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Vulnerability: a micro perspective

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High downside risk to income and livelihoods is part of life in developing countries. Climatic risks, economic fluctuations, and a large number of individual-specific shocks leave these households vulnerable to severe hardship. The paper explores the links between risk, vulnerability and poverty, taking a micro-level perspective. Risk does not just result in variability in living standards. There is increasing evidence that the lack of means to cope with risk and vulnerability is in itself a cause of persistent poverty and poverty traps. Risk results in strategies that avoid taking advantage of profitable but risky opportunities. Shocks destroy human, physical and social capital limiting opportunities further. The result is that risk is an important constraint on broad-based growth in living standards in many developing countries. It is a relatively ignored part when designing anti-poverty policies and efforts to attain the Millennium Development Goals. The paper discusses conceptual issues, the evidence and the policy implications.

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1. Introduction

This paper discusses risk, vulnerability and their links with poverty. It will introduce some recent work that has tried to highlight the crucial role played by risk and vulnerability in determining people's living conditions and opportunities to escape poverty. Many development practitioners and researchers have long recognised that individuals, households and communities face a large number of risks, related to for example climate, health or economic shocks. Different disciplines, including economics, geography and nutritional studies have analysed the consequences of life in this risky environment. Specific policies, such as preventive health care, safety nets or famine early warning systems form a well-established part of the aid and policy efforts in developing countries.

It would therefore be wrong to suggest that risk has been largely ignored. However, in much analysis on development and in the design of anti-poverty policies it has largely remained on the periphery, an add-on in a more general analysis. This paper presents evidence that should encourage policy-makers to give risk and uncertainty a more central place in their thinking about poverty and destitution. The central argument is that risk is not just another expression or dimension of poverty, but it is also an important cause of persistent poverty and poverty traps.

The term 'vulnerability' has been used in a variety of related but different meanings. In one of its most well-known definitions, Chambers (1989) stated that vulnerability "refers to exposure to contingencies and stress, [...] which is defencelessness, meaning a lack of means to cope without damaging loss" [p.1]. The World Development Report 2000/01 made 'security' a central part of the framework underlying its analysis. It provided a number of related definitions, of which "vulnerability measures [...] – the likelihood that a shock will result in a decline in well-being" [p.139] is most relevant for our purposes. Alwang, Spiegel and Jorgenson (2001) present a number of different definitions as found in the literature. A common thread appears to be that vulnerability relates to a sense of insecurity, of potential harm people must feel wary of – something bad may happen and spell ruin. In this paper, we use vulnerability as the existence and the extent of a *threat* of poverty and destitution; the danger that a socially unacceptable level of well-being may materialise.

In our analysis, we will focus on *risk-related* vulnerability: the exposure to risk and uncertainty, the responses to these, the welfare consequences, and the implications for policy. The downside risk people face is a central ingredient in this analysis. It is also useful to make clear what we are *not* intending to do. The term 'vulnerability' is used in some research and definitely in policy-analysis in another sense, referring to particular 'vulnerable groups', such as the elderly, orphans, widows or even more generally, the landless or low-paid workers. In these cases, vulnerability is used as referring to some more general 'weakness' or 'defencelessness'. Such groups may face risk-related vulnerability as well, but their defining characteristic is not related to risk, but to their general inability to take advantage of profitable opportunities, so that without substantial support they may well end up in severe and persistent poverty. A focus on these groups is obviously justified, but it is not the focus of this paper, which is narrower. From a policy point of view, there is much mileage to be had from such a

narrow focus, even if some of the instruments that would help for risk-related vulnerability would also assist 'vulnerable groups'. Section 5 will develop this policy focus further, building on the earlier findings in the paper.

The next section will first briefly introduce some of the typical findings and implications of risk on household welfare, but also focus on the strategies people use to cope with risk and shocks. This will lead to the core part of the analysis in section 3, where risk and shocks as a cause of poverty will be discussed. In particular, the exposure to risk and the responses and actions taken by households to cope with risk conspire to result in poverty persistence or even poverty traps, whereby households are stuck permanently in poverty, unable to take advantage of sufficiently profitable, yet risky activities. One of the key consequences is that the possibility for broad-based growth is undermined.

In section 4, the paper considers whether considering vulnerability has any bearing on much of the current debate of getting better ways of measuring poverty. Not only concepts such as income or consumption poverty, but also attempts to operationalise 'capabilities' and the inherent 'multidimensionality' of poverty are effectively derived in a world of certainty, in which risk and vulnerability has little room. In this section, some efforts to measure vulnerability will be discussed. When trying to measure vulnerability, the paper will do so by assessing the extent of the *threat* of poverty, measured ex-ante, before the veil of uncertainty has been lifted. This can be compared to poverty, which is itself an expression of the extent of low welfare outcomes, but as observed without uncertainty and whereby low welfare results from outcome levels below some accepted poverty line. After highlighting the policy implications of the analysis in the paper, section 5 concludes. Throughout the analysis, the paper will highlight recent examples from the literature, and report of some more recent findings of my own work with collaborators on Ethiopia.

Finally, it is worth briefly defining what is meant by 'risk' in this analysis. Risk is used as potential states of the world, exogenous to the person. Which state of the world will occur is not known to this person. In economic analysis, it is usually assumed that the person has formed a (subjective) distribution of the likelihood of particular states occurring, and much of the analysis underlying some of the papers quoted below makes this assumption. The fact that risk is exogenous does not mean that it affects all people in the same way. Some risks may be irrelevant, for example, frost is irrelevant for a farmer growing only crops that do not suffer from occasional frost. A crucial ingredient of the analysis below will also be that households try to shape the impact of risk by a variety of risk strategies.

A common distinction is between risk and uncertainty, whereby in the latter case those states of the world are included which the person could not have foreseen even possibly occurring, and in any case does not take specifically into account in any strategies.² It is hard to ignore the fact that uncertainty defined in this way may well exist, as the recent Tsunami highlighted. While for much of the analysis, the distinction is not crucial and not emphasised, it will be picked up again in the discussion of the policy response to risk and vulnerability.

² Risk can be viewed as the 'known unknowns', while uncertainty are the 'unknown unknowns'.

2. Risk and Vulnerability: a central part of poor people's livelihoods

One of the more striking findings in much qualitative work using short and longer lifetime histories and other methods is that an essential part of the life of the poor is trying to cope and survive in the face recurring misfortune – such as illness, loss of employment, harvest failure (for plenty of examples, see the background papers for the Voices of the Poor work, as part of the preparations for the World Development Report 2000/01).

These shocks can take on a variety of forms but many can lead to substantial loss of income, wealth or consumption. There are different ways of recording these, but a simple household questionnaire-based investigation in rural Ethiopia yielded that over a five-year period (1999-2004), virtually all households, 95 percent to be precise, reported to have experienced a shock that had caused substantial loss of income, assets or consumption. Table 1 reports the breakdown. Of those households hit by a shock, 47 percent reported that a drought had affected them, 43 percent that a death and 28 percent that an illness in the household had seriously affected them. Other instances, such as marketing, pests, crime or policy/political issues were investigated as well, and while important for specific people, in general they were less important.³

Table 1: The incidence of serious shocks 1999-2004 in rural Ethiopia

Type of shocks households reported to be affected by, leading to serious loss of assets, income or consumption, of those affected by a shock (note: 95 percent of households reporting such a shock)	Percentage
Drought	46.8
Death of head, spouse or another person	42.7
Illness of head, spouse or another person	28.1
Inability to sell outputs or decreases in output prices	14.5
Pests or diseases that affected crops	13.8
Crime	12.7
Difficulty in obtaining inputs or increases in input prices	11.3
Policy/political shocks (land redistribution, state confiscation of assets, resettlement, forced contributions or arbitrary taxation)	7.4
Pests or diseases that affected livestock	7.0

Source: Ethiopian Rural Household Survey, 2004, and Dercon, Hoddinott and Woldehanna (2005). Based on recorded three worst shocks per household, leading to serious loss of income, consumption or assets. 95 percent of households report at least one serious shock.

This evidence is of course only suggestive at best. One of the most thriving parts of the analysis of risk and shocks in developing countries has been the study of the mechanisms people use to cope with these shocks. Indeed, these mechanisms have been widely acknowledged as a central part of people's livelihoods. To begin with, households have strategies to cope *ex-post* with shocks, to smooth consumption and nutrition when shocks happen, even if formal credit markets and insurance are not available. They may use savings, often in the form of live animals, built up as part of

³ Similar questions had been asked to the same households a decade earlier, see Dercon (2002) or the World Development Report, 2000/01, p.140, table 8.2. The recall period was longer in this case, so only the relative importance of shocks offers a suggestive comparison. The pattern is not dissimilar with one exception: the issue of taxation, land expropriation and other 'policy' related problems were then the second most important category of problems reported, with at least 42 percent reporting taxation or forced labour and 17 percent reporting land expropriation problems.

a precautionary strategy against risk, or engage in informal mutual support networks, for example, clan- or neighbourhood-based associations, or even more formal groups such as funeral societies.⁴

However, group-based systems cannot work effectively in the face of ‘covariate’ shocks, affecting the whole group, while the lack of good stores of wealth, with limited risks, also mean that building these ‘buffer stocks’ is highly costly and indeed not as effective as hoped for. On the latter, an example is that when households in Northern Wollo in Ethiopia tried to use their standard smoothing device – selling small and larger livestock – to cope with the drought and famine in the mid-1980s, livestock prices collapsed due to oversupply and lack of demand, in the face of high grain prices, providing a classic case of entitlement failures as in Sen (1981).

Overall, it tends to be found that households manage to keep consumption and nutrition smooth to some extent, but by no means entirely (Townsend, 1995, Dercon, 2002). Large covariate shocks are typically not insured and for some or in some settings, also idiosyncratic (household-specific) shocks are affecting outcomes. For example, table 2, based on the Ethiopian rural used in table 1, gives the regression results using a simple specification linking consumption per adult in 2004 (almost 80 percent of which is basic food consumption) to initial conditions in 1999 in terms of household demographics, land, livestock, and other household characteristics, as well as community fixed effects. As can be seen, reporting a serious drought shock in the last two years is correlated with 16 percent lower consumption, while a shock in the preceding two years is still reducing consumption by 14 percent (suggesting slow recovery). A problem in local markets linked to declining crop prices or lack of demand in recent years reduced consumption by 19 percent. Note that all these shocks are typically ‘covariate’ – affecting many people in the same community, and by nature hard to insure. But, at the same time, many of the reported shocks, typically idiosyncratic ones, appear to have had relatively limited impact on consumption, and in any case not systematically a significant impact on those reporting the event. The only significant idiosyncratic shock relates to illness between 3 and 5 years ago, but not recent ones. One possible explanation is that some of the immediate effects of illness can be handled by mutual support and/or savings, but illness can have debilitating effects (in terms of productivity) in the medium term.

⁴ In particular in economics, the ‘consumption smoothing’ and ‘risk-sharing’ literature has thrived, and indeed they are examples where work on developing countries has heavily influenced the mainstream research agenda. Surveys of this literature are found in Townsend (1995), Deaton (1997), Dercon (2002), Morduch (2004).

Table 2: Impact of shocks on (log) consumption per capita, 2004

	Estimated coefficient	t statistic (absolute value)
Drought, 2002-04	-0.163	2.46**
Drought, 1999-2001	-0.137	2.72**
Pests or diseases that affected crops, 2002-04	-0.006	0.07
Pests or diseases that affected crops, 1999-2001	-0.052	1.05
Pests or diseases that affected livestock, 2002-04	-0.002	0.18
Pests or diseases that affected livestock, 1999-2001	0.022	0.24
Difficulty in obtaining inputs or increases in input prices, 2002-04	0.055	0.63
Difficulty in obtaining inputs or increases in input prices, 1999-2001	0.001	0.02
Inability to sell outputs or decreases in output prices, 2002-04	-0.187	2.23**
Inability to sell outputs or decreases in output prices, 1999-2001	-0.026	0.36
Lack of demand for non-agricultural products, 2002-04	-0.037	0.19
Lack of demand for non-agricultural products, 1999-2001	-0.195	2.28**
Crime shocks, 2002-04	-0.018	0.36
Crime shocks, 1999-2001	0.083	0.99
Death of head, spouse or another person, 2002-04	0.043	0.69
Death of head, spouse or another person, 1999-2001	-0.001	0.02
Illness of head, spouse or another person, 2002-04	-0.019	0.32
Illness of head, spouse or another person, 1999-2001	-0.151	2.33**
R ²	0.34	
Sample size	1290	

Notes:

1. Specification includes controls for Female headship, age head, schooling, household size, dependency ratio, land holdings (quintiles), livestock, ethnic minority, religious minority, holding official position in PA or important place in social life, all in 1999. PA dummies, month of interview dummies and perceptions of rainfall in previous harvest year are also included but not reported. 2. Standard errors are robust to locality cluster effects. * Significant at the 10% level; ** significant at the 5% level. Source: Ethiopian Rural Household Survey 1999-2004, and Dercon, Hoddinott and Woldehanna (2005).

This inability to smooth consumption has implications for poverty in a direct way: households may drift occasionally under some socially acceptable level, possibly bounce back up and drift back in. Uninsured shocks result then in poverty fluctuations, and this is indeed what has been found in data sets. A concept that allows some assessment of this is ‘transient poverty’ as distinct from ‘chronic poverty’, as formalised by Ravallion (1988). 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. The definition involved is not restricted to the headcount so that the overall poverty measure may contain elements of chronic and transient poverty for each individual. 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 four provinces in rural China: about half of the mean squared poverty gap is transient. In Ethiopia, using earlier data from the ERHS (1994-1995), it was found that about 36 percent of the poverty gap was transient poverty.

While useful, there is an important problem related to the use of transient poverty, as defined above. Transient poverty is measured as a residual, and as a consequence it contains all the measurement error that may bedevil the concept and measurement of consumption. The regression in table 2 can provide an alternative means of assessing the relevance of ‘transient’ poverty, defined in the same spirit but *not* calculated as a residual but using the direct shock measures. Simple simulations can provide an estimate of the contribution of particular shocks to poverty. In particular, consumption can be predicted for the case in which the shocks would not have occurred, to allow some estimate of ‘chronic’ poverty, while ‘transient’ is the poverty added due to the shocks.⁵ It is also straightforward to calculate the contribution of each significant shock to overall poverty. Table 3 reports these for the significant shocks, grouped as ‘drought’, ‘markets’ and ‘illness’ shocks, using the headcount index of poverty, based on an absolute poverty line defined as the consumption level needed to reach some minimal basket of basic needs.

Table 3: The impact of shocks in 1999-2004 on poverty in 2004

	Head count
Actual poverty	47.3
Predicted poverty (based on table 2)	43.8
Predicted poverty without drought shocks	33.1
Predicted poverty without illness shocks	40.4
Predicted poverty without input/output markets shocks	41.2
Predicted poverty without shocks	29.4
Transient as share of total (predicted) poverty	32.8

Source: Ethiopian Rural Household Survey 2004. The poverty line is a revalued poverty line based on the 1994 round of the same survey, valued at 61.48 birr in 2004 prices. Based on 1370 complete observations. Note that the transient poverty share is calculated relative to the predicted poverty level. As an estimate of ‘national’ poverty, it is deficient in terms of offering a comparison with national and other figures, since methods differ.

Drought shocks have had the most serious impact, contributing the largest share of transient poverty in this period. Overall, poverty would appear to have been only about 29 percent, but is about 50 percent higher due to the occurrence of shocks (i.e. shock-related transient poverty accounts for about a third of total poverty). In other words, if these shocks had been insured and smoothed, either via household strategies or via interventions, then poverty would have been substantially lower in rural Ethiopia by 2004 by a third. Doing the same calculations but based on a distribution-sensitive poverty measure (such as the squared poverty gap), then the share of transient in total poverty is predicted to be even larger, at about 47 percent. These estimates are high, but also cover a difficult period in Ethiopia’s recent history, with development efforts, aid and reforms first stalled due to the Ethio-Eritrean conflict, and then subsequently, a serious drought affecting large parts of the country in 2002.

These figures can be viewed as a first order approximation of the poverty reduction that could be gained from removing transient poverty, and the inability of current

⁵ Some caution is needed in using this information. If unobserved heterogeneity is correlated with the direct shock terms, then what we may be picking up is not the impact of the shock, but some other characteristic, correlated with observing particular shocks. Arguably, we may then be measuring that unobserved characteristic and not the impact of the shock

policies and interventions to deal with shocks. Indeed, it is this type of concern that is behind much of the ‘safety net’ thinking, whereby the presence of a real risk that individuals’ and families’ may experience poverty episodes due to shocks justifies more intervention to avoid this. But, at the same time, it can be inferred from this analysis, that there is another group, arguably deserving and needing more of our attention: those that rarely if ever manage to get outcomes above the socially accepted poverty line, the destitute or ‘chronic’ poor. These are the poor that even without shocks would have been predicted to be poor in 2004, based on their characteristics in 1999. In that view, ‘safety nets’ or more in general, policies that focus on managing the risks faced by people in developing countries are more of a luxury, that threaten to distract from the core activities of stimulating growth and/or reducing poverty of the ‘chronically poor’.⁶

This is a powerful argument against a focus on risk and shocks, but incorrect or at least incomplete. Risk and shocks have further implications for poverty: they are a cause of poverty. One cannot ignore that the actions people take to reduce the impact of risk have poverty implications as well. First, households are organising their livelihoods taking risk into account, *ex-ante*, before any shocks materialise. A standard example is income diversification, whereby activities and assets are diversified, so that risks are spread, or the formation of low-risk activity and asset portfolios, with activities skewed to more certainty, at the expense of mean returns. Indeed, we observe rural and urban households in developing countries usually engaged in a variety of crops, some with low risks but low mean returns, keeping different small and larger livestock, being involved in a multitude of petty business activities, temporary migration, etc. (for reviews on the evidence for this, see Morduch, 1995; Dercon, 2002). However, a key issue is that these diversified or low risk portfolios, while offering lower overall risks, may come at the expense of mean returns, if compared to more profitable but more risky activities and asset portfolios. This may well mean that households may have to *choose* to be relatively poor, to avoid even more serious hardship and destitution, induced by shocks. This is one mechanism through which risk may be a *cause* of poverty.

A second mechanism for poverty to be caused by risk is related to assets lost or destroyed due to shocks. Despite the fact that households actively try to manage risk, shocks affect them, and at best, the evidence suggests only partial smoothing of welfare and nutrition. Assets, and more in general, households’ livelihoods and their ability to generate future income is affected, in part due to the necessity to cope with shocks, so that assets are sold-off, or more directly, the asset base is often directly affected by the shocks – such as death of livestock or a loss of human capital due to illness or temporary poor nutrition.

Both mechanisms imply that risk can be a cause of poverty and that the concept of transient versus chronic poverty is misleading: if anything, poverty related to risk is underestimated when using ‘transient’ poverty, and the true poverty cost of risk is

⁶ It has to be admitted that this is straw man, set up to destroy in the rest of the paper and ‘hard’ evidence of this view is not easily found. However, it was most prominently present during the period of ‘social dimensions to adjustment’ in the 1980s and 1990s, whereby it was considered necessary to set up ‘temporary safety nets’ to cushion the possible hardship following retrenchment and public sector reform, as an afterthought in the context of stimulating growth as the key means to reduce poverty.

substantially higher. But how substantial is an empirical issue, and the next section turns to some of the emerging evidence on this.

3. Risk and Vulnerability as a Cause of Poverty

There are at least three literatures on development issues that have long recognised that risk is an important factor, explaining levels of poverty and deprivation. It is helpful to briefly discuss them, and explain how they fit in with the more general issue of risk as a cause of poverty, as argued in this paper. The first is the fertility literature, where it is commonly argued that high infant and child mortality, i.e. the risk that children will not survive beyond a certain age, increases the fertility rate. This rise often puts pressure on women's health and well-being, and can cause e.g. some of the well-documented externalities on environment, land pressure and well-being of others (for a careful, balanced discussion on these issues, see Dasgupta (1993)). Behind this view are more general arguments of the family-level benefits of more labour or old age security, not least in circumstances of limited entitlement to alternative social protection measures. Note that this is an example whereby the risk inherent in living conditions induces ex-ante behavioural responses by households (effectively an over-investment in children), that may well divert resources from more profitable assets.

A second literature is largely based on evidence from agricultural economics although it is making a broader point, well-established in basic textbook economics. It focuses on preferences towards risk, and more specifically risk aversion (a preference trait, whereby people are willing to pay to avoid being faced with a risky choice, in favour of a less risky choice). Risk aversion will lead to profitable opportunities not being taken up in favour of less risky choices with lower expected returns. There is wide evidence of behaviour consistent with risk aversion, and more importantly, of risk aversion to be higher when expected incomes are lower, not least in developing countries (Newbery and Stiglitz, 1981; Binswanger, 1981). It leads to a well-established view that the 'poor' are more risk averse, and this will contribute to persistence in poverty, since they will not take the entrepreneurial risk required to enter into particular profitable activities.⁷ While some of the points made have some link with this view, it will be argued that its emphasis on preferences is essentially misleading both as a complete theory of how risk causes poverty and as a guide to policy.

A third literature is the nutrition literature, whereby poor nutrition in particular periods in a child's early life may contribute to poorer 'long-term' nutrition circumstances, in the form of stunting (height-for-age levels below some level observed in healthy populations). Short-term shocks to nutrition may then lead to lower nutritional outcomes in the long-run as well, i.e. a persistent health effect. While there is evidence for this process, this is not exactly borne out by all studies: some have suggested that 'catch-up' remains possible: i.e. that *over time* children may

⁷ The fact that the expanding experimental literature on risk and preferences has questioned the validity of some of the underlying behavioural models for this analysis is not necessarily changing this view. Kahnemann and Tversky's work has shown that 'risk aversion' may not be the appropriate concept, but instead that agents, at any level of income do not like losses, leading to a concept of 'loss aversion'. Ideas of 'safety-first', while seemingly not consistent with most experimental evidence, would also entail preference-led persistence in poverty.

recover the lost nutrition and return to their personal growth curve. Again, this is an empirical issue, and most evidence would suggest that stunting is a serious, permanent problem, not least in early years, since evidence suggests a strong correlation between child height at age three and adult height (Martorell, 1995, 1999).⁸

These nutritional effects may have far reaching consequences. Children with slow height growth are found to perform less well in school, score poorly on tests of cognitive functions and develop slower. Short adult height is correlated with low earnings and productivity, poorer cognitive outcomes and premature mortality due to increased risk of cardiovascular and obstructive lung disease. Taller women experience lower risks of child and maternal mortality. In the case of adults, an increasing body of evidence links adult weight or BMI⁹ (the Body Mass Index, also known as the Quetelet Index) to agricultural productivity and wages (Dasgupta, 1993; Dercon and Krishnan, 2000; Strauss and Thomas, 1998; Pitt, Rosenzweig and Hassan, 1990). Low BMI is correlated with a large number of health-related indicators, including early onset of chronic conditions and increased risk of premature mortality (North, 1999).

For our purposes, it is interesting to trace these effects from direct evidence on shocks, but beyond its nutritional impact and to broader outcomes. To take one example, Alderman, Hoddinott and Kinsey (2004) trace the impact of the 1982/83/84 droughts in Zimbabwe, as well as exposure to the civil war preceding independence, on longer-term measures of child health and education in the 1990s in a rich panel data set in particular resettlement areas. They focus on shocks on children in the critical 12-24 month age category – generally recognised as the most critical time for child growth. These children were interviewed again 13 to 16 years later. Using an instrumental variables estimator, with maternal fixed effects, they show that lowered stature as a pre-schooler leads to lowered stature in late adolescence as well as delays in school enrolment and reductions in grade completion. The magnitudes of these impacts are meaningful. Using careful estimation methods, they found that the 1982/83/84 drought shock resulted in a loss of stature of 2.3 centimetres, 0.4 grades of schooling, and a delay in starting school of 3.7 months for this particular age-group. Using the values for the returns to education and age/job experience in the Zimbabwean manufacturing sector provided by Bigsten *et al.* (2000, Table 5), the impact of the shock translates into a 7 per cent loss in lifetime earnings.

These *permanent* effects from effectively *transitory* events are not restricted to nutrition or health. Lack of insurance and credit markets implies that recovery of assets lost to cope with a crisis or destroyed by it will not be straightforward and immediate. For example, Rosenzweig and Wolpin (1993) show that bullocks are one of the mechanisms used to cope with shocks in their rural South Indian setting, resulting in sub-optimal levels of capital goods. These effects are also not restricted to physical capital: for example, studies in India have found that negative income shocks caused households to withdraw children from schools. Even if children may later on return to school, this causes lower educational levels, affecting the children's ability to build up a better life for themselves (Jacoby and Skoufias, 1995). Recent work on Zambia has shown that teacher absenteeism, closely linked to illness shocks in the

⁸ The discussion of the evidence is based on Dercon and Hoddinott (2004).

⁹ BMI is the Body Mass Index, defined as weight in kg, divided by the square of height in meters.

context of the HIV/AIDS epidemic, reduces cognitive achievement by children, again affecting long-term outcomes (Das, Dercon, Habyarimana and Krishnan, 2004).

This evidence would suggest processes in which incomes and levels of well-being are permanently affected by transitory shocks. It is possible to conceptualise these as poverty traps¹⁰, equilibrium levels of poverty from which there is no possible recovery without ‘outside’ intervention. One mechanism could be the classic nutrition-productivity poverty trap (Dasgupta and Ray, 1986). It is well established that below some critical nutritional level, no productive activity of any sort is possible. So if during a crisis, all assets are wiped out except for a person’s labour, and if the crisis also pushes the person’s nutritional status below this threshold, there is no hope of ever recovering using own productive means. Only a serious windfall, such as in the form of aid, could induce the person to climb out of poverty, provided it is sufficient to pass the threshold value of nutritional status. While the evidence for this to be a direct description of actual poverty traps is limited, it provides a useful narrative for more general poverty traps: there may be thresholds in some productive assets – if pushed below these asset thresholds, the person finds no possible recovery, but rather an equilibrium level of very low asset holdings and poverty. Barrett and Carter (2004) use evidence from Kenya to suggest that such thresholds can be observed at least among pastoralists, given that minimum herd sizes are required for possible accumulation and escape from a potential ‘asset poverty trap’.

The existence of poverty traps has been tested more directly by Ravallion and Lokshin (2000) and Jalan and Ravallion (2004) for Bulgaria and China. Most interestingly, they find no evidence of poverty traps, but in any case, of relatively long persistence of the effects of shocks: it takes many years to recover, and the recovery was longer for the poor. Their method exploited the insight that transition paths of incomes or consumption, when poverty traps exist, would be non-linear and allowing for multiple equilibria. Another way of looking at whether there is evidence of long-lasting effects from shocks was used by Dercon (2004), using a subset of the same panel data households reported in tables 1 to 3.¹¹

In this paper, detailed data were exploited on the experience during the 1984/85 famine, more specifically the extent to which households had to resort to famine coping strategies, such as cutting meals and portions, selling valuables, relying on wild foods and moving to feeding camps. An index of these experiences in the mid-1980s was then introduced in a model of consumption growth based on data from 1989 to 1997, regressing changes in food consumption on initial levels of food consumption at the household and community levels and a number of common and idiosyncratic shocks. Note that if shocks only have transitory effects, then lagged shocks should have no effect. However, it was found that rainfall shocks several years before the period in which growth was measured, still affect growth. Most strikingly,

¹⁰ A poverty trap can be defined as an equilibrium outcome and a situation from which one cannot emerge without outside help, for example, via a positive windfall to a particular group, such as redistribution or aid, or via a fundamental change in the functioning of markets. Poverty traps are often conceptualised as caused by the presence of increasing returns, although other mechanisms are possible, such as credit market failures or externalities. Dercon (2004) has a review of models relevant for poverty analysis, as has Barrett (2004).

¹¹ This paper did not allow for the non-linearities implied by multiple equilibria, as in more direct tests of poverty traps.

the extent of the famine impact, as measured by the index of severity of coping strategies, strongly affected growth in the 1990s. This growth impact was substantial: depending on the estimation method, comparing the 25th and 75th percentiles of households in terms of the severity of suffering, the latter had about 4 to 16 percentage points lower growth in the 1990s, a period of on average substantial recovery of food consumption and nutrition levels after crisis and war in the 1980s. Furthermore, it took on average ten years for livestock holdings, a key form of savings and assets for accumulation in rural Ethiopia, to recover to the levels seen before the 1984-85 famine.

Table 4: Testing for persistent effects of shocks on food consumption growth. Dependent variable: change in ln food consumption per adult between survey waves (1989-94 and 1994-97). Hausman-Taylor and Jalan and Ravallion estimators.

	$\Delta \ln$ food cons (1) (HT)		$\Delta \ln$ food cons (2) (JR)	
	Coeff	p-value	Coeff	p-value
\ln food consumption _{t-1}	-0.318	0.000	-0.204	0.000
Village mean \ln food cons _{t-1}	0.211	0.000	0.135	0.004
Rainfall shocks _t	0.622	0.000	0.614	0.002
Rainfall shocks _{t-1}	0.069	0.016	0.195	0.013
Adult serious illness	-0.043	0.076	-0.053	0.064
Crop shock (-1 is worst)	-0.014	0.757	-0.217	0.041
Livestock shock (-1 is worst)	-0.018	0.704	-0.009	0.910
Severity of famine impact	-0.116	0.079	-0.397	0.068
Constant	0.519	0.000	0.920	0.071
Number of observations	636		319	

Source: Dercon (2004), table 6. Regression (1) uses the Hausman-Taylor model, and assumes rainfall shocks, livestock shocks and crop shocks as time-varying, exogenous variables, and demographic changes, illness shocks and lagged consumption at household and village levels as time-varying endogenous variables. The index of the severity of the crisis experienced (coping index) was treated as time-invariant exogenous, as was (if applicable) whether there was a road available. As time-invariant exogenous variables and instruments, the presence of harvest failure during the famine period, the estimated percentage of households suffering in each village and the logarithm of livestock before the famine were used. Regression (2) uses the Jalan-Ravallion estimator (Jalan and Ravallion, 2002).

In general, we have only limited evidence on persistent effects of shocks but this is largely related to the lack of data available for this purpose. Still, careful analysis of available evidence can typically also uncover some of these effects. An example is recent work on the longer-term impact of the Indonesian crisis in 1998. Suryahadi, Sumarto and Pritchett (2003) estimated that the poverty rate more than doubled between the outset of the crisis and its peak, effectively one year. The results in Thomas et al. (2004) suggested that there was some disinvestment in schooling, particularly amongst the poorest households. Subsequently, GDP recovered fast, and positive growth was restored by 2000, and poverty may even have fallen between 1997 and 2000 (Strauss et al., 2004). Lokshin and Ravallion (2005) argue nevertheless that this hides a geographically diverse picture. Using a series of extensive cross-section data sets, they find that living standards in many districts are still affected by the shock, even five years after it began, and three years after the sharp recovery. They suggest that a majority of those living below the poverty line in 2002 would not have done so except for the 1998 crisis: in other words, they experience persistent poverty effects from the 1998 shock.

All this evidence is related to a persistent or permanent effect from a shock, so that uninsured risk is a cause of poverty. There is also evidence of the other effect: that the mere presence of uninsured risk changes household behaviour in terms of investment and activity portfolios. The fertility example at the start of this section can be viewed in this way. Beyond the fertility example, there is further evidence that such behaviour may be directly linked to risk and be a cause of perpetuating poverty. In Morduch (1990), using the ICRISAT sample, it is shown 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. 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 holdings 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 the wealth distribution: 54 percent of wealth is held by the top 20 percent of households. Jalan and Ravallion (2001) cite other examples, focusing on both asset and activity portfolios, although their evidence is more mixed.

In a careful study, Elbers and Gunning (2003) use simulation based econometric methods to calibrate a growth model that explicitly accounts for risk and risk responses, applied to panel data from rural Zimbabwe. They found that risk substantially reduces growth, reducing the capital stock (in the steady state) by more than 40 percent. Two-thirds of this loss is due to ex-ante strategies by which households try to minimize the impact of risk, i.e. the build-up of livestock holdings to cope with consumption risk. Dercon and Christiaensen (2005), using the same data set on Ethiopia discussed above, find a significant increase in fertiliser use if some insurance were to be offered against downside consumption risk, since when rains fail, financial returns to fertiliser use are typically negative. They reach this conclusion from finding significant sensitivity of fertiliser use to the predicted levels of consumption when rains were to fail. Since they also control for actual current levels of assets, it is clear that the problem is not just a matter of seasonal credit.

These results on the impact of uninsured risk on assets, activities and technology choices do not follow simply from differences in risk preferences: controlling for preferences, those with less access to insurance possibilities select a low-risk, low-return portfolio while the others take on a riskier set of activities. These results reflect the constraints on the options available to specific households, and *not* simply the risk preferences of households, as some of the earlier agricultural economics literature mentioned earlier often would let us believe: reducing these choices as only governed by preferences belittles the problems faced by households in their efforts to cope with uninsured risk. As Kochar (1995) notes, “the set of options faced by farmers offers little role for preferences” (p. 159). The behaviour of the poor with few insurance

possibilities may *look* as if they have more (innate) risk-averse preferences, but it is the lack of insurance and credit, and the set of options available to them that forces them to take less risk and therefore forego income (see Eswaran and Kotwal, 1989, for a careful theoretical discussion).¹²

In sum, there is increasing evidence that uninsured risk increases poverty, through ex-ante behavioural responses, affecting activities, assets and technology choices, as well as through persistent and possibly permanent effects from transitory shocks via the loss of different types of assets. This clearly has important implications for the design of policies, putting strategies to reduce risk and the vulnerability it entails at the core of poverty reduction efforts. But given that poverty concepts rarely incorporate risk, in the next section, the emerging literature on the possible use of a concept of vulnerability to poverty, as guide to policy making, is discussed.

4. Vulnerability as a Normative Welfare Concept

The preceding analysis has emphasised that uninsured risk (ex-ante) has potentially serious consequences for poverty, as measured in observable ex-post outcomes in income, consumption, health, education and other dimensions. If, however, risk and uncertainty are an essential part of a person livelihood and well-being, then it begs the question whether vulnerability as a concept or dimension of welfare would not deserve more attention as well.

Recent years have seen an evolution to view multidimensionality as part of mainstream thinking about poverty. Some have viewed it as a progression in keeping with a basic needs approach, emphasising the attainment of ‘human development’ outcomes, such as education and life expectancy (as in the UNDP Human Development Reports), while others have brought in a more eclectic view, for example, as reflected in the 2000/01 World Development Report, which emphasised poverty as a lack of opportunities, vulnerability and insecurity, and lack of power. All appear to have embraced the broad thinking on well-being entailed in Sen’s ‘capabilities approach’, emphasising that poverty is the lack of freedom to achieve particular outcomes, broadly defined (Sen, 2000). Some of these achieved outcomes or ‘functionings’ could be measured and are essentially multidimensional, while the means to achieve – such as incomes or endowments – are only ‘instrumental’ to well-being.

On the basis of much of the preceding analysis, it would be appropriate to emphasise the ‘instrumental’ role of risk, as a cause of poverty and deprivation. Viewed as such, it has a role on the analysis of poverty but it does not ask for a further consideration in any discussion of appropriate concepts of well-being. However, it could be argued that the risk of being poor and the uncertainty about one’s ability to secure decent living conditions in the future are essential parts of the experience of well-being. Concepts of ‘capabilities’ and ‘achieved outcomes’ without recognising risks to

¹² A possible source of confusion in the literature is the concept of ‘asset integration’ (see for example, Newbery and Stiglitz, 1981), arguing that risk preferences should be measured relative to final wealth levels. With imperfect credit and insurance markets, wealth is a *constraint* in the choice set and other constraints could be entered in assessing the behaviour towards risk, but this is arguably different from assessing preferences, before constraints on choices are considered.

translate capabilities in outcomes may miss an important element or dimension of well-being. More specifically, measuring achieved outcomes in health, nutrition, consumption, longevity or education would miss the point that ex-ante they could potentially have been better or worse. Furthermore, given that risk would intrinsically be linked to all other dimensions of well-being, it can hardly be seen as a separate dimension.

Poverty measurement, made operational via the measurement of achieved outcomes, tends to involve three steps: the choice of a welfare indicator, the identification of the 'poor' via some norm, the poverty line, and an aggregation procedure. However, the entire analysis tends to take place in a world of certainty: poverty measures are defined after all uncertainty surrounding the individual welfare indicator has been resolved. In many instances this does not have to be a serious problem. For example, when assessing the impact of a new transfer scheme after it has been introduced, data on its actual impact and the resulting poverty outcomes are obviously relevant. However, when deciding to commit resources to competing schemes ex-ante, evaluating which one will be more effective to reduce poverty will have to take into account potential outcomes in different states of the world. Furthermore, the possibility of serious hardship contains information relevant for assessing low well-being. For example, consider two families, both with the same expected consumption, above some accepted norm, but one with a positive probability of hardship, and the other one facing no uncertainty. Neither is expected to be poor, and ex-post we may observe them to have the same consumption, but surely the possibility of downside risk for the former has some bearing on the ex-ante analysis of welfare.

It is surprising that the calculus of risk has not systematically entered into the (welfare-economic or quantitative) analysis of poverty until fairly recently. Even Sen's (1981) seminal contribution on famines is in its welfare analysis concerned with the ex-post consequences of the crisis in terms of poverty and destitution. Policy analysis is done with the benefit of hindsight, even though the sequence of events unfolding during the Bangladesh famine in 1974 and the realised outcomes were just one set among a number of possible scenarios ex-ante.

In the rest of this section, I will introduce some recent work on vulnerability concepts and measurement. Our concern is not to give a unified descriptive 'positive measure' of vulnerability, whereby we would claim to describe a person's or society's welfare, but rather, in the same spirit as in poverty measurement, a normative analysis, whereby all value judgements used to construct a measure are explicit, as a tool to conduct analysis and design policy, for example to prioritise interventions.¹³ Furthermore, we will briefly comment on attempts to operationalise this concept.

¹³ There has obviously been a long debate whether welfare measurement in economics can ever be 'positive', i.e. devoid of value judgements, going back to Friedman and others. In the context of risk, economists typically use the 'expected utility' framework, a weighted average of the satisfaction linked to each outcome, weighted by the probability of the state in which it would occur. It is used descriptively, as if decision-making by households implies that they implicitly or explicitly maximise this. But even when using this as a descriptive concept for individual welfare, one has to enter the realm of normative economics as well as when aggregating to obtain society-wide measurement. Poverty analysis, by focusing on specific welfare indicators, evaluated using a specific norm and aggregated by attributing weights to outcomes, is explicitly normative. Sen (2000) and his previous writings have clear discussions on these issues.

We can define vulnerability as the magnitude of the *threat* of poverty, measured ex-ante, before the veil of uncertainty has been lifted.¹⁴ This can be compared to poverty, which is itself the magnitude of low welfare outcomes, as observed without uncertainty and whereby low welfare is defined as outcome levels below some accepted poverty line. The focus is on exposure to the threat or the danger of low welfare outcomes, i.e. downside risk, not just risk in general.

Let the vulnerability of a particular person be measured by

$$V^*=V(z,y,p)$$

where z is the poverty line, y is a vector of outcomes across n states of the world, and p is a vector of corresponding probabilities. It may be easiest to think of these outcomes as consumption levels, but we shall avoid such language as an effort to stress our measure is suitable to other well-being dimensions.¹⁵

Vulnerability is then a function of outcomes, a norm and the probabilities linked to each outcome. Many functions could be imagined. To narrow this down for a measure, it is possible to define a number of desirable properties of a vulnerability measure. With a close parallel to well-known poverty axioms (e.g. Foster and Sen, 1997) and definitions of risk (e.g. Rothschild and Stiglitz, 1970), consider six desiderata: (i) symmetry (only outcomes matter, and all states of the world are treated in the same way), (ii) focus (we only focus on outcomes at or below the ‘norm’; those above are only valued as the norm), (iii) probability-dependent outcomes (in the measure, the impact of a change in the outcome in a particular state should only dependent on the probability of that state), (iv) probability transfer (an increase in the probability for a better state at the expense of the probability of a worse state should not increase vulnerability), (v) risk sensitivity (the presence of risk increases vulnerability) and (vi) scale invariance (the units in which z and y are measured do not matter). Calvo and Dercon (2005) has more discussion about the intuition behind these statements. They show that these six axioms are sufficient to obtain a narrow class of measures defined as:

$$V^* = \sum_{i=1}^n p_i v(x_i),$$

where $x_i = \frac{\tilde{y}_i}{z}$, $v(\cdot)$ is monotonically decreasing and convex and $\tilde{y}_i = \text{Min}(y_i, z)$ (i.e. y_i , but censored at z). This simply reads as the probability-weighted average of some (convex) function of outcomes, so that the worst states of the world get no lower weight (and higher, if strictly convex) than good states.

A number of measures have been used in recent research that could be compared to this result. Both Ligon and Schechter (2003), and Elbers and Gunning (2003) take a utilitarian stance and view vulnerability as ‘*low*’ *expected utility*, where ‘*low*’ can be further specified by defining some minimum socially acceptable utility level. Ligon

¹⁴ The rest of the analysis in this section is based on Calvo and Dercon (2005).

¹⁵ Recall the parallel with individual poverty measures which can be written as $P_i^*=P(z,y_i)$, but then only one outcome y_i needs to be considered. Aggregate poverty indices that aggregate over P_i^* also aggregate over a vector of different y_i , but then aggregation is over individuals not over states of the world (as it will be the case with V^*).

and Schechter’s work uses a measure that may violate scale invariance and especially the focus axiom, and thereby they do not focus on downside risk but on all risk for the welfare assessment, in line with expected utility. Their utilitarian (or ‘welfarist’) view of vulnerability leads to some (arguably) peculiar normative results. For example, given the existence of serious downside risk, a person’s vulnerability would be reduced by responding to the existence of that danger by increasing her outcomes in exceptionally good states of the world (for example, increasing the cash prize in the national lottery would then be part of a vulnerability reducing policy).

Another set of measures were inspired by Ravallion (1988). Christiaensen and Subbarao (2004), Suryahadi and Sumarto (2003), Kamanou and Morduch (2004), and Chaudhuri, et al. (2002) are recent examples. They all see vulnerability as expected poverty. As poverty is usually measured by FGT indices (Foster et al., 1984), here we may write vulnerability (V^{EP}) as

$$V^{EP} = \sum_{i|y_i < z} p_i \left(\frac{z - y_i}{z} \right)^a \quad \text{where } a \geq 0,$$

If $a > 1$, then all our axioms thus far are satisfied, but not for $1 \geq a$. This is an important caveat, because the empirical literature resorts to both the probability of being poor ($a=0$) and the expected shortfall ($a=1$) with great frequency. For example, $0 < a < 1$ implies that increased risk will reduce vulnerability, while $a=0$ would violate the probability transfer axiom. Moreover, even though $a > 1$ would secure all our axioms, it also proves to be a troublesome condition, as it imposes that better outcomes will exacerbate the extent to which the individual dreads an increase in risk exposure, in spite of empirical evidence to the contrary (Ligon and Schechter, 2003).

Two further axioms offer some better alternatives: normalisation (so that the measure is bounded between 0 and 1) and constant relative risk sensitivity (a *proportional* increase in the outcomes of all possible states of the world leads to a similar *proportional* increase in the certainty-equivalent outcome, implying *inter alia* that better outcomes will reduce the extent to which the individual dreads an increase in absolute risk exposure).¹⁶ A straightforward measure, satisfying all these axioms, is as follows:

$$V^*_\alpha = 1 - E[x_i^\alpha],$$

with, as before, $x_i = \frac{\tilde{y}_i}{z}$ and $\tilde{y}_i = \text{Min}(y_i, z)$, and where $0 < \alpha < 1$ and E is the expectation sign. The parameter α can be interpreted as a weight, reflecting risk sensitivity. Given outcomes, normalised by the poverty line and weighted by the risk sensitivity parameter, vulnerability is one minus the probability weighted value of these normalised and weighted outcomes.

To be clear about what we have obtained in this way: it is a measure of individual vulnerability, a valuation ex-ante of possible welfare levels, taking into account a poverty norm and risk sensitivity. As an individual measure, it provides a basis for comparison between individuals in terms of their vulnerability. Vulnerability is

¹⁶ Alternatively, one could impose absolute relative risk sensitivity. See Calvo and Dercon (2005) for details.

distinct from poverty: a crucial distinction is when it is measured, before or after the veil of uncertainty is lifted. But anyone who is poor with certainty ex-post, will also have (non-zero) vulnerability ex-ante, since all possible outcomes are below the norm.¹⁷ Similarly, all ex-ante actions to minimize exposure to risk (such as entering into low-risk activities at the cost of low return) would be reflected in the overall valuation of vulnerability, and the focus is not just on risk but on all possible outcomes. For example, take two individuals, one with a certain flow of outcomes at a level below the norm in each state of the world, and another individual, otherwise similar, but with some outcomes above the norm and some below in particular states of the world. Vulnerability measurement would provide a clear quantification of the relative position of these individuals, based on the threat of poverty. Admittedly, the approach is however by necessity ignorant about whether the individuals themselves would judge the other's implied vulnerability higher or lower than their own.

Quite a number of papers have tried to apply vulnerability related to the discussion above to data, although most appear to have focused on the probability of being poor (i.e. the expected headcount), with the drawbacks reported above. Furthermore, they tend to focus on reporting the head line figures. Just as with poverty analysis, these head line figures are less interesting and less helpful for policy design, even though they end up the only reported evidence. A more fruitful approach would be to make profiles: finding the correlates of higher and lower vulnerability, based on initial conditions, household and community histories and policy measures. This type of application is still rare. One example is Ligon and Schechter (2003), who derive a vulnerability measure (albeit in the expected utility mode, assuming relative risk aversion, and not just focusing on downside risk) and regress it on some characteristics using data from Bulgaria. They find that education substantially reduces vulnerability – for example those with college education are on average 37 percent less vulnerable. Households living in urban areas are (surprisingly) more vulnerable, while land holdings have no impact on vulnerability and owning farm animals reduces vulnerability. Possibly, in post-communist Bulgaria, the countryside can manage the vulnerability linked to change more easily. The sex of the head has no impact, while larger households are more vulnerable, although having more employed members or having members drawing a pension reduces vulnerability.

¹⁷ So statements such as 'person x is not vulnerable but outright poor' and 'person y is vulnerable if she is not poor but ...' are not statements that could be helpfully made using our concept, or at best reflect confusion about what is observed and when.

Table 5: Correlates of vulnerability (based on total consumption) in Bulgaria in 1994. Based on table 2, Ligon and Schechter (2003).

Variable	Coefficient	Standard error
Primary Education	-0.0717	(0.0321)
Secondary Education	-0.2356	(0.0354)
Post-Sec. Education	-0.3350	(0.0377)
Male headed?	-0.0300	(0.0256)
Age	0.0083	(0.0047)
Age Squared	-0.0000	(0.0000)
Owns Animals?	-0.1001	(0.0259)
Land Cultivated in ha	-0.0011	(0.0025)
Urban?	0.0758	(0.0262)
# of Pensioners in hh.	-0.1183	(0.0212)
# of Employed in hh.	-0.3095	(0.0237)
Family Size	0.2426	(0.0137)

Note: These regressions also include province dummies. Details on variables and method in Ligon and Schechter (2003).

Just as with standard (ex-post) poverty profiles, it should therefore be possible to generate multivariate vulnerability profiles for different contexts, and make statements on the relative differences in vulnerability between different types of households in different localities. However, one crucial part of the analysis has thus far been ignored: how to generate the possible outcomes in different states of the world, necessary for vulnerability measurement. And this is not straightforward: one needs a forecasting model for outcomes and the necessary data to estimate or calibrate a distribution of future outcomes using only information available ex-ante.

In recent years, it has proved very tempting for many researchers to use the limited available data in a number of contexts for this purpose. Some use creative but rather glorious and ultimately unsatisfactory assumptions to exploit estimated and parameterised error distributions from cross-section data to derive distributions of potential outcomes, usually consumption (see for example, Chaudhuri, et al., 2002). Others used relatively short panel data sets to calibrate more carefully models to generate outcome distributions, although typically by necessity with relatively simple dynamics (for example, Ligon and Schechter (2003)). Alternatively, a more dynamic structure was imposed in Elbers and Gunning (2003). Ultimately, all these studies have to rely on backward-looking information while the purpose is to derive forward-looking outcome distributions – of course, a problem very familiar to the time-series forecasting literature. And as in this literature, a careful Monte-Carlo simulation study also showed that the appropriateness of different forecasting models used in the vulnerability literature will effectively depend on the underlying time-series properties of the outcome data, such as whether outcomes are following a non-stationary or a stationary process¹⁸ (Ligon and Schechter, 2004). If consumption or other outcomes are stationary, then even a short panel or even a cross-section may well contain sufficient information for an appropriate forecasting model to determine

¹⁸ A stationary series can be understood as observations derived from a data generating process that has stable mean and variance. In our context, this would mean that, for a particular household, the distribution of the outcome variable is identical in each period. A non-stationary series would not have this property. An example would be if consumption were to follow a random walk: i.e. any shock has a permanent impact so that the best prediction of the current level is the last period's level.

vulnerability. But if outcomes are non-stationary, then these models would be inappropriate.

This is an empirical issue, but with short panels, this is hard to address. Even more problematic, if some of the processes described in the previous section are prevalent, such as the possibility of a shock permanently changing the underlying income process, stationarity would be violated, but it would be hard to detect such non-stationarity in very short panels. Overall, the best bet would be to develop careful dynamic models and more work is definitely needed in this respect, but long panel data are typically missing. Does this mean that this endeavour is by necessity doomed? Not necessarily; the growth in good quality data sets for developing countries is impressive, and it is definitely a direction worth considering further.¹⁹

5. Policy Implications and the Way Ahead²⁰

The presence of uninsured risk results in welfare losses. For the poor, it is a reason for substantial hardship. At present, many poor people are not offered opportunities to insure themselves against this hardship, while the support offered when shocks occur is often limited. Viewed like this, this justifies public action to foster more insurance and mechanisms to protect the poor. In the presence of insurance and credit market failures, there is a further issue: given their exposure to downside risk, the poor may enter into activities and asset portfolios with low risk, but also low returns. While this reduces their exposure to downside risk, in turn it affects their long-term income and their ability to move out of poverty in the long-run. Furthermore, shocks may have long-lasting effects: productive assets may be destroyed or sold off to survive, health may be undermined or children may be taken out of school. All these actions lead to a lower future income-earning potential of the current and future generation. The result is higher poverty that may persist.

The presence of risk-reducing but low-return strategies on the part of households trying to reduce their vulnerability as well as the occurrence of shocks with long-lasting effects both suggest that uninsured risk may lead to poverty traps: there is persistence in poverty, caused by market imperfections, the presence of risk and the household's responses to it. Temporary support may avoid households to fall into the trap, and may also lift them out. In fact, given that market failures contribute to the existence of these traps, there may be efficiency gains from interventions, so that transfers focused on these groups may be productivity enhancing, without an efficiency-equity trade-off. This provides a strong justification for focusing aid on these problems, not least in a context of promoting broad-based growth. In fact, even in a growing economy, these processes may otherwise mean that these groups may well end up staying behind, since they cannot take advantage of new profitable opportunities, undermining the poverty impacts of growth.

This paper has presented evidence supporting this view, but it could be argued that this is not a wealth of evidence. There is a need to establish much more firmly the

¹⁹ One issue ignored in this discussion is the time scale over which vulnerability is being measured – next year, in the next five years? In principle, prediction models can be constructed for different time spans, but again, the errors involved in these predictions will be dependent on the underlying properties of the series and the quality of the prediction model.

²⁰ This section is partly based on Dercon (2004), chapter 19.

quantitative importance of these effects in different contexts. More empirical work on the short and long-run consequences of uninsured risk on poverty and growth in the developing world is a priority. One should also not overstate the role ‘insurance’ can play in promoting poverty reduction. If some forms of structural inequalities are behind persistent poverty, then offering ‘full insurance of risk’ to everyone would simply make these inequalities permanent.²¹

Even with this proviso, the case for fostering better risk-focused social protection²² seems strong, justifying public action and the allocation of budgetary resources to its provision. But this does not settle the issue of the form public action should take. State involvement is an obvious option, but encouraging NGOs, local social institutions and the private sectors to provide more insurance and protection should not be ignored. A general state-run system of universal social insurance and substantial direct means-tested transfers may seem an admirable ideal from an equity point of view, but it is unlikely to be the most cost-effective system, involving high administrative costs and possibly substantial incentive-related inefficiencies. The informational requirements make this generally unfeasible in poor countries with limited budgets and administrative capacity anyway. Still, it does not mean that public action cannot achieve substantial improvements in risk-related social protection, even given limited means.

Possible measures can be classified in two categories: first, *ex-ante* measures that result in the poor and vulnerable taking action to reduce risk impact or take out more insurance, before the veil of uncertainty has been lifted; secondly, *ex-post* measures that provide transfers to the poor when they face bad shocks that remained uninsured. *Ex-ante* measures would provide incentives and means to the poor to protect themselves better against hardship: examples are supporting self-insurance via savings, assisting income risk management by providing access to credit, supporting community-based risk-sharing and encouraging the introduction of insurance products tailored to poor contexts. *Ex-post* measures would provide a genuine safety net, appropriately targeted to the poor but large enough in scale and coverage to provide broad-based social protection at some minimally accepted and feasible level of standard of living. It could be part of a more general welfare support system, or specifically targeted for risk-related hardship. All these options will be briefly discussed below.

²¹ Banerjee (2004) warned about another problem: providing more insurance in the form of protection against downside risk may provide incentives for more risk-taking so that the poor take on high return, risky investments. But this may undermine their access to credit markets, if moneylenders and banks need sufficient incentives for the borrower to repay in case the project fails. Social protection and safety nets may reduce these incentives, so the poor may become more excluded from credit markets. If they need access to these markets to grow out of poverty, they may become locked in long-term poverty because of social insurance such as the presence of a safety net. The empirical significance of this effect is unknown, but worth exploring.

²² The term ‘social protection’ as used in this concluding section is rather narrow, and often qualified with ‘risk-focused’. The term is used to focus on measures that support managing risk and the reduction of risk impact on the population and the poor in particular. Often, social protection is more broadly used to include as well the general or targeted welfare policies, including redistribution efforts and targeted transfers, without any risk focus. The paper does not try to argue that these broader social protection policies are not important (on the contrary), but rather, that there is much mileage to be had from focusing on social protection with a specific risk-related vulnerability focus, as is done in the concluding section.

Introducing new insurance products In recent years, microfinance institutions and even insurance companies in developing countries have started to design and provide insurance products for low-income clients. Life and health insurance are most common. Nevertheless, relative to micro-credit programmes, they are typically still relatively limited. What scope is there for experimenting and expanding insurance products? First, it is worthwhile to recall some of the main reasons for the lack of insurance to start with. Market-based insurance requires a high information environment while problems of adverse selection and moral hazard will limit the extent to which insurance providers would be willing to offer insurance. Problems with enforcement of payouts for claims undermine the willingness of clients to take out insurance. A possible solution for this credibility problem requires the establishment of reinsurance markets, but this is not self-evident. Non-market insurance may benefit from a better information environment but there is no scope for insurance of important covariate or infrequent risks. Both market and non-market insurance solve some of the information problems they face by excluding certain groups and individuals from their arrangements.

Could micro-insurance, in the form of the provision of simple, low-cost insurance contracts, tailored to low-income clients provide a way out? Such contracts need to overcome the same information and enforcement problems as market-based insurance, and the small scale of the contracts will make transactions costs high. Still, just as with micro-credit, it could provide a service to low-income clients that otherwise would remain rationed in the market, even if it would mean rather substantial subsidies. It is nevertheless helpful to emphasise some differences with micro-credit provision. First, the enforcement problem in credit is faced by the loan provider, but in insurance, it is a problem for the client. Secondly, with credit, there is repeated interaction between borrower and lender during the repayment period and this implies regular transactions and monitoring costs. In the case of insurance, the information content of the regular payment of the premium is rather limited, while there are only small transactions costs for the provider, since the insurance can be easily withdrawn when the premium is not paid. For the provider, transactions costs are irregular and only high when a claim comes in. Finally, reinsurance is essential to keep the costs of insurance provision low. This implies the need for regulation, high quality of actuarial data and the certification of events to allow this reinsurance market to function.

The need for reinsurance and the costs of verification of claims imply that the types of risk that can be insured at relatively low cost are limited. Certain events may be easily verifiable – such as death or serious illness – so that life and health insurance may be obvious contracts to start with. But even in those cases there may be problems. To avoid adverse selection, there would be a need to exclude certain groups, based on disease (such as AIDS) or age – but these are groups that may suffer serious hardship without insurance. Reinsurance would require systems of certification – but what if in certain locations with poor institutions it may be easy to obtain false death or poor health certificates?

In general, there is surprisingly little research on micro-insurance, at least compared to the vast micro-credit literature. There is also little or no systematic evidence on how existing risk-sharing or other social institutions could be mobilised to provide a basis for more widespread insurance provision for different types of risk. The main

requirement now is to obtain empirical evidence. This also implies the need for experiments combined with research, preferably in the form of ‘natural’ micro-insurance experiments to evaluate its impact.

Alternative insurance products could also be promising. Weather-indexed bonds are one such example. A key advantage is that claim verification is straightforward: a key source of losses is insured, not the loss itself²³. Still, given the high covariance of rainfall and other climatic factors across regions and countries, the development of reinsurance markets covering large geographic areas would be particularly important in this case. Whether products for weather or catastrophic risk can be introduced in some of the poorest countries remains to be seen, although there is some encouraging evidence emerging (Skees et al., 2004).

Promoting more self-insurance via savings and micro-credit Besides designing and supplying better insurance products for the poor, there is also scope for assisting the poor in protecting themselves. There is substantial scope for more self-insurance provided better savings instruments suitable for the poor can be offered (Dercon, 2002). Key problems with existing self-insurance via assets is that they tend to be risky and may well be strongly covariate with incomes, limiting their effectiveness, while financial savings products are typically not tailored to the poor, offering low or negative returns, and involving prohibitive transactions costs.

As an area for subsidised intervention and regulation, it also does not suffer from the important informational problems affecting credit and insurance. There is no issue of adverse selection or moral hazard, nor any serious reinsurance issues. The main issues are potentially high transactions costs and the need for credibility of the institution (Morduch and Sharma, 2002). With few exceptions, such as SafeSave in Bangladesh, initiatives remain relatively thin on the ground. Most savings instruments within microfinance institutions still appear to be mostly used as instruments for accessing micro-credit – for example, as a means of developing reputation and commitment. Flexible savings instruments for precautionary motives are usually not encouraged.

This does not mean that there is no further role for more standard micro-credit products, on the contrary. Increasing assets and incomes, that in turn allow savings to increase offers a virtuous cycle to provide a buffer against future hardship. Furthermore, access to credit can serve as a means of insurance, allowing the poor to borrow in bad years against future incomes. Finally, since profitable sources of income, suitable for diversification purposes in an income risk management strategy often involve important set-up costs, small loans could have a very large impact on income risk exposure. Overall, however, this requires that microfinance institutions offer flexible products that allow the poor to enter into credit despite being faced with substantial risk. One possible route would be to provide interlinked contracts, which typically offer more efficient outcomes than separate credit and specific insurance contracts – a standard solution for mortgage lending products in developed countries. An example would be to link credit with health insurance. There is substantial room for more experimentation and research on such products.

²³ Developing weather insurance tailored to the poor may be less straightforward. It would require verifiable records on rainfall. But if the poor tend to live in marginal areas with limited agricultural wealth, few rainfall stations are likely to be available at present. Unless the local rainfall is highly covariate with rainfall in ‘richer’ areas, rainfall insurance would not offer much protection to them.

The role of targeted transfers Ex-ante measures may provide substantial protection, but ultimately they cannot fully insure individuals and families. Informal mechanisms only offer limited insurance. Micro-insurance products will have to be simple, insuring only specific, highly observable risks, while high risk groups may have to be excluded by design. The existence of certain risks, for example catastrophic risks, can hardly be anticipated beforehand. Self-insurance fails if shocks happen to materialise in successive periods. All self-protection strategies require some outlay beforehand, at times high to guarantee the sustainability of the institution, and the poorest households may not be able to afford this, while credit to pay for insurance may not be available. Finally, the presence of uncertainty as distinct from risk (the unknown unknowns) also implies that household strategies and market-based products would fail in particular circumstances. In short, some ex-post measures, providing transfers to those affected by uninsured risk, would always be necessary as part of a risk-related social protection system.

This is not the place for an exhaustive discussion on the scope and form of a transfer-based safety net. A few issues are relevant for our discussion. For example, targeting support is probably the most efficient solution given limited means, but one should be aware of the potential errors of targeting, especially for those requiring support but excluded due to imperfections in the targeting design. Self-targeted programmes may seem most attractive, where the design of the programme ensures incentives for participation only by the target group and not by others, so avoiding costly identification of the beneficiaries. Workfare programmes such as food-for-work are often designed in such a way, but the return to the beneficiaries has to be kept low to ensure incentives for others not to participate. Coverage is typically not complete: certain groups may not be reached by such programmes, for example, women that have to look after children may not find the time to take part. Alternative targeting schemes, such as allowing community leaders to select beneficiaries or schemes based on observed characteristics (such as nutritional status or livestock ownership) have their own costs and problems (Conning and Kevane, 2000; Ravallion, 2002). In the case of uninsured risk transfers, the question of who should be targeted is also not self-evident. In principle, for an efficient safety net, one should arguably be most concerned with reaching those for whom protection will avoid poverty traps or persistence, via their effects on investment and activity choice. Given the problems of identifying those currently poor, it is unlikely that one can identify these using any of the possible targeting methods.

The ex-ante and ex-post measures discussed above are relatively strictly focused on risk. However, at least as important would be to build-in risk-related dimensions in more standard policy interventions. Just as risk is intrinsically linked to processes of income generation and asset formation, any programme focused on income generation and asset formation should recognise these risk dimensions. Consider the following two examples.

Promoting modern inputs adoption Since the mid-1990s, the Ethiopian government has been promoting the adoption of modern input packages, provided on seasonal credit with strict repayment enforcement, often involving local government officials. In the early years, with good rains, adoption was increasingly rapidly since mean returns were very high. However, after a series poor harvests, repayment enforcement

resulted in serious hardship for some in some areas and adoption flattened as well. It remains the case that mean returns are high in many areas, but clearly in poor rainfall years, returns are very low and possibly negative given the need to repay the credit. A credit product with some insurance element, for example weather-indexed, would surely be superior in this high climatic risk environment.

Conditional cash transfer programmes In the 1990s, a number of programmes were introduced inspired by the Progresa programme in Mexico whereby families receive a cash transfer conditional on children enrolling and attending school. The incentive appears to have resulted in substantial increases in enrolment and other positive welfare effects. However, the programme design ignores possible risk, while evidence in other settings has shown that school attendance may well be responsive to income shocks (Jacoby and Skoufias, 1995). It has been suggested that even in the Progresa setting, such effect can be found so that a more efficient conditional cash transfer programme would have included some element of ‘insurance’ whereby cash transfers vary, for example on the basis local climatic and other circumstances.²⁴

It is an empirical issue to determine whether particular programmes focused on risk, or including some risk considerations are effective. There is a dearth of evidence at the moment, and often all possible interventions are reduced to more standard safety nets. While in some settings this may be the most appropriate response, much more field-testing and experimentation with alternative programmes, in the context of well-designed evaluations, would be very worthwhile.

Bibliography

- Alderman, H., J. Hoddinott and B. Kinsey (2003). ‘Long term consequences of early childhood malnutrition’. Mimeo, Department of Economics, Dalhousie University, Halifax, Canada.
- Alwang, J., P. Siegel and S. Jorgensen (2001), ‘Vulnerability: a View from Different Disciplines’, Social Protection Unit, Human Development Network, World Bank, May 2001.
- Banerjee, A. (2004), “The Two Poverties”, chapter in S. Dercon, *Insurance against Poverty*.
- Barrett, C.B., (2004), ‘Rural Poverty Dynamics: Development Policy Implications’, mimeo, Cornell University.
- Barrett, C.B. and M. Carter (2004), “The Economics of Poverty Traps and Persistent Poverty: An Asset-based Approach”, Cornell University, mimeo.
- Bigsten, Arne *et al.*, (2000). ‘Rates of return on physical and human capital in Africa’s manufacturing sector’, *Economic Development and Cultural Change*, Vol.48, 801-828.
- Binswanger, H., (1981), ‘Attitudes toward Risk: Theoretical Implications of an Experiment in Rural India’, *Economic Journal*, Vol.91, No.364, 867-90.

²⁴ Elisabeth Sadoulet, personal communication, March 2005.

- Bourguignon, F., C. Goh, and D. Kim (2004), *Estimating Individual Vulnerability Using Pseudo-Panel Data*, World Bank Policy Research Working Paper 3375.
- Calvo, C. and S. Dercon (2005), 'Measuring Individual Vulnerability' Department of Economics Working Paper Series, No.229, Oxford University.
- Chambers, R. (1989), "Editorial Introduction: vulnerability, coping and policy", *IDS Bulletin*, Vol. 2, 1-7.
- Chaudhuri, S., J. Jalan, and A. Suryahadi (2002), *Assessing Household Vulnerability to Poverty from Cross-sectional Data: A Methodology and Estimates from Indonesia*, Columbia University, Discussion Paper 0102-52.
- Christiaensen, L. and K. Subbarao (2004), *Toward an Understanding of Household Vulnerability in Rural Kenya*, World Bank Policy Research Working Paper 3326.
- Christiaensen, L. and R. Boisvert (2000), 'On Measuring Households Food Vulnerability: Case Evidence from Northern Mali', Working Paper, Department of Agricultural, Resource and Managerial Economics, WP 2000-05, March.
- Conning, J. and M. Kevane (2004), chapter 15 in S. Dercon, *Insurance against Poverty*.
- Conning, J. and M. Kevane (2002), 'Community Based Targeting Mechanisms for Social Safety Nets: A Critical Review', *World Development*, Vol. 30, No.3, 375-394.
- Das, J., S. Dercon, J.Habyarimana and P. Krishnan (2004), "When Can School Inputs Improve Test Scores", Policy Research Working Papers, No.3217, The World Bank.
- Dasgupta, P. and D. Ray (1986), 'Inequality as a Determinant of Malnutrition and Unemployment: Theory', *Economic Journal*, Vol.90 (December), 1011-34.
- Dasgupta, P., (1993). *An inquiry into well-being and destitution*, Oxford: Oxford University Press.
- Deaton, A. (1997), *The Analysis of Household Surveys: A Microeconomic Approach*, Johns Hopkins University Press, Baltimore.
- Dercon, S. (1996), 'Risk, Crop Choice and Savings: Evidence from Tanzania', *Economic Development and Cultural Change*, Vol.44, No.3, 385-514.
- Dercon, S. (2002a), 'Income Risk, Coping Strategies and Safety Nets', *World Bank Research Observer*, Vol.17, 141-166.
- Dercon, S. (2004), "Growth and Shocks: Evidence from Rural Ethiopia", *Journal of Development Economics*, August.
- Dercon, S., J. Hoddinott and T. Woldehanna, (2005), "Vulnerability and shocks in 15 Ethiopian Villages, 1999-2004", University of Oxford, mimeo.
- Dercon, S. (2004a), "Poverty traps and Development: the efficiency-equity trade-off revisited", in AFD, *Poverty, Inequality and Growth, Proceedings of the AFD-EUDN Conference 2003*.

- Dercon, S. and J. Hoddinott (2004), chapter 6 in S. Dercon, *Insurance against Poverty*.
- Dercon, S. and P. Krishnan (2000a), ‘Vulnerability, Seasonality and Poverty in Ethiopia’, *Journal of Development Studies*, Vol.36, No.6, 25-53.
- Dercon, S. and P. Krishnan (2000b), ‘In Sickness and in Health: Risk-Sharing within Households in Ethiopia’, *Journal of Political Economy*, Vol.108, No.4 (August), 688–727
- Dercon, S. (2004), *Insurance against Poverty*, Oxford: Oxford University Press.
- Dercon, S. and L. Christiaensen, 2005, “Consumption Risk and Technology Adoption in rural Ethiopia”, mimeo.
- Elbers, C., and J. Gunning (2003), “Growth and Risk: Methodology and Micro-evidence”, Tinbergen Institute Discussion Papers, 03-068/2..
- Eswaran, M. and A. Kotwal (1989), ‘Credit as Insurance in Agrarian Economies’, *Journal of Development Economics*, Vol.31, No.1, 37–53.
- Foster, J., J. Greer, and E. Thorbecke (1984), “A Class of Decomposable Poverty Measures”, *Econometrica*, Vol.52, No.3, 761-766.
- Jacoby, H. and E. Skoufias (1997), ‘Risk, Financial Markets and Human Capital in a Developing Country’, *Review of Economic Studies*, Vol.64, No.3, 311–36.
- Jalan, J. and M. Ravallion (2001), ‘Behavioral Responses to Risk in Rural China’, *Journal of Development Economics*, Vol.66, No.1, 23-49.
- Jalan, J. and M. Ravallion (2000), ‘Is Transient Poverty Different? Evidence from Rural China’, *Journal of Development Studies*, Vol.36, No.6.
- Jalan, J. and M. Ravallion, (2004), chapter 5 in S. Dercon (ed.), *Insurance against Poverty*
- Kamanou, G., and J. Morduch (2004), “Measuring Vulnerability to Poverty”, chapter in Dercon, S. (ed.), *Insurance against Poverty*, Oxford University Press.
- Kochar, A. (1995), ‘Explaining Household Vulnerability to Idiosyncratic Income Shocks’, AEA Papers and Proceedings, *American Economic Review*, Vol.85, No.2, 159–64.
- Ligon, E. and L. Schechter (2003), ‘Measuring Vulnerability’, *Economic Journal*, Vol.113, No.486, C95-C102.
- Ligon, E. and L. Schechter (2004), ‘Evaluating different approaches to estimating vulnerability’, Social Protection Discussion Paper 0210, The World Bank, Washington D.C.
- Lokshin, M. and M. Ravallion, (2005), “Lasting Local Impacts of an Economy-Wide Crisis”, mimeo, DECRG, The World Bank.
- Lokshin, M. and M. Ravallion (2000), “Short-Lived Shocks with Long-Lived Impacts? Household Income Dynamics in a Transition Economy”, World Bank Working Paper Series No.2459, World Bank, Washington D.C.

- Morduch, J. (1990), 'Risk, Production and Saving: Theory and Evidence from Indian Households', Harvard University, Manuscript.
- Morduch, J. (1995), 'Income Smoothing and Consumption Smoothing', *Journal of Economic Perspectives*, Vol.9 (Summer), 103–14.
- Morduch, J. (1999), 'Between the State and the Market: Can Informal Insurance Patch the Safety Net?', *World Bank Research Observer*, Vol.14, No.2 (August), 187–207.
- Morduch, J. and M. Sharma (2002) 'Strengthening Public Safety Nets from the Bottom Up', Social Protection Discussion Paper Series, Social Protection Unit, Human Development Network, The World Bank.
- Morduch, J. (2004), "Consumption Smoothing Across Space", chapter in S. Dercon, *Insurance against Poverty*.
- Martorell, R. (1999). 'The nature of child malnutrition and its long-term implications'. *Food and Nutrition Bulletin*, Vol. 20, 288-292.
- Newbery, D. and J. Stiglitz, (1981), *The Theory of Commodity Price Stabilization*, Oxford University Press.
- North, D. (1999). 'Catching up with the economy'. *American Economic Review*, Vol. 89, 1-21.
- Pitt, M., M. Rosenzweig and MD Hassan (1990). 'Productivity, health and inequality in the intrahousehold distribution of food in low income countries'. *American Economic Review*, Vol. 80, 1139-1156.
- Ravallion, M. (2002), 'Targeted Transfers in Poor Countries: Revisiting the Trade-Offs and Policy Options', World Bank, processed.
- Ravallion, M. (1988), "Expected Poverty under Risk-Induced Welfare Variability", *The Economic Journal*, Vol.98, No.393, 1171-1182.
- 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*, Vol.101, No.2, 223–44.
- Rosenzweig, M. and H. Binswanger (1993), 'Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments', *Economic Journal*, Vol.103, No.416, 56–78.
- Skees, J. P. Varangis, D. Larson and P. Siegel (2004), "Can Financial Markets be Tapped to Help Poor People Cope with Weather Risks?", chapter in S. Dercon, *Insurance against Poverty*.
- Sen, A. (1981), *Poverty and Famines. An Essay on Entitlement and Deprivation*, Oxford, Oxford University Press.
- Sen, A. (2000), *Development as Freedom*, Oxford: Clarendon Press.

- Strauss, J. and Thomas, D. (1998). 'Health, Nutrition, and Economic Development', *Journal of Economic Literature*, Vol.36, No.2, 766-817.
- Suryahadi, A., and S. Sumarto (2003), "Poverty and Vulnerability in Indonesia Before and After the Economic Crisis", *Asian Economic Journal*, Vol.17, No.1, 45-64.
- Thomas, D., K. Beegle, E. Frankenberg, B. Sikoki, J. Strauss and G. Teruel (2004), 'Education in a Crisis', *Journal of Development Economics*, Vol.74, No1, 53-85.
- 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.
- van de Walle, D. and K. Nead (eds) (1995), *Public Spending and the Poor: Theory and Evidence*, Baltimore: Johns Hopkins University Press.
- Waller, H. (1984). 'Height, weight and mortality: The Norwegian experience'. *Acta Medica Scandinavica*, Vol.77, 279-303.
- Waterlow, J. (1988). *Linear growth retardation in less developed countries*, Nestle Nutrition workshop series Vol.14, Raven Press, New York.
- World Bank. (1993). *World Development Report: Investing in health*, Oxford University Press, New York.
- World Bank, (2001), *World Development Report 2000/2001. Attacking Poverty*, New York, Oxford University Press.