collier and Gunning (1999)). Reardon et al. (1994, p.240) report an average share of 39 percent in across 8 countries in rural West-Africa. Besides non-agricultural activities, households fragment their land holdings into many plots, grow different crops or engage in local farm wage employment. But is diversification effective in practice? Townsend (1995, p.85) suggests that in the ICRISAT villages in India, substantial scope for diversification exists, but in practice relatively little takes place. Or at least, income remains highly variable. Other examples were provided above.

- *Income diversification for effective risk-reduction appears limited. Observed diversification patterns are often not aimed at reducing risk. Households face entry constraints to enter into profitable activities.*

What are the limits of income diversification strategies? First, it should be emphasised that, contrary to the impression created, combining different income sources is not necessarily meant to handle risk. For example, different activities may be conducted at different times (e.g. seasonal activities), providing income across the year by serving to smooth labour over time. Also, activities often described as risk-spreading, such as intercropping, may in fact serve to increase returns, even at the cost of increased variability (Carter (1991)).

Secondly, while in ‘normal’ years, farm and off-farm activities may be relatively uncorrelated, during crises, they may move together. Since downturns could be severe, this would severely limit the use of diversification. There is evidence that this is the case. Czukas et al. (1998) find evidence that non-farm income is also positively correlated with shocks affecting crop income: drought adversely affects not only crop income but also non-farm income. They refer to Sen’s analysis of famine – crop failure leads to a collapse of the demand for local services and crafts, limiting the use of diversification to handle risk.

Thirdly, and probably most importantly, non-agricultural activities or profitable alternative agricultural activities are not accessed easily. Most effectively-risk-reducing activities with a reasonable return cannot be easily entered. Entry constraints could take the form of working capital needs, skills requirements etc. Reardon et al. (1988) report that richer households have a higher share of nonfarm income in Burkina Faso, i.e. the poor seem less diversified. Reardon (1997) suggest that entry constraints exist in Kenya. Hussein and Nelson (1998) give numerous other examples.

Dercon and Krishnan (1996) look explicitly at the role of different constraints to enter into activities in Tanzania and Ethiopia. They find that the poor typically enter into activities with low entry costs: firewood collection, charcoal, collecting dung cakes, casual agricultural wage employment, etc. Entry into high return non-crop activities, such as cattle rearing or shop keeping, is restricted to richer households, presumably with access to capital. Non-agricultural wage employment is restricted to those with education. When asked, most households would like to invest into cattle rearing and to a lesser extent, trade and business. More recent data from Ethiopia on non-farm business activities and the investments typically needed to enter into these activities seems to confirm the relatively high capital needs for some activities. While some activities require virtually no investment, others are quite costly. Median investment into charcoal making, dungcakes collection, handicrafts, weaving or food processing was between 0 and 20 birr (3 U.S. dollars), but the returns to these activities are relatively low. More lucrative activities, such as starting a shop, entering into livestock trade or transport services required 300 to 550 birr (about \$45 to \$80). A mature cow costs about 400 birr (\$60). These are large sums in an economy with mean per adult income below \$200 (own calculation from data from Ethiopian Rural Household Survey 1995).

Dercon (1998) looked further at the evidence on whether activity choice towards high return activities in rural Tanzania is affected by entry constraints or by comparative advantage, and finds the former far more relevant. Risk considerations matter as well, but only forcing the poorer households to enter into low return activities. This leads us to the next point.

- *Income risk reduction often comes at a cost. Income skewing is likely if less protection is available through assets. The long-term consequences for the asset-poor are lower average incomes and a higher income gap relative to asset-rich households.*

Profitable or mean income preserving diversification is therefore not easily possible. Collier and Gunning (1999, p.83), building on the evidence discussed above, suggest

that the poor have to enter into low return-capital extensive activities, since high return activities require capital. The poor are less diversified despite facing more serious consequences of bad income draws with limited insurance and credit market imperfections. The implication is that many diversification or income skewing strategies are actually mean income reducing, making them less interesting for households: lower risk will have to be weighed against low returns, providing another reason for the limited income smoothing achieved in practice.

Another implication is that income-based strategies are directly linked to asset-based strategies (and other forms of protections offered, such as by informal insurance). As analysed by Eswaran and Kotwal (1989), credit can serve as insurance substitute but credit market imperfections usually imply collateralised lending. The consequence is that asset-poor households cannot enter into high-risk activities, since downside risks are too high, while asset rich households do not face this problem. Those with access to (liquid) assets can borrow in terms of crisis, or, if credit is absent, sell them as part of a buffer stock strategy. To handle income risk, asset-poor households will have to enter low-risk, low-return activities. The consequence is further impoverishment, or at least increased inequality.

There is evidence that this indeed is happening. Morduch (1990), using the ICRISAT sample, shows that asset-poor households devote a larger share of land to safer traditional varieties of rice and castor than to riskier but high-return varieties¹⁰. Dercon (1996) finds that households with limited liquid asset (livestock) grow proportionately more sweet potatoes, a low-return, low risk crop. A household with an average livestock holding has a proportion of land allocated to sweet potatoes which is 20 percent smaller than for a household with no liquid assets. The return per adult is 25 percent higher for the crop portfolio of the wealthiest group compared to the poorest quintile. Choosing a less risky crop portfolio has substantial consequences for incomes.

Bliss and Stern (1982) found that fertiliser was underutilised in Palanpur, India. Fertiliser, as many purchased inputs in general, can be considered high return but also high risk, since they increase yields, but by using less, investment losses in bad years are reduced. Rosenzweig and Binswanger (1993) suggests that the portfolio of activities (and investments) in the ICRISAT villages in India is affected by high risk. Increasing the coefficient of variation of rainfall timing by one standard deviation would reduce farm profits for the poorest quartile by 35 percent; for the richest quartile the effect is negligible. Efficiency is affected and average incomes of the poor are reduced. Wealthier farmers are not affected and achieve therefore higher incomes. The long-term wealth distribution is affected: 54 percent of wealth is held by the top 20 percent of households.

Jalan and Ravallion (1998) use data on China to test other behavioural responses. They find that increased income risk limits out migration of labour (presumably to reduce the risk of family labour shortage), although no effect on schooling decisions is found. Also they do not find that the holdings of unproductive, liquid assets are not

¹⁰ Note that he finds a significant effect on plot diversification but not on a crop diversification index, which may well be linked with some of the points made above.

increased in response to risk, although this could be due to the presence of productive liquid assets (such as livestock).

Note that these results do not follow from differences in risk preferences. Controlling for preferences, the poor select a low risk-low return portfolio, while the rich take on a more risky set of activities. The results are related to the constraints on the options available to households. Kochar (1997) states for example in the Indian ICRISAT-villages “the set of options faced by farmers offers little role for preferences” (p.159). See also Morduch (1990), Dercon (1998) or Dercon and Krishnan (1996) for a discussion.

- *Several income-based strategies are only invoked when a crisis looms. These (income) ‘coping’ or ‘survival’ strategies are especially important when the shock is economy-wide.*

When a large negative occurs, the usual household activities may not yield sufficient income. If all households in a community or region are affected, local income earning activities are unlikely to be sufficient. Examples of these crises are drought, floods, but also large economic shocks, such as those affected parts of Asia in recent years.

Kochar (1997) argues that labour supply adjustments, rather than asset or other strategies, are the main strategy used by households in India to cope with negative idiosyncratic shocks. Increased labour force participation in response to economic shocks is also found elsewhere. Moser (1998) reports increased female labour market participation and child labour in communities in Ecuador and Zambia (p.8). Jacoby and Skoufias (1997) find that in the Indian ICRISAT villages, children are taken out of school in response to adverse income shocks to work, resulting in low human capital accumulation.

A lot of attention has been given to these strategies in times of famine, such as those affecting the Horn of Africa or the Sahelian countries in the mid-1980s. In some cases, the strategies are just an intensification of the ‘usual’ risk-coping strategies; in other cases, additional action is taken to prevent destitution¹¹. Dessalegn Rahmato (1991), Corbett (1988), Davies (1996), De Waal (1987) report many examples, including temporary migration for jobs, longer working days, collecting wild foods, collecting forest products for sale such as firewood, etc. As an illustration of the scale of involvement in these activities, table 5 gives some details on survival strategies used in Ethiopia. It gives the frequency of households using a particular strategy during the famine of the mid-1980s in Ethiopia, in six different villages across the country.

¹¹A similar intensification of asset-based strategies can be noted during serious crises. While liquid assets are used to deal with fluctuations in reasonably bad years, when several bad years have followed, one observes more productive assets to be sold. For example, during the Ethiopian famine in the mid-1980s, households started to sell ploughs and other tools, as well as furniture, utensils and any other assets they had (Dessalegn Rahmato (1991)).

Table 5 Coping strategies employed during the worst period of 1984/85 and subsequent crisis in 1980s in Ethiopia. Percentage of households reporting the use of particular strategy (n=520).

<i>Village</i>	Cutting wild foods back food	sold assets	sold livestock	Feeding Camp	migrated for work	food aid	
Dinki	100%	78%	26%	80%	1%	2%	84%
D Berhan	52%	2%	8%	93%	1%	1%	0%
Adele	89%	80%	58%	8%	15%	5%	42%
Korod	93%	62%	26%	38%	1%	21%	7%
Gara Godo	93%	99%	78%	86%	27%	6%	56%
Domaa	92%	74%	45%	31%	1%	3%	36%

Own calculations using data from IFPRI-survey, 1989

- *To conclude, diversifying income sources is useful but for the poor it may come at a high cost. Observing specialisation does not necessarily imply that the household follows a high-risk strategy. Also, entry constraints may limit the diversification that can be achieved, leaving only low return activities free to the poor. Income portfolios must be seen in relation to the asset portfolio and other options available: a risky, specialised portfolio may mean lower consumption risk than a diversified portfolio, depending on the asset position.*

4. Informal risk-sharing and safety nets

- *There has been increasing interest in the empirical analysis of informal risk-sharing and theoretical modelling on the sustainability and consequences of these arrangements.*

Beyond income-based strategies and self-insurance, households use a variety of informal risk-sharing arrangements to cope with the consequences of risk. Typically, they involve a system of mutual assistance between family networks or communities. In recent years, research into the extent of risk-sharing obtained by these institutions has boomed. Some of this literature has had a clear empirical emphasis. Central questions addressed have been whether there is any empirical evidence of complete risk-sharing both in communities in developing country as in a wide variety of settings, including the U.S.¹² and how (partial or complete) risk-sharing is obtained. The tests have generally found that complete risk-sharing has to be rejected, including in the U.S., in communities in India, in extended families in the PSID or even within nuclear households in Ethiopia (Mace (1991), Cochrane (1991), Townsend (1994), Hayashi et al. (1996), Dercon and Krishnan (1999)).

These studies tend to test the presence of outcomes similar to those obtained by risk-sharing, although it cannot distinguish results due to self-insurance (i.e. accumulating and depleting assets) and informal insurance (or insurance-like behaviour, via transfers or credit). Nevertheless, there is evidence of partial risk-sharing via transfer behaviour in different countries or state-contingent ('quasi')-credit. Udry (1994) present evidence on state-contingent loans in Northern Nigeria. Lund and Fafchamps

¹² Note that this is the question that macroeconomists would love to see us prove: indeed, complete risk-sharing via formal and informal mechanisms would provide one of the few possible justifications to work with representative consumer models in macroeconomics...

(1997) show that loans and transfers play a role in risk-sharing. Grimard (1992) ordered the LSMS Côte d'Ivoire data by tribe and appears to find more stable consumption by tribes than for the full data set, suggesting that tribal networks allow smoothing over space, including via transfers. Full risk-sharing is rejected, however. Rosenzweig (1988) finds that poor households marry daughters deliberately out over space. Since covariance in income risk is likely to decline with distance, remittance flows between areas are found to contribute to smoother consumption, when either experiences a negative shock. Other evidence on the role of transfer in coping with shocks is in Ravallion and Dearden (1988) and Lucas and Stark (1985).

The theoretical literature has focused on the role of information on the possibilities for and consequences of risk-sharing arrangements (Hoff (1996)) and especially on the nature and sustainability of (partial or complete) risk-sharing arrangements given the lack of formal enforcement (Coate and Ravallion, Thomas and Worrall (1994), Platteau (1997), Ligon et al. (1997), Attanasio et Rios-Rull (1999)). Ligon et al. (1997) shows evidence that the constrained risk-sharing model fits the ICRISAT-data for India better.

- *Risk-sharing can be viewed as the cross-sectional equivalent of consumption smoothing over time.*

The key prediction of the full risk-sharing model is that marginal utilities across individuals in a risk-sharing group move in lock-step. This is obviously similar to the prediction of a permanent income/life-cycle model without liquidity constraints (as above), where marginal utilities over time for an individual are equated, conditional on appropriate discounting. The existence of full risk-sharing implies that all group resources are effectively pooled, although the theory is agnostic about the who gets what share of the joint resources. Risk-sharing implies that any unpredicted event is covered by a state-contingent transfer from other members in the group. From this it should be obvious that the group can insure idiosyncratic shocks, not common shocks. It would then be tempting to suggest that other means should be used to insure common shocks - savings or public safety nets should be developed to cope with these risks. However, the consequences of these alternatives should be well understood.

- *In the absence of enforcement problems, the existence of better savings opportunities and a public safety net providing transfer when common shocks occur, could improve welfare without crowding out the informal insurance arrangement. A transfer-based safety net is, however, likely to crowd out private (precautionary) savings.*

Suppose that full risk-sharing is always feasible for the group. The easiest assumption to justify this, is that besides full information, strong social norms exist that punish deviations, so that it is never better to renege on the agreement to share risks¹³. If saving is possible, then households would have incentives to build up assets to cope with hardship. However, if they know that they are locked into a risk-sharing arrangement, then assets will only be built up to cope with common shocks, since the

¹³ This is obviously not satisfactory as an assumption, and will be relaxed below. For the time being, it provides a useful way to develop the arguments.

risk-sharing agreement would continue to handle idiosyncratic shocks. Effectively, this would be equivalent to building up assets at the group level for self-insurance of the group to cope with common shocks. The corollary, the implications for savings when a group enters into a risk-sharing agreement, would be to reduce precautionary savings, since idiosyncratic shocks could now be insured via other means.

The introduction of a public safety net based on transfer and activated when a common shock occurs, has similar effects. If it only deals with common shocks, then the risk-sharing arrangement would not be crowded-out, but function for idiosyncratic shocks. If savings are possible, then the introduction of a public safety net would reduce precautionary savings, since overall risk has been reduced, which by definition means lower precautionary savings (Deaton (1991)). Private savings would be ‘crowded-out’. These savings are generally kept in liquid form and are not very suitable as basis for credit multiplication. However, if one worries about this crowding-out effect, then improving savings opportunities may be superior in some circumstances to a transfer-based public safety net.

Finally, if a public safety net is also available for dealing with idiosyncratic shocks, then some displacement of the informal insurance system is likely, especially if the safety net provides net transfers into the community (rather than an actuarially fair insurance system)¹⁴.

- *Informal insurance arrangements are likely to have to be self-enforcing, imposing sustainability constraints. Circumstances in which risk-sharing arrangements may be sustained are, inter alia: a low discount rate of the future, high frequency of interactions, situations in which idiosyncratic shocks are more frequent relative to other shocks.*

Enforcement through norms alone is unlikely to be sufficient. In recent years, formal models of informal insurance arrangements have clarified the conditions in which agreements could be sustained (Coate and Ravallion (1993), Thomas and Worrall (1994), Ligon et al. (1997)¹⁵). The models rely on specifying an enforceability (or sustainability) constraint in each state, in which individuals must find it in their interest to remain in the scheme, rather than going it alone. Punishment for renegeing on the agreement is exclusion from the scheme in the future. These models systematically find that risk-sharing arrangements can be sustained if individuals discount future returns at a low rate, so that any future benefits matter in deciding to enter or to remain in the scheme. Also, they rely on a large number of shocks and interactions; idiosyncratic shocks can be insured, or in general, shocks in which a large number of members are not affected by a shock relative to the number of members affected.

¹⁴ Cox and Jimenez (1991) find that in Peru, formal social security payments reduced private transfers from the young to the old by 20 percent.

¹⁵ For a discussion of the differences in some of the models, see Platteau (1997)). In Ravallion and Coate (1993) the state-contingent transfers are fixed; in Thomas and Worrall (1994), an updating rule for risk-sharing is obtained, which changes according to changes in the participation constraint over time.

- *Evaluating the effects of alternative coping mechanisms such as savings, or policy interventions such as providing better savings instruments or public safety nets needs to take into account their effect on incentives to sustain the agreement rather than to go it alone. It is possible that opportunities for precautionary savings or a public safety net would actually be welfare-reducing and displace the informal insurance arrangement by more than one to one.*

The standard models do not allow for self-insurance. Introducing the possibility of savings in the model provides better insurance to individuals to cope with common shocks. However, it will also affect the outcome when leaving the arrangement, since self-insurance can reduce the consequences of both idiosyncratic and common shocks (and as was shown in section 2, rather substantial insurance could be obtained in this way). Ligon et al. (1998) have shown that it may then not be optimal to sustain the agreement and the risk-sharing arrangement may break down. Indeed, it can be shown that fewer agreements would be sustained. Unless the welfare effect of having access to savings increases beyond the loss from the breakdown of the arrangement, welfare would be lower after the introduction of savings. Self-insurance via private savings could crowd out the informal insurance scheme by more than one-to-one, i.e. more is lost than gained.

This principle of the possible ambiguous consequences of alternative insurance opportunities on the informal insurance arrangements and on welfare is more general, if the alternatives result in improving an individual's outcome when renegeing on the agreement, i.e. the enforceability constraints are affected. In that case, more than one-to-one crowding out of the informal arrangement could occur and overall welfare could be reduced (although this is not necessarily so). In particular, Attanasio and Rios-Rull (1999) consider the consequences of introducing a safety net to deal with common shocks. Since the insurance of some part of the total risk faced by households improves the households' autarky position, it is possible that more than one-to-one crowding out occurs and total welfare is reduced by the safety net.

- *Any policy intervention that improves an individual's position outside a private group-based informal risk-sharing arrangement may provide incentives to break down the informal arrangement. Targeted interventions that target only some members of communities or groups could be particularly counterproductive.*

Policy interventions, such as a public safety net, are presented with a dilemma. If informal arrangements are present, then any outside intervention that provides an alternative source of insurance may displace the existing informal arrangements. The reason is again that the individual's outside option – part of the enforceability constraint – is likely to be affected.

Currently, many safety net interventions are targeted: particular groups, e.g. women or landless workers tend to be targeted by schemes. Public works employment schemes are set up for able-bodied people; direct transfers target to the ill and infirm, etc. Targeted interventions has become part of the standard safety net package supported by international donors, including e.g. in the current crisis in Indonesia or in the recurrent local famine situations in parts of Africa. Note that they may affect current informal systems since they affect the enforceability constraint by changing the

outside options available to members. If one is concerned about sustaining informal (traditional) insurance systems, more attention should be paid to understand the existing mechanisms¹⁶.

To avoid these problems, schemes that target groups rather than individuals, e.g. employment schemes for the group or the whole community involved in an informal scheme may be more appropriate. This of course requires detailed information about the informal schemes operating (Attanasio and Rios-Rull (1999)). If the scheme only deals with common and not idiosyncratic shocks, none of the crowding-out or welfare effects should apply. Of course, this presents substantial design and information problems.

- *Group-based savings schemes could provide a useful alternative or complement if one is concerned about crowding-out. The possibly negative welfare effects can be avoided.*

An alternative could be to encourage and support groups involved in informal insurance arrangements to develop group-based self-insurance mechanisms. Indeed, the standard distinction that individual-based self-insurance can deal best with common shocks, while informal arrangements are suitable for idiosyncratic shocks, is misleading. Groups have incentives to self-insure as well, especially if there are economies of scale in asset holdings (e.g. transactions costs, opportunities for risk-pooling of assets, etc.). Groups could build up assets in good years, to deplete in bad years for the benefit of its members, using transfer rules and mechanisms parallel to the risk-sharing arrangement for idiosyncratic shocks¹⁷.

If individuals can only benefit from the savings when part of the group, then the negative incentive effects working via the enforceability constraints of the agreement, would not exist. Groups could then extend their brief to deal to the extent possible, with common shocks as well.

Policy interventions could provide incentives for this type of behaviour. Better savings instruments, access to banking, but also macroeconomic stability would assist this process. One could also endeavour to include a more important savings-for-insurance element in group-based credit programmes, a current favourite in donor interventions.

- *Whether the crowding-out and potential negative welfare effects of interventions on informal insurance mechanisms are significant is an empirical question. If common shocks are dominant and if groups and communities rather than just individuals are targeted, these negative effects are likely to be less significant.*

Ultimately, more empirical research should shed light on the very groups and institutions engaging in informal arrangements, their functioning and role and their

¹⁶ Note that self-targeted schemes may not necessarily solve the problem: they also affect the individuals' outside option. Of course, the lower the payments in the scheme, the less they will affect the enforceability constraints. This is simply equivalent to providing lower insurance.

¹⁷ Indeed, in some traditional societies, this type of group behaviour was common. An example could be found in Western Tanzania (Sukumaland), where a community food stock, run by the village head, provided protection for the village when a large-scale crisis occurred.

potential for expansion. Also, we need more work on whether and how these informal arrangements are affected by interventions and whether alternative schemes can be designed. It is likely that interventions should especially be cautious in contexts conducive to these private informal institutions, such as tightly-knit groups affected by substantial idiosyncratic shocks. In a context where common shocks are dominant and if groups or communities can be targeted, then interventions are more likely to be beneficial in net terms¹⁸.

5. Monitoring income risk, vulnerability and coping strategies

- *Standard quantitative poverty analysis assumes that consumption is smooth. If smoothing is not possible, especially when large negative shocks occur, then alternative measures of poverty and vulnerability need to be explored.*

Income as a measure of welfare to identify poverty has long been recognised to be problematic. As an alternative, current consumption, as found in cross-section surveys, has been used for most quantitative poverty analysis. The argument is that consumption is smoother than income and due to concavity of utility (risk-aversion), households have strong incentives to keep consumption smooth. However, the combination of high income risk and the observed inability of households to keep consumption smooth via risk-management or coping strategies, especially when a serious shock hits them, would suggest that alternative measures are needed¹⁹.

- *If inter-temporal data are available, broader definitions can be used to describe vulnerability. Aggregate measures of 'vulnerability' can be obtained.*

If data are available on consumption over time, it is possible to take into account that some households may only be poor in some years. For example, one could distinguish those that are poor in each period from those that are poor in only some of the periods sampled. In all panel data sets on developing countries currently available, the large consumption fluctuations in the data result in a large number of the households moving in and out of poverty. For example, in the Indian ICRISAT data set, about 25

¹⁸There is some evidence that these issues may be relevant in Ethiopia. While generally the success of NGO programmes is rather limited in parts of the country, one NGO particularly targeted traditional funeral societies as the basis for their interventions, providing assistance and credit to members, using rules parallel to those of the funeral society, apparently rather successfully. Communities and groups may also be concerned that safety nets affect their community in a negative way. In Ethiopia, due to practical reasons, community councils were instructed to select workers among the poorest for many public works employment generation programmes. Apparently, targeting was in the end limited – the communities allowed virtually everybody to participate on a rotational basis. While other reasons are bound to be relevant as well, it would be consistent with attempting not to break down other risk-sharing arrangements.

¹⁹ Alternatives to consumption as a welfare indicator suffer from the same problems, despite apparent suggestions to the contrary. Alternative measures, such as nutrition, food expenditure, expenditure on specific commodities (such as health or education), and even measures such as health or enrolment into schools would suffer from the same problems. See the evidence on education and nutrition quoted above (Jalan and Ravallion (1998), Jacoby and Skoufias (1998), Dercon and Krishnan (1999), Foster (1995)).

percent of the poor in each period move out of poverty in the next period. Gaiha and Deolalikar (1998) reported that only 12 percent of households were never poor. Jalan and Ravallion (1996) reported that about half the poor in each year were not poor on average in their sample from Rural China. Using data from rural Ethiopia, Dercon and Krishnan (1999b) report that while poverty remains largely the same on average between 1994 and 1995 at about 40 percent, about a third of the poor are different households in each year. In all these data sets, the longer the time period considered, the fewer the households that appear to be always poor²⁰.

One could define ‘vulnerable households’ as those liable to fall under the poverty line over time, even though they need not be always poor. The evidence from panel data sets would suggest that a far higher percentage of people is vulnerable than observed to be poor in a particular year.

Another way to approach the problem is due to Ravallion (1988). He has proposed a means to capture the distinction between chronic and transient poverty. Using consumption as the underlying welfare measure, the chronically poor are those with average consumption below the poverty line. Transient poverty for an individual is the average poverty over time of this individual minus chronic poverty. Formally, for the case of the Foster-Greer-Thorbecke poverty measures, chronic poverty P_{α}^c can be

defined as: $P_{\alpha}^c = \frac{1}{n} \sum_{i=1}^n (P_{\alpha}^{ci})$, with P_{α}^{ci} individual chronic poverty, defined over mean

individual consumption over time \bar{c}_{it} as $P_{\alpha}^{ci} = \left(1 - \frac{\bar{c}_{it}}{z}\right)^{\alpha}$ if $\bar{c}_{it} < z$ and zero otherwise.

Individual transient poverty equals $P_{\alpha}^{tr,i} = P_{\alpha}^i - P_{\alpha}^{ci}$, in which P_{α}^i is the expected value (or the average over time) of individual poverty, defined in each period t as

$P_{\alpha}^{it} = \left(1 - \frac{c_{it}}{z}\right)^{\alpha}$ if $c_{it} < z$ and zero otherwise.

These definitions mean that poverty can be decomposed into a transient and chronic part. For example, using the squared poverty gap, Ravallion and Jalan (1996) report that roughly half of total (inter-temporally aggregate) poverty in their Chinese rural panel data set covering 1985-90 is contributed by transient poverty. They find that transient poverty is highest for those with average consumption near the poverty line and about 40 percent of transient poverty is found among those not poor on average. But almost all transient poverty is for households whose mean consumption is no more than 50 percent above the poverty line. Again, this means that in any given year, the poor will exclude some that are at risk to be poor in the near future²¹. Some of the

²⁰ One needs to be cautious when interpreting the evidence on widespread poverty transitions and fluctuations. Measurement error in the data would show up as increased movement up and down the poverty line, increasing the apparent mobility. Still, since most studies can find variables correlated with the fluctuations which are unlikely to be correlated measurement error in consumption, it is likely that a substantial part of the observed consumption fluctuations are genuine. See for example Deolalikar and Gaiha (1993), Baulch and McCulloch (1998), Dercon and Krishnan (1999).

²¹ Or, to put it more correctly, given that Ravallion and Jalan (1996) use the squared poverty gap (P_2), the non-poor in any given year will contribute to poverty in other years.

non-poor tend to have relatively high average consumption over time (but within bounds).

One could argue that those who are not chronically poor, i.e. who have average consumption levels above mean consumption, are not or less ‘deserving’ attention. However, if these outcomes in particular periods cannot be avoided, i.e. they cannot smooth consumption, due to constraints on their risk-management and risk-coping strategies, then this position is hard to maintain. The empirical discussion has to focus on whether this transient poverty is due to preferences (‘poor’ choices) or constraints on their choices. The available evidence discussed above may well lead us to consider that their choices are indeed often constrained.

In looking at poverty transitions in the currently available data sets, one may be tempted to interpret these fluctuations as closely linked to risk and shocks. The decomposition of poverty into transient and chronic poverty similarly suggests that transient poverty is linked to risk. However, this link needs to be established. Paxson (1992) links shocks in rainfall directly to income and consumption fluctuations. She finds that part of the fluctuations are unlikely to be linked to constrained responses towards shocks.

Dercon and Krishnan (1999) look explicitly at the link between shocks and poverty transitions, using panel data from Ethiopia. They use a fixed-effects model of consumption in which changes in consumption are linked to idiosyncratic and common shocks, such as rainfall shocks, a series of other crop shocks, illness shocks, shocks to livestock, etc. They find some of the fluctuations appear to be seasonal responses to prices and labour requirements. Nevertheless, shocks matter. Most areas in the sample experienced a fairly good harvest in the sample period. In the best period of the year (the post-harvest period) they find actual poverty of about 33 percent; in the worst period about 40 percent. Using the model and the shock information, they find however that depending on how good the year is, poverty in the post-harvest period could be up to 56 percent in the post-harvest period to 60 percent in the worst period. In other words, given current coping opportunities, a large percentage of the population would be vulnerable in a bad year, substantially larger than current poverty estimates from the (relatively good) 1990s would suggest. The figure of 60 percent may then be considered a good estimate of the ‘population at risk’ in the sample area.

All this points to the limitations of current ‘static’ poverty measures. Measures of vulnerability, ‘population at risk’, have a useful policy content, as have measures that distinguish chronic from transient poverty. The former could help the policy debate on whether poverty is increasing or not – any poverty estimates at different points in time will reflect the current circumstances, including the effects due to shocks. It is perfectly possible for poverty figures to be higher in one year relative to the next, but the vulnerable population may have gone down. Economic policy measures may increase opportunities to handle risk, e.g. via better access to or better functioning asset markets and reduce vulnerability. At the same time, a terms of trade shock may have increased the actual number of poor. While the net effect may have been a poverty increase, in fact, vulnerability may have decreased.

Information on the scale of chronic poverty relative to transient poverty could inform policy makers on the balance between mean-income increasing economic measures ('growth') relative to opportunities to mitigate fluctuations in income and consumption – such as safety nets, credit and insurance markets, etc. The size of transient poverty is also a significant constraint on the scope for reaching the chronically poor using targeted anti-poverty policies contingent on current levels of poverty (Jalan and Ravallion (1996)).

- *Targeting assistance to the vulnerable population requires specific kinds of information. Analysing the characteristics of households experiencing chronic or transient poverty, or in general, their consumption fluctuations, can provide this information. Panel data are required here.*

Ravallion and Jalan (1996) investigated the determinants of transient and chronic poverty in rural China in a (reduced-form) non-parametric regression using household characteristics as explanatory variables. They find that they are determined by different models, although some variables are significant in both regressions. Both are determined by variables such as certain physical assets (including land per capita and wealth) and household characteristics, including literacy of the head and household size.

Glewwe and Hall (1998) considered vulnerable households as those experiencing large declines in consumption following economic shocks during the adjustment between 1985 and 1990 in Peru. In this period, GNP per capita fell by 30 percent. They find that households with poorly educated heads and with more children are more affected by the shock. Contrary to what is usually stated, they found that female-headed households were not more vulnerable than male headed households.

Both approaches give information on the characteristics of the vulnerable. They do not give information on *why* they may fail to keep consumption smooth when shocks hit them. Nor give they direct information on *how* others manage to avoid consumption declines²². Still, the data requirements for this analysis are high – panel data on welfare outcomes – to obtain some understanding of the type of households at risk or chronically poor. However, once the analysis is done, identification could be done on the basis of relatively easily observable characteristics (e.g. certain assets and household characteristics).

- *If policies are exogenous to the risk management and coping strategies, then information on how households handle income risk is irrelevant. However, policies may affect household opportunities to cope with risk (e.g. by changing exit options from informal insurance). In that case, how households cope with risk is relevant for the design of policies, in turn increasing data requirements.*

In most applied poverty policy analysis, most attention goes towards identifying the poor and then promoting targeted interventions, such as safety nets via public

²² Glewwe and Hall (1998) do some analysis on this. They find that those receiving transfers from abroad (and contrary to those relying on transfers from within the country) managed to avoid consumption declines.

employment schemes. Self-targeting mechanisms are then considered a way of reaching the poor in a cost-effective way. However, once we are acknowledging that the poor may well engage in alternative coping mechanisms, then more care will be needed in designing policies.

In general, policies such as providing safety nets and or changes to economic policy will affect household opportunity sets. A new safety net may well affect household actions, such as reducing self-insurance (see above) as well as increasing overall risk in the income activities portfolio. However, while the ‘traditional’ activities may be affected negatively, overall households have more livelihood security, so this can hardly be looked upon as a welfare loss.

Of course, other economic policies may well have negative effects on risk management strategies, for example through general equilibrium effects. One can imagine trade liberalisation resulting in cheaper imports of clothes and utensils, reducing demand for weaving and handicraft, both relatively low entry cost activities, used to reduce income risk.

For our purposes, the negative externalities of otherwise ‘positive’ policies are very important. As was discussed before, a safety net may provide more protection for an individual, but if this person is linked via informal insurance with other persons not benefiting from the safety net, then a problem may arise. The informal agreement may become unsustainable, leaving some individuals worse off, despite the safety net.

A targeted safety net may cause these problems. Optimal policy design would then require not just information on those currently most at risk, but also use insights on the informal links and insurance between the targeted group and other possibly vulnerable groups dependent on informal arrangements. In general, if policies cannot be assumed to be exogenous to household behaviour and networks, then more detailed analysis on the shocks experienced by households and the way households cope with income risk would be needed to inform policy. At present, very little analysis is available.

- *If effective safety nets and other consumption risk-reducing policies require detailed knowledge of existing risk-reducing actions by households, then surveys need information on physical, human and social capital, on shocks, as well as on opportunities in labour, product and asset markets. Panel and cross-section surveys could be used to collect relevant information.*

The analysis of the success and failings of existing risk-reducing strategies by household is highly data-intensive. Most analysis published in the economics literature on risk and its consequences in developing countries is based on a handful of data sets, with most stylised facts entering into textbook development economics based on the three villages in South India, covered by ICRISAT. It is not realistic to expect this detail for a large number of countries in the developing world.

While more work is no doubt needed on detailed panel data sets, household surveys, including cross-sections, could be used to derive some measures and insights to establish vulnerability and the strategies used by households. In particular, most

studies find that vulnerability to shocks is closely linked to assets in the form of human capital and physical capital. In many ways, these are similar factors as typically highlighted as determining long-term poverty²³. Households with limited land holdings, with few assets that can be liquidated and with limited education, typically are most affected by the consequences of income risk. This is reflected in a lower mean level of consumption (due to consumption risk averting actions, such as income skewing) or higher consumption fluctuations. Most cross-section household surveys contain information on physical and human capital, although in recent years, some of the instruments promoted for monitoring welfare changes appear to have been cutting back on these measures²⁴. Information on human and physical capital may be contributing to insights on access to income-based strategies and self-insurance (or access to credit markets).

Information on physical and human capital may not be enough. In the discussion in section 3, it was argued that households may face constraints to enter into profitable diversification. Existing research suggests that physical and human capital are crucial determinants for entry into these activities. However, at the same time opportunities must exist to exploit these activities. Well-functioning markets, helped by infrastructure, roads and a demand for these products are just as important; general economic policies matter as well. It may well be possible that physical capital or skills are available, for example to enter into handicrafts or trade, as part of a coping strategy, but some areas may just be too remote to enter into them profitably. In short, information on opportunities available is just as important²⁵.

Note that entry constraints and incentives to skew income towards low-risk activities imply that indexes measuring the degree of diversification (e.g. the number of activities, the share of off-farm income, etc.) are unlikely to be a good measure of vulnerability. As was argued before, diversification is a useful strategy, but it may well be that a diversified portfolio is held for other reasons than risk-reduction. There is also no reason why a household specialised in a low risk activity faces higher risk than a household having a diversified portfolio of two very risky, correlated activities. Furthermore, it is important to look at the income portfolio in conjunction with the other risk-coping strategies: assets for self-insurance and informal insurance. Indeed, one important lesson from the literature surveyed is that the degree of diversification will be endogenous to the other strategies used, including self-insurance, irrespective of constraints on diversification.

Physical asset information is bound to be very useful to describe vulnerability. Studies that find the lack of consumption smoothing over time usually conclude that households with relatively low asset holdings are more at risk. The total value of

²³ Note however, the remark from Jalan and Ravallion (1996) that the model determining the link between assets and transient versus chronic poverty appears different.

²⁴ For example, in some countries, the SDA Priority Surveys and the Quick surveys appear to have less and less asset information in the data, with an increased focus on monitoring consumption only.

²⁵ A good example are the 'traditional' coping mechanisms with a localised drought in Ethiopia. During the drought in Northern Ethiopia in 1984-85, households could not fall back on one of their typical strategies, temporary migration to look for work, because there was a ban on casual wage labour imposed by the government, while the war effort made anyone travelling suspect. The consequences are well-known.

assets alone may not provide sufficient information on the ability to self-insurance. Important questions also relate to the liquidity of assets – can they be sold if needed? Note that many assets held in developing countries are liquid: crop inventories, cash, but also livestock, jewellery, etc, even though the latter examples may have a cost in lumpiness. As the discussion in section 2 showed, information on the functioning of asset markets is necessary to determine the usefulness of the assets.

In short, data on physical and human capital, combined with information on the functioning of and opportunities in product, labour and asset markets could provide a good basis to identify vulnerable households. Standard household surveys, including cross-section surveys, may contain a substantial part of the relevant information at the household level.

Note that consumption poverty measured in a cross-section is likely to be correlated with these asset holdings. But as was argued above is unlikely to identify the vulnerable households correctly. Once vulnerability to consumption shortfalls is the focal point, broader asset-based concepts of poverty data are needed to evaluate policies and progress. Static poverty assessments and, in general, the discussion of dynamic welfare change based on two or more static measures of poverty, derived from cross-sections, are bound to give only a limited insight in the actual patterns of change.

Data collection on household involvement in informal insurance systems is also necessary to describe household vulnerability. The lack of such information is an important shortcoming of most standard household surveys. Nevertheless, understanding vulnerability and designing interventions to address these problems require information on the networks households can fall back onto. It is possible to include in household surveys questions about the association of the household with others, and whether any insurance element is included. Observed transfers and other linkages may be one option; direct questioning on opportunities available to ask for help in times of crisis is another. A simple enumeration of the presence of networks may be useful, but care has to be taken to interpret any linkage or network as a proof for the existence of informal insurance mechanisms. Insurance and support networks definitely form part of social capital, but all social capital cannot simply be reduced to have insurance purposes.

Finally, a full description of the opportunities available to households to cope with shocks requires also information on the available formal safety nets. Any formal safety nets, for example as part of a social security policy, is relevant and needs to be taken into account for monitoring vulnerability or designing policy initiatives. The existence of public employment schemes and the way they function need to be taken into account.

The study of different forms of capital and the opportunities available to use them to reduce consumption risk can be enhanced by relatively simple, but revealing evidence on the experience of households during shocks, whether idiosyncratic or common. In particular, it is useful to ask households shocks they have experienced in recent years and how they handled these crises. This would include questions on whether they have adjusted their income generating activities, how they have used their assets and

whether they could rely on other people to support them during the crisis. Similarly, one could investigate how households would respond if particular shocks hit them now. While qualitative in nature, these direct questions, combined with information on assets could provide rich information on existing strategies to cope with risk and could inform appropriate policy design. Townsend (1996) reports on the results of a relatively simple questionnaire in used in some villages in Thailand. The focus of the questionnaire was on the difference between good and bad years and on whether or how households might have managed to smooth consumption²⁶.

- *The complexity of consumption-risk reducing strategies implies that a simple indicator is unlikely to be available. Measures of vulnerability would typically require detailed data, including from panels. Some indicators that aim to describe vulnerability are typically flawed.*

Cross-section surveys could provide useful information on relevant questions related to the understanding household vulnerability and its scale. These questions include: Do households have assets to sell? Do they have assets to reallocate? Do they have labour to reallocate? What opportunities for reallocation labour and assets exist? Can they fall back on anyone?²⁷ If panel data are available for some years, it would be possible to derive aggregate measures of ‘population at risk’, in the way discussed before. Cross-section data alone are not sufficient for such measures.

Some international agencies have developed measures that aim to describe ‘population at risk’ using food security information. For example, the FAO uses a ‘Aggregate Household Food Security Index’, based on per capita dietary energy supply (DES) from food balance sheets (and its deviation to long-term average), per capita GNP in PPP and the coefficient of variation of the income distribution. For reliable statements, the data requirements are very high and clearly not met in this case. An estimate of ‘population at risk’ is derived by assuming a time-invariant log-normal distribution around mean DES. Information gaps and the total lack of information on household behaviour and constraints make it quite unreliable for any policy purpose. Similarly, USAID has a ‘Food Security Index’ combining five indicators: food production per capita, foreign exchange earnings (as a measure of import capacity), GNP per capita, child mortality (as a proxy for income distribution) and daily calorie supply (as a proxy for food prices). One purpose is to rank countries using this index. But again, problems with the data and the lack of information on

²⁶ He finds that some rich households in one village try to smooth using buffer stocks, and some relatively poor households increased labour supply. Another group borrow and lend from each other and have developed village institutions, such as a rice bank, a housewife fund and a health insurance fund. He also finds that in a relatively rich village integrated in the cash economy, these village level institutions do not function and severe illness appears to result in serious shocks to consumption, suggesting the type of disincentive effects for sustainable informal arrangements when outside options change, as were discussed before.

²⁷ The emphasis in this paper has been on the household as the main unit engaging in strategies to reduce consumption risk. The analysis does not need to stop here: if resources are allocated as part of bargaining between members of the household, individual strategies could also be described and discussed. Similarly, in data collection, one could collect data on individual strategies, access to capital and opportunities. Detailed analysis of this goes beyond the scope of this paper. Few empirical studies have successfully addressed these issues as well.

household opportunities limit its use (see Devereux (1998) for a discussion of these and other food security monitoring activities).

- *The emphasis on the ability to cope with risk via assets, human capital and informal insurance and on the opportunities available, marks a convergence of different disciplines, bridging gaps with more qualitative approaches.*

The increasing emphasis on monitoring different forms of capital (human, physical and social) and the opportunities to use these capital goods when needed clearly draws inspiration from Sen's 'entitlements' approach to the analysis of famine. Although we emphasise that household surveys can derive much of the relevant information to monitor and understand vulnerability to risk, similar approaches can be found in social-sciences literature using qualitative approaches. An example is Moser's 'Asset Vulnerability Framework' in which households' access to different types of assets determines vulnerability (Moser (1998) and the reference therein). Similarly to the approach taken in this paper, households are considered managers of complex portfolios of assets and interventions should be aimed to promote better opportunities to use these assets. This approach relies on more qualitative data collection techniques, such participatory assessment.

Some may be tempted to suggest that quantitative surveys should *not* be used to study vulnerability and risk-coping strategies, and leave qualitative studies fill the gap (as appears to be case at present in welfare monitoring activities). We do not take this position. Integrating qualitative data collection into quantitative household surveys is bound to yield less contradictory evidence than presently seems to be found by the different approaches, for example on the effects on vulnerability and poverty from economic policies. National household surveys are likely to be required to obtain information on the scale of vulnerability and its regional spread and diversity, and to inform decisions about policies and priorities. The local nature of qualitative studies is bound to add more detailed understanding of vulnerability, but the results are difficult to aggregate and compare across areas.

6. Conclusions

Households in developing countries continue to face considerable risk, threatening their livelihood. In this paper, we have discussed the different strategies households use to cope with this risk. We have focused on income-based strategies, on assets as self-insurance and on informal insurance arrangements. Households are constrained in using these strategies. Income-based strategies are limited because of entry-constraints into profitable activities, leaving the poor to concentrate on low return, low risk activities. Self-insurance is limited by access to assets and poor functioning of asset markets when a crisis hits the household. Informal insurance arrangements are affected by sustainability constraints, often excluding the poor from these arrangements; furthermore, economy-wide shocks cannot be handled by these arrangements.

Economic policies could contribute to better protection against risk. Improved working of asset markets and macroeconomic stability would contribute to the

usefulness of self-insurance. Increased access to alternative economic activities and increased opportunities could allow income-based strategies to be strengthened. Public safety nets might be thought to provide a useful alternative; however they are likely to result in some crowding out and even a decline in average welfare, since incentive effects could affect the sustainability of informal insurance arrangements. Initiatives to develop safety nets should take into account existing risk-coping strategies. Issues of the net welfare effects and crowding-out are relevant. Strengthening self-insurance may remain an insufficiently explored alternative, such as via group-based savings. More empirical research, however, is necessary to assess the functioning of informal risk-sharing arrangements and the consequences of interventions thereof.

Obtaining estimates on the vulnerable population rather than the currently poor is very data intensive, requiring panel data. Measures of transient and chronic poverty could provide useful descriptions for policy analysis. Cross-section surveys could also provide useful insights. In particular, they could provide information on the underlying determinants of the risk-reducing strategies, in the form of physical, human and social capital. They also could inform about the opportunities available to households, currently and during past crises. Qualitative studies could provide useful insights but incorporating some of these concerns in large quantitative household surveys is likely to yield important pay-offs in terms of better understanding of changes in welfare and vulnerability, and in terms of optimal policy design.

References

- Alderman, H. and C. Paxson, (1994), "Do the poor insure? A Synthesis of the Literature on Risk and Consumption in Developing Countries", in *International Economics Association Moscow*, vol.4.
- Alderman, H., (1998) "Saving and Economic Shocks in Rural Pakistan", *Journal of Development Economics*.
- Attanasio, O. and J.Rios-Rull (1999), "Consumption Smoothing and Extended Families: the Role of Government Sponsored Insurance", mimeo, University of Pennsylvania.
- Bell, C. (1988), "Credit Markets, Contracts and Interlinked Transactions", in Chenery, H. and T.N.Srinivasan (eds.) *Handbook of Development Economics*, vol.1, North Holland.
- Behrman, J. (1988), "Intrahousehold Allocation of Nutrients in Rural India: Are Boys Favored? Do Parents Exhibit Inequality Aversion", *Oxford Economic Papers*, vol. 40, 32-54.
- Behrman, J. and Deolalikar, A., (1990), "The intrahousehold demand for nutrients in rural South India: individual estimates, fixed effects and permanent income",

Journal of Human Resources, 25, 665-96.

- Besley, T. (1995), "Nonmarket Institutions for Credit and Risk Sharing in Low-Income Countries", *Journal of Economic Perspectives*, vol.9, Summer, 115-127.
- Besley, T., (1994), "Savings, Credit and Insurance", in the *Handbook of Development Economics*, vol. IIIA (eds. J. Behrman and T.N. Srinivasan). Amsterdam. North-Holland Press.
- Bevan, D., P.Collier and J.W.Gunning (1991), *Peasants and Governments*, Oxford: Oxford University Press.
- Binswanger, H. and J.McIntire (1987), "Behavioral and materina determinants of production relations in land-abundant tropical agriculture", *Economic Development and Cultural Change*, vol.36, 73-99
- Bliss, C. and N.Stern (1982), *Palanpur: The Economy of an Indian Village*, Oxford: Oxford University Press.
- Carter, M. (1991), "Risk, Reciprocity and Conditional Self-Insurance in the Sahel: Measurement and Implications for the Trajectory of Agricultural Development in West Africa", Dept.of Agricultural Economics Staff Paper #333, University of Wisconsin.
- Chaudhuri, S. and C.Paxson (1994), "Consumption Smoothing and Income Seasonality in Rural India", discussion paper #173, Princeton University Research Program in Development Studies.
- Chaudhuri, S. and M.Ravallion (1994), "How well do static indicators identify the chronically poor?", *Journal of Public Economics*, vol.53, pp.367-394.
- Coate, S. and M.Ravallion, (1993), "Reciprocity without Commitment: Characterisation and Performance of Informal Insurance Arrangements", *Journal of Development Economics*, 40, 1-24.
- Cochrane, J.,(1991), "A simple test of consumption insurance", *Journal of Political Economy*, 99, 957-976.
- Collier, P. and D.Lal (1986), *Labour and Poverty in Kenya 1900-1980*, Oxford: Clarendon Press.
- Collier, P., S.Radwan, S.Wangwe and A.Wagner (1990), *Labour and Poverty in Rural Tanzania: Ujamaa and Rural Development in the United Republic of Tanzania*, Oxford: Clarendon Press.
- Collier, P. and J.W.Gunning (1999), "Explaining African Economic Performance", *Journal of Economic Literature*, March, vol.XXXVII, No.1, 64-111.

- Corbett, J. (1988), "Famine and household coping strategies", *World Development*, vol.16, no.9.
- Cox, D. and E.Jimenez (1992), "Social Security and Private Transfers in Developing Countries: the Case of Peru", *The World Bank Economic Review*, vol.6, no.1, 115-169.
- Czukas, K., Fafchamps, M. and C.Udry, (1998), "Drought and Saving in West-Africa: Are Livestock A Buffer Stock", *Journal of Development Economics*.
- Dasgupta, P., (1993), *An Inquiry into Well-Being and Destitution*. Oxford: Oxford University Press.
- Davies, S. (1993), "Are coping strategies a cop out", *Institute of Development Studies Bulletin*, vol.24, no.4, pp.60-72.
- Davies, S. (1996), *Adaptable Livelihoods*, London: Macmillan Press Ltd.
- Deaton, A., (1991), "Savings and Liquidity Constraints", *Econometrica*, vol.59, no.5, 1221-48.
- Deaton, A. (1992), "Household Saving in LDCs: Credit Markets, Insurance and Welfare", *Scandinavian Journal of Economics*.
- Deaton, A. (1997), *The Analysis of Household Surveys: A Microeconomic Approach*, Baltimore: Johns Hopkins University Press.
- Dercon, S. (1996), "Risk, Crop Choice and Savings: Evidence from Tanzania", *Economic Development and Cultural Change*, 44, no.3, 385-514.
- Dercon, S. (1998), "Wealth, Risk and Activity Choice: Cattle in Western Tanzania", *Journal of Development Economics*, 55, 1-42.
- Dercon, S. and P.Krishnan (1996), "Income Portfolios in rural Ethiopia and Tanzania: choices and constraints", *Journal of Development Studies*, 32, 6, 850-875.
- Dercon, S. and P.Krishnan (1999), "In Sickness and in Health: Risk-sharing within Households in Ethiopia", forthcoming *Journal of Political Economy*.
- Dercon, S. and P.Krishnan (1999b), "Vulnerability, seasonality and poverty in Ethiopia", draft, Centre for the Study of African Economies.
- Dessalegn Rahmato, (1991), *Famine and Survival Strategies, A Case Study from Northeast Ethiopia*, Nordiska Afrikainstitutet, Uppsala.
- Devereux, S., (1998), "The need for adequate information and institutions", Food Insecurity Seminar in ACP Countries, Leuven, mimeo.
- De Waal, A. (1987), *Famines that kills: Darfur Sudan, 1984-85*, Oxford: Clarendon.

- Eswaran, M. and A.Kotwal (1989), "Credit as Insurance in Agrarian Economies", *Journal of Development Economics*, vol.31, no.1, 37-53.
- Fafchamps, M., (1997), "Risk Sharing, Quasi-Credit and the Enforcement of Informal Contracts", Stanford University, mimeo.
- Fafchamps, M. (1992), "Solidarity Networks in Preindustrial Societies: Rational Peasants with a Moral Economy", *Economic Development and Cultural Change*.
- Foster, A.D., (1995), "Prices, credit markets and child growth in low-income rural areas", *The Economic Journal*, 105, May, pp. 551-570.
- Gaiha, R. and A.Deolalikar (1993), "Persistent, expected and innate poverty: estimates for semi-arid rural South India 1975-1984", *Cambridge Journal of Economics*, vol.17, 409-421.
- Glewwe, P. and G.Hall, "Are some groups more vulnerable to macroeconomic shocks than others? Hypothesis tests based on panel data from Peru", *Journal of Development Economics*, vol.56, 181-206.
- Grimard, F., (1997), "Household consumption smoothing through ethnic ties: evidence from Côte d'Ivoire", *Journal of Development Economics*, vol.53, 391-422.
- Gertler, P. and Gruber, J., (1997), "Insuring Consumption Against Illness", National Bureau of Economic Research Working Paper Series no. 6035.
- Hayashi, F., J.Altonji and L.Kotlikoff, 1996, "Risk-sharing between and within families", *Econometrica*, 64, no.2, 261-294.
- Hoff, K. (1996), "Informal Insurance Schemes: an Equilibrium Analysis", mimeo.
- Hussein, K. and J.Nelson (1998), "Sustainable Livelihoods and Livelihood Diversification", Working Paper no.69, Sustainable Livelihood Programme, May.
- Jacoby, H. and E.Skoufias (1997), "Risk, financial markets and human capital in a developing country", *Review of Economic Studies*, 64, 311-335.
- Jalan, J. and M.Ravallion (1996), "Transient versus Chronic Poverty, Evidence from China", mimeo, World Bank.
- Jalan, J. and M.Ravallion (1997), "Are the poor less well insured. Evidence on vulnerability to income risk in rural China", World Bank, mimeo.
- Jalan, J. and M.Ravallion (1998), "Behavioral Responses to Risk in Rural China", Policy Research Department, Working Paper 1978, World Bank.

- Kinsey, B., K.Burger and J.W.Gunning (1998), "Coping with Drought in Zimbabwe: Survey Evidence on Responses of Rural Households to Risk", vol.26, no.1, 89-110.
- Kochar, A. (1995), "Explaining Household Vulnerability to Idiosyncratic Income Shocks", AEA Papers and Proceedings, *American Economic Review*, 159-163.
- Ligon, E., J.Thomas and T.Worrall (1998), "Mutual Insurance, Individual Savings and Limited Commitment", mimeo.
- Ligon, E., J.Thomas and T.Worrall (1997), "Mutual Insurance with Limited Commitment: Theory and Evidence from Village Economies", mimeo.
- Lund, S. and M. Fafchamps, (1997), "Risk-sharing networks in rural Philippines", mimeo.
- Lucas, R. and O. Stark (1985), "Motivations to Remit: Evidence from Botswana", *Journal of Political Economy*, October.
- Mace, B., (1991), "Full Insurance in the Presence of Aggregate Uncertainty", *Journal of Political Economy*, 99, no.5, 928-956.
- Morduch, J. (1997), "Between the Market and State: Can Informal Insurance Patch the Safety Net?", mimeo.
- Morduch, J., (1995), "Income Smoothing and Consumption Smoothing", *Journal of Economic Perspectives*, vol.9, Summer, 103-114.
- Morduch, J. (1991), "Consumption Smoothing Across Space: Tests for Village-Level Responses to Risk", draft, Harvard University.
- Morduch, J., (1990), "Risk, Production and Saving: Theory and Evidence from Indian Households" Harvard University, Manuscript.
- Moser (1998), "The Asset Vulnerability Framework: Reassessing Urban Poverty Reduction Strategies", *World Development* vol.26, no.1, 1-19.
- Paxson, C. (1993), "Consumption and Income Seasonality in Thailand", vol.101, no.1, 39-72.
- Paxson, C. (1992), "Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand", *American Economic Review*, March, 82, 1, 15-33.
- Platteau, J.-P. (1997), "Mutual Insurance as an Elusive Concept in Traditional Rural Communities", *Journal of Development Studies*, vol.33, 6, 764-796.
- Rashid, M. and R.Townsend (1994), "Targeting Credit and Insurance: Efficiency,

- Mechanism Design and Program Evaluation”, ESP discussion paper series, World Bank 1994
- Ravallion, M. (1988), “Expected Poverty under Risk-Induced Welfare Variability”, *Economic Journal*, March, pp.1173-1183.
- Ravallion, M. (1991), “Reaching the Rural Poor through Public Employment”, *World Bank Research Observer*, vol.6, no.2, 153-175.
- Ravallion, M. (1995), “Household Vulnerability to Aggregate Shocks: Differing Fortunes of the Poor in Bangladesh and Indonesia”, in K.Basu, P.Pattanaik and K.Suzumura (eds.), *Choice, Welfare and Development*, A Festschrift in Honour of Amartya K.Sen, Oxford: Clarendon Press.
- Ravallion, M. and L.Dearden (1988), “Social Security in a ‘Moral Economy’: an Empirical Analysis for Java”, *Review of Economics and Statistics*, vol.70, 36-44.
- Reardon, T. (1997), “Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa”, *World Development*, May.
- Reardon, T., A.A.Fall, V.Kelly, C.Delgado, P.Matlon, J.Hopkins and O.Badiane (1994), “Is income diversification agriculture-led in the West African Semi-Arid Tropics”, in A.Atsain, S.Wangwe and A.G.Drabek (eds.), *Economic Policy Experience in Africa: What have we learned*, 207-230.
- Reardon, T., C.Delgado and P.Matlon (1988), “Coping with Household-Level Food Insecurity Drought-Affected Areas of Burkina Faso”, *World Development*, 16, 9, 1148-1170.
- Rose, E. (1994), “Consumption Smoothing and Excess Female Mortality in Rural India”, University of Washington, mimeo.
- Rosenzweig, M., (1988), “Risk, Implicit Contracts and the Family in Rural Areas of Low Income Countries”, *Economic Journal*, 98, 1148-1170.
- Rosenzweig, M. and O.Stark, (1989), “Consumption Smoothing, Migration and Marriage: Evidence from Rural India”, *Journal of Political Economy*, 97.
- Rosenzweig, M. and K.Wolpin, (1993), “Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-income Countries: Investment in Bullocks in India”, *Journal of Political Economy*, 101, no.2, 223-244.
- Rosenzweig, M. and H.Binswanger (1993), “Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments”, *Economic Journal*, vol.103, no.56-78.
- Thomas, J. and T. Worrall, (1994), “Informal Insurance Arrangements in Village

- Economies”, University of Warwick, mimeo.
- Townsend, R.M., (1994), “Risk and insurance in village India”, *Econometrica*, 62, no.3, 539-591.
- Townsend, R.M., (1995), “Consumption Insurance: An Evaluation of Risk-Bearing Systems in Low-Income Economies”, *Journal of Economic Perspectives*, vol.9, Summer, 83-102.
- Townsend, R.M., (1996), “Financial Structures in Northern Thai Villages”, *Quarterly Journal of Economics*,
- Lim, Y. and R.Townsend (1994), “Currency, Transaction Patterns, and Consumption Smoothing: Theory and Measurement in ICRISAT Villages”, mimeo.
- Udry, C., (1994), "Risk and insurance in a rural credit market: An empirical investigation of Northern Nigeria" *Review of Economic Studies*, 61, no.3, 495-526.
- Udry, C. (1991), “Credit Markets in Northern Nigeria: Credit as Insurance in a Rural Economy”, *World Bank Economic Review*, vol.4, no.3, 251-71.
- Walker, T.S. and J.G.Ryan (1990), *Village and Household Economies in India's Semi-Arid Tropics*”, Baltimore: Johns Hopkins University Press.
- World Bank (1980), World Development Report 1980, Washington D.C.: The World Bank.