



## Rural Strategy Background Paper #7

# Risk Management in Rural Development

*A Review*

Jock R. Anderson

Rural Development Strategy  
Background Paper #7

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**Jock R. Anderson**

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*Work in Progress*

*The World Bank  
Rural Development Family*

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# Contents

<b>Contents</b> .....	<b>iii</b>
<b>Acronyms</b> .....	<b>iv</b>
<b>Acknowledgements</b> .....	<b>v</b>
<b>Foreword</b> .....	<b>vi</b>
<b>Summary</b> .....	<b>vii</b>
<b>Introduction to Risk in Rural Development</b> .....	<b>1</b>
<b>Self-Determining Farmers and Rural Risk Management</b> .....	<b>3</b>
<b>Farm Risks, Market Failures, and Government Interventions</b> .....	<b>15</b>
<b>Rural Risks and the World Bank</b> .....	<b>28</b>
<b>Conclusion</b> .....	<b>30</b>
<b>References</b> .....	<b>34</b>

# Acronyms

AKIS	Agricultural Knowledge and Information Systems (Thematic Team of the Rural Sector Board, World Bank, dealing with agricultural education, extension and research)
BDA	Agricultural Development Bank, Panama
DEC	Development Economics Vice Presidency (World Bank)
DPRTF	Drought Policy Review Task Force, Australian Government, Canberra
FAO	Food and Agricultural Organization (United Nations)
FCIC	Federal Crop Insurance Corporation (USA)
GDP	gross domestic product
GM (O)	genetically modified (organism)
GPS	global positioning system
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IRRI	International Rice Research Institute
M&E	monitoring and evaluation
MF	microfinance
NGO	non-governmental organization
OED	Operations Evaluation Department (World Bank)
PREM	Poverty and Economic Management Network (World Bank)
PRSP	Poverty Reduction Strategy Paper (World Bank and partners)
QAG	Quality Assurance Group (World Bank)
R&D	research and development
RDV	Rural Development Department (World Bank)
RNFE	rural non-farm economy
VtoA	From Vision to Action (1997 World Bank rural development strategy)
WDR	World Development Report (World Bank annual publication)
WTO	World Trade Organization

# Acknowledgements

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This review is dedicated to the memory of my long-standing colleague John L Dillon, a persistent reviewer of topics of this review (Dillon 1971, 1979, 1986), who approved of my first draft but did not manage to see this final version. His particular deadly risk was the solar skin damage so prevalent in rural areas of Australia, where he died at Armidale, June 5, 2001.

While this paper was in press, the events of September 11, 2001 in eastern USA brought forward new dimensions of risk. The consequences of aircraft being targeted at urban infrastructure may have little direct bearing on rural development *per se*, but there will be many ramifications that have indirect consequences for rural residents. First will be the profound changes in the insurance industry as governments come to play an increased role in what was hitherto a largely private economic service. There will be increased costs of mail and transport servicing of rural areas and probably some reduction in service. Such changes in conjunction with changed perceptions of travel risks, especially among tourists, are already directly affecting some non-farm economic activities in rural areas. In short, the world, including its rural areas, is now perceived as an even riskier place. To the extent that risk and risk aversion act as frictions on economic activity, the associated costs must be accounted in future rural development effort, including in implementing the Bank's new strategy, *Reaching the Rural Poor*.

# Foreword

Poverty reduction is the overarching objective of the World Bank, and with 75 percent of the world's poor living in rural areas, rural development is a key element in achieving progress in this objective. At President Wolfensohn's request, the rural family has prepared a revised rural development strategy, *Reaching the Rural Poor*. This has been done in close cooperation with the regions and the other sectoral units active in the rural space. The objectives of the new strategy are to revitalize the World Bank's activities in the rural areas by: (a) adjusting the strategic framework; and (b) formulating a program of concrete and implementable actions.

The new rural development strategy addresses a rural situation which is different from the past, and a rural population which confronts many new problems, especially the challenges and opportunities facing the poor with regard to globalization. The new vision and articulation of a development strategy builds upon the strengths of past efforts as well as incorporates new ideas from other models. In this context, our priorities are geared to fulfill World Bank poverty reduction objectives in the rural sector. We are convinced that the following critical components of a rural development strategy will contribute most to accelerated growth in rural economies and, consequently, to measurable poverty reduction: crafting efficient and pro-poor policies and institutions; facilitating broad-based rural economic growth; improving access to, and management of natural, physical, and human assets; and reducing risk and vulnerability for the rural poor.

A number of studies on both global and regional issues, as well as a broad portfolio analysis were commissioned to support the development of the new strategy. These studies provided a rich foundation for both the regional action plans and the corporate strategy. This study is one of the selected number of background papers which have been published in the Rural Development Strategy Background Paper Series to provide Bank staff and others with a more in-depth look at some of the issues surrounding rural development, beyond what is covered by the strategy document itself. This paper, and others in the series are available on line at: [www.worldbank.org/ruralstrategy](http://www.worldbank.org/ruralstrategy). Additional information on obtaining other papers from this series can also be found at the end of this report.

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# Summary

The primary activity of the great majority of rural households, agriculture, is an intrinsically risky activity. The risks faced by rural residents depend on the local farming systems, climate, infrastructure and the policy and institutional settings. Rapid changes in the rules of trade, technology and climate often increase the risks that confront rural households. Similarly, many of the human and animal diseases that affect rural residents may be increasing in incidence. In addition to weather-related and other production risks, the rural poor also suffer under an economy's vulnerability to financial shocks and volatile commodity prices. While agricultural producers with a marketed surplus may benefit from devaluation, many of the rural poor are net consumers. Moreover, financial shocks and terrorism influence remittance patterns and may prompt the return of urban workers back to rural areas.

Many features of economic development directly reduce the riskiness of rural incomes as they facilitate growth. For example, investments such as irrigation, improved roads and modern telecommunications add both to the average level of production and to stabilization of yields. In industrial countries formal risk-sharing institutions are widely available to help farmers overcome problems associated with uncertainty and risk. Farmers can usually borrow for production or consumption purposes to ease the transition from good years to bad. In many cases, they have access to a variety of privately provided insurance against specific types of risks, and they can trade in commodity futures and options markets.

In developing countries, however, these kinds of institutions are usually much more rudimentary, and may not be available at all for small-scale farmers or other impoverished households. Poor rural residents generally rely on a wide range of informal arrangements to reduce risk, such as share tenancy contracts and sale of livestock. They also rely on extended family and other community networks as well as traditional money-lenders to help smooth consumption when income falls. In general, however, these informal risk-sharing strategies are not as efficient as would be desired. A major limitation to these arrangements is that the participants tend to come from the same region, or even perhaps the same village, and hence often face much the same risks. The arrangements, therefore, do not pool risks as efficiently as they would if they spanned regions or broader sectors of a national economy, as do nation-wide crop-insurance or credit schemes. The evidence that rural households sell assets or suffer increased malnutrition during a drought is proof that they have limited, or at least costly, means to self- and co-insure. The lack of efficient risk-mitigation mechanisms implies a loss of potential income.

The paucity of market mechanisms to help mitigate the risks faced by small farmers suggests that there may be a case for public intervention to reduce the risk-coping costs to poor households. Past publicly driven interventions designed to reduce risk, such as agricultural price stabilization schemes and crop insurance have, however, all too often proven unsustainable and ineffective. Nevertheless, this does not negate the importance of addressing rural vulnerability. There appears to be wide scope for enhanced social protection mechanisms to be more generally available in rural areas, as is being pursued in the Bank's general social protection strategy. As well, an adequately developed system of commodity price-risk management using market instruments, as well as yield and weather insurance and the promotion of warehouse receipts, should constitute important components of a comprehensive rural development strategy. The Bank is exploring innovations that seek to make such instruments accessible to the rural poor while avoiding the pitfalls of past interventions, e.g., by examining mechanisms to retail option contracts for floor prices and designing insurance policies that are tied to readily verifiable weather events.

Globalization also creates new challenges for the rural poor. Economic growth and globalization themselves have risks, even as they increase opportunities. Global patterns do not reveal a trade-off of growth and poverty reduction. The data do reveal, however, that volatility affecting developing countries is much greater than for industrial countries, especially those dependent on a few commodity exports. Thus, the new challenge that globalization adds to a rural poverty strategy is akin to the challenge of reducing vulnerability in general. Thus, part of a strategy to reduce risk entails assisting the transition to a more efficient policy framework by providing compensation to groups negatively affected by reforms.

Whether or not they are linked to policy reforms, targeted transfers serve to convey income to the poor and vulnerable. However, such programs face special challenges in rural areas due to the difficulty in defining targeting criteria, collecting beneficiary contributions and administering programs in communities with low population densities and undeveloped infrastructure. There is a particular challenge to design such safety nets for low-income countries. The poorest countries with the greatest need for poverty programs also have the greatest need to be selective to avoid compromising macroeconomic stability or investment in human and physical capital.

One way that low-income countries may deliver assistance to households with an income loss is by supporting informal support programs that build upon traditional rural community structures. While these frequently fail in times of shared hardship, this shortcoming may be reduced with support from a central government. Income losses arising from individual shocks such as illness are often as large or a larger source of income variability as covariate shocks from the natural or economic environments. This is particularly the case for resource-poor farmers.

An approach that supports community structures may allow access to the norms under which a community allocates assistance through defined grants to local organizations, ensuring both fairness and incentives for communities to monitor targeting and exit criteria. However, this type of program must still be subject to oversight to protect minorities. Assistance to micro-credit programs might also be included in this category of support. In addition to the judicious provision of subsidies to operating costs (but not interest rates), the insurance function of micro-credit may be enhanced with reinsurance in the face of large covariate shocks. The risk of lending to poor rural producers can also be reduced by novel price insurance mechanisms. In turn, the ability to provide unsubsidized, market-related, price-risk insurance instruments aimed at protecting the poor against short-term downward price fluctuations is enhanced when low income farmers have good access to credit.

Another approach to smoothing consumption in times of economic crisis is by providing employment in public-works programs. Such programs generally allow self-selection by offering wages slightly below market rates. Thus, low-income individuals can seek employment in accord with their need and to exit when other opportunities arise. The value to the poor of such programs is not measured only in terms of income support but also in terms of the benefits they receive from the infrastructure created. Therefore, programs can be enhanced with technical assistance in drafting projects, preferably with a shelf of such projects available to draw upon when needed. Since not every poor household has an able-bodied member able to take up employment opportunities, public works can also be enhanced with complementary targeted programs, such as removing a barrier to participation of caregivers by the provision of crèches.

Many disasters have a low probability of occurring in any given area, yet incur high costs when they occur and, thus, are unsuited to private insurance. It is, however, a challenge to design publicly funded programs to stabilize income or consumption without creating inducements that encourage risk taking, and that have a clearly defined exit strategy. Cost-effective income stabilization programs, however, are not completely unprecedented. For example, subsidies for livestock transport in Kenya have successfully prevented livestock price collapse during a drought and thus have served as insurance for pastoralists. In Bangladesh, access to microfinance has stabilized consumption as well as raised incomes.

The Bank is now actively assisting in disaster early warning. Previously, the Bank's comparative advantage in long-term lending for development and the necessary procedures for project preparation and supervision had not seemed compatible with response to disasters. Moreover, lending for disaster preparedness does not readily translate to standard calculations of rates of return to investments. Following major efforts to respond to floods following the 1997 El Niño and Hurricane Mitch, as well as to assist earthquake victims in Turkey and India, however, the distinction between development and disaster response seems artificial.

An issue related to that of disaster management is reconstruction after conflicts. As with many types of disasters, rural areas may be particularly vulnerable to devastation, since isolated communities are often targets in insurgencies. The Bank's overall approach to post-conflict recovery recommends flexibility of procedures. Priorities include capacity building, infrastructure rehabilitation and demobilization of ex-combatants. External partnerships, always part of country strategies, must play a key role in post-conflict programs.

Rural areas will always be subject to the incidence of unpredictable, risky events in their natural, social and economic environments. Mechanisms for helping individuals and communities to deal with these have improved over time in many countries but their adoption and active use varies greatly around the developing world. It is thus appropriate for all strategic considerations of rural development to make an explicit assessment of the adequacy of prevailing arrangements and available options for risk management and coping, in order that the vulnerability of the rural poor be addressed and minimized.

# Introduction to Risk in Rural Development

Managing the important risks with which rural communities and individual residents must deal received only brief and rather un-actionable treatment in VtoA. The scheme here is to take advantage of past and recent work in risk management<sup>1</sup> to update the strategic position on rural risk, and to identify: new risks, such as development of GMOs; changing risks, such as related to climate change; and new risk-management tools that show promise, such as rainfall insurance, with due regard to the challenges of implementation, the scarcity of public funds in developing countries, and the respective roles of private and public agents.

Development is an inherently risky business, as evidenced by the history of interventions by many would-be actors (e.g., Deaton, 1992, Bernstein 1996, Fafchamps 1999b). Agriculture itself, a key sector operating largely in rural space, is an intrinsically risky industry (e.g., Anderson 1979, Robison and Barry 1987, Fleisher 1990, Anderson and Dillon 1992). There is a plethora of unpredictable uncertainties that impinge on the billions of farmers and other business operators who function in rural space, not to mention those who supposedly serve them in the various legislative, administrative, judicial, commercial and other domains of influence. It follows that the impacts of risk in rural development are pervasive indeed, and the task of agents at all levels to deal with these impacts is a tremendous one, albeit not new. Some of the issues canvassed here include the precious, largely informal, risk-coping mechanisms of rural households<sup>2</sup> and policies that impinge on these, hopefully not making them less effective. Others relate to interplay among financial-sector instruments that are intrinsically involved in risk management (e.g., Deaton 1992, Pflueger and Barry 1986, Saunders 1999).

There has been much analysis in the World Bank recently of issues such as household-level vulnerability associated with natural and economic risks, government emergency interventions following natural disasters such as hurricanes, and commodity price stabilization, for example, involving such diverse entities as the Disasters Thematic Group, the Social Protection Unit of the Human Development Network, DEC, the Commodity Risk Management Group, PREM, and perhaps most prominently, the *WDR 2000/2001* (World Bank 2000a). Other R&D centers around the world have also been active in the field. The task here is to assess the relevance of risk-analysis findings to rural development in impoverished countries around the world. Since the type and severity of the risks confronting farmers and others vary greatly with the farming system and local rural characteristics, and with the changing climatological, infrastructural, policy and institutional settings, there is a certain boundlessness to the issues, which has naturally made the attention of governments, NGOs and international agencies to such matters not only challenging but also highly varied.

The scope of the present review is largely limited to discussion of risks in rural areas of direct potential relevance to rural development policy, and which are not the subject of other sectoral policies, such as health and economy-wide social protection (World Bank 2001) and conflict resolution and governance,

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<sup>1</sup> Definitions of risk management surely abound but one that appeals for its breadth is due to Raiffa (1982, p. 28): "Risk management in its broadest sense involves the identification, estimation, assessment, monitoring, evaluation, and control of risk, including preventative, reactive *ad hoc*, and unorganized processes to deal with them. Institutions for this purpose include courts, legislatures, administrative agencies, business enterprises, labor unions, research institutions, citizen groups, and educational institutions, as well as individuals."

<sup>2</sup> E.g., livestock build-up and sale, such as has been long practiced in Southern Africa (Kinsey, Burger and Gunning 1998), and grain sharing in West Africa (Carter 1997).

which is by no means to suggest that coping with other such risks is not absolutely vital to survival (e.g., Avery, Heymann and Zeckhauser 1995), let alone development, in rural areas, as cogently illustrated by much of the literature, such as Jodha (1975, 1978), Fafchamps (1999b, chapter I) Dercon and Krishnan (2000) (and earlier works such as those of Anderson and Roumasset 1996 and Bohle and Adhikari 1998), extensively reviewed in World Bank (2000a) and its background papers (Dercon 1999, Sebstad and Cohen 2000, Sinha and Lipton with others 1999), and further explored in the companion papers by Alderman (2001a) and Cord (2001).

By way of noting some of the emerging World Bank concerns in the broader domain, consider the recent strategic analysis of the Social Protection Unit, which has articulated Social Risk Management (Holzmann and Jørgensen 2000) as an underlying conceptual framework for its Social Protection Sector Strategy Paper (World Bank 2001), as well as in the 'security' chapters of the *WDR 2000/2001* (World Bank 2000a). The main thrust of the concept is that the poor are more exposed to many kinds of risks while having the least instruments to manage them, and so are highly vulnerable. Hence, it is argued that providing appropriate risk-management instruments and supporting the critically vulnerable is one key pillar in an effective and sustainable poverty-reduction strategy. It is further argued that this pillar allows the able-bodied to engage in high risk/higher return activities and thus gradually to move out of poverty. The framework suggests multiple strategies (prevention, mitigation, coping) and arrangements (informal, market-based, public) for dealing with risk, instruments that take account of the source and characteristics of risk, and a closer correspondence of the distinct suppliers and demanders of the risk-management instrument set. The Unit has proposed a methodological framework for a Social Sector Expenditure, Financing and Performance Review to give effect to these concerns in practice. Naturally, these themes are also emphasized in the World Bank's Poverty Reduction Strategy Papers (PRSP) Sourcebook (a living document), e.g., in the chapter on social protection (Coudouel et al. 2000) and the one on rural development (summarized by Okidegbe 2000).

It follows from these diverse deliberations that a first conclusion for a spatial differentiation of risk management is to note that a review of risk management instruments should identify what features of risk in rural areas are different from those of urban areas, and how effective are the instruments available in that space. A corollary of this conclusion is that any economy-wide analysis of risk management issues must take particular account of the realities of rural risk experience and management, informal and otherwise, and the applicability of relevant instruments operating in rural space.<sup>3</sup> The fact that the poor are the most vulnerable to risk of whatever source is intuitively obvious and has been documented in various World Bank studies leading up to *WDR 2000/2001* (e.g., Jalan and Ravallion 1999) and in the long and larger literature of the predominantly rural phenomena of famines and extreme food insecurity (e.g., Jodha 1975, 2001, Sen 1981 Anderson and Scandizzo 1984, Ravallion 1987, 1997, Anderson and Roumasset 1996, Chavas 2000, Barrett 2001). On spatial dimensions, the aggregation of risk aspects is non-trivial and, although not pursued here, is a feature of the subject that will probably require closer attention if more detailed considerations of the theme are pursued in Bank work on risks in rural areas (Anderson 2000a). Other broader but related topics not taken up in this review are theoretical developments relating to risk preferences that will assist in better understanding of the risk management challenges, and in refinement of decision analysis (e.g., Quiggin 1981, 1993, MacCrimmon 1999, Chambers and Quiggin 2000, Buschena 2001).

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<sup>3</sup> Indeed, as Peter Hazell (IFPRI) has suggested to the author, perhaps what is needed to help to target analysis and intervention is a typology of rural risk situations. Classifying variables could include agro-climate (especially weather risk) factors, whether farms are net sellers or buyers of food (since this gives very different price and yield risk exposures), the existence or not of catastrophic risk that threatens survival (rather than just fluctuations in income), access to effective financial markets and non-farm income diversification. Perhaps for the poorest groups some of the social safety net issues exempted from this paper are key ones in rural development policy, and a typology would show where these are most relevant.

# Self-Determining Farmers and Rural Risk Management<sup>4</sup>

Among the diverse occupants of rural space, farmers and the rural labor force stand out as the groups most different from their urban cousins, and accordingly are given particular attention here. Needless to say, the close connections between farmers and other business operators in rural areas (e.g., Haggblade and Hazell 1989) means that many of the observations made about farmers will have validity for both groups. If risk is everywhere and is substantially unavoidable,<sup>5</sup> it follows that management of risk is not something too different from management of other aspects of a farm business, and every managerial decision made there has risk implications of some sort. There are, however, some types of management decisions that bear strongly on the riskiness of farming, and these are that types primarily taken up here. The treatment is general because every decision should be considered in the context of the particular circumstances, notably the beliefs and preferences of the decision maker (e.g., Hardaker, Huirne and Anderson 1997). It follows, therefore, that few really general (and worthy) prescriptions about strategies to manage risk are possible. The strategic options considered here have, of course, been worked on extensively by agricultural economists in recent decades, and have been comprehensively examined by Robison and Barry (1987), Huirne, Hardaker and Dijkhuizen (1997) and, especially for developing countries, McConnell and Dillon (1997).

Profit is the reward for risk-taking, therefore any profit seekers in the business of farming, or in any other business, must be prepared to bear some risk. Ways of establishing which risks are bearable and which are not for a particular farmer are the heartland of agricultural decision analysis (Anderson, Dillon and Hardaker 1977). While virtually every decision will have risky consequences, it is clear that not every decision exposes a business to 'unbearable' risk. Many decisions can be made by basing choice on some notion of expected return, accounting in the calculation of expected value, with more or less formality, for any downside risk, but not giving explicit attention to risk aversion (as captured by the several technical measures, such as set out by Bar-Shira 1991). Such an approach will be appropriate if the magnitude of the entailed dispersion of outcomes is sufficiently small such that any effect of aversion to risk is insignificant, a situation likely to apply for many 'small' decisions that affect only a part of a business and can have only a limited impact on overall income or asset position (Feder 1980). On the extent of risk aversion per se, the evidence is skimpy, mixed, and confounded with problematic issues of method (e.g., following on some tentative Australian data elicitation in the late 1960s (summarized by Dillon and Anderson 1990, p. 156), Scandizzo and Dillon 1978, Binswanger 1980, 1981, 1982, Hamal and Anderson 1982, Binswanger and Sillers 1983, Antle 1987, 1989, and a proliferating but still quite limited sampling of attitudes of rural dwellers, especially in the developing world).

While the question of whether risk aversion *needs* to be taken into account is often quite easy to judge, on occasion it would be useful to have some approximate quantitative indication of whether risk aversion really matters (e.g., Wolgin 1975, Binswanger et al. 1982, Anderson and Hamal 1983, Walker and Ryan 1990, pp. 233-48). Such a method has been proposed by Anderson (1989), and has been illustrated in

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<sup>4</sup> One semantic point should be dispatched at the outset: here, *uncertainty* is defined as imperfect knowledge, *risk* as uncertain consequences. In artistic rather than semantic vein, a thought for the day from Jacques Dréze (1987, p. ii): "Without uncertainty, love, which always entails risks as well as the joy of discovery, loses its sharp edge."

<sup>5</sup> "Along with death and taxes, risk is one of the certainties of life" (MacCrimmon and Wehrung 1986, p. 4).

various farm business contexts, such as in rice farming (Anderson 1995). On the basis of indicative calculations of that type, it can be argued that risk aversion will often not be as important as getting the expected-value calculation right, at least in relatively commercial farming, and in policy making generally. On the other hand, it is, of course, readily possible to construct cases where risk aversion is indeed important (e.g., Kanwar 1998),<sup>6</sup> for example by increasing the degree of relative risk aversion and/or the proportionate size of an additional risky activity. These are exactly the situations that so often confront subsistence farmers and impoverished business operators and many household members in developing countries, which is why it is necessary to consider strategies that they can, do, and perhaps should deploy.

## **On-Farm Risk Management Strategies<sup>7</sup>**

### *Collecting information*

Whether or not risk aversion matters much, better decisions in a risky world can usually be made if additional information that reduces uncertainty is available. Examples where investments of time and money in collecting information can have substantial payoffs in agriculture include collecting information about more productive technology options and gathering information about marketing opportunities and market trends.(e.g., Just and Zilberman 1984, Bosch and Pease 2000).

The case of Grameen Telecom in Bangladesh illustrates in a micro way the use of information for better risk management. Using cellular technology, farmers are able to obtain up-to-date information, for example, on the market price of poultry, which enables them to sell better than at a price set more arbitrarily by a trader (Bayes 2000, Burr 2000).

Bearing in mind that all probabilities in decision making are best regarded as subjective, information gathering can be seen to have two impacts on subjective distributions. First, the dispersion of the distribution will usually be reduced as knowledge is accumulated. For example, a farmer who has no knowledge of a new technology may be thought of as having a prior distribution for the returns from that technology with wide dispersion. Once the farmer has accumulated some information about the technology, for example by observing it in place on a neighbor's farm or by learning through the media of the results of trials of the technology, the distribution will be modified and become much tighter (Hiebert 1974, Feder 1980). Moreover, if still more relevant information is obtained, for example by the farmer personally trying the technology out on a pilot scale, a still lower subjective variability may well result.

The second impact of information on subjective distributions is likely to be a shift in the location of the distribution. In fact, the whole distribution may shift but, for convenience, this change can be thought of as an adjustment to the subjective mean as excessive optimism or pessimism is corrected based on accumulated information. Again, farmers learning about a new technology may initially be pessimistic about how it will perform on their own farms. They may well have been disappointed in the past by giving too much credence to the optimistic claims of agricultural scientists, farm advisers or rural sales representatives, and so may heavily discount any new claims. Yet, if they take the trouble to find out

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<sup>6</sup> Kanwar (1998, p. 161) goes so far as to observe that "... rigid views regarding the complete unimportance of incorporating risk preferences in farm decision analysis are just not tenable."

<sup>7</sup> A somewhat broader perspective on risk management strategies in the context of African smallholders is offered in World Bank (2000b). Other diverse perspectives are to be found in the Rural chapter of the emerging/living World Bank Sourcebook for Poverty Reduction Strategies.

more, perhaps trying out the technology on a small scale if this is possible, their initial skepticism may be modified. Whichever way it goes, the newly perceived subjective mean may be of greater influence than the new subjective dispersion.

For rural development strategists, there is thus a need to ensure that arrangements (including incentives, naturally) are in place for farmers, and others such as traders, to have access to *reliable* information that will help them do a better job of managing their risks. These arrangements will usually involve a mix of public and private suppliers, as is elaborated in the companion contribution to the Corporate Rural Development Strategy by the Bank's 2001 Agricultural Knowledge and Information Systems (AKIS) Thematic Group. Access to better marketing information will be influenced by various infrastructural elements, such as telecommunications and the better functioning of local markets through reduced transaction costs that come from better transport infrastructure, as also argued in the companion paper on rural infrastructure.

### *Avoiding or Reducing Exposure to Risks*

While life without risk is unthinkable, it is the case that some unwanted risks do not need to be faced. When an action (or inaction) carries with it the possibility of serious negative consequences, such as bankruptcy or death, actions to avoid or reduce that risk should be carefully considered. Such actions may include:

- postponing a decision to change the existing situation until more information is obtained about the possibility of serious negative results from the change;
- in a situation where continuation or projection of present practices creates the threat of serious negative consequences, strict 'safety standards', may be imposed, at least until more is known;
- somewhat in the spirit of the postponement 'action', take a decision that does not depart too radically from the status quo, knowing that it is overtly cautious but never the less avoiding any charge of indecision or inaction.

In suggesting these precautionary principles, it is not being implied that decision makers should always adopt a very risk-averse attitude. As observed, many farming risks are so small as to be relatively insignificant in the context of the survival and overall profitability of the farm business. The same is even more so the case for agricultural policy making and planning at the national level. Precaution is, however, called for where the impact on expected costs and benefits of negative outcomes may be serious, as mentioned, or where too little information is available to know whether the risks could be serious, such as may well be the case with the environmental consequences of some farming practices (e.g., Anderson and Jodha 1994, Holden and Binswanger 1998, Smith and Lewandrowski 2000, Jodha 2001). Note that, in adopting a precautionary stance, some actual or opportunity costs are usually incurred by acting cautiously, and these costs must be balanced against the achieved reduction in the chance of serious negative consequences.

Risks, in the sense of the possibility of bad outcomes, can also be avoided or reduced by adopting effective farm system monitoring and control procedures. Such is part of the logic of the World Bank's safeguard policy relating to Integrated Pest Management, for instance. There are, in fact, many dimensions to such monitoring and control procedures (Mangel 1995). For example, the chance of serious crop and animal losses due to diseases or pests may be minimized by careful monitoring of evidence of beginning outbreaks (e.g., Nunn 1997, Huirne et al. 2000, Glauber and Narrod 2001). Similarly, the

chances of outbreaks of certain diseases in an intensive livestock enterprise can be minimized by adopting careful control procedures to avoid the introduction of infected stock and to prevent people who may have had contact with infected animals elsewhere from entering the property. As the elements of rural areas are increasingly better integrated through improved infrastructure, the opportunity for (and risk of) disease transmission is enhanced, for both human and livestock residents of the space. More research is evidently needed to refine effective management schemes (e.g., Beare and Hinde 2001).

Needless to say, how individuals act in respect of disease management depends on their knowledge of such matters and has effects external to themselves, so there is a further role for provision of cogent information some of which will be largely of a public-good nature, thus implying some role for government, as financier, facilitator, or provider.

### **Selecting Less Risky Technologies**

It is evident that some farming activities give more stable returns over time than others. For example, intensive livestock production is likely to be more stable, at least in terms of levels of production achieved, than is extensive grazing, since the latter is directly exposed to the effects of climatic variability and the former is usually not, although disease outbreak may be another story. Again, for some farming activities in some countries, prices are more or less guaranteed by government market interventions, while prices for other agricultural outputs are determined in fluctuating world markets. Risk-averse farmers will obviously consider these aspects in deciding what to produce.

Farmers also often have the possibility of selecting between relatively more or less risky ways of producing the same commodity (e.g., Hiebert 1974, Feder 1980, Leathers and Smale 1991). One important case is the use of cultivars that are more resistant to weather extremes, such as drought (e.g., Anderson 1991, Anderson and Hazell 1994, Carter 1997, Pandey et al. 2001). For other examples, investments in irrigation may (but not necessarily so) give more assured levels of crop or pasture production in areas of unreliable rainfall (e.g., Arrow 1971, Pandey 1989), and adoption of practices to reduce risk usually helps (e.g., Dillon and Hardaker 1993 ch. 6). Similarly, investments in actions to control outbreaks of pests and disease may be successful in limiting the chance of serious losses (e.g., Huirne et al. 2000). If such operators can benefit from public investment in these risk-moderating assets, they will be advantaged, but whether such make wise use of scarce public funds is quite another matter, for which there is no valid general answer.

Yet other novel cutting-edge technology assessment may be able to inform developing-country programs. For example, Lowenberg-DeBoer (1999) discusses the effective use of computer technology (precision farming) to reduce the probability of low yields and returns. According to him, most previous computer technology used in agriculture was for things that most farmers found uninteresting (e.g., accounting, tax preparation, payrolls). However, GPS-based information technology for agriculture uses monitors to provide information on something in which farmers are ‘passionately’ interested—crop yields.

Methods of farm planning that account for risk are appropriate for decision analyses of what to produce and how to produce it (Dillon and Anderson 1990, ch. 7), but are not generally available, even in industrial countries. However, simpler, less formal approaches are often followed. In this context it is important to avoid falling into the trap of equating risk with variability, measured by such descriptors as variance. Just because one activity has, say, a higher variance of returns than another, does not mean that it is less risk-efficient. The key is having sufficient advantage in average performance. The lesson for the selection of farming enterprises and methods of production that are risk-efficient is to look first at what is profitable in an expected-value sense and, if high enough relative to the alternatives, dispersion may not matter much.

## *Diversification*

Similar considerations apply to the matter of diversification of farming activities to manage risk. One key idea in diversification is to reduce the risk of the overall return by selecting a mixture of activities that have net returns with low or negative correlations. Luckert et al. (2000), for example, cite empirical evidence from rural Zimbabwe, which shows that households allocate resources to other than pure agriculture, such as to woodlands, livestock and urban activities, in order to buffer their welfare from rainfall shocks, which are exaggerated by increasing population pressures. Analogous cases are to be found around the world (e.g., Valdivia, Dunn and Jette 1996).

The aim with diversification should be to find a risk-efficient (Anderson 1974, 1975) combination of activities, not the one that only minimizes variance (Hardaker, Huirne and Anderson 1997). While the potential gains in risk efficiency from on-farm diversification are an empirical matter to be resolved on a case-by-case basis, these gains are often less than may be imagined, for a number of reasons. First, even farm plans to maximize expected return will often be reasonably diversified before risk aversion is considered. Mixtures of activities will typically make best use of available resources, risk aside. Mixed cropping allows more productive and sustainable crop rotations; labor and machinery requirements for a mixed system will be more evenly spread throughout the year, using these resources more efficiently; and seasonal cash-flow troughs will be filled by having income from diverse sources received at several stages during the farming year, again favoring some system diversification (e.g., Upton 1987, chapter 5, McConnell and Dillon 1997, chapter 11, Kydd et al. 2001, Mortimore et al. 2001). Tight growing seasons rather restrict the possibilities but as long as the season is not too short, there are usually useful opportunities that can be exploited to contain risk (Walker and Ryan 1990, pp. 242-48). Moreover, the majority of the risk-reducing benefits from diversification can often be captured by having only two or three enterprises (although, of course, this is an empirical matter).

More generally, the fact that returns from different activities are typically strongly positively correlated limits the gains from diversification on farm. Better opportunities to spread risks may lie in spatial diversification, although this type of diversification in its most extreme form is open only to the largest businesses (Anderson 1971a, b). On a more modest scale, the fact that many smallholders have their land in spatially separate plots may be of some risk-spreading advantage, particularly if different proximate elements of the landscape are subject to less than fully covariate weather experience (Nugent and Sanchez 1998, Pandey et al. 2001). Less ambitiously, investments in off-farm activities may provide an effective risk-spreading avenue that should not be overlooked by World Bank analysts and strategists, even for relatively poor farmers (Ellis 1998, Reardon 1997, 2000). For example, farm families in developing countries often diversify income sources, engaging in such non-farm activities as agricultural processing, providing services such as construction and repair, small-scale manufacturing such as handicraft production, or investing in relocation costs, and even education costs, for family members to find wage employment off the farm. This is done in the expectation that those who leave will remit part of their earnings back to those family members left at home. More generally, enhanced mobility of rural residents boosts their risk-management capacity.

Traditionally, labor migration and remittance strategies have been used as a social security mechanism by smallholder households in the absence of insurance markets to cover production risk (e.g., Rosenzweig 1988c, p. 752, Hoddinott 1992), and such migration continues to be important in many places (e.g., to cope with drought in eastern India (Pandey et al. 2001). Schrieder and Kneer (2000), however, find empirical evidence from Cameroon that, recently, young urban migrants from rural regions tend to neglect their traditional obligations to support their elderly parents, especially if they do not intend to return to their native village, do not expect any sizable inheritance, and have no reciprocal insurance commitment with their parents. These various imperfect mechanisms for risk management mean that there may often be a case for assisting stressed rural households overtly.

## *Flexibility*

Flexibility refers to the ease and economy with which the farming business can adjust to changed circumstances. It is intuitive that flexibility has a virtuous role in risk management but Fafchamps (1999b) provides an elegant formalization of how it has an important option value, which explains why individuals are likely to resist changes that reduce their range of choice. The risk-management strategies that can be adopted by farmers to enhance flexibility include asset, product, market, cost and time flexibility.

Asset flexibility means investing in assets that have more than one use. For example, when constructing a farm building for some specific use, it may not cost much more to modify the design so that it could be readily adapted to an alternative use at modest cost, should circumstances make this desirable. Similarly, land that can be used for several different types of production is a more flexible investment than land that is limited, by soil type or climate, to only one or two uses. Of course, the most flexible form of asset is cash, and maintaining an adequate level of liquidity in the farm business is an important part of prudent financial management. Other forms of reserves may also add to flexibility, such as fodder reserves held as a precaution against drought.

Product flexibility exists when an enterprise produces a product that has more than one end use, or when the enterprise yields more than one product. Both attributes may enhance flexibility. For example, coconuts may be used for home consumption, livestock feed, processed into copra, sold as green nuts for drinking, as whole nuts for direct consumption, or processed into desiccated coconut for sale. In addition, the trunks, fronds, husks, shells and milk of coconuts all have economic uses, and the coconut farmers can produce sweet sap for alcoholic spirits, which can be drunk at home or sold, making coconuts perhaps the world's most flexible crop.

Related to product flexibility is market flexibility, whereby a product can be sold in different markets that may not be subject to the same risks. For example, a small domestic market may be subject to greater change than an export market. However, only those producers who are able to meet export quality needs may have access to the more stable export market. Products with high value to weight or value to volume ratios can more easily be shipped to distant locations, which may become an attractive option when market prices there are relatively high.

With cost flexibility the idea is to organize production keeping fixed costs low, incurring higher variable costs as necessary. For example, land or machinery may be leased rather than purchased, labor may be hired on a contract or casual basis rather than as permanent workers. By such means, fixed costs are kept to a minimum and there is greater scope to change levels of resource use or to switch to other types of production should circumstances warrant it.

Finally, time flexibility relates to the speed with which adjustments to the farming operations can be made. Activities with short production cycles enable obviously more flexibility than those with long cycles. Contrast tree crops, which may have a production cycle of several decades, with short-term seasonal crops which may be planted, grown, harvested and sold, all within six months or so. Time flexibility may also be relevant on a more limited scale, but still be important. For example, a crop may be grown using a schedule for the application of inputs of fertilizer and sprays that is adjusted according to developing seasonal conditions, rather than being predetermined. Rainfed cropping in semi-arid areas provides diverse examples of where varietal characteristics, such as photoperiod insensitivity, contribute usefully to producers' time flexibility (Fafchamps 1999b).

These considerations of flexibility at the individual farm level do carry over to rural areas themselves. Areas that feature concentration of highly similar economic activities, all using much the same

techniques, technologies and markets, are in a relatively vulnerable situation. Accordingly, it will be worthwhile for rural strategists to explore innovative approaches to diversifying and opting for more flexible approaches to production and marketing, in order to reduce vulnerability to whatever risks are being faced. As always, assessment of the utility of intervention must depend on the costs and returns involved.

## **Strategies to Share Risk With Others**

### *Informal Risk Pooling*

Alderman and Paxson (1992) produced one timely review of the diversity of mechanisms used to manage assets to spread risk, a field that has attracted the attention of rural economists and others increasingly in recent decades (e.g., Wiens 1970, Stiglitz 1974, Jodha 1978, 2001, Walker and Jodha 1986, Rosenzweig 1988a, b, Rosenzweig and Binswanger 1986, 1989, Ellis 1988, Bromley and Chavas 1989, Rosenzweig and Stark 1989, Udry 1990, 1994, Fafchamps 1992, 1993, Reardon, Delgado and Matlon 1992, Coate and Ravallion 1993, Deaton and Paxson 1994, Besley 1995, Morduch 1995, Townsend 1995, Dercon 1996, 1998, Dercon and Krishnan 1996). Cogent analytic work in this area continues apace (e.g., Jalan and Ravallion 2000, Alderman 2001b). For example, Carter (1997), for example, has investigated norms of social reciprocity (sharing rules between households with equal or unequal wealth endowments) in rural West Africa, and found that these customary tenure structures play an important risk-management role. While agreeing that such mechanisms can be highly effective in the right circumstances, Morduch (1999a) finds that most recent studies show that such informal arrangements are often weak. Foster and Rosenzweig (2001) focused on an aspect of behavior that intuitively could be expected to strengthen informal arrangements, namely altruism; they find that where it is prevalent, such as among kin, it does compensate to some extent the constrained benefits of risk reduction of the common lack of full commitment among informal risk sharers. Fafchamps (1999b) also identifies weaknesses in some traditional arrangements that superficially appear to be risk-sharing in underlying rationale yet, in fact, turn out to be engines of poverty as households struggle to meet their ritual obligations, a case of what he terms “ritual risk”.

Sharecropping is, of course, a way to share not just the output and costs of productive activity but also the associated risks (e.g., Stiglitz 1974, Sharma and Dréze 1996, Ray 1998), although it is usually a fairly formal arrangement, even if not by means of written contract (Sadoulet, de Janvry and Fukui 1997). In a sharecropping arrangement, a risk-averse tenant agrees to pay the (relatively less risk-averse) landlord a share of his output in some pre-assigned proportion between the landlord and tenant. The proportions vary from country to country and across regions within a country, and novel multi-party cooperative arrangements are under experimentation (e.g., Townsend and Mueller 2000).

### *Farm Financing*

The way a farm business uses debt (and savings) can have major implications for risk exposure (Barry and Baker 1984). A key concept in this regard is financial leverage, defined as the use of credit and other fixed-obligation financing relative to the use of equity capital (Robison and Barry 1987, Chapter 16). Increases in financial leverage magnify the impact of variability of firm returns from the point of view of the owner. If the return on total assets is above the borrowing rate, the rate of return on the owner's equity will be increased, and conversely, if the overall rate of return is less than the borrowing rate, the owner will suffer, in the extreme case receiving a negative rate of return on equity. The effect of financial leverage in magnifying risk raises the question of the optimal financial structure for a farm business. The answer depends on the investor's risk preferences. Given this information and information about the

decision maker's beliefs about future income levels, it is possible in principle to determine the optimal level of debt for any given interest rate on loans.

There are, however, some limitations to this relatively simple and static approach to the determination of optimal financial structure. Notably, the dynamics of farm debt are ignored. Given a run of bad years, the farmer may reach the limit on borrowing set by the bank, or may run up more debt than can be serviced, especially if there is a persistent downturn in farm profitability. Such situations can obviously lead to bankruptcy. It is recognized as unwise to borrow to the limit of available credit set by lending institutions since holding a credit reserve can be a way to provide liquidity to get a business through troubled times. However, while the direct costs of holding a credit reserve are usually low, the opportunity costs, in terms of the return on the forgone investment, may be considerable. A similar argument is made by Deaton (1991, 1992), Sarris (2001) concerning the holding by the rural poor of liquid assets as 'insurance' rather than investing their savings in directly productive activities. Some careful risk analysis is needed to work out the best strategy in particular circumstances.

The reality of the financial management of a modern commercial farm business is still more complicated than has been indicated (e.g., Featherstone, Preckel and Baker 1990, Smith, Smithson and Wilford 1990). For example, in many countries there is now available to farmers a wide range of financial instruments, such as fixed or flexible interest rate loans, loans with more or less flexible repayment conditions, and even various arrangements such as investment trusts that in effect enable the farmer to sell a portion of equity to outside investors. Clearly, this situation varies greatly around the world, and aspects relevant to rural strategy development need to be identified separately in the various Bank Regional strategies.

Evaluating the financial structure of a modern commercial farm business is naturally more complex than is suggested by the few issues briefly addressed here (e.g., Leatham and Baker 1988). The challenge is not pursued here because the relevance for farmers in developing countries is dubious, on account of the different nature of such structures in subsistence farming (Binswanger 1986, Deaton 1992) and rural non-farm enterprises (Krause et al. 1990). Policy aspects of credit provision to residents of rural areas are returned to in the second (intervention) part of this paper.

Informal credit arrangements are widely used in developing countries, since formal lending institutions often do not consider small farmers as credit-worthy (e.g., Alderman and Paxson 1992, Fafchamps 1999a). Rural households often attempt to smooth consumption through reciprocal gifts and informal credit (e.g., Paxson 1993, Jacoby and Skoufias 1998, Ray 1998). Formal lending institutions in rural areas may be unwilling to lend money to small farmers as the latter may offer collateral in unacceptable forms (e.g., a small plot of land, livestock, etc.). However, informal moneylenders—the landlord, the shopkeeper, the trader—are in a position to accept collateral in exotic forms. For example, a large landowner who has land adjacent to that of a poor farmer may be interested in a tiny plot as collateral. Or an employer of labor will accept labor as collateral, in case the laborer-borrower fails to repay. In addition, informal moneylenders often have much better information regarding the activities and characteristics of their clientele (e.g., Ray and Ghosh 1999). Notwithstanding the existence of such informal mechanisms in rural credit markets, rural residents may be considerably assisted in their risk management by interventions that lead to better access by the rural poor to competitively supplied financial instruments.

### *Insurance*

There are various types of insurance contracts available to farmers, including, but not by any means universally available: fire and theft cover for physical assets; death and disability cover for members of the farm family; cover for workers' injuries and for public liability; and mortality and infertility cover for

some categories of livestock. Sarris (2001) notes the frequent absence of markets for some of these insurance products in poor rural areas. In many areas, however, it is often possible to insure crops commercially for fire and storm damage but comprehensive crop insurance is usually only provided under subsidized government schemes. The principle of insurance as a risk-sharing device is that, by accepting appropriate premiums from a large number of clients, the insurance company is able to pool the risks (Ahsan 1985, Hazell 1992). Moreover, by use of information on the frequency and level of claims, a company aims to set premiums at levels that will enable it to pay all claims from the aggregate contributed premiums and still leave a margin for operating costs and profit.

From the point of view of the farmer considering buying insurance, this means that the expected value of insuring is almost certainly negative. The expected value can only be positive if the farmer assesses his or her probability of making a successful claim as considerably higher than the probability judged by the company from actuarial information, problems of adverse selection aside (Just, Calvin and Quiggin 1999). Such an outcome is unlikely since most policies require the person taking out the insurance to disclose to the company any special circumstance that might increase the risk of the insured event occurring. To fail to do so is supposed to invalidate the policy. That so many agricultural insurance schemes have been complicated by such 'moral hazard' difficulties means that many farmers have not strictly adhered to the rules (Hazell, Pomarada and Valdés 1986).

It follows from the above that insurance will usually be attractive only for risk averters, and then only for risks that are sufficiently serious to warrant paying a premium equal to significantly more than the expected loss without insurance (Bardsley, Abey and Davenport 1984, Quiggin 1986, Bardsley 1986, Fraser 1992). For most farmers, and most people, this means that insuring small, easily borne risks will not be worthwhile. However, it may be worth attempting to insure large risks that otherwise could threaten the continued existence of the farm business or that could seriously damage the welfare of the owners (Anderson and Hazell 1997).

Design of agricultural insurance schemes is a commercial art form demanding of many skills beyond mere actuarial analysis, if schemes are to meet the desires of potential insurers efficiently, and to perform successfully and as intended. It is beyond the present purpose to delve into these issues that must continue to receive close analytic attention, but suffice it to note the contributions of Quiggin, Karagiannis and Stanton (1993), Meyer and Ormiston (1999), Duncan and Myers (2000), Vercammen (2000), and Turvey (2001) towards making schemes work better.

Design issues aside, actual insurance decisions will often be quite complex to analyze. For example, a major threat to the survival of a family farm business is the death or serious disability of one of the principal partners. This is often an insurable risk, but it is seldom clear what value should be attached to the insured event when buying insurance. Other policies may include an optional excess that the person taking out the insurance agrees to pay if the insured event happens, with the company only being liable for the balance of the agreed loss. In some forms of insurance, such as vehicle cover, insurance companies may offer a no-claim bonus to discourage small claims for minor damage. The person taking out the policy therefore has to consider whether, if some claimable damage does occur, it is worth making a claim and sacrificing the accumulated bonus.

For rural development strategists, the key questions to ask relate to the availability of an insurance market to which rural communities, rich and poor, have access to fair commercial terms free of political influence. When access is limited, and when insurable risks seem prevalent and compromising of economic advance, analysis of what the impediments to an effective market are should be made, and policy developed accordingly. This might best be thought of as a particular case of private-sector development.

Informal insurance arrangements should not be forgotten in assessing the options available to communities (e.g., Townsend 1994 [but see Ravallion and Chaudhuri 1997], Townsend and Mueller 1998). Informal insurance schemes within groups, for example, a cropping group that pools risks and resources and jointly farms the land of a single landowner under either a fixed- or share-rent contract, can be useful elements of rural risk-management practice.

### *Contract Marketing and Futures Trading*

In many countries, farmers have the opportunity (if not an obligation in some cases) to reduce price risks for commodities not yet produced, or for inputs needed in the future, by various marketing arrangements. The most important alternatives, from a risk-management perspective, include cooperative marketing with price pooling, forward contracts for commodity sales or for input delivery, and hedging on futures markets (Varangis and Larson 1996).

Of these, *price pooling* arrangements are usually the least effective for risk management. They operate by a group of farmers collectively buying their inputs or selling their outputs through a cooperative or marketing board. Membership of the selling group may be voluntary or compulsory. The price pooling arrangements may be operated in various ways but are generally designed to protect the individual from short-term fluctuations in prices by some form of averaging. There may also be claimed advantages from increased market power and economies of size, leading to lower input prices or higher product prices than could be obtained by the individual, but these benefits, if they do indeed exist, will be at least partially offset by the administrative costs of the scheme.

*Forward contracting* of sales or purchases is a much more effective and relatively widely used form of risk management for farmers, the most common being a contract for the sale of a crop. The contract is written, perhaps at planting time, or maybe later in the season, between the farmer and the purchaser of the product, agreeing on a price (or a basis for determining a price, such as a price scale according to grade). The contract may stipulate the quantity of produce to be delivered by the farmer, or may relate to the whole production, which will obviously depend on the yield. Of course, the price offered is likely to be discounted below the generally expected price for the future delivery date, since the merchant is taking a risk of loss should the market drop between the contract date and the delivery date, although elevator operators in the USA, for instance, routinely hedge their own risks and this is passed on to farmers at quite low cost (Harwood et al. 1999, p. 75). A risk-averse farmer alone may, however, also be willing to accept a discounted price for the security of an assured price for the product. Personal assessment will be needed to determine whether or not the contract offer should be accepted (Allen and Lueck 1995). Depending on the details of the contract and the size of the harvest realized, it may be necessary for the farmer to purchase on the market to meet the contracted delivery requirements.

*Hedging on a futures market* is rather similar to forward selling on contract but with a number of differences. One important difference is that the futures contracts are standardized contracts that are widely traded, so prices are more competitively determined than for a specific contract between a single farmer and a single merchant. That might mean that the farmer can get a better deal by hedging on the futures market than by selling forward on contract.

Under a futures contract, delivery of the commodity normally does not take place. A farmer can hedge to reduce future price risk by selling a futures contract, which is an obligation to deliver an agreed amount of a specified grade of the commodity at a particular date in the future. The buyer of the contract obviously agrees to pay the contract price for the commodity at that date. However, the farmer will not normally expect to deliver the commodity to the buyer, but rather will 'close out' the position by buying back a futures contract at around the time the real commodity is sold on the spot market, so effectively canceling

it. In other words, a futures market is mainly a speculative market in contracts, not a market in the commodity itself.

The difference between the current price and the futures price is called the basis. Basis risk is attributed to location, quality and timing discrepancies between commodities traded in the cash market and those deliverable on futures (Paroush and Wolf 1989, Pennings and Meulenberg 1997). So, the basis will vary over time, and is a source of uncertainty that cannot be eliminated by the farmer. However, as the contract date draws nearer, the basis will narrow, approaching the actual market price. (If this were not so, speculators could make a sure profit by simultaneously trading in real product and in futures.) For developing countries trading on foreign markets, there is the additional disadvantage of large variations in basis, consisting of ocean freight, currency rates and possibly also export subsidies.

Agricultural economists have devoted much effort to attempts to analyze futures markets systematically and to show how risk-averse farmers 'should' use such markets (e.g., Karp 1987, Turvey and Baker 1989, Gaspar, Gatete and Verammen 1992, Lapan and Moschini 1994, Carter 1999; Knudsen and Nash 1990 review the situation for developing countries). Yet the reality is that rather few farmers actually use futures hedging, probably mainly because of lack of knowledge of how the market works. Use by farmers even in the USA is low (Carter 1999, Harwood et al. 1999), and Gardner (2000) opines that this is because of the relative unimportance of the agricultural share of the incomes of the majority of relatively small-scale farmers who gain most of their livelihood in non-farm activities. Moreover, there are in general some limitations to hedging on futures as a means of risk management. Not all risk can be eliminated, since the basis is not certain. Prices for the grade of product sold by the farmer may move somewhat differently from prices for the grade specified in the futures contract, creating a further source of uncertainty. In many settings it is necessary also to examine simultaneous use of insurance contracts (e.g., Coble and Heifner 1998, Schnepf, Heifner and Dismukes 1999). Finally, farmers must be able to finance their futures trading operations. They will be required to place a deposit with their brokers when selling the contract, and will also face the possibility of additional calls for funds to cover potential losses should the futures price move against them, called margin calls. While the deposit and margin calls are recoverable when the contract is closed out, the funds still have to be found.

The decision on whether to hedge hinges principally on the farmer's expectations about the cash price at the date in the future when the commodity is to be sold, relative to the futures contract price for that period. Harwood et al. (1999, p. 76) note that the extent of risk reduction achieved can be quite small where variability of yield is high or yield and price are negatively correlated. For a risk averter, hedging will be attractive only if the more or less certain futures contract price is above the expected value of the subjective distribution of future cash price by an amount more than sufficient to cover the costs of the transactions. If a decision is taken to hedge, usually it will pay to hedge an amount approximately equal to projected actual sales, although, as with forward contract selling, it is possible to hedge only a portion of expected sales.

These remarks about futures contracts largely apply to farming in a country where the farmers and others readily have the option to trade in futures if they wish, a situation that has not always prevailed in the rural areas of many developing countries. Access to futures markets is, however, increasing around the world (e.g., Prioivolos and Duncan 1991, Claessens and Duncan 1993), but even so, it will be moot as to how useful futures markets are to resource poor farmers who lack the information and financial acumen to take direct advantage of them. It is likely that their access will be indirect, such as through their marketing cooperative hedging future sales on their behalf (e.g., Claessens and Coleman 1993). Indeed, this has long been the practice in some countries specializing in production of commodities for which there is an active futures market, such as West African cotton relative to the New York cotton futures market (Satyanarayan, Thigpen and Varangis 1993). Analysis has suggested useful possibilities for futures trading to assist in risk management in diverse circumstances, such as wheat in Pakistan (Faruqee and

Colman 1996) and coffee in Costa Rica (Claessens and Varangis 1993). For rural strategists, the task is to analyze the potential value of futures trading arrangements, and as necessary, undertake the necessary policy and institutional work to introduce such marketing innovations. This relates directly to the work in progress in the Commodity Price Risk Management initiative operated from the World Bank (International Task Force on Commodity Risk Management in Developing Countries 1999).

## **Conclusions**

For farmers to use many of the principles outlined above may seem to amount to mere common sense in dealing with the ordinary problems of life. But managing risk in farming is something of a taxing task for individuals and families to perform, which is why definitive statements about 'good practice' are difficult to make and to do justice to the many possibilities. Some principles will surely lend themselves to further depth of insight and greater confidence in the chosen strategies if subjected to systematic analysis, as has been undertaken by various agencies in the recent past, including in the World Bank (Claessens and Duncan 1993). Just how formal and extensive such analysis needs to be is still something of a research question, and only a well monitored set of detailed analyses will be able to inform this challenging arena.

# Farm Risks, Market Failures, and Government Interventions

The incidence of risk and risk-averse behavior in farming has been perceived to be important to policy makers for several reasons, now briefly overviewed. Fluctuations in farm incomes, particularly the risk of catastrophic loss, may present difficult welfare problems for farmers. There are also important spillover effects on other rural households and businesses. Destroyed crops and livestock reduce employment opportunities, with serious implications for the landless rural poor in developing countries, and add to unemployment problems in other countries. Destroyed crops and stock also lower farm output and so reduce turnover for agricultural merchants and agro-processors. Moreover, reduced farm incomes have negative multiplier effects on income and employment for many rural non-farm businesses and towns (Powell and Mandeville 1978, Haggeblade and Hazell 1989). The negative economic consequences of reduced rural tourism in the United Kingdom during the 2001 Foot and Mouth Disease controls illustrates another dimension of these risky interconnections.

Farmers' efforts to avoid risks through on-farm management practices tend, as has been discussed above, to reduce the average returns to their resources. This not only reduces average farm incomes, with immediate welfare ramifications, but also leads to smaller supplies of the 'riskier' agricultural commodities (e.g., Pannell and Nordblom 1998). If these are important food or export crops, increasing their production can affect consumers' welfare directly, as well as reduce foreign exchange earnings. It also leads to lower national income and to reduced long-term productive investments in agriculture (Anderson and Hazell 1997). Somewhat against this assessment, Jalan and Ravallion (1998) have found that in rural China, holding of wealth in unproductive forms is little used to buffer against risk, and so has had little influence in lowering productivity. Most farm inputs have to be allocated well before yields and product prices can be known. Farmers must allocate resources each year on the basis of their expectations about yields and prices. If these expectations are wrong, their resource allocations will not be 'optimal'. Such errors may be costly to national income. Typically they are costly to farmers, when judged by comparing their average incomes with the incomes that could be achieved given more perfect foresight.

Yield variability naturally leads to unstable supplies of agricultural commodities. The problem is accentuated as farmers adjust input use and the area they sow to different crops from year to year in response to changing expectations about uncertain prices and yields. Instability in national food production tends to increase domestic price variability, presenting food security problems for the poor and increasing uncertainty for farmers. Instability in export-crop production leads to more volatile foreign-exchange earnings, which can destabilize the national economy.

Finally, exposure to severe risks increases the likelihood that farmers will default on loans, particularly in years of natural catastrophe. The performance and long-term viability of rural banks can be severely impaired by poor loan collection, particularly if many farmers default at the same time because of a shared catastrophe (Yaron, Benjamin and Piprek 1997).

Given these diverse concerns, it is hardly surprising that governments around the world have intervened in order to try to help farmers and consumers cope more efficiently with risk and, as Sumner has noted (1988, p. ix), have done so since the time of the pharaohs. The positions taken by economists on the virtues of intervention have been diverse (contrast, e.g., Jabara and Thompson, 1980 with Lloyd and Mauldon, 1986). In this paper, the conditions under which government and Bank interventions can be

justified are reviewed, and the experience with the more popular risk-oriented policy interventions is assessed.

In the ideal world sometimes assumed by economists, a full range of costless 'contingency' markets would exist that enable economic agents to neutralize risks. In such a world, resources would be allocated in agriculture as if risk did not matter, and all individuals would be able to smooth their consumption over time, regardless of income and price fluctuations. In reality, many risk-spreading mechanisms exist, but these are neither costless nor as widely available as is seemingly desired. A key question is the extent to which there is market failure: how inadequate are the risk-management options already available, and how costly is market failure in terms of social welfare? The answers to these questions provide a basis for evaluating the need for government intervention in making markets more complete.

From the farmers' perspective noted above, risk can reduce welfare in several important ways. It can lead to a reduction in average productivity (and hence average income) because of forecasting errors that lead farmers to use resources sub-optimally, in part because they may need to adopt on-farm risk-reduction strategies (e.g., crop diversification) that are less productive on average than are strategies that could be followed if risk could be ignored. Farmers may also be concerned about their ability to repay loans, and their ability to meet family living expenses in catastrophic years. In developing countries, there may not even be enough food for the family when things go badly wrong on the farm.

Risk-sharing institutions are widely available in industrial countries to help farmers overcome such risk problems. Farmers can usually borrow for production or consumption purposes to ease the transition from good years to bad. In many cases, they have access to a variety of privately provided insurance against specific types of risks, and they can trade in commodity futures and options markets. In developing countries these kinds of institutions are usually much more rudimentary (e.g., Knudsen and Nash 1990, Udry 1990, 1994), and may not be available at all for small-scale farmers or other impoverished residents of rural areas. Nevertheless, a wide range of informal risk-sharing arrangements has evolved, and it is unlikely that all are as efficient as would be desired by all concerned. These include share tenancy contracts, traditional money-lending, and risk sharing within extended family and other community networks. A major limitation to these arrangements is that the participants tend to come from the same region, or even perhaps the same village, and hence often face much the same risks (see, e.g., Kurosaki and Sawada (1999) on credit and insurance markets in rural Pakistan). The arrangements, therefore, do not pool risks as efficiently as they would if they spanned regions or broader sectors of a national economy, as do nation-wide crop-insurance or credit schemes (Siegel and Alwang 1999). Better understanding of the limitations of prevailing arrangements and of the opportunities presented by alternatives would assist policy analysis in this domain.

Zeuli (1999) has discussed how agricultural cooperatives might enhance the risk-mitigation role they play for farmers, especially in the context of catastrophic events when members are doubly exposed to economic losses. New, alternative risk-sharing instruments for cooperatives are presented wherein the risk-mitigation role they play for their farmer members can be enhanced by: (a) mitigating their own risk directly with capital market innovations that shift or share their systemic risk exposure, and (b) offering insurance directly to their members to cover each member's independent risk.

Needless to say, there are shortcomings in informal risk-pooling arrangements, as noted earlier. Fafchamps (1999b), for example, argues that poor rural households may smooth consumption through reciprocal gifts and informal credit but fail to achieve Pareto efficiency in risk sharing. Again, while customary tenure structures have traditionally played an important risk management role, the arrangements are fragile and can leave individuals exposed to risk (e.g., Carter 1997). Consumers also have options for managing fluctuations in food prices. In addition to substituting different foods in their diet, they can smooth consumption through use of credit and food storage. Food storage will be

undertaken commercially in response to demand, where governments do not undermine storage incentives through poorly designed price-stabilization interventions. But how effective are farmers and consumers in managing risk, and how large are the social costs that remain? The available empirical evidence is too patchy to provide definitive answers. One case study of the effect on human-capital development through schooling participation found the adjustments to seasonal risks had little effect on average (Jacoby and Skoufias 1997), but how representative this finding is must remain uncertain until further similar investigation. Estimated welfare losses (measured as the sum of producer and consumer surpluses) arising from risk-averse behavior can be quite large at the sectoral level, e.g., 5 to 10 percent in a model of irrigated agriculture in Mexico (Hazell and Scandizzo 1977), and even larger for some types of individual farms. These estimates, often based on mathematical programming models, typically ignore risk-sharing strategies that farmers use other than crop diversification, and hence may well be biased upwards. However, experience observed through survey work in India reveals large efficiency losses through risk-averse farmer behavior (Rosenzweig and Binswanger 1993, Holden and Binswanger 1998). More contemporary survey-based findings of Pandey et al. (2001) in an analysis of the cost of drought in eastern India also support the thesis that losses can be large indeed.

The welfare losses arising from forecast errors will, however, tend to be minimal and probably small if all farmers held 'rational' price expectations (Muth 1961, Kantor 1979, Newbery and Stiglitz 1981, Williams and Wright 1991). But they can be much larger if farmers make price forecasts in more naïve ways such as assuming that this year's price will be the same as last year's, particularly if yield risks are also large (Scandizzo, Hazell and Anderson 1984). The literature on attempts to assess whether farmers do indeed hold more or less rational price expectations is still rather slender (e.g., Fisher 1982, Helmberger, Weaver and Haygood 1982, Eckstein 1984, Ravallion 1985). More recent studies find increasingly optimistic results about farmers' ability to forecast probabilistically (Holt and Johnson 1989, Pluske and Fraser 1995), perhaps reflecting accumulating experience, as well as possibly more relevant education.

Market failures seem to be most evident when catastrophic events, such as droughts or widespread floods, occur, largely because of the 'covariation problem' or the problem of 'covariate risk' (Holden and Binswanger 1998, Siegel and Alwang 1999). This is claimed to be a major reason for default on bank loans (Yaron, Benjamin and Piprek 1997), even in some industrial countries such as the USA, although it is often difficult to determine whether loan defaults are really driven more by an inability to pay, or by the expectation that governments, under political pressure, will provide debt 'relief' in bad years (Anderson and Dillon 1988). In the past, governments have too often responded to farmers' difficulties by 'forgiving' their loans, which undermines the operation of the credit system and sends the wrong signal to farmers about the need for them to take responsibility for managing their own risks. World Bank policy in this regard has been clarified during 2000 in the context of preparing the Financial Sector Strategy (World Bank Group 2000), which inter alia seeks to change past practices that have compromised the viability of many specialized agricultural credit institutions. These topics are developed further in a later section.

Price instability does not appear to be a serious problem for consumers in countries where food expenditure is only a small share of household income. This is even true of some countries where household incomes are only modest, such as Costa Rica (Hazell and Stewart 1993). More serious problems arise in very low-income countries, and with poor people more generally (Siegel and Alwang 1999), where options for managing high food prices are much more limited (Sahn and von Braun 1989). This situation, in fact, provides much of the rationale for preparing the present paper and the corresponding section in Chapter 3 of the new Bank rural development strategy *Reaching the Rural Poor*.

Despite the lack of adequate quantitative assessments of the costs of market failures in risk management, and hence of the potential benefits from public interventions, governments around the world have implemented various forms of risk-management policies. An assessment of experience with these

interventions is now broached with a view to identifying potentially useful elements of a rural development strategy, and potential areas for further research.

## **Experience with Public Risk-Management Policies**

Given the diversity of their nature, and their proliferation over time and geopolitical boundaries, the experience of risk-intervention policies is, not surprisingly, diverse and varied. Much of the focus of the profession of agricultural economics has been on dealing with the instability inherent in the sector, especially following the USA-oriented writings of Schultz (1945), Johnson (1950) and Heady (1952). Fortunately there is no necessity here to undertake a comprehensive examination of this experience as it has been well reviewed by authors such as Fackler (1988), Rausser (1988), Anderson and Hazell (1997), Harwood et al. (1999), Coble and Barnett (1999), Moschini and Hennessy (2001), Gardner (2000), Just (2000), OECD (2000) and Tomek and Peterson (2000), so the generalizations presented below represent a synthesis of some cogent studies in the field.

The emphasis here on public interventions reflects the situation that has prevailed in agriculture in most countries, but at another level it betrays the fundamental importance of the private sector in overall risk management around the world, such as underpins international trade in agricultural and other products. For instance, the insurance industry that supports such trade and deals with a diversity of inherent political risks (e.g., Haufler 1997) is almost completely private and is vital to commerce in general and to the globalization of agriculture. Of course, increasing globalization does not mean that all around the globe yet have ready access to insurance markets, or other markets, and consideration must be given to those many cases in rural areas where such access is absent.

### *Investment in Public Goods*

Public investments aimed at risk reduction in farming have been considerable, although not always intended only or explicitly for this purpose. Irrigation investments are one such case in point, where the explicit intention has been to boost the productivity of the land and water resources involved, as well as to increase rural employment and provide greater food self-reliance. Indeed, such investment formed the core of the Green Revolution in South Asia and elsewhere in the 1960s. An important associated benefit, however, was the considerable reduction in the inherent variability of the local agro-ecosystem because of the less direct reliance on local rainfall amount and timing relative to the crop-growing seasons (Pandey 1989).

Analogous risk-reduction effects arose from plant breeding targeted at such attributes as resistance to pests and diseases and to abiotic stresses associated with such natural phenomena as droughts and floods (Anderson 1991). To the extent that such work has been concentrated on self-pollinating crops such as rice and wheat, these risk-reduction benefits (along with the corresponding productivity gains) are classic public goods for which investment via public research agencies has been the necessary source of invention (Anderson 2000b). As Anderson and Hazell (1994) have argued, this process has not been uniformly successful in spite of some notable achievements, and there is a continuing need for further improvements. Filling the need faced is not easy because of the contemporary crisis in funding of public R&D, in countries rich and poor. The private sector surely has a role to play in providing at least some of these needed risk-reducing agricultural services, and indeed is already doing so in crops that lend themselves to efficient production of hybrids, such as of maize, where the property rights surrounding the more productive germplasm can be protected at low cost.

It is not only crop-improvement research that can be important in generating materials and information that helps farmers better manage their production risks (Dillon and Anderson 1990, Anderson and Jodha 1994). Much contemporary agronomic research has just such an aim (e.g., IRRRI 1995 for biotic stresses), and increasingly this is supported by modeling work, such as crop simulation models emphasizing management of abiotic stresses (Muchow and Bellamy 1991). Observers differ as to the extent of social returns that can be generated through such public-good-oriented research, Anderson (2000b) being rather upbeat, and Walker (1991, p. 523) arguing a more cautious position, at least in semi-arid areas.

### *Price Stabilization*

Price uncertainty in the traded commodities produced in developing countries has long been seen as a significant problem for everyone concerned from small-scale producer to statutory marketing authority. Intriguingly, there is no apparent relationship between a country's experience of uncertainty and the type of commodity that dominates its exports (Dehm 2000). Price stabilization is the major 'traditional' intervention in the agricultural sector (Gardner 1985, Varangis and Larson 1996). Various mechanisms have been used to pursue such stabilization objectives, with varying degrees of success and many failures. Price supports, buffer stocks, variable tariffs and the like have been among the most popular instruments (Quiggin and Anderson 1979). The theoretical justification for price stabilization measures has been explored in detail over recent decades (e.g., Samuelson 1972, Wright 1979, Newbery and Stiglitz 1981, Quiggin and Anderson 1981, Quiggin 1983, Gardner 1985). An important frequent finding, however, is that the welfare gains that are possible from price stabilization are relatively small (e.g., Anderson et al. 1981, Myers and Oehmke 1988, Wright 1988). Moreover, the practical implementation of stabilization schemes raises many thorny problems to be overcome by program administrators (Anderson, Hazell and Scandizzo 1977, Townsend 1977, Scandizzo, Hazell and Anderson 1983, 1984, Bardsley 1994). These include the difficult-to-assess supply responsiveness to induced stability (Just 1974, 1975, Griffiths and Anderson 1978, Quiggin 1991).

Improved understanding of the economics of storage, including the complex effects of different rules on the behavior of the various agents involved, came somewhat later in the theoretical and empirical developments but, now that it is so well synthesized by Wright (1988) and Williams and Wright (1991), there is less excuse for the public blunderings into ill-conceived schemes such as have littered the past. For one concerned agency, the World Bank, has been reluctant to support commodity stabilization ventures in its borrowing countries, a considerable departure from past practice (Braverman et al. 1992).

Storage problems aside, operation of buffer fund schemes supported by variable levies and tariffs is not immune from design and management problems that have compromised their performance in many situations (Knudsen and Nash 1990). Yet other more macro changes must also be considered. While for the fifty years following World War II, price stabilization was the preferred approach of most policy makers, and the programs were expected to confer benefits to rural households as well as the economy generally, there were other changes over the period that surely had many significant influences on the risk encountered by commercial producers, especially those producing for an export market. If the risk experience of such producers is assessed by the variability in real domestic currency prices, the effect of the general shift to flexible exchange rates depends on several factors: the exchange rate variation, the good's own foreign currency price variation, domestic price level variation, and the covariation between these three variables (Smith 1999). In the case of Australian wool, for example, it seems likely that producers suffered less price volatility following the floating of the exchange in 1974, quite apart from the later debacle of the Reserve Price Scheme for wool (Phillips and Bewley 1991, O'Donnell 1993).

Among the important reasons for taking a cautious approach to such stabilization schemes is the tendency for political forces to intrude into the management of schemes virtuously put in place, and to modify the

rules (e.g., concerning parameters such as trigger prices) in ways that benefit particular groups and inevitably bankrupt the scheme itself (Kannapiran 2000), or cause it to be such a drain on the public purse that it becomes impossible to sustain (Gilbert 1995, 1996). The theoretical prognostications of Townsend (1977) on the inevitability of collapse of such schemes should also dictate extreme caution to would-be stabilizers.

### *Price and Revenue Insurance*

Fafchamps (2000) argues that price risk per se is not important to farmers in poor countries, whose main worry is net revenue. He identifies farmers' most pressing concern as protection against distress sales of their productive assets, and advocates government intervention for contract enforcement, which is seen as central to helping farmers manage risk. He notes that governments could, in principle, be active on existing international commodity exchanges to pursue futures and protect themselves against short-run price fluctuations.

Various ideas have been floated for dealing with the downside of commodity price variations without seeking to change storage arrangements. The proposals under test by the commodity price risk group in the World Bank supported by the International Task Force on Commodity Risk Management in Developing Countries (1999) are not intended to stabilize prices in real markets, but rather focus on placing a floor on the prices of traded commodities received by producers in developing countries that have been selected for testing novel arrangements. The work is not yet sufficiently advanced to be able to draw lessons for this strategic Update. Indeed, a research component of the effort is designed to inform debate on emerging policy in this area.<sup>8</sup> Other recent work may also reveal fresh approaches to this challenge of joint yield and price risk coverage (e.g., Roberts, Goodwin and Coble 1998, Mahul 2000).

Revenue insurance is one of the newest insurance products around (Harwood et al. 1999), still in its early and experimental stages of marketing (mainly in Iowa and Nebraska), although the advantages of its conceptual structure have long been discussed (e.g., Quiggin and Anderson 1979), with its simultaneous treatment of both price and yield risk. The scheme under way in the US features selectable yield and price options that are well below the respective means, so there is a substantial deductible built into the design, although the fact that the Federal Government pays about one-third of the premium cost (as well as covering some of the administration costs) adds appreciably to the attractiveness of the package (Skees, Harwood, Somwaru and Perry 1998, Gardner 2000). The policy issue to be confronted by both rural development strategists and respective governments is just how much less wealthy countries can afford to subsidize such privately-provided market-based risk-management mechanisms, which may not do much at all for the bulk of the really poor in rural areas. As well, there are grave risks of the hijacking of such government-supported schemes by rent-seeking non-poor (Skees 1999a) so, in spite of interesting design features, the lessons for developing countries are yet distant and uncertain.

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<sup>8</sup> There are diverse views about the value of any such subsidized interventions, e.g., "The management of commodity risks has entered a new era with the global liberalisation of agricultural markets. This liberalisation has strong support within economic research, which judges international and domestic efforts to stabilise prime commodity prices to be difficult, if not impossible, to implement without subsidies, highly likely to be captured by special interests, and of unproven social benefit. Research is needed on the question of the social value of reducing price uncertainty and/or price variability and under what circumstances or for which commodities it is likely to be of benefit." (Duncan 1997, p. 442).

## *Crop Insurance*

Crop insurance is provided or supported by the public sector in both industrial countries and developing countries. The driving force for such programs often originates in governmental concern about catastrophic risks such as drought, or the desire to reduce the incidence of loan defaults to banks (e.g., see the critical analysis of Hazell, Oram and Chaherli 2001).

With few exceptions, the financial performance of public crop insurers has been ruinous (Hazell 1992). To be financially viable without government subsidies, an insurer needs to keep the average value of annual outgoings—indemnities plus administration costs—below the average value of the premiums collected from farmers. In practice, many of the larger all-risks crop insurance programs pay out \$2 or more for every dollar of premium they collect from farmers, with the difference being paid by governments. Even at these high levels of subsidy, many farmers are still reluctant to purchase insurance. As a result, many public crop-insurance programs are made compulsory, either for all farmers growing specified crops (e.g., Japan), or for those who borrow from agricultural banks (e.g., Mexico).

The primary reason for the high cost of public crop-insurance schemes is that they invariably attempt to insure risks that are prone to severe moral-hazard problems (Hazell 1995a). These risks include many climate, disease and pest risks that are difficult to quantify and assess, and whose damage can be influenced by farmers' management practices. The problem is made worse by a common practice of insuring 'target' yields rather than compensating for actual losses. But this is not the only reason for failure!

Another overwhelming factor is the incentive problem that arises once the government establishes a pattern of guaranteeing the financial viability of an insurance provider. If the insurance staff know that any losses will automatically be covered by government, they have little incentive to pursue sound insurance practices when setting premiums and assessing losses (Wright and Hewitt 1994). In fact, they will find it profitable to collude with farmers in filing exaggerated or falsified claims.

Yet another common reason for failure has been that governments undermine public insurers for political reasons. In Mexico, the total indemnities paid has borne a strong statistical relationship with the electoral cycle, increasing sharply immediately before and during election years, and falling off thereafter.<sup>9</sup> In the USA, the government has repeatedly undermined the national crop insurer (FCIC) by providing direct assistance to producers in disaster areas. Why should farmers purchase crop insurance against major calamities (including drought) if they know that farm lobbies can usually apply the necessary political pressure to obtain direct assistance for them in times of need at no financial cost?

A further reason for their high cost is that crop insurers tend to be too specialized, focusing on specific crops, regions and types of farmers, particularly when the insurance is tied to credit programs designed to serve particular target groups identified by the government. Without a well-diversified insurance portfolio, crop insurers are susceptible to covariability problems, and face the prospect of sizable losses in some years (Holden and Binswanger 1998). Since public insurers are rarely able to obtain commercial reinsurance or contingent loan arrangements, this specialization increases their dependence on the government (Okidegbe 2000, p. 3). It may well be that a key strategic consideration for policy analysts is the regulatory environment in which reinsurance takes place (Turvey, Nayak and Sparling 1999). Reinsurance markets are usually thin, and are notably inefficient in dealing with catastrophic risk (Skees 1999b). Novel mechanisms for having governments participate in reinsurance markets to help deal with

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<sup>9</sup> A similar phenomenon has been observed with social fund expenditures in Peru (Schady 2000).

the catastrophic dimensions of cover may yield new insurance products that are both cheaper and more effective (Skees and Barnett 1999, Skees 2001). Further work in this domain seems well warranted.

Public crop insurers also tend to have high administration costs. This is partly because they often insure small-scale farmers, but also because crop-insurance work is very seasonal, and the absence of a well-diversified portfolio means that staff and field equipment are underemployed for significant parts of the year. When subsidies abound, and participation is wide, as has been the case in the US, for instance, these difficulties diminish, and the experience with crop insurance can be viewed rather positively, as it has by Harwood et al. (1999).

There is yet, however, little convincing evidence that public subsidization of crop insurance has been socially beneficial. Indeed, social benefit-cost analyses of the Mexican and Japanese schemes show negligible social returns in relation to their high costs (Bassoco, Cartas and Norton 1986, Tsujii 1986). One important contrary view is presented by Mishra in his analysis of the Indian Comprehensive Crop Insurance Scheme. While acknowledging the heavy degree of subsidization of this scheme, he argues strongly (Mishra 1996, p. 290) that the broader benefits such as expansion of production credit are so large that there is a significant net social gain. Others believe that there is little evidence that crop insurance increases agricultural lending or benefits agricultural banks (e.g., Von Pischke 1986). In a study that supports this view, Pomareda (1984) compared the performance of insured and uninsured loans in the portfolio of the Agricultural Development Bank (BDA) of Panama. Insured loans had slightly higher and more stable returns than uninsured loans. They were also repaid and cleared from the books closer to their expected duration. But the overall gains to the bank were modest, and could have been achieved more easily at no cost to the government simply by allowing a 2 per cent increase in the interest rate that BDA charged its borrowers. This would also have been cheaper for the borrowers than the premium rates they paid for the compulsory insurance (Pomareda 1986).

Private crop insurance is growing in some countries, and annual premiums worldwide have been thought to exceed \$1 billion per year (Gudger 1990). The limitation of private insurance in the present context is that it is almost exclusively confined to specific perils applicable to large-scale commercial farms growing high-value crops, and it is not likely to become a major factor for the larger population of resource-poor farmers. Other approaches are evidently required, and it to some of these that attention is now turned.

### *Area-Based Index Insurance Such as Rainfall Insurance*

Analysts have long had the idea of eliminating moral hazard and adverse selection problems that have bedeviled crop insurance so persistently by insuring instead of an individual's crop and its performance, some more objectively measured index that is less subject to the unplanned-for influence of the insurance purchaser. Peter Hazell, when in the World Bank, pushed hard for analysis of area rainfall as a basis for insurance of farmers subject to drought risk. His efforts included attempts to establish the existence of latent demand for such insurance (e.g., Gautam, Hazell and Alderman 1994, Sakurai and Reardon 1997), and this was supported by evidence from India and West Africa. This idea has been vigorously pursued in various ways, and is currently under experimental implementation in a few countries (e.g., Skees et al. 2001, Miranda and Vedenov 2001), in spite of universal agreement about the virtues offered (e.g., Quiggin 1986, Bardsley 1986, Miranda 1991). Theoretical investigation of the concept is also continuing (e.g., Quiggin 1994, Mahul 2001, Turvey 2001). The general idea is elaborated by Skees, Hazell and Miranda (1999): specifically defined perils such as failure to reach a defined fraction of normal rainfall at agreed recording stations; policies consisting of standard contracts for each unit at a fixed price for a defined region; no limits to the number of units an individual can purchase. Even with these simplifications relative to conventional insurance contracts presently used in agriculture, there are

implementation issues yet to be ironed out, and thus it is premature to declare such index insurance instruments to be routine good practice in rural areas in general, although it seems likely that they will soon be widely recommendable, and handled routinely by the private insurance industry. Meantime, further field testing of such novel schemes should be continued, and evaluations used to refine the instruments and thus assist industry to develop and market insurance products that can better help the poor.

### *Disaster Relief*

Disaster relief policy, or sometimes the lack of it, represents a significant opportunity for public intervention, long the subject of policy analysis (e.g., Anderson and Woodrow 1989). There has been a tendency for emotion and public outcry to drive a process that leads governments to intervene in ways that, with the wisdom of hindsight, are demonstrably ineffective and distorting of individual incentives to plan more carefully for what in many situations are inevitable occasional bad outcomes. Such planning would naturally include selective purchase of insurance contracts, as discussed above, with the predictable negative consequences for broad participation in formal insurance markets. It is worth recalling, from time to time, that the world is indeed a risky place, and the extent of resultant costs can be considerable. If governments rush to bail people out of the effects of otherwise-insurable natural disaster risks whenever there is political clamor to do so, development of commercial insurance markets will be fatally compromised. Just where governments should seek to position themselves relative to the insurance market in sharing responsibilities has long been on the research agenda of public policy (e.g., Kunreuther with others 1978) and continues to be today.

A distinguishing mark of a potentially good policy is one that swings into action as needed, without requiring (or even allowing) political largesse, and yet provides no disincentives for affected producers to do the best that individually they can to plan for and manage their own natural-disaster (e.g., drought) experiences as they unfold. Australia, for instance, now has such a system in place for droughts (DPRTF 1990), after a long history of at best questionable interventions (Butler and Doessel 1979), such as in fodder and livestock markets under the rubric of assisting producers in their drought management. The long experience of India with its food for work programs should also be mentioned as perhaps the best example of a sustained program that has worked well in assisting the poor through tough times (Ravallion 1999).

An important part of the World Bank mission is providing assistance to prepare for and recover from natural or man-made disasters that can result in great human and economic losses. Indeed, developing countries suffer the greatest costs when disaster hits: more than 95 percent of all deaths caused by disasters occur in developing countries; and losses due to natural disasters are 20 times greater (as a percent of GDP) in developing countries than in industrial countries. Moreover, poorly planned development can turn a recurring natural phenomenon into a human and economic disaster. Allowing dense populations on a floodplain or permitting poor or unenforced building codes in earthquake zones is as likely as a natural event to cause casualties and losses. In this connection, the World Bank's Disaster Management Facility was established in July 1998, to provide proactive leadership in introducing disaster prevention and mitigation practices into the World Bank's development efforts. To date, efforts have been concentrated on urban aspects of disaster zones but in principle rural areas will also receive attention of the Facility as its work program develops.<sup>10</sup> In this sense, the Bank's strategy for dealing with

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<sup>10</sup> Several relevant papers on recent activities, including those pertaining to the vulnerability of rural infrastructure to climatic variability are available at [www.proventionconsortium.org](http://www.proventionconsortium.org).

catastrophic disasters in rural areas is well articulated and under implementation. On-going work must be in a learning mode, and the particular needs of the rural poor identified to improve intervention.

Any effective strategy to manage disaster risk must begin with an identification of the hazards and what is vulnerable to them. This involves information on the nature and extent of risk that characterizes a particular location, including information on the nature of particular physical hazards obtained through hazard assessments, as well as information and data on the degree of exposure of a population to such hazards. In this way informed decisions can be made on where to invest and how to design sustainable projects that will withstand the impacts of potential disaster events, a task made all the more formidable by the changing nature of some risks, such as the possible effects of the Enhanced Greenhouse Effect in low-lying parts of the developing world. A more complete understanding of the full economic, financial and social impacts of disasters on a country also helps to demonstrate the importance of including risk reduction measures in development plans.

Disasters result when an extreme natural or technological event coincides with a vulnerable human settlement. Reducing disaster risk requires that all stakeholders change their perceptions and behavior to place a high priority on safety in planning and development. Effective risk reduction involves mitigation measures in hazard-prone developing countries. Such measures include land use planning, structural design and construction practices, and disaster warning systems. In addition to employing scientific and technical knowledge, risk reduction may also involve overcoming the socioeconomic, institutional and political barriers to the adoption of effective risk reduction strategies and measures in developing countries. This may be accomplished through projects analyzing the possible roles of government, non-government, and private-sector organizations in risk reduction, workshops aimed at heightening the awareness of stakeholders to the threat of natural disaster and what can be done about it, and educational and training activities that increase the understanding of policy makers, decision makers and practitioners about disaster management. Surely a large agenda!

### *General and Credit Instruments for Risk Intervention*

Other mechanisms are available to governments intent on easing the pain of dealing with risk in various parts of the economic system, or at least sharing in the enterprise risk (e.g., Ahmad and Stern 1989). In an economy where the income-tax system functions well, schemes may be put in place that enable taxpayers, including farmers, to manage their post-tax income streams in a manner that causes them less financial suffering and presumably boosts enterprise efficiency in the face of variable fortunes in productivity and markets (e.g., Buffier and Metternick-Jones 1995). Where some groups contribute little to taxation revenues, as may be the case with many farming communities, there are obvious limitations to such instruments as risk-management mechanisms. The idea of having mechanisms that are neutral across sectors of the economy is, however, virtuous.

One potential such mechanism is the credit system. In principle, having a financial system serving rural areas in a flexible manner that recognizes the riskiness of life in such areas is the best single approach to helping all concerned to manage their risks. Credit, as noted above, serves as a useful, largely self-managed instrument in industrial countries, but is not so straightforward in developing countries, where much agricultural lending is tied to farm inputs and must be repaid at the end of the season, even if it is a bad one. Credit to smooth consumption across years is rarely available from the formal sector in developing countries (Binswanger 1986, Deaton 1991, Behrman, Foster and Rosenzweig 1997, Holden and Binswanger 1998). This is part of the rationale for the proposals noted above as being under examination by the International Task Force on Commodity Risk Management in Developing Countries (1999), and variously discussed by others in recent years (e.g., Varangis, Akiyama and Mitchell 1995, Duncan 1997, Sarris 1997).

Rural financial markets have proved more effective in servicing the needs of commercial farmers than subsistence-oriented farmers, many of whom are hardly viable borrowers because they are relatively costly to serve, and typically face high production and default risks. Many governments thus established publicly-owned agricultural development banks to provide targeted and subsidized loans to the small-farm sector. The high costs and miserable performance of such banks in the 1970s and 80s led to much effort at reform, so that by the end of the 1990s, agricultural banks were almost a thing of the past (Yaron, Benjamin and Piprek 1997). The key elements have involved liberalization of financial markets and encouragement of private-sector lending of various levels of formality.

Commercial banking institutions, particularly those in developing countries lending to agriculture, face considerable risk in identifying ‘problem borrowers’ who have little intention of repayment. In managing their resources, banks typically diversify across sectors and regions, maintain financial reserves, establish contingent loan arrangements with other banks, and build up personal relationships with their clients. In times of stress they will work with a borrower to develop a rescue plan of roll-overs, interest rate adjustments, and so on around the agreed collateral. But such flexibility was seldom encountered in the traditional agricultural banks, which were thus correspondingly vulnerable (Hazell 1995b). One hope for progress was agricultural credit insurance, but this too has met the fate of most crop insurance programs (Pomareda 1984, Hazell 1995b), and attention has now shifted to the possibility of loan guarantee schemes. There is yet little evidence to suggest that credit insurance helps banks much, or that they increase the volume of lending to agriculture in general and to small-scale farms in particular, but they may still prove to be effective, and more research seems warranted.

The great hope in the financial sector servicing the poor in rural areas today is microfinance (MF), which uses much higher interest rates than the subsidized programs, because such instruments must cover the higher costs of collection and risk of default (World Bank Group 2000, p. 15). All types of institutions are used to reach borrowers, including commercial banks, specialized credit institutions, NGOs, grassroots saving groups, cooperatives and credit unions. When the approach is profitable, the private sector becomes involved, and can also then address the demand for non-credit financial services by the poor. MF has been—and necessarily continues to be—the subject of much attention in the World Bank and elsewhere recently, including for the *WDR 2000/2001* (World Bank 2000), and particularly in one of its background papers prepared by Sebstad and Cohen (2000). The latter study reveals the remarkable resourcefulness of MF clients in coping with risk but sees such MF services as contributing importantly to helping the clients (particularly women) build their assets critical in protecting against risks ahead of time and coping with losses afterwards. Such financial services were found also to strengthen other coping mechanisms as well, especially by offering a safe place to save, and by building social networks, although there does seem to be scope for innovative approaches to new loan products focused in a more directed dealing with emergencies. There is much more to be done in the field of microfinance in risk management and more generally, because it is still in an early, innovative and uncertain phase, as well depicted by Morduch (1999b). For example, Mauri (1998) has reviewed a new screening methodology, based on symptomatic information, for lending institutions operating in rural areas of developing countries, which focuses on default factors. The model suggested has the practical advantage of being easy and cheap to implement. There will doubtless be many analogous and needed innovations in coming years that will add to the stock of instruments the poor should have access to for economic advance and personal risk management.

### *Uncertainty and Policymaking*

Thus far, attention has been concentrated on policy making to reduce risk and uncertainty in the rural sector. There is, however, an inverse set of considerations that are deserving of comment. This is the creation of additional risk within the rural sector as a result of policy interventions that have uncertain

outcomes, or which are subject to frequent and unpredictable political changes in their design and implementation (MacLaren 1980, Gardner et al. 1984).

The attempts by many countries to reform domestic policies within the context of the GATT trade agreement (e.g., von Witzke 1987) and WTO discussions is a case in point. Despite valuable work that has been done on the effects of trade liberalization by analysts such as Anderson and Blackhurst (1992), the consequences for world agricultural market prices remains uncertain, both in terms of their means and variability. For example, while more open agricultural trade between countries should have a risk-pooling effect that reduces world price variability, this may be more than offset by price spikes stemming from reductions in global food stocks that are themselves the result of the reductions in domestic price supports. Moreover, as governments in many countries maneuver to balance their commitments to international agreements with domestic political interests of farmers and consumers, they are likely to adjust and modify policies during the transition in unpredictable ways that add to the overall level of uncertainty. An intriguing feature of policy-induced risk is that some governments have been considering additional public risk-management policies to help farmers cope with it. For example, the USA has considered an income insurance scheme that would protect farmers against all sources of income risk, including price changes induced by government policies (Tweeten et al. 1994).

One emerging agricultural field that is riddled with uncertainties is 'the environment'. The complexities that confuse this topic are intense, and range from the biological, through the physical and chemical, to the social and economic (Walker and Gardner 1992, NSCGP 1995, Downing 1996). The phenomena of potential concern are diverse and include, for instance, loss of biological diversity at the genetic, species and ecosystem level at an unprecedented rate, threatening critical ecosystem goods and services (Watson 2000), agricultural contributions to the Enhanced Greenhouse Effect, and agricultural responses to the resulting changing but yet uncertain agronomic circumstances (Darwin et al. 1995). Risk plays many parts in influencing environmental outcomes of agricultural producers' decisions (e.g., Anderson and Thampapillai 1990, Ardilla and Innes 1993, Anderson and Jodha 1994, Shively 1997, Holden and Binswanger 1998). Risk-management policy itself may through changes induced in, say, cropping practices, have environmental consequences (e.g., Keeton, Skees and Long 1999) Another possibly even more challenging set of uncertainties relate to research on and trade in products of crops involving transgenic modification, which has generated considerable controversy. While genetically modified (GM) crops have been grown extensively in Argentina, Canada, and the United States since 1996, environmental and consumer groups have largely blocked the GM-crop revolution in Europe and Japan. It is less clear, however, what choices developing countries will make toward the new technology, as they struggle with GM-crop policy in the areas of intellectual property rights, food safety, biosafety, trade, and public research investment, issues dealt with in the Science and Technology section of *Reaching the Rural Poor*. It is the uncertain policy response to such matters, as governments translate their international agreements and electoral commitments into domestic policy and new requirements for farmers, which will contribute greatly to new uncertainties in the rural development sphere.

One field where there is a fairly clear mandate for governments acting domestically is in the area of legislative protection of property rights in order to reduce risk; insecure access to land, irrigation water or other important resources is a significant source of risk. Yet the record of governments in making such risks less severe by strengthening property rights is mixed. A thorny issue in many countries today is land rights, especially with regard to access by traditional owners. By legislating for access by groups not currently operating farms, such as previously or potentially excluded indigenous people, government can significantly reduce the degree of certainty in the planning environment. Of course, government may choose to innovate in other ways to compensate for such risk-increasing intervention. While there is no end to the challenge of such potential policy determinations involving uncertain land rights, there has been remarkably little formal analysis using explicit recognition of the risk dimension.

### *Response by Farmers and Other Rural Managers to Intervention*

Risk is reality. The presence of government in agriculture and rural affairs is another part of reality. No one obliges farmers to stay in farming, although many may find it challenging to leave even if they wished to do so, but many choose to stay. Governments find it difficult not to intervene in farming, especially when there is the excuse of being seen to be helpful in major risk management. Farmers everywhere know that farming is risky, in spite of, and sometimes even because of, what governments do. The farm sector is probably no more risky than other sectors dominated by a majority of small-scale business operators. Combining these few sentiments raises fundamental questions about the tendency for governments absent careful policy analysis to mess around with farmers' risk management in the name of 'helpful' policy interventions (Tweeten 1995).

By dint of the absence of much policy directly focused on the rural non-farm economy (RNFE), there has been less experience with such operators being disadvantaged by changed government positions. If, as is argued elsewhere (e.g., Lanjouw and Feder 2001) in *Reaching the Rural Poor*, governments should get more pro-active in this part of the economy, there will emerge a new set of potential risks facing such operators.

Examination of the rationale for and experience with various instruments that claim to modify the risk environment faced by farmers leads this reviewer to a rather skeptical position about the virtue of most traditional forms of intervention and interventions implemented traditionally. For analysts aiming to be helpful to farm decision makers, the main message of this part of the review is that governments too often contribute to the complexity of the environment in which farm decisions must be made. To the extent that perception and incidence of risks are modified, farmers need to take all this into account in their planning, and in this way respond appropriately to the incentives or whatever is offered by government. The degree to which farmers actually react to government programs naturally depends on the whole decision environment, and so seeking general insight to such a question is not too fruitful (Binswanger 1979). Nevertheless, in the decision environments, specific distortions can and do have specific impacts.

As rural residents become more wealthy, they will tend to be less averse to risk, and thus will be guided more by *average* performance indicators, and tend to be less interested in any form of risk-reducing intervention. Successful economic development will then provide a further rationale for government to try to contain its proclivity for intervention under the banner of helping to reduce farm risk. Similarly, as rural areas are better served by infrastructure, and economic integration within it increases, the absent-market arguments for intervention will diminish. Taken together with the expanding number of risk-management instruments, the future of rural policy work dealing with uncertainty may thus be less bleak than it has been in the past, although for the present, there are many persistent problems faced by the poor for which policies, institutions and market mechanisms deserve continuing close attention by those concerned with developing rural areas, and with reducing poverty and improving risk management in them (Anderson, Larson and Varangis 2001).

# Rural Risks and the World Bank

The discussion thus far has been focused on how risk in rural areas is handled by the various agents with which the Bank deals, such as governments and more indirectly farmers, and thus how this aspect of management in rural areas might be recognized and handled in Bank operations. There is another level of risk analysis and management that must be of concern to the Bank too, namely its own risk 'exposure'. These risks are of several types: development effectiveness risks; business operating risks; financial risks; and 'reputational risk' that may link to all of these and is particularly associated with the perception outside the Bank that it has somehow done badly (e.g., Khambata 2000).

The past year (2000) saw the Bank taking increased explicit focus on these risks, and several Bank-wide committees addressed the topic from a variety of points of view, making diverse recommendations that will surely influence Bank practice over coming years. There are many instruments already in place in the Bank but there is evidently considerable scope for improvement in practice related to risk management in general. For instance, risks identified in project documents are usually 'mitigated away' as part of the preparation and approval process, so there is typically a less than fully candid recognition of the residual risks that persist in spite of the acknowledged precautions. Several aspects of risk associated with the performance of projects supported by the Bank are tracked by QAG and independently assessed by OED. In the former case are failures to accord with the Bank's Safeguard Policies, such as relating to dam safety and resettlement, followed up on by several units, including under extreme cases the Bank's Inspection Panel. Such risks may, for instance, encompass the indirect 'involvement' of the Bank in work on GM organisms, as is already being pursued in the context of some Bank-supported agricultural research or science and technology projects. The general performance risks in the development effectiveness arena range over many considerations, but are usually focused on what is happening or has happened relative to the stated and agreed intentions in a project or program.

Although many data are assembled on these aspects of M&E, there is no simple and consistent framework established for reaching useful generalizations about the Bank's risk management experience. There is general recognition that, since development is understood to be a risky business, a riskless portfolio would be quite inappropriate. But there is also a general understanding that it is proper and indeed necessary for the Bank to seek to take the best account it can of perceived risks so that both the interests of Borrowers and of the Bank itself are protected as adequately as is feasible. Accordingly, every contemporary Project Appraisal Document has a section explicitly addressed to risks that are perceived, and to what is being done to control their effects; but these are seemingly not always attended to with a level of analysis that matches the main parts of the Document, and the incentive structure within the Bank must be adjusted to encourage full candor in these discussions. In short, there must be a 'robust' assessment and treatment of all the risks perceived to impact on a project or any other Bank operation. Change over time in lending instruments used by the Bank clearly brings with it change in risk exposure. Thus, for instance, the shift to policy lending (agricultural adjustment lending) in the 1980s saw this part of the rural portfolio generally performing much better (less 'risky') than the rural investment portfolio, at least according to the proportion of operations judged 'Satisfactory' by OED, but this was to be expected as the operations were usually less demanding of Borrower actions. It is similarly to be anticipated that small pilot operations that are often deliberately risk-taking, such as Learning and Innovation Loans, will prove to be riskier than the more conventional operations.

One of the few analyses of risk attributes across Bank operations is reported by Buckley (1999, p. 17). He arranges data by sector according to the risk (standard deviation) and return (mean) of a development effectiveness index (reported in his Annex 1, which sets out the weights applied to the three OED ordinal

ratings: Outcome, Sustainability and Institutional Development Impact). In this representation, Agriculture shows up as one of the few low-risk, high-reward sectors over the 1997-98 period analyzed, in contrast to industry for instance, which then was high-risk, low-reward. Such coarse and partial analysis may well raise more questions than answers about risk management in the Bank's portfolio but is suggestive of work that could be undertaken at other levels, such as within the rural development portfolio more generally and more recently. Such work might inform whether the new emphasis on program rather than project lending is serving to moderate the riskiness of the Bank's rural portfolio, although there remains the 'chalk and cheese' problem of finding useful indicators of the performance of very different operations. In due course, when the further anticipated shift of the World Bank to be more of a Knowledge Bank (providing services more than loans) takes place, such questions might well again be asked, and the assessment will surely be even more challenging given the measurement difficulties. If the foreshadowed commitment of the Bank to do a generally more thorough and more realistic job of risk management throughout its operations comes to pass, this set of questions considered here should have much better answers in a few years time than is possible at this time. The Rural Family must be prepared to play a full and proactive role in this new environment.

# Conclusion

On balance, as development proceeds, risk management in rural areas should become less needed, and in some sense, easier. Particularly as the private sector develops in its many service roles in rural areas, there will be less need for governments even to ponder intervention for agricultural and other rural development purposes. To this extent, the future for areas that really are developing looks promising, even rosy, for adequate rural risk management.

The same sanguine fate is, however, still disturbingly distant for the many rural areas where this is not happening. Plagued by poverty, in all the different senses of assets and incomes, residents of these areas will continue to need the types of social protection supports, such as economy-wide safety nets, as have been argued for in *WDR 2000/2001*. But in the Bank context, these are not usually *rural development* policy issues per se, and are fairly adequately covered in other Bank sectoral strategy papers. Exceptions in rural areas are covered in the companion background papers by Alderman (2001a) and Cord (2001).

Along the tortuous way of the present review, a number of new research needs have been identified that may be addressed after the Update period. It seems likely that such work will be an on-going challenge to rural and other development workers (e.g., Fafchamps 1999b), and thus should feature in the Bank's rural development work program and in work supported by the Bank's Research Committee.

The task here has been to assess the relevance of risk-analysis findings to rural development in impoverished countries around the world. The scope of the present review was limited to discussion of risks in rural areas of direct potential relevance to rural development policy, and which are *not* the subject of other sectoral policies, such as health and economy-wide social protection.

A first conclusion is that a review of risk management instruments should identify what features of risk in rural areas are different from those of urban areas, and how adequate and effective are the instruments available in that space.

## Self-Determining Farmers and Rural Risk Management

*Collecting more and better information.* Acting on the best information available is a clear desirability in farming. Rural development strategists should therefore ensure that arrangements are in place for farmers and others to have access to reliable information that will help them do a better job of managing their risks. These arrangements will usually involve a mix of public and private suppliers, as is elaborated in chapter 3 of *Reach the Rural Poor* (World Bank, forthcoming). Access to better marketing information will be influenced by various infrastructural elements, such as telecommunications and the better functioning of local markets themselves through reduced transaction costs that come from better transport infrastructure.

*Avoiding or reducing exposure to risks.* How individuals act in respect of, say, livestock disease management depends on their knowledge of the threats and opportunities, and has effects external to themselves, so there is a further role for provision of cogent information, some of which will be largely of a public-good nature, thus implying some role for government, as financier, facilitator, or provider.

*Selecting less risky technologies.* The main lesson for the selection of farming enterprises and methods of production that are risk-efficient is to look first at what is profitable in an expected-value sense and, if

high enough, dispersion may not matter much. Where dispersion is greater, there may be benefit in seeking to discover methods of production that are less risky, even if there are some tradeoffs in average gains.

*Diversifying.* Farm families in developing countries often diversify income sources, by engaging in such non-farm activities as agricultural processing, providing services such as construction and repair, small-scale manufacturing such as handicraft production, or investing in relocation costs, and even education costs, for family members to find wage employment off the farm. This is done in the expectation that those who leave will remit part of their earnings back to those family members left at home. More generally, enhanced mobility of rural residents boosts their risk-management capacity.

*Flexibility.* Considerations of flexibility at the individual farm level carry over to rural areas themselves. Areas that feature concentration of highly similar economic activities, all using much the same techniques, technologies and markets, are in a relatively vulnerable situation. Accordingly, it will be worthwhile for rural strategists to explore innovative approaches to diversifying and opting for more flexible approaches to production and marketing, in order to reduce vulnerability to whatever risks are being faced.

*Farm financing.* The way a farm business uses debt (and savings) can have major implications for risk exposure. Holding a credit reserve can be an efficient way to provide liquidity to guide a business through hard times. More generally, trying to smooth consumption over time by prudent management of savings has always been a good idea.

*Insurance.* Purchasing insurance is potentially a key instrument in farm and business risk management, depending of course on the circumstances of the individual and the insurance market. For rural development strategists, the key questions to ask relate to the availability of an insurance market to which rural communities, rich and poor, have access on fair commercial terms. When access is limited, and when insurable risks seem prevalent and compromising of economic advance, analysis of what the impediments to an effective market are should be made, and policy developed accordingly. This might best be thought of as a particular case of private-sector development.

*Contract marketing and futures trading.* Forward contracting is often found to be a useful instrument for farmers in many situations. Access to futures markets is increasing around the world, but even so, it will be moot as to how useful futures markets are to resource poor farmers who lack the information and financial acumen to take direct advantage of them. Analysis has suggested useful possibilities for futures trading to assist in risk management in diverse circumstances around the world, although surprisingly few farmers avail themselves of this option, even when it is readily available. For rural strategists, the task is to analyze the potential value of futures trading arrangements and, as necessary, undertake the necessary policy and institutional work to introduce such marketing innovations.

For farmers to use many of the principles outlined above may seem to amount to mere common sense in dealing with the ordinary problems of life. But managing risk in farming is something of a taxing task for individuals and families to perform, which is why definitive statements about 'good practice' are difficult to make and to do justice to the many possibilities. Some principles will surely lend themselves to further depth of insight and greater confidence in the chosen strategies if subjected to systematic analysis, as has been undertaken by various agencies in the recent past, including in the World Bank. Just how formal and extensive such analysis needs to be is still something of a research question, and only a well monitored set of detailed analyses will be able to inform this challenging arena. Such work is planned in future DEC/RDV research in the Bank, in the spirit of Anderson, Larson and Varangis (2001).

## Farm Risks, Market Failures, and Government Interventions

*Investment in public goods.* The public sector has a clear responsibility for the provision of public goods that serve to stabilize the productive environment and diffuse risks, such as irrigation infrastructure and relevant research. The private sector surely has a role to play in providing at least some of the needed risk-reducing agricultural services, and indeed is already doing so in crops that lend themselves to efficient production of hybrids, such as of maize, where the property rights surrounding the more productive germplasm can be protected at low cost.

*Price stabilization.* Among the important reasons for taking a cautious approach to commodity price stabilization schemes is the tendency for political forces to intrude into the management of schemes virtuously put in place, and to modify the rules (e.g., concerning parameters such as trigger prices) in ways that benefit particular groups and inevitably bankrupt the scheme itself, or cause it to be such a drain on the public purse that it becomes impossible to sustain.

*Price and revenue insurance.* One policy issue to be confronted by both rural development strategists and respective governments is just how much less wealthy countries can afford to subsidize privately-provided market-based risk-management mechanisms, which may not do much at all for the bulk of the really poor in rural areas. The lessons for developing countries are yet uncertain, and new research-based information is needed to inform policy-making.

*Crop insurance.* The primary reason for the high cost of public crop-insurance schemes is that they invariably attempt to insure risks that are prone to severe moral hazard problems. Yet another common reason for failure has been that governments undermine public insurers for political reasons. There is no convincing evidence that public subsidization of crop insurance has been socially beneficial. The limitation of private insurance in the present context is that it is almost exclusively confined to specific perils applicable to large-scale commercial farms growing high-value crops, and it is not likely to become a major factor for the larger population of resource-poor farmers.

*Area-based index insurance such as rainfall insurance.* Even with novel design simplifications relative to conventional insurance contracts presently used in agriculture, there are implementation issues yet to be ironed out, and thus it is premature to declare such index insurance instruments to be routine good practice in rural areas in general, although it seems likely that they will soon be widely recommendable, and probably handled routinely by the private insurance industry. Meantime, more field experience with such instruments in client countries is needed to better identify improved practices and services.

*Disaster relief.* A distinguishing mark of a potentially good policy is one that swings into action as needed, without requiring (or even allowing) political largesse, and yet provides no disincentives for affected producers to do the best that individually they can to plan for and manage their own natural-disaster (e.g., drought) experiences as they unfold. An important part of the World Bank mission is providing assistance to prepare for and recover from natural or man-made disasters that can result in great human and economic losses. The World Bank's Disaster Management Facility was established in July 1998, to provide proactive leadership in introducing disaster prevention and mitigation practices into the World Bank's development efforts, including in principle those in rural space. A more complete understanding of the full economic, financial and social impacts of disasters on a country also helps to demonstrate the importance of including risk reduction measures in development plans.

*Credit instruments for risk intervention.* MF services are contributing importantly to helping the clients (particularly women) build their assets critical in protecting against risks ahead of time and coping

with losses afterwards. More generally, having a financial system serving rural areas in a flexible manner that recognizes the riskiness of life in such areas is the best single approach to helping all concerned to manage their risks. But this is easier said than done. Even for programs of microcredit, there is much more to be done in the field of microfinance in risk management and more generally, because it is still in an early, innovative and uncertain phase. As in so many other risk-management domains, more research is called for. Notwithstanding the existence of informal mechanisms in rural credit markets, rural residents may be considerably assisted in their risk management by interventions that lead to better access by rural poor to financial instruments.

*Uncertainty and policymaking.* The uncertain policy response to such matters as intellectual property rights, food safety, biosafety, trade, and public research investment, as governments translate their international agreements and electoral commitments into domestic policy and new requirements for farmers, will contribute greatly to new uncertainties in the rural development sphere. Meantime, although there is usually a clear potential role for government in legislative protection of property rights (e.g., of land) in order to reduce risk, the track record has been mixed indeed.

The main message of this part of the review, not too different from the position reached by observers such as IAC (1978) and Lloyd and Mauldon (1986), is that governments too often contribute to the complexity of the environment in which farm decisions must be made. Successful economic development will provide a further rationale for government to contain its proclivity for intervention under the banner of helping to reduce farm risk. Similarly, as rural areas are better served by infrastructure, and economic integration within it increases, the absent-market arguments for intervention will diminish. For the present, however, there are many persistent problems faced by the poor for which policies, institutions and market mechanisms deserve continuing close attention by those concerned with developing rural areas, and with reducing poverty and improving risk management in them.

## **Rural Risks and the World Bank**

The discussion has been focused mainly on how risk in rural areas is handled by the various agents with which the Bank deals, such as farmers and governments, and thus how this aspect of management in rural areas might be recognized and handled in Bank operations. But there is another level of risk analysis and management that must be of concern to the Bank too, namely the Bank's own risk exposure. There is wide recognition that, since development is understood to be a risky business, a riskless portfolio would be quite inappropriate. But there is also a general understanding that it is proper and indeed necessary for the Bank to seek to take the best account it can of perceived risks so that both the interests of Borrowers and of the Bank itself are protected as adequately as is feasible. Much work is in progress to make this part of the Bank operations much more risk-aware and risk-responsive.

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