
Income Risk, Coping Strategies, and Safety Nets

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Poor rural and urban households in developing countries face substantial risks, which they handle with risk-management and risk-coping strategies, including self-insurance through savings and informal insurance mechanisms. Despite these mechanisms, however, vulnerability to poverty linked to risk remains high. This article reviews the literature on poor households' use of risk-management and risk-coping strategies. It identifies the constraints on their effectiveness and discusses policy options. It shows that risk and lumpiness limit the opportunities to use assets as insurance, that entry constraints limit the usefulness of income diversification, and that informal risk-sharing provides only limited protection, leaving some of the poor exposed to very severe negative shocks. Public safety nets are likely to be beneficial, but their impact is sometimes limited, and they may have negative externalities on households that are not covered. Collecting more information on households' vulnerability to poverty—through both quantitative and qualitative methods—could help inform policy.

High income risk is part of life in developing economies. Climatic risks, economic fluctuations, and a large number of individual-specific shocks leave households vulnerable to severe hardship. In Ethiopia, for example, rural households are exposed to a variety of risks, including harvest failure as a result of drought, floods, frost, and other climatic events; policy shocks, such as changes in taxation and bans on migration; and the death and illness of livestock (table 1).

Many studies have reported high income variability related to risks of various forms. Using the 10-year panel data for one of the three International Crops Research Institute for Semi-Arid Tropics (ICRISAT) villages in India, Townsend (1994) reports high yearly yield fluctuations (in monetary terms) per unit of land for the dominant crops. Kinsey and others (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) estimate that in Palanpur, India, a two-week delay in the onset of production is associated with a 20 percent decline in yields. Morduch (1995) provides many other examples.

Table 1. Risk-Related Hardship Faced by Rural Households in Ethiopia

<i>Event</i>	<i>Percentage of households reported to have been severely affected in past 20 years</i>
Harvest failure	78
Policy shock	42
Labor problems	40
Oxen problems	39
Problems with other livestock	35
Land-related problems	17
Loss of assets	16
War	7
Crime/banditry	3

Source: Author's calculations based on Ethiopian Rural Panel Data Survey (1994–97).

This article reviews the strategies households and individuals use to avoid consumption shortfalls caused by risk. It draws on a growing empirical economic literature based mainly on panel data studies, supplemented by my own work on Ethiopia. This is not the first survey on this topic. Alderman and Paxson (1994), Morduch (1995, 1999), Townsend (1995), and Fafchamps (1999) have also published surveys. This article is different from those studies because I focus on the constraints households face in using these strategies and on the policies needed to strengthen the ability of communities, households, and individuals to avoid severe consumption shortfalls caused by risk. Most of the examples cited are from Africa and Asia. Lustig (2001) provides relevant examples from Latin America.

In the next section, I introduce the risk problem faced by households. In the following section, I focus on asset strategies. I then review income-based strategies, examine informal and formal safety nets, and briefly review ways of defining and monitoring vulnerability to poverty.

Types of Risks and Poor Households' Strategies for Dealing with Them

Households respond to risk in different ways. To understand their behavior, it is helpful to consider the nature of the different sources of risk they face.

Common versus Idiosyncratic Risks

Income risk is caused by a variety of factors. Common risks are aggregate, economy-wide, covariate risks that affect all members of a community or region. Individual

or idiosyncratic risks affect only a particular individual. In practice, even within well-defined rural communities, few risks are purely common or idiosyncratic. Data from a three-period panel data set on Ethiopia reveal that most of the shocks experienced by households included both idiosyncratic and common risk features (table 2).

Other studies also find that the idiosyncratic part of income risk is relatively large. Deaton (1997) finds that common components explain very little of the variation in household income for particular villages in Côte d'Ivoire in 1985–86. Townsend (1995) reports evidence from Thailand that suggests that there are few common regional components in income growth. The Indian ICRISAT data also suggest relatively limited correlation in incomes within villages. Morduch (2002) concludes that idiosyncratic risk (inclusive of measurement error) accounts for 75–96 percent of the total variance in income within these villages. Udry (1991) reports similar magnitudes for northern Nigeria.

Other characteristics of income risk include the frequency and intensity of shocks and the persistence of their impact (see Morduch 1999). Relatively small but frequent shocks, such as transient illness, are easier to deal with than large, infrequent negative health shocks, such as disability or chronic illness. Gertler and Gruber (2002) find that in terms of consumption levels, households in Indonesia can protect themselves against only 30 percent of low-frequency serious health shocks with severe long-term effects. In contrast, they are able to insure their consumption against about 70 percent of high-frequency smaller health shocks.

If shocks persist, coping is more difficult. In a theoretical study Deaton (1991) examines the effects of autocorrelation in income on consumption smoothing when credit markets are missing. Using panel data from Pakistan, Alderman (1998) shows that successive shocks make consumption smoothing more difficult than do single shocks. Some shocks, such as health problems, may also have persistent effects.

Identifying the nature of the shock helps identify the possibilities for dealing with its consequences. Idiosyncratic shocks can be insured within a community. Common shocks cannot, because if everyone is affected, the risk cannot be shared. Formal or informal insurance transfers (credit or insurance) from outside the community or intertemporal transfers (such as depletion of individual or community-level savings) are therefore necessary to deal with common shocks.

Strategies for Reducing the Impact of Shocks

Alderman and Paxson (1994) distinguish risk-management from risk-coping strategies.¹ Risk-management strategies attempt to reduce the riskiness of the income process *ex ante* (income smoothing). Examples include income diversification, achieved by combining activities with low positive covariance, and income skewing, achieved by taking up low-risk activities, even at the cost of low returns.

Table 2. Shocks Affecting Income of Rural Households in Ethiopia, 1994–95

Shock	Round 1	Round 2	Round 3	Village-level variance (as percent of total variance) ^a	F-test of analysis of variance ^b
Village rainfall (percent above long-run mean)	0.06	0.12	0.12	100	n.a.
Rain index (individual)	0.57	0.57	0.63	40.6	64.6
Total nonrain shock index	0.65	—	0.80	28.2	37.2
Nonrain shock: low temperature, frost, storm, or other climatic event	0.71	—	0.82	34.4	49.9
Nonrain shock: crop pests and diseases (index)	0.59	—	0.77	28.9	38.7
Nonrain shock: animal damage, trampling, or related shock (index)	0.68	—	0.85	30.9	42.6
Nonrain shock: weed damage (index)	0.29	—	0.14	13.8	15.3
Crop index	0.33	0.65	0.43	34.0	49.1
Livestock affected by animal disease (index)	0.72	0.86	0.89	24.6	30.6
Livestock affected by lack of water and grazing land (index)	0.71	0.78	0.78	31.7	25.3
Number of days lost by adults in past month, per adult	0.66	0.45	0.39	5.2	5.3
Number of adults who died in past six months	—	0.04	0.02	5.6	5.8
Smaller harvest linked to not having labor due to illness (%)	0.19	—	0.13	15.9	17.8
Smaller harvest due to not finding labor when needed (%)	0.18	—	0.13	14.4	15.7
Smaller harvest due to not finding oxen at right time (%)	0.40	—	0.27	32.0	43.5

— = Not available.

n.a. = Not applicable.

Note: Number of observations = 1,450 households in 15 communities. Data collected in 1994 and 1995, with about six months between survey rounds. Index data are based on reported problems: 1 = no problems reported, 0 = all possible problems occur. Rain index (individual) is based on problems for own activities from rainfall, including whether it rained during harvest and whether the pattern of rainfall was irregular. Crop index is based on reported moderate or severe crop failures. For each index, the mean value of the index is reported. Percentages refer to the percentage of households reporting a problem.

^aResults 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 R^2 of a regression on a full set of time-varying village-level dummies. The lower the contribution of the village-level variance to total variance, the more idiosyncratic is the shock.

^bAll tests are significant at the 5 percent level. The higher the F -statistic, the higher the contribution of village-level shocks to total shocks.

Source: Dercon and Krishnan (2000b).

Risk-coping strategies include self-insurance (through precautionary savings) and informal group-based risk-sharing. They deal with the consequences of income risk (consumption smoothing). Households can insure themselves by building up assets in good years, which they deplete in bad years. Alternatively, informal arrangements can be made among members of a group or village to support each other in case of hardship. These mechanisms are observed within extended families, ethnic groups, neighborhood groups, and professional networks.

Risk-coping strategies may also involve attempting to earn extra income when hardship occurs. Kochar (1995) reports increased labor supply as the key response in the ICRISAT villages in south India. During famines in Ethiopia or Sudan, villagers tried to earn additional income by temporarily migrating, collecting wild foods, and engaging in gathering activities, such as collecting firewood.

The social science literature on household strategies dealing with shocks often uses different terminology. Davies (1996) uses the term *coping strategies* to describe strategies employed during crises. In her terminology, *coping* refers to success in dealing with a crisis. *Adaptation* is a characteristic of a *vulnerable* household, using coping strategies as part of standard behavior. Adaptive strategies are then defined as a permanent change in the mix of ways in which households earn a living, irrespective of the year in question (for a good review, see Moser 1998).

I adopt a framework in which households develop strategies to deal with contingencies. The distinction between adaptation and coping seems less relevant. Any coping strategies will require 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 well as possible. Whether they do so using traditional coping strategies is conceptually irrelevant, however, as will be seen, it has analytical and policy implications (regarding long-term incomes, for example).

The Role of Formal and Informal Credit and Insurance Markets

High risks are not easily insured by formal market mechanisms. Credit and insurance markets are typically absent or incomplete in developing countries, either for good theoretical reasons or because of bad policy (for surveys, see Bell 1988 or Besley 1994, 1995). Consumption loans are rare. Traditional credit systems (*roscas*, *susu*, *tontines*), however, often extend loans, which may be used for consumption purposes. Formal loans or loans in microfinance programs also often finance consumption because the funds they provide are fungible.

Informal credit markets appear 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, with negative shocks translated into more favorable terms for the party experiencing them.

The Need for Safety Nets

Despite these strategies for managing and coping with risk, vulnerability to consumption shortfalls remains high in developing countries. Further development of safety nets is therefore necessary. Townsend (1995) notes that income variability remains high in the ICRISAT villages in south India, where diversification and other income strategies are used only to a limited extent and are in any case inadequate. Risk-coping strategies are also typically insufficient. Rosenzweig (1988) estimates that transfers in India amount to less than 10 percent of typical income shocks. Other studies also suggested imperfect risk-sharing or consumption smoothing (Chaudhuri and Paxson 1994; Deaton 1991, 1992, 1997; Morduch 2002; Paxson 1993).

The experiences during the famines in the Horn of Africa in the mid-1980s also illustrate the limitations of these coping strategies. Despite complex coping strategies, as documented by Rahmato (1991), the effects of the famines were severe. Dercon (2002) reports that 10 years after the famine, cattle holdings were still only two-thirds what they were just before the famine. Reardon and others (1988) report that transfers in the aftermath of the 1984 drought were equivalent to only 3 percent of the losses for the poorest households in the Sahel.

Events in east Asia during the financial crisis of the late 1990s also exposed the limitations of informal insurance and self-insurance. In Indonesia, for example, consumption poverty increased substantially, and household investment in health and education declined, affecting future generations (Chaudhuri and others 2001; Frankenberg 1999; Thomas and others 2001).

Rose (1999) finds that in rural India negative rainfall shocks are associated with higher child mortality rates in landless households but not in households with significant landholdings. Jacoby and Skoufias (1997) finds that households in some villages in south India send their children to work instead of school to supplement income after adverse shocks. Foster (1995) shows that child growth was affected during and after severe flooding in Bangladesh in 1988. He does not find evidence of a sex bias, but other studies do. Using ICRISAT data, for example, Behrman (1988) shows that the inability to smooth consumption negatively affects child health in the period before the major harvest, with girls affected more than boys. Using data on individual nutrient intakes from India, Behrman and Deolalikar (1990) report that estimated price and wage elasticities of food intake 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 (2000a) examine risk sharing by rural households in Ethiopia. They studied adult nutrition to investigate whether individuals are able to smooth their consumption within the household over the seasons. Poor households in the southern part of the country do not engage in complete risk-sharing between husbands and wives: women in these households bear the brunt of adverse shocks. Be-

cause of imperfect risk-sharing, women in poor households lose an average of 1.6–2.3 percent of their body weight as a result of loss of labor caused by illness.

Using Assets to Smooth Income and Consumption

Saving in good times and depleting assets when the going gets tough are commonly observed consumption-smoothing strategies. Its effectiveness, however, is restricted by the circumstances faced by many of the poor in developing economies.

Self-Insurance through Savings

Deaton (1991) describes the benefits of self-insurance through savings when credit markets are imperfect. In his model, the household maximizes expected utility over time. The household is risk averse and has a precautionary motive for savings, so that it will save more if risk increases. Households can save, receiving a safe return on asset, which is assumed to be relatively low. Income is risky.² Because households are impatient (that is, they have a preference to consume today rather than in the future), interest rates are lower than the rate of time preference.

Deaton assumes further that households behave as if they have an infinite planning horizon. In that case, they will build up assets in good years to deplete in bad years. As a result of impatience, assets are not systematically accumulated to very large levels. High levels of fluctuations are observed in savings, and consumption is smoother than income. Severe crises are not easily insured, however. Despite these strategies, a sequence of bad draws can still mean that consumption is very low. Deaton argues that for many developing countries, this model fits well with some of the stylized facts of occasional low consumption, low asset holdings, and high frequency of asset transactions. It is not easy to draw immediate policy conclusions from this work, however. The key result—imperfectly smooth consumption—follows largely from the impatience of households. If only they were patient, they could build up sufficient assets to cope with future stress.

The Effect of Common Shocks on Asset Prices and the Terms of Trade

To understand household savings behavior in risky environments in developing economies, one needs to acknowledge that assets are risky. 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 the difficulties the poor face in obtaining access to internationally traded assets means that the portfolio of assets available to them is limited. When a common negative shock occurs, incomes are low and returns to different assets are also low, often even negative.

Consequently, 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 throughout most of the developing world), a drought causes both a decline in crop incomes and the death of and drop in fertility of livestock. The consequence is a smaller herd (or even loss of all livestock) just when these assets are needed as part of the self-insurance scheme.³ Similarly, stock market returns may be low when a crisis hits an economy, as they were during the Asian financial crisis. The likely covariance of asset values and income as a result of common shocks thus reduces the usefulness of self-insurance.

Another problem with holding assets to buffer consumption is that the terms of trade between goods for consumption and assets change as a result of a common shock. If a negative common shock occurs, households would like to sell some of their assets. However, if everyone wants to sell assets at the same time, asset prices will collapse and the amount of consumption that can be purchased with the proceeds will fall. Similarly, when a positive shock occurs, everyone will want to buy assets for future protection, pushing up prices (box 1).

There is a lot of evidence, albeit some of it anecdotal, that this effect is common. During the famine in Ethiopia in 1984–85, terms of trade between livestock and food collapsed (Rahmato 1991). Relative food prices rose by a factor of three, reducing the purchasing power of assets by two-thirds.

Box 1. Simulating the Effects of Asset Lumpiness and Risk on Consumption Smoothing

Dercon (2000) uses simulations to illustrate the effects of asset lumpiness and risk on the ability of savings to buffer consumption. Assuming reasonable values for the parameters of an extension of a model similar to Deaton's (1991), he calculates the risk premium (the amount one would be willing to pay in the first period to avoid risk) using different assumptions about assets. The model assumes a 20-year horizon, as well as logarithmic utility, risky income with mean of 50 and a standard deviation of 10, and a rate of time preference and an expected interest rate of 5 percent.

Without access to credit, insurance, or savings, the risk premium was 19.8 percent of mean income. This value can be viewed as the benchmark, a measure of the risk that needs to be covered. Expressing the risk premium in each case as a percentage of total risk provides a measure of how much risk remains uninsured; one minus this value is a measure of how well self-insurance works. For safe assets the value was 67 percent, meaning that two-thirds of total consumption risk is insured if households have access to safe assets and use them optimally. Including asset return risk (introduced as returns with a mean of 5 percent and a coefficient of variation of 0.2) reduces this value slightly to 65 percent. If the correlation of incomes and assets (covariate risk) is 0.5, the value drops to 58 percent.

The presence of covariance in the terms of trade is far more problematic for households to deal with. If asset prices are risky (a coefficient of variation of 0.2), then if price risk is independent of income risk, self-insurance can cover only 50 percent of the total risk premium. Given a positive covariance in the terms of trade (with a correlation coefficient of 0.5), the figure falls to just 16 percent. Introducing lumpiness in the assets (so that they need to be purchased in units of 10) reduces the figure to just 5 percent. Asset lumpiness and the terms of trade risk, especially if it is covariate with income, thus significantly reduce the usefulness of self-insurance through savings.

The same phenomenon occurs following positive shocks. Bevan and others (1991) describe the construction boom that took place in Kenya during the coffee boom in the mid-1970s, when prices for construction materials and other durables increased markedly. Households tried to put some of their positive windfall into more assets, but their choice set was sharply restricted by macroeconomic policies, such as foreign exchange and capital controls.

The Problem of Lumpy Assets

Though risk in asset returns and in the terms of trade may reduce the usefulness of assets for smoothing consumption, holding assets can nevertheless help smooth consumption. Rosenzweig and Wolpin (1993) show 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 used by these households. Access to relatively safe and profitable assets may be limited, however. The lumpiness of assets may partly explain why the poor cannot protect themselves easily by holding assets. For example, buying and selling cattle is generally recognized as a common strategy for coping with income fluctuations in many rural areas (Binswanger and McIntire 1987; Davies 1996). But a large proportion of households often do not own livestock. 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 the culture. The explanation is not that half of all households choose to engage in other activities but that investing in livestock requires a sizable surplus: livestock are lumpy. A cow, for example, costs about a fifth of mean annual crop income. Cattle ownership is generally determined by endowments in male labor and land. Households with small endowments cannot accumulate sufficient means to purchase cattle, leaving them more exposed to income risk (see box 1).

There is some evidence that household behavior is consistent with these predictions. During the 1984–85 famine, households in Ethiopia cut their consumption to dangerously low levels rather than sell their assets when asset terms of trade had collapsed (Rahmato 1991). Czukas and others (1998) find that livestock sales (both cattle and small stock) offset at most 30 percent and probably closer to 15 percent of the crop income shortfall during severe drought.

Helping Poor Households Deal with Shocks

Policies that reduce asset market risks could help households deal with shocks. Maintaining macroeconomic stability during income downturns, for example, would allow self-insurance to function better. Providing households with access to more attractive and more diversified assets could also help them deal with shocks. Integrating asset markets with the wider economy could prevent much of the often-observed

covariance between asset prices and incomes. In rural Africa or India, for example, facilitating the holding of assets other than animals—low-cost financial savings held in post office accounts, for example—could help households weather shocks. Introducing a focus on savings for self-insurance in the booming number of initiatives related to microfinance operations could also help.

Macroeconomic policy could also reduce the effects of shocks in the terms of trade. For example, a worsening of the terms often coincides with inflationary increases in consumer prices relative to asset prices, as occurred during the famines in Bangladesh in 1974 and Ethiopia in 1985. Low inflation and exchange rate stability could limit large shocks in relative prices when incomes are low. Policies that reduce the macroeconomic impact of common shocks would enhance self-insurance.

Income-Smoothing Strategies

Income smoothing refers to strategies that reduce risk and fluctuations in income. They are commonly observed in developing countries, but they may come at a cost in terms persistent poverty.

Income Diversification and Income Skewing

Income smoothing often involves diversifying income sources. Theoretically, as long as the different income sources are not perfectly covariate (that is, they have a correlation coefficient less than 1), combining two income sources with the same mean and variance will reduce the total income risk. Stated in this way, there appears to be no cost to diversifying, because mean income remains unchanged. A more realistic scenario is one in which mean income is reduced to lower risk. This strategy can be called *income skewing*, because it involves allocating resources to low-risk, low-return activities. It is different from diversification because it is possible that households specialize in only one activity, with low risk and a low return.

Widespread diversification of income sources is observed in developing economies. Across the developing world, farm households receive a substantial share of income from nonfarm activities. Reardon and others (1994) report an average share of 39 percent of income from nonfarm activities in eight countries in rural west Africa. In addition to engaging in nonagricultural activities, households fragment their land holdings into many plots, grow different crops, and engage in local farm wage employment.

Is diversification effective? Townsend (1995) notes that in the ICRISAT villages in south India substantial scope for diversification exists. Relatively little appears to take place, however, and income remains highly variable. Diversification does not always result in income smoothing, for several reasons. First, combining different

income sources is not always intended to manage risk. Different activities may be conducted at different times of the year, providing income throughout the year by smoothing labor over time. Second, though farm and off-farm activities may be relatively uncorrelated in normal years, during crises they may move together. In a severe downturn, this would severely limit the usefulness of diversification.

There is evidence that this is the case. Czukas and others (1998) show that non-farm income is positively correlated with shocks affecting crop income: drought adversely affects not only crop income but also nonfarm income. This finding is consistent with Sen's (1981) analysis of famine, in which crop failure sometimes leads to a collapse in demand for local services and crafts, limiting the usefulness of diversification to reduce risk.

There are also important constraints to entering into profitable and risk-reducing diversification. Nonagricultural activities or profitable alternative agricultural activities are not easily accessed. Entry constraints could take the form of working capital, skills, or other requirements (see Reardon and others 1988; Reardon 1997).

Dercon and Krishnan (1996) look explicitly at the role of different constraints in Tanzania and Ethiopia. They find that the poor typically enter into activities with low entry costs, such as collecting firewood and dungcakes, making charcoal, and working as casual agricultural wage earners. Entry into high-return noncrop activities, such as cattle rearing or shopkeeping, in which most households would like to engage, is restricted to richer households, presumably those with access to capital. Non-agricultural wage employment is restricted to people with education.

Recent data from Ethiopia on the investments needed to enter nonfarm business activities indicate that relatively high levels of capital are required for some activities (Dercon 2000). The median investment needed to enter into charcoal making, dung cake collection, handicraft production, weaving, or food processing—activities with relatively low returns—was 0–20 birr (up to US\$3). More lucrative activities, such as starting a shop, trading livestock, or providing transport services, required 300–550 birr (\$45–80). A mature cow costs about 400 birr (\$60). These are large sums in an economy in which mean per adult income is less than \$200/year (author calculation based on data from Ethiopian Rural Household Survey 1995). Dercon (1998) shows that barriers to entry were more important than comparative advantage in determining entry into high-return activities in rural Tanzania.

The Cost of Reducing Income Risk

Reducing income risk often comes at a cost, because it is difficult to diversify the sources of income without reducing the level of mean income. Although they face more severe consequences from risky incomes (because of more limited insurance and credit market imperfections), the poor are often less diversified than wealthier households. The reason may be that many diversification or income-skewing strategies

reduce mean income, making them less attractive for poor households. Capital and other entry constraints exclude the poor from diversification into activities with a higher return. This unwillingness (or inability) to accept lower returns may partly account for the limited income smoothing observed in developing countries. The long-term consequences for the asset-poor are lower average incomes and a higher income gap relative to asset-rich households.

Another reason the poor have less diversified sources of income than other households is that income-based strategies are directly linked to asset-based strategies (and other forms of protections, such as those provided by informal insurance). As Eswaran and Kotwal (1989) show, credit can serve as an insurance substitute, but credit market imperfections usually imply collateralized lending. The consequence is that asset-poor households cannot enter into high-risk activities because downside risks are too high. Asset-rich households do not face this problem. Households with access to (liquid) assets can borrow in times of crisis or, if credit is not available, sell assets as part of a buffer stock strategy. In contrast, to reduce their income risk, asset-poor households have to enter low-risk, low-return activities. The consequence is further impoverishment, or at least increased inequality.

Evidence suggests that this is indeed 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 higher-return varieties.⁴ Dercon (1996) finds that Tanzanian households with limited liquid assets (livestock) grow proportionately more sweet potatoes, a low-return, low-risk crop. A household with an average livestock holding allocates 20 percent less of its land to sweet potatoes than a household with no liquid assets. The crop portfolio of the wealthiest quintile yields 25 percent more per adult than that of the poorest quintile. Choosing a less risky crop portfolio thus has substantial negative consequences for incomes.

Rosenzweig and Binswanger (1993) suggest that the portfolio of activities (and investments) in the ICRISAT villages is affected by high risk. Increasing the coefficient of variation of rainfall timing by one standard deviation reduces farm profits of the poorest quartile by 35 percent; for the richest quartile, the effect is negligible. Efficiency is affected, and the average incomes of the poor decline. Wealthier farmers are not affected and are therefore able to earn higher incomes. This phenomenon affects wealth distribution: 54 percent of wealth is held by the top 20 percent of households. Jalan and Ravallion (2001) cite other examples, although their evidence is more mixed.

These results do not follow from differences in risk preferences: controlling for preferences, the poor select a low-risk, low-return portfolio, whereas the rich take on a riskier set of activities. These results reflect the constraints on the options available to poor households. As Kochar (1995) notes, "the set of options faced by farmers offers little role for preferences" (p. 159). The policy implication is that just promoting diversification is not necessarily a solution. Finding ways of reducing entry constraints into profitable low-risk activities is crucial.

Income-Based Strategies for Dealing with Crises

Several income-based strategies are invoked only when a crisis looms. These coping or survival strategies are especially important when the shock is economywide. Examples of economywide shocks include drought, floods, and large economic shocks, such as those affecting parts of Asia in recent years. When a large negative shock 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.

Kochar (1995) argues that labor supply adjustments, rather than asset or other strategies, are the main strategy used by households in India to cope with negative idiosyncratic shocks. Increased labor force participation in response to economic shocks is also found elsewhere. Moser (1998) reports increased female labor market participation and child labor in Ecuador and Zambia. Jacoby and Skoufias (1997) find that in response to adverse income shocks, children in the ICRISAT villages in south India were taken out of school to work, reducing the accumulation of human capital. In Indonesia female labor participation rose and children were withdrawn from school to help households weather the recent crisis (Frankenberg 1999; Thomas and others 2001).

During a severe crisis, such as a famine, additional action is often taken to prevent destitution. These actions include temporarily migrating to obtain work, working longer hours, and collecting and selling wild foods and forest products (Davies 1996; De Waal 1987; Rahmato 1991).

Informal Risk-Sharing and Safety Nets

Households use a variety of informal risk-sharing arrangements to cope with the consequences of risk. Typically, these arrangements involve a system of mutual assistance between family networks or communities.

Insuring Idiosyncratic Risks

There has been growing interest in the empirical analysis of informal risk-sharing and in the modeling of the sustainability and consequences of these arrangements (see Morduch 1999). Empirical studies have sought to determine whether there is evidence of complete risk sharing in developing countries and other settings, including the United States, and to understand how (partial or complete) risk-sharing is achieved. Results from the United States, communities in India, and nuclear households in Ethiopia suggest that complete risk sharing is not taking place (Dercon and Krishnan 2000a; Hayashi and others 1996; Townsend 1994) but that partial risk sharing may be occurring.

These studies test the presence of outcomes similar to those obtained by risk sharing. The tests cannot distinguish between the effects of self-insurance (that is, accumulating and depleting assets) and informal insurance (or insurance-like behavior through transfers or credit). Nevertheless, they reveal evidence of partial risk-sharing through transfer behavior or state-contingent (quasi-)credit. Udry (1994) presents evidence of state-contingent loans in northern Nigeria. Fafchamps and Lund (forthcoming) show that loans and transfers within networks play an important role in risk sharing. Grimard (1997) appears to have found more stable consumption by tribes in Côte d'Ivoire than for the full data set, suggesting that tribal networks facilitate consumption smoothing, including through transfers. Evidence of full risk sharing was not found, however.

More direct evidence on the extent of risk sharing also reveals its limitations. Using detailed data on northern Ghana, Goldstein and others (2001) show that many idiosyncratic shocks are not insured by community contacts or even spouses. De Weerdt (2002) uses a detailed survey of all networks in a Tanzanian village to show that poorer households have fewer contacts to which to turn in times of need and that they can typically rely only on other poor households.

Theoretical work also reveals the limits of risk-sharing arrangements. Hoff (1996) highlights the possible negative consequences of informal risk sharing on poverty. Fafchamps (2002) discusses the persistence of inequality and patronage linked to risk-sharing arrangements. Coate and Ravallion (1993), Platteau (1997), Ligon and others (2001), and Attanasio and Rios-Rull (2000) examine the nature and sustainability of (partial or complete) risk-sharing arrangements given the lack of formal enforcement. Ligon and others (2002) present evidence that the constrained risk-sharing model fits the data on household food consumption in the ICRISAT villages in India better than the perfect risk-sharing model.

Insuring Common Risks

Even if imperfect, these risk-sharing networks are crucial in helping many poor households in developing countries cope with misfortune. Such groups can insure only idiosyncratic shocks, however, not common shocks. Savings or public safety nets could be developed to cope with common risks and to protect against idiosyncratic shocks not covered by communities. Informal risk-sharing arrangements can complement public safety schemes. For example, targeting the most needy is notoriously difficult. If, however, a risk-sharing arrangement exists within a community, poorly targeted transfers would be redistributed within the risk-sharing group (Ligon 2002). Dercon and Krishnan (2002) discuss evidence from Ethiopia suggesting that despite poor targeting of food aid, some of this aid reaches a large part of the community. But such programs often have other unintended consequences, which need to be clearly understood.

Much attention has been paid in the public transfer literature to the problems of crowding out. The impact of public transfers for the poor is typically smaller than the total transfer, because net private transfers to the poor are reduced (see Cox and Jimenez 1992). Public safety nets can also crowd out informal arrangements. If the safety net provides full protection to all vulnerable households and individuals, this is hardly a serious problem from a welfare point of view (even if the budgetary cost may be high). The problem is more complicated in the case of informal risk-sharing arrangements in which enforcement is not self-evident.

Some households may have incentives to leave a risk-sharing arrangement if they feel that staying in the arrangement—supporting others when the going is good to receive support when the going gets bad—may not be in their interest. For example, following a series of lucky income draws, individuals may prefer to hold on to and invest their income themselves, rather than use it to support others. The arrangement may also come under pressure if some households in the network have access to a new source of risk reduction or protection. Sometimes renegotiating the reciprocal arrangement may allow the arrangement to continue, albeit on new terms. When that is not possible, the arrangement may break down (Ligon and others 2002; Platteau 1997).

Public safety nets create a change of circumstances that may have undesired welfare effects by putting pressure on informal arrangements. Information, budget, or other constraints often mean that some needy households are excluded from these programs, even if targeting methods, including self-targeting, are used. The result may be a specific type of crowding out. Some households covered by the safety net may have incentives to leave their informal risk-sharing arrangements, leaving other households less protected. As a result of the safety net, then, some households may be made more vulnerable.⁵ This problem is not limited to public safety nets: 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 (Dercon and Krishnan 2002; Ligon 2002). Some researchers have suggested that this form of crowding out is significant (Albarran and Attanasio 2002). However large the effect may be, it is important that policymakers recognize that informal schemes for dealing with idiosyncratic risk may be negatively affected by other interventions, including better functioning safety nets for common shocks or support for more self-insurance activities.

One way of avoiding these problems is to target groups rather than individuals—by creating employment schemes for an entire group or community involved in an informal scheme, for example. Of course, doing so requires detailed information about the informal schemes in place. Another alternative could be to encourage and support groups involved in informal insurance arrangements to develop group-based self-insurance mechanisms. The notion that individual-based self-insurance can deal best with common shocks whereas informal arrangements are suitable for idiosyncratic shocks is misleading. Groups have incentives to self-insure, especially if there are

economies of scale in asset holdings (lower transactions costs, for example, or better opportunities for risk pooling of assets). Groups could build up assets in good years to deplete in bad years for the benefit of their members, adopting the same transfer rules and mechanisms used to manage idiosyncratic shocks.⁶ Policy interventions could provide incentives for this type of behavior. Better savings instruments, access to banking, and macroeconomic stability would facilitate this process. Policymakers could also try to include a stronger savings-for-insurance component in group-based credit programs, a current favorite in donor interventions. Group-based targeting and insurance schemes have their own problems, however.⁷

Monitoring Income Risk, Vulnerability, and Coping Strategies

The presence of significant income risk in developing countries and the limited ability of poor households to smooth resulting shocks have implications for measuring poverty. Furthermore, it begs the question whether alternative measures capturing risk and vulnerability should be developed.

Measuring Poverty

Using income as a measure of welfare to identify poverty has long been recognized as problematic. As an alternative, current consumption, as found in cross-sectional surveys, has been used for most quantitative poverty analysis. The argument is that because risk-averse households prefer less variable consumption, consumption is smoother than income. However, the combination of high income risk and the observed inability of households to smooth consumption through risk-management or coping strategies, especially when faced with severe shocks, would suggest that alternative measures are needed.⁸

If time-series data are available, dynamic poverty definitions can be used. If data on consumption over time are available, it is possible to take into account the fact that some households may be poor only in some years.⁹ One could distinguish those who are poor in every period from those who are poor in only some of the periods sampled. In all panel data sets on developing countries currently available, large consumption fluctuations mean that a large number of households move in and out of poverty. For example, in the Indian ICRISAT data set, about 25 percent of the poor in each period move out of poverty in the next period. Gaiha and Deolalikar (1993) report that only 12 percent of households in the ICRISAT sample were never poor. Jalan and Ravallion (2000) report 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 (2000b) report that although poverty remained essentially unchanged between 1994 and 1995 (at about 40 percent), about a third of the poor were differ-

ent households each year. More evidence can be found in Baulch and Hoddinott (2000) and other articles in the same special issue of the *Journal of Development Studies*.

One needs to be cautious in interpreting the evidence on widespread poverty transitions and fluctuations. Measurement error in the data would show up as increased movement above and below the poverty line, increasing the apparent mobility. Still, because most studies find variables correlated with fluctuations that are unlikely to be correlated with measurement error in consumption, it is likely that a substantial part of the observed consumption fluctuations are genuine.

Ravallion (1988) proposes a way of measuring chronic and transient (including risk-related) poverty. Using consumption as the underlying welfare measure, he defines the chronically poor as those with average consumption below the poverty line. A measure of transient poverty for an individual is then derived as the average value of the individual's period by period poverty level minus the value for chronic poverty. Additive poverty measures can then be decomposed into transient and chronic components. For example, using the squared poverty gap, Jalan and Ravallion (2000) report that roughly half of total poverty observed in their rural Chinese panel data set covering 1985–90 is transient poverty. Transient poverty is highest for households with average consumption near the poverty line, with about 40 percent of transient poverty found among households that are not poor on average. Almost all transient poverty is experienced by households whose mean consumption is no more than 50 percent above the poverty line. This evidence implies that in any given year, the measured poverty level will exclude some people at risk of being poor in the near future.¹⁰

Dercon and Krishnan (2000b) 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, other crop shocks, illness, and the death or sickness of livestock. Their results suggest that some of the fluctuations appear to be seasonal responses to prices and labor requirements and that shocks matter. Most areas in the sample experienced a fairly good harvest in the sample period. In the best period of the year (the postharvest period), the incidence of poverty was about 33 percent; in the worst period, it was about 40 percent. During the worst period of the year, up to 60 percent of the population could be poor. This estimate is substantially larger than poverty estimates from the (relatively good) 1990s would suggest.

Measuring Vulnerability to Poverty

Work on poverty dynamics, including work on transient poverty, has highlighted the limitations of current static poverty measures (see Baulch and Hoddinott 2000 for a review). In response, researchers are currently developing measures of vulnerability to poverty. These measures, however, remain backward-looking; they describe the past

consequences of shocks and fluctuations. Information on the characteristics of households experiencing poverty transitions may help identify those most at risk for consumption shortfalls, but it does not provide a measure of vulnerability to poverty. Such a measure should be *ex ante* (forward-looking). One could define "vulnerable households" as those liable to fall below an agreed-on poverty line (more than 50 percent below the current poverty rate, for example) with a particular probability. Some nonpoor households could be classified as vulnerable to poverty, whereas some poor households could be classified as not vulnerable to poverty in the future. Christiaensen and Boisvert (2000), Chaudhuri and others (2001), Pritchett and others (2000), and Alwang and others (2001) propose measures. More generally, one could construct measures of vulnerability for different dimensions of poverty (such as health or nutrition) or measures that take into account the extent to which households are likely to fall below the poverty line (Kamanou and Morduch 2002). Vulnerability measures and profiles based on these measures could help policymakers design better policies.

Some researchers have proposed measures based purely on cross-sectional household data (Chaudhuri and others 2001), but the assumptions needed to identify common and idiosyncratic risk are very strong. Panel data have the advantage that recent shocks and responses to risk can be modeled and households less able to cope with risk identified. These data can be used to measure and analyze vulnerability (Amin and others 1999; Dercon and Krishnan 2000b; Kamanou and Morduch 2001).

Quantitative analysis of the effectiveness of households' risk-reducing strategies requires detailed panel data. In the economics literature, most analysis of risk and its consequences in developing countries is based on a handful of data sets, with most stylized facts entering into textbooks based on data from the three villages in south India covered by ICRISAT. It is not realistic to expect this level of detail for many developing economies.

Although more work is needed on detailed panel data sets, household surveys, including cross-sectional surveys, could be used to derive some measures of and insights into vulnerability and the strategies used by households to reduce it. Most panel data studies suggest that vulnerability to shocks is closely linked to human and physical capital assets (Baulch and Hoddinott 2000; Deaton 1997; Jalan and Ravallion 2000). These factors are similar to those identified as determining long-term poverty, although the extent to which they matter is usually different. Households with limited landholdings, few assets that can be liquidated, and limited education are typically most affected by the consequences of income risk. Their more limited ability to deal with risk 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-sectional 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 included fewer of these measures.

The total value of assets alone may not provide sufficient information on the ability to use self-insurance. It may not be possible to liquidate some assets. Other assets

may lose their value during a crisis due to covariate risk. For these reasons, current asset values may not be a good indicator of the ability of an asset to buffer consumption. At the least, information is needed on how well asset and food markets function in times of crisis.

Information on physical and human capital may not be sufficient for another reason. Households may be unable to enter into profitable diversification because of physical and human capital constraints or the lack of opportunity to use their capital. Well-functioning markets, facilitated by infrastructure and demand for the products the poor produced, are just as important. Individuals, for example, may possess the physical capital or skills needed to enter into handicrafts or trade as part of a coping strategy, but they may live in areas that are too remote for them to pursue these activities profitably.

Entry constraints and incentives to skew income toward low-risk activities imply that indexes measuring the degree of diversification (number of activities, share of off-farm income) are unlikely to be good measures of vulnerability. There is, for example, no reason why a household specializing 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 other risk-coping strategies, including self-insurance and informal insurance. Indeed, one important lesson from the literature surveyed is that the degree of diversification is endogenous to the other strategies used, including self-insurance, irrespective of constraints on diversification.

In short, data on physical and human capital, combined with information on the functioning of and opportunities in product, labor, and asset markets, could provide a good basis for identifying vulnerable households. Standard household surveys, including cross-sectional surveys, may include much of the relevant information at the household level.

Data on household involvement in informal insurance systems are also necessary to analyze vulnerability to poverty. The lack of such information is an important shortcoming of most standard household surveys. Understanding vulnerability and designing programs to address these problems require information on the networks households can fall back on. Household surveys could include questions about households' association with other households and whether these associations include any insurance elements. Observing transfers and other linkages is one way of identifying these networks; direct questioning about opportunities for help in times of crisis is another (see De Weerd 2002; Dercon and Krishnan 2000b; Goldstein and others 2002). Simple enumeration of networks may be useful, but care has to be taken not to interpret any linkage or network as proof of the existence of informal insurance mechanisms. Insurance and support networks form part of social capital, but all social capital cannot be assumed to serve insurance purposes.

A full description of the opportunities available to households to cope with shocks also requires information on formal safety nets. All formal safety net programs (including, for example, safety nets provided as part of a social security policy and public employment schemes) need to be taken into account in monitoring vulnerability or designing policy. In addition to the amount of support offered, the timeliness, targeting, and overall impact on household vulnerability need to be considered. Taking these factors into account may reveal that these programs have less impact than they appear to have (Barrett and others 2002; Dercon and Krishnan 2002).

The different forms of capital and the opportunities to use them to reduce consumption risk can be identified by studying how households respond to shocks. It is useful, for example, to ask households how they handled idiosyncratic and common shocks in recent years. Questions could cover the impact of the shocks, whether the household adjusted its income-generating activities, how it used its assets, and whether it could rely on other people for support during the crisis. Households could also be surveyed about how they would respond if particular shocks hit them now. Though qualitative in nature, these direct questions, combined with information on assets, could provide rich information on strategies to cope with risk and could inform policy design (for examples, see De Weerd 2002; Goldstein and others 2002; Udry 1994).

The Effect of Policy on Risk Coping by Poor Households

Economic reform programs are bound to affect the opportunities and the ability of households to cope with risk—and not necessarily in a positive way. Although more economic opportunities or better-functioning asset and product markets are likely to strengthen households' strategies, they may also expose households to other risks. For example, market liberalization could spread local price risk over larger geographical areas, but shocks in other areas would then be reflected in local prices as well.

Even new safety net programs may have unwanted impacts, as a result of imperfect targeting or the crowding out of households not covered by the program. Policy design should require study of the informal links and insurance mechanisms that exist between the targeted group and other vulnerable groups that depend on informal arrangements. In general, if policies cannot be assumed to be exogenous to household behavior and networks, detailed analysis of the shocks experienced by households and the way households cope with income risk should be performed to inform policy. Such work is rarely conducted, however.

Households' ability to cope with risk by using assets and informal insurance can be gauged using both quantitative approaches, such as household surveys, and qualitative approaches, such as participatory assessment (see Moser 1998). The emphasis in both approaches is on monitoring different forms of capital (human, physical, and social) and households' ability to use that capital when necessary. Both types of

methodology view households as managers of complex portfolios of assets and suggest that policy should seek to improve their opportunities to use their assets.

I do not believe, as some researchers have proposed, that only qualitative methods should be used to study vulnerability and risk-coping strategies. Integrating qualitative data collection into quantitative household surveys is likely to yield less contradictory evidence than that provided by studies adopting one approach or the other. National household surveys are likely to be needed to measure the scale of vulnerability and its regional spread and diversity as well as to inform decisions about policies and priorities. The local nature of qualitative studies is likely to provide a more detailed understanding of vulnerability, but the results of such studies are difficult to aggregate and compare across areas.

Conclusion

In this article I examine the different strategies households use to cope with risk. I focus on income-based strategies, the use of assets as self-insurance, and informal insurance arrangements and show that households are constrained in using these strategies. Income-based strategies are limited because of entry constraints into profitable activities, forcing the poor to pursue low-return, low-risk activities. Self-insurance is limited by diminished access to assets and the poor functioning of asset markets when a crisis hits. Informal insurance arrangements are affected by sustainability constraints and often exclude the poor. Such arrangements, moreover, cannot handle economywide shocks

Economic policies could help protect the poor against risk. Macroeconomic stability and better-functioning asset markets would increase the usefulness of self-insurance. Better access to alternative economic activities and increased income-earning opportunities could strengthen income-based strategies. Public safety nets could be a useful alternative, although initiatives to develop such programs should take into account their effect on existing risk-coping strategies. Strengthening self-insurance—through group-based savings, for example—is an alternative that remains insufficiently explored. More empirical research is needed to assess the functioning of informal risk-sharing arrangements and the effect policy interventions may have on them.

Obtaining estimates of the vulnerability to poverty rather than of current poverty is very important and requires panel data. Cross-sectional surveys could also yield useful insights. In particular, they could provide information on the underlying determinants of risk-reducing strategies—physical, human, and social capital. They could also provide information on the risks faced by households and the opportunities they have for dealing with those risks, currently and during past crises. Qualitative studies alone could provide useful insights, but incorporating qualitative research into large quantitative household surveys is likely to yield a deeper understanding of changes in welfare and vulnerability and to better inform policy design.

Notes

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1. The *World Development Report 2000/2001* (World Bank 2001) uses a different classification, distinguishing among risk-reduction, risk-mitigation, and risk-coping strategies. The classification used here follows the economics literature and focuses on welfare outcomes, such as consumption. It distinguishes risk strategies based on whether or not they take income as given.

2. In the basic model, income is also independently identically distributed. This assumption is relaxed in other simulations.

3. This type of risk in returns to assets is not limited to commodity-based assets. The risk of bank failure and a run to withdraw deposits during an economic crisis means that seemingly safe assets are also risky, with covariate returns with incomes.

4. Morduch 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 here.

5. This may happen even if everyone is covered by the safety net, as Attanasio and Rios-Rull (2000) show. Because 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. Self-targeted schemes may not necessarily solve the problem because they also affect the individuals' outside options. Of course, the lower the payments in the scheme, the less they will affect the enforceability constraints. This is equivalent to providing less insurance.

6. Indeed, in some traditional societies, this type of group behavior is common. In western Tanzania a community food stock, run by the village head, provides protection for the village when a large-scale crisis occurred (Dercon 1998).

7. Conning and Kevane (2002a, 2002b) discuss some of these problems, including high delegated monitoring costs, norm behavior, and local power relations.

8. This is a problem for nonmonetary dimensions of poverty as well. Alternative welfare measures, such as nutrition, food expenditure, expenditure on specific commodities (such as health or education), and even health or school enrollment, would suffer from the same problem. For evidence on the effect of risk on education and nutrition, see Dercon and Krishnan (2000a), Foster (1995), Jacoby and Skoufias (1997), and Jalan and Ravallion (1998).

9. Risk need not be the only reason for fluctuations in poverty: if credit and asset markets are imperfect, even predictable fluctuations in income may cause fluctuations in consumption and poverty. An example is seasonality.

10. More precisely, given that Jalan and Ravallion (2000) use the squared poverty gap (P_2), the nonpoor in any given year will contribute to poverty in other years.

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