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Chapter 12

Risk Considerations in Agricultural Policy Making and Planning[1]

Why governments intervene in risky agriculture

'Stability has been a central topic in public policy towards agriculture since at least the time of the pharaohs' (Summer 1988, p. ix). Our illustrations in earlier chapters also demonstrate that the type and severity of the risks confronting farmers vary greatly with the farming system and with the climatological, policy and institutional setting. Nevertheless, agricultural risks do seem to be prevalent throughout the world, and have naturally attracted the attention of many governments, groups of decision makers who have received little attention in our discussion thus far. In this chapter we focus on analysis of risk management from this rather different point of view.

The incidence of risk and risk-averse behaviour in farming has been perceived to be important to policy makers for a number of reasons. First, 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. Destroyed crops and livestock reduce employment opportunities, with serious implications for the landless rural poor in less-developed countries (LDCs), and adding 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

[1] This chapter draws heavily on a review by Anderson and Hazell (1997).

many rural non-farm businesses and towns.

Second, 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.

Third, farmers' efforts to avoid risks through on-farm management practices tend 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. If these are important food or export crops, increasing their production can affect consumers' welfare directly, as well as reducing foreign-exchange earnings. It also leads to a lower national income and to reduced long-term productive investments in agriculture.

Fourth, because of the time required for agricultural production, 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.

Fifth, yield variability 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.

Given these 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. In this chapter, we review the conditions under which government interventions can be justified, and seek to evaluate the experience with the more popular risk-oriented policy interventions.

Farm risks, market failure and policy intervention

In the sort of ideal world imagined 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 do 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 this failure in terms of social welfare? The answers to these questions provide a basis for evaluating the need for government intervention.

From the farmers' perspective, 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 LDCs there may not even be enough food for the family when things go badly wrong 'down on the farm'.

Risk-sharing institutions are widely available in more-developed countries (MDCs) 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 LDCs these kinds of institutions are usually much more rudimentary, and may not be available at all for small-scale farmers. Nevertheless, a wide range of informal risk-sharing arrangements has evolved. These include share tenancy contracts, traditional money-lending, and risk sharing within extended family 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. The arrangements, therefore, do not pool risks as efficiently as they would if they spanned regions or broader sectors of the national economy, as do nation-wide crop-insurance or credit schemes.

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.

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. Estimated welfare losses (measured as the sum of producer and consumer surpluses) arising from risk-averse behaviour can be quite large at the sectoral level, e.g., 5 per cent to 10 per cent in a model of irrigated agriculture in Mexico (Hazell and Scandizzo 1977), and even larger for some types of individual farms. But the estimates, often based on mathematical programming models, typically ignore risk-sharing strategies that farmers use other than crop diversification, and hence are undoubtedly biased upwards.

The welfare losses arising from forecast errors will 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—as explained in Chapter 4—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 growing but is still rather slender (e.g., Fisher 1982; Helmberger, Weaver and Haygood 1982; Eckstein 1984; Ravallion 1985). Scandizzo, Hazell and Anderson (1984) provided evidence that farmers in Western industrial countries tend to use revenue expectations (the rational expectation in the model used), whereas farmers in LDCs and centrally planned economies tend not to. 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'. This is claimed to be a major reason for default on bank loans, even in some MDCs 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 (Chapter 11).)

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, where options for managing high food prices are much more limited (Sahn and von Braun 1989).

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. We turn now to an assessment of experience with these interventions.

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 inherent instability in the sector, especially following the USA-oriented writings of Schultz (1945) and Heady (1952). Our present purpose does not permit a comprehensive examination of this rich tapestry of experience, fortunately for us well reviewed by authors such as Fackler (1988) and Rausser (1988), so the generalizations we present here represent our synthesis of some cogent studies in the field.

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. 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 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 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

Price stabilization is the major 'traditional' intervention in the agricultural sector. 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 was explored in detail some years ago (e.g., Wright 1979; Newbery and Stiglitz 1981; Quiggin and Anderson 1981). An important frequent finding, however, was that the welfare gains that are possible from stabilization are relatively small (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 programme administrators (Anderson, Hazell and Scandizzo 1977; Scandizzo, Hazell and Anderson 1984). These include the difficult-to-assess supply responsiveness to induced stability (Just 1974, 1975; Griffiths and Anderson 1978). Life would be so much simpler if storage was indeed costless! But it isn't, as extensive experience of the European Union commodity mountains and lakes and of, say, the Australian wool stockpile, attests.

Improved understanding of the economics of storage, including the complex effects of different rules on the behaviour 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. Indeed, one concerned agency, the World Bank, is now reluctant to support commodity stabilization ventures in its borrowing countries, a considerable departure from past practice (Braverman *et al.* 1992). Among the important reasons for discouraging such activities 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 (Gilbert 1995, 1996).

Crop insurance

Crop insurance is provided by the public sector in both MDCs and LDCs. The driving force for such programmes often originates in governmental concern about catastrophic risks such as drought, or the desire to reduce the incidence of loan defaults to banks.

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 programmes pay out $2.50 or more for every dollar of premium they collect from farmers. The difference is paid by governments, at costs varying from $10 to $400 per insured hectare. Even at these levels of subsidy, many farmers are still reluctant to purchase insurance. As a result, many public crop-insurance programmes 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. 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. 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?

Another 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 programmes 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 sizeable losses in some years. Since public insurers are rarely able to obtain commercial reinsurance or contingent loan arrangements, this specialization increases their dependence on the government.

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.

There is no 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, Artas and Norton 1986; Tsujii 1986). Nor is there much evidence that it has increased agricultural lending or benefited agricultural banks. In a rare study, Pomerada (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.

Private crop insurance is growing in some countries, and annual premiums worldwide are thought to exceed $1 billion per year (Gudger 1991). The drawback is that private insurance is almost exclusively confined to specific perils for large-scale commercial farms growing high-value crops, and it is not likely to become a major factor for the larger population of farmers.

Disaster relief

Disaster relief policy, or sometimes the lack of it, represents a significant opportunity for public intervention. 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. We need to remind ourselves from time to time, if such should be necessary after reading this book, that the world is indeed a risky place, and the extent of resultant costs can be considerable.

The mark of a good policy is one that swings into action as needed, without requiring (or even allowing) political grandstanding, 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 (DPRTF 1990), after a long history of at best questionable interventions in fodder and livestock markets under the rubric of assisting producers in their drought management.

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. 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. 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 market. Credit, as noted above, serves as a useful, largely self-managed instrument in MDCs, but is not so straightforward in LDCs, where most 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 LDCs.

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 (ADBs) to provide targeted and subsidized loans to the small-farm sector. The high costs and miserable performance of such ADBs in the 1970s and 80s led to much effort at reform. 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 LDCs 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 is seldom encountered in the ADBs, which are thus correspondingly vulnerable (Hazell 1995b). One hope for progress was agricultural credit insurance, but this too has met the fate of most crop insurance programmes (Pomerada 1984; Hazell 1995b), and attention has now shifted to the possibly of loan guarantee schemes. There is little evidence yet to suggest that these help 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.

Uncertainty and policy making

Thus far, our 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 current attempt by many countries to reform domestic policies within the context of the recent GATT trade agreement is a case in point (Witzke 1987). 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 manoeuvre to balance their commitments to the GATT Agreement 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 are now considering additional public risk-management policies to help farmers cope with it. For example, the USA has recently been considering 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). Given the unfortunate experience with public crop insurance in the USA that has focused only on biological and climatic risks, income insurance, if enacted, is likely to elevate the concept of 'farming the government' to heights until now unimagined.

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). The phenomena of potential concern are also diverse, and include, for instance, agricultural contributions to the Enhanced Greenhouse Effect, pollution of soils through inappropriate use of agricultural chemicals or ill-managed intensive animal production, or even plain old anthropogenic (as opposed to geological) soil erosion (Anderson and Thampapillai 1990). 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 that will contribute to new uncertainties for the sector.

One field where there is a 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 or risk. Yet the record of governments in making such risks less severe by making property rights more secure 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 excluded aboriginal 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.

Farmers and response to intervention

Risk is reality. The presence of government in agriculture is another part of reality. No one obliges farmers to stay in farming, but many choose to. 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 a risky business, 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 to mess around with farmers' risk management in the name of 'helpful' policy interventions (Tweeten 1995).

Our examination of the rationale for and experience with various instruments that claim to modify the risk environment faced by farmers has led us to a rather sceptical position about the virtue of most forms of intervention. For decision analysts aiming to be helpful to farm decision makers, the main message of this chapter is that governments usually 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 programmes naturally depends on the whole decision environment, and so seeking general insight to such a question is not too fruitful (Binswanger 1979). One could note that, as farmers become more wealthy, they will tend to be less averse to risk, and thus will be guided more by average performance indicators, and 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.

One might hypothesize that skills in decision analysis among policy analysts are insufficiently developed to enable them to come to grips sufficiently with the risks faced by farmers so as to be able to design effective government programmes in risk management. Earlier chapters may provide a contribution towards rectifying this situation and, taken together with the rapidly expanding number of instruments for intervention, the future of agricultural policy work dealing with uncertainty may thus be less bleak than it has been in the past.

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