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Risk and Household Behavior in Development Economics

Poor households in developing countries use various mechanisms to smooth consumption, since they tend to be highly risk averse and formal insurance arrangements are seldom available. There is a large and expanding literature in development economics on these mechanisms. This chapter provides a brief review on studies that are relevant to the following chapters to align the theoretical and empirical models in this study in a broader perspective.[1]

I. Risk and Insurance as a Development Issue

It is well known that, with a complete set of markets including insurance markets against risk, competitive equilibrium is Pareto-optimal (Arrow 1964; Debreu 1959) and production decisions by agricultural households are separable from their risk and consumption preferences (Singh, Squire, and Strauss 1986). If insurance markets are missing or imperfect, however, this separability may no longer hold, and risk considerations may affect farm management (Antle 1983; Roe and Graham-Tomasi 1986). The fact that formal insurance arrangements are seldom available in rural areas in developing countries suggests that insurance markets are incomplete. Furthermore, there is now ample empirical evidence that farmers in developing countries can be characterized as risk averse (Moscardi and de Janvry 1977; Binswanger 1980, 1981; Antle 1987, 1989; Dillon and Scandizzo 1978).

In the recent literature on household behavior under uncertainty, theoreti-

cal models of optimal intertemporal consumption have been used extensively (Besley 1995a; Deaton 1991). Based on such theoretical models, several authors tested the model of full risk-sharing empirically (Alderman and Paxson 1992). Among them, Townsend (1994) carried out a seminal study that applied the model of optimal risk-sharing to households in a developing country, namely, India. His findings suggested that rural households in semiarid India are insured much better than previously expected but that the hypothesis of optimal risk-sharing and thus the existence of complete insurance markets were rejected in many cases. Townsend (1994) even claimed that the full insurance model represents "a surprisingly good benchmark" (p. 539). On the other hand, Ravallion and Chaudhuri (1997) criticized Townsend's paper in stating that his empirical procedure has a bias in favor of full insurance results. Furthermore, using the same data sets but different methodology, Ligon (1993), Morduch (1991), and Rosenzweig (1988) rejected the full insurance model more strongly than Townsend. Results from other developing countries are also mixed (Jalan and Ravallion 1996b; Townsend 1995b; Udry 1994; Rashid 1991; Gillani 1996). To summarize the empirical findings, the full insurance model is generally rejected, although empirical evidence of *some* risk-sharing is found in most of the cases reviewed here.

These studies have confirmed the importance of risk considerations for rural households in developing economies. Analyzing the effects of risk is not only interesting theoretically but also important as a policy issue because potential and dynamic effects are expected from improved insurance. A lack of insurance is likely to result in lower levels of average income, consumption, and productive investment. Existing insurance mechanisms may not be accessible to the poor because of high entry costs, which implies that uninsured income risk may exacerbate income inequality. Therefore, improving insurance is expected to have favorable effects both on efficiency and on equity (Besley 1995b; Townsend 1995a; Kochar 1995). Recent studies on the interaction between inadequate insurance mechanisms and persistent poverty have further emphasized the importance of risk analysis (Ravallion 1995; Jalan and Ravallion 1995, 1996a; Ravallion, van de Walle, and Gautam 1995; Kochar 1994).

II. Risk-Coping Mechanism and Risk-Management Strategy

Facing uncertainty and incomplete insurance markets, households use various mechanisms to smooth consumption. The first category of these mechanisms was referred to as "risk-coping mechanism" by Alderman and Paxson

(1992), which includes ex post mechanisms to stabilize household utility, contingent on a realized state.

Use of credit markets is the most popular mechanism to cope with risk (Jodha 1978, 1981; Rosenzweig 1988; Eswaran and Kotwal 1989; Udry 1990, 1994; Townsend 1995b; Alderman and Garcia 1993). When credit markets are imperfect, however, households may become liquidity-constrained, so that self-accumulation and decumulation of assets become important measures of ex post consumption smoothing. The assets include savings (Deaton 1989, 1992; Morduch 1990; Paxson 1992), bullocks (Rosenzweig and Wolpin 1993), land (Cain 1981; Zimmerman 1993), or food storage (Park 1996; Saha and Stroud 1994; Renkow 1990). Investment in children's education is now analyzed in a similar framework as the accumulation/decumulation of human capital (Jacoby and Skoufias 1997). Demographic adjustments are another important mechanism of risk coping, such as reliance on extended family (Kotlikoff and Spivak 1981; Cain 1981), marriage relationship (Rosenzweig and Stark 1989), or remittances (Lucas and Stark 1985; Rosenzweig 1988). Rural reciprocity can also be interpreted as an informal insurance arrangement in this category (Kimball 1988; Fafchamps 1992b; Coate and Ravallion 1993; Carter and Zimmerman 1993).

Various means of risk coping can be further classified into intertemporal smoothing and risk-sharing arrangements (Alderman and Paxson 1992). Use of credit markets, assets, and human capital investment are included in the intertemporal smoothing measures. Demographic adjustment and rural reciprocity are major risk-sharing measures. An important policy implication is that the use of intertemporal smoothing measures is an expensive way to mitigate the ill effects of risk. It transfers the adverse effects of a purely transitory income fall to the whole future path of household consumption.

On the other hand, the literature on agricultural production decisions under uncertainty has emphasized ex ante adjustments that control the distribution of risky variables. Alderman and Paxson (1992) referred to these measures as "risk-management strategy." These adjustments include: enterprise selection and diversification on the farm and off the farm (Cain 1981; Shahabuddin, Mestelman, and Feeny 1986; Walker and Ryan 1990; Fafchamps 1992a; von Braun and Pandya-Lorch 1992); marketing options including interlinked transactions (Bardhan 1989; Goetz 1992, 1993); and risk-reducing inputs or investments in production (Just and Pope 1978, 1979; Rosegrant and Roumasset 1985; Wan and Anderson 1990).

In practice, the two categories are closely interrelated—availability of risk-coping mechanisms determines the necessity of a risk-management strategy,

and the cost effectiveness of a risk-management strategy determines whether a certain risk-coping mechanism is used or not. Therefore, a typical assumption in the risk-coping mechanism literature that the stochastic distribution of annual income flow is exogenous to household decisions is clearly unsatisfactory. The distribution becomes endogenous when households also make use of ex ante risk-management strategies. Similarly, a typical assumption in the risk-management strategy literature that there are no insurance or credit markets at all is not justifiable. A highly risk-averse farmer with effective measures to smooth consumption may make a production decision as if he or she were risk neutral. The divergence of observed production decisions from those predicted by expected-profit maximization should be interpreted as the measure of consumption insurance availability, rather than the innate risk attitudes of farmers.

A limited number of recent studies have attempted to distinguish between the innate risk attitudes and the consumption smoothing availability (Morduch 1995, 1990; Rosenzweig and Wolpin 1993; Rosenzweig and Binswanger 1993). The intertemporal consumption model is now linked with the risk-management model on the production side in these studies. The household production model in Chapter 6 of this study is another attempt in this direction. It attempts to extend the literature with a motivation similar to Morduch's (1990), who showed that the ability to borrow to smooth consumption is critical in determining the effect of risk on the choice of production portfolio.

III. Considerations for Domestic Consumption of Farm Products

Another important issue discussed in this study refers to households' considerations for domestic consumption of farm products. Small-scale farmers in developing countries devote a larger share of land to food crops for family consumption than to cash crops that have higher expected returns.

One explanation for this observation emphasizes subsistence requirements.[2] In the absence of food markets, households have to be self-sufficient in these goods so that their consumption preferences for goods directly affect crop choices (de Janvry, Fafchamps, and Sadoulet 1991). However, the assumption of completely missing markets is too restrictive because at least partial markets for most agricultural products exist in developing countries.

Fafchamps (1992a) and Finkelshtain and Chalfant (1991) relaxed the assumption of missing markets. Their models showed that, even when food markets exist, households would attempt to avoid price risk by growing the food crop by themselves if its market prices are volatile. They even suggested that price variability of a produced good that is also an important consump-

tion good may lead to a perverse result—risk-averse farmers may choose to produce more of a risky crop. This is in sharp contrast to Sandmo's (1971) classic derivation that the output of a risk-averse firm is lower under price risk.

These studies have in common the fact that their models are based on multiple-attribute utility maximization, in which an indirect utility function is defined for both income and prices. This specification of utility maximization was strongly suggested by Newbery and Stiglitz (1981) for a farm analysis in developing countries. When multiple-attribute utility maximization is applied to decision making under uncertainty, consumption preferences for individual goods, such as income/price elasticities of demand and a budget share of each item, affect production decisions. These demand characteristics are referred to as "ordinal consumption preferences" in this study, because they can be defined in terms of an ordinal utility function. On the other hand, risk preference is defined by the shape of the upper curvature of the (cardinal) utility frontier.

Chapter 6 attempts to test econometrically whether or not a model with ordinal preference effects on crop choices is able to explain the behavior of agricultural households in Pakistan. Since the studies of both Fafchamps (1992a) and Finkelshtain and Chalfant (1991) are theoretical, the empirical test is interesting both methodologically and empirically.

IV. Empirical Studies on South Asian Agriculture and Their Implications

Many of the studies reviewed above are based on case studies from South Asia, mainly due to the prevalence of poverty as nearly one half of the world's population under the poverty line lives in this region (World Bank 1990). Poor households are more vulnerable to income fluctuations than the nonpoor since a small decrease in consumption implies a critical deprivation of the poor's welfare. Moreover, access to consumption credit and other income smoothing measures are more restricted for poor households with few assets.

One of the focal areas of studies on risk in South Asia is the Deccan plateau of India. This area belongs to the semiarid tropics (SAT) and is prone to frequent dry spells. Numerous studies have applied recent methodologies to the panel data of village households surveyed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).[3] In this sense, the ICRISAT data set has contributed to the development of the recent risk literature.

It is impossible to summarize the findings of these studies in the limited space here. Some of the most important findings are listed below, which will

be compared with those of this study in the following chapters. First of all, in dryland agriculture associated with low income in India's SAT, households are subject to a large fluctuation of household income. A surprisingly high proportion of this income fluctuation is attributable to idiosyncratic disturbances.[4] For instance, Morduch (1990) found that idiosyncratic disturbances accounted for 75 to 96 per cent of the total household income fluctuation.

Second, income sources of rural agricultural households are diversified to an extent that crop income typically accounts for less than half of the household income. Livestock income and nonfarm income are equally important.

Third, in spite of this volatility in income flow, poor households manage to stabilize their consumption at least partially. Empirical tests of consumption smoothing have confirmed this point, although the full risk-sharing model is rejected generally (Townsend 1994; Morduch 1990; Ligon 1993; Rosenzweig 1988).

In the case of Pakistan, empirical studies on risk and household decisions are scarce. Among them, the study carried out by Rashid (1991) is unique in that he directly addressed the issue of consumption smoothing based on nationwide data. New panel data collected by the International Food Policy Research Institute (IFPRI) are now available that are sufficiently detailed for a rigorous analysis (Alderman and Garcia 1993; Adams and He 1995; Gillani 1996). Ample information on household decisions over three years in the data set is expected to enhance our understanding of risk and household decisions in Pakistan. Using this data set, Alderman (1996) investigated the effects of income variation on savings decisions using a version of the permanent income model. He showed that it is more difficult for households to smooth consumption after successive shocks than with a single shock. Behrman, Foster, and Rosenzweig (1997a) focused on the sequential decision-making process in agriculture and showed that savings decisions fundamentally differ between planting and harvesting seasons. They also applied their model to investigate the relationship between savings decisions and calorie-income relations (Behrman, Foster, and Rosenzweig, 1997b).

Aside from the models of consumption smoothing, there is a vast empirical literature on farm response in Pakistan. Following the seminal study of price response carried out by Falcon (1964), a number of authors examined the supply response in Pakistan's agriculture and supported the view of positive price response (Falcon and Gotsch 1967; Qureshi 1973; Tweeten 1987; Hamid et al. 1987; Pinckney 1989b; Ali 1990; Khan and Iqbal 1991, 1992; Ashiq 1992). Supply response functions were estimated for livestock products also, such as in the reports of Walters, et al. (1987), Anjum et al. (1989), and Akmal (1993, 1994). Although not incorporated fully in the supply response litera-

ture, empirical studies on risk showed that agricultural commodities in Pakistan are subject to substantial market price risk, including major crops under the support price system (Mohammad 1983, 1985; Byerlee and Iqbal 1987), and crop output is also subject to yield risk (Ahmed and Mahmood 1992).

Interaction between crops and livestock has been analyzed fully in the mathematical programming literature (Gotsch et al. 1975; Perry 1982) and in the literature centered on farming systems (Byerlee, Sheikh, and Azeem 1992; Byerlee and Khan 1992). Following the studies by Tweeten (1987) and Hamid et al. (1987), it is possible to incorporate the crop-livestock interaction in an econometric model. Extension to this direction is also desirable considering the recent shift in Pakistan's agriculture toward livestock products (Chapter 2). For this purpose, microeconomic data are necessary because aggregate data on livestock production are simple interpolations of survey results conducted every ten years. Existing reports of Walters et al. (1987), Anjum et al. (1989), and Akmal (1993, 1994) are misleading in a sense that aggregate, interpolated data are treated as valid observations.

Therefore, this study explicitly takes into account consumption smoothing under production risk and crop-livestock interaction in Pakistan's agriculture. A decision model of household production will be proposed that incorporates these two issues in a theoretically consistent way. Empirical models will be proposed that enable to estimate and test the theoretical model using microeconomic data from Pakistan's agriculture. The following chapters will investigate every aspect related to these issues.

Notes

1 See also Besley (1995a), Alderman and Paxson (1992), and papers reported in "Symposium on Consumption Smoothing in Developing Countries," *Journal of Economic Perspectives* 9, no. 3 (1995) for a more general review.

2 Another line of the literature emphasizes the importance of transportation costs (Omamo 1995; Key 1996). The existence of substantial transportation costs may induce small landholders to be self-sufficient in food crops. However, this literature cannot explain their marginal tendency toward self-sufficiency once they initiate market transactions of these food crops.

3 Among these studies discussed so far, Antle (1987, 1989), Cain (1981), Jacoby and Skoufias (1997), Jodha (1978, 1981), Kochar (1994), Ligon (1993), Morduch (1990, 1991, 1995), Rosenzweig (1988), Rosenzweig and Binswanger (1993), Rosenzweig and Stark (1989), Rosenzweig and Wolpin (1993), and Townsend (1994, 1995a) are based on the ICRISAT data. See Walker and Ryan (1990) for

overall characteristics of the ICRISAT households and for further references of studies based on the data set.

4 In investigating the incidence of risk, distinguishing common and idiosyncratic disturbances is important. An idiosyncratic disturbance is defined as a shock that falls on an individual sample with statistical independence from the shocks that fall on other samples in a cross-section.