Informal mechanisms for risk-spreading in low-income rural credit markets

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ABSTRACT

Variations in behavior amongst farmers differ accordingly to idiosyncratic risk-related preferences. In a context where insurance coverage depends on the distribution of wealth, we recover from selected literature what might be expect from the role played by informal credit markets as a risk-spreading device for low-income farmers.

Key words: Credit market; Asymmetric information; Uncertainty.

Variations in behaviour amongst farmers in risky agricultural environments might differ, according solely to distinct risk-related individual preferences. It is expected that risk-adverse individuals will choose more conservative portfolio compositions for their holdings, and behave with more precaution in relation to their options when choosing what to produce, the inputs to be used, and how to finance current expenditures.

Regardless of heterogeneity in diverse individual preferences associated with risky choices, the point to be made in this paper will recover major arguments presented in related literature, stressing the relationship between distribution of wealth (amongst other institutional characteristics in which individuals are embedded) and conditioned responses with respect to specific attitudes facing risky choices, in particular the effectiveness of informal mechanisms for risk-spreading.

To start, following Rosenzweig & Biswanger (1993), it will be discussed in the

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first section a formal model that "examines how the composition of productive and non-productive asset holdings varies across farmers with different levels of total wealth and across farmers facing different degrees of weather risk". (Rosenzweig & Biswanger, 1993, p. 56)[1]

In a second section it will be discussed how different institutional settings might alter the way informal mechanisms of risk-spreading act, allowing or not more efficient resource allocation to farmers in agricultural risky environments.

Finally, a final section with concluding remarks will present a tentative balance between the arguments recovered along the essay, with particular emphasis on the likelihood of success from focused public sector intervention in such environments.

THE TOSENZWEIG-BISWANGER MODEL[2]

The problem faced by an individual farmer might be stated as maximising:

$$U = V(\mu_c, \sigma_c), V\mu > 0, V\sigma < 0 \quad (1)$$

where:
μ_c = mean of farmer's consumption and

σ_c = standard deviation of farmer's consumption.

For the model to link Max U with farmer's portfolio decision-making, it is assumed that particular choices of production assets can influence the arguments in (1) according to the following relationships:

$$\mu_\Pi = Wf(\alpha_i)\mu_w \text{ and} \quad (2)$$
$$\sigma_\Pi = W\Gamma(\alpha_i)\sigma_w; f_{\alpha\alpha}, \Gamma_{\alpha\alpha} < 0 \quad (3)$$

where:
μ_Π = mean of farmer's profits per unit of wealth;
W = farmer's total asset holdings (wealth);
α_i = productive investment portfolio vector, with the element α_i representing the value share of the ith investment input in total wealth;[4]
σ_Π = standard deviation of farmer's profits per unit of wealth;
and μ_w, σ_w are the first two moments of the weather distribution, where the weather is assumed to follow a stochastic process.

In developing such model, the authors assumed the "weather risk" as a proxy for agricultural risks, given their objective of "measuring the riskiness of farmer's investment portfolios, in terms

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[1] In the next section, it will be reproduced the model presented in the quoted article. The arguments will be developed following closely the original ones, whereas some personal comments will be made over the model allowing to link its results with related literature on informal credit markets.
[2] This model was chosen as a starting point for this paper by reasons that will be evident along its presentation. See Biswanger (1981) for alternative benchmark models concerning functional forms for the utility function, as well as models based on security motives.
[3] The authors pointed out that Meyer (1987) "demonstrated that the quasi-concavity of [1] is sufficient to guarantee convexity of preferences, so that $V_{\mu\mu}$ and $V_{\sigma\sigma} < 0$, and $V_{\mu\mu}V_{\sigma\sigma} - V^2_{\sigma\mu} \geq 0$". (Rosenzweig & Biswanger, 1993, p. 59)
[4] Normalising by the nth production asset and assuming constant returns to scale.

of [...] a observed stochastic variable (with extensive data available)" (Rosenzweig & Biswanger, 1993, p. 56, 59, brackets added by myself).[5] Associating perceived risk with profitability, and further considering $\mu_c = \mu_\Pi$, production decisions under risky environments might be related to the problem of maximising expected utility.

Additionally:

$$\sigma_c = k(W)\sigma_\Pi; \ k'(W) < 0 \qquad (4)$$

where $k(W)$ expresses a certain degree of reversibility for investment decisions, constraints on capital markets and absence of fully coverage for insurance against income fluctuations. In such context, the total level of asset holdings ("wealth") might serve as collateral for loans in a limited market. Therefore, $0 < k \leq 1$ expresses the "wealth influence" which will be discussed later.

Substituting μ_c and σ_c in (1) by the expressions in (2), (3) and (4), and taking the first derivatives to $\text{Max}_{\alpha i} U$, it follows (applying the chain rule and remembering that profit variability depends on the portfolio choice, which in turn depends on weather variability):

$$V\mu f_{\alpha i} = -V_\sigma \Gamma_{\alpha i} \sigma_w k \quad (i = 1, \dots, n-1)(6)$$

where:
$f_{\alpha i} = f_i - f_n$ and $\Gamma_{\alpha i} = \Gamma_i - \Gamma_n$ (given the normalisation adopted); f_j and Γ_j representing the marginal contributions of the jth production capital to the mean and standard deviation of profits.

The last expression summarises an investment equilibrium condition to the farmer, in which a central feature is that if risk-averse farmers with incomplete insurance choose inputs in order to reduce income variability, they are doing so at expense of profitability (riskier assets produce higher average returns).

In other words, if a farmer is risk-neutral (or fully insured against income fluctuations), it is possible for him to choose an investment portfolio composition that maximises his expected profits and consumption ($f_{\alpha i} = 0$). On the other hand, if he is risk-adverse and/or not fully insured, it will not be possible for him to maximise profits.

Given this result, and recovering the relationship represented by $k = k(W)$, it is implied by the model that wealthier (larger) farmers will be able, on average, to make more efficient resources allocation decisions, if not by the usual assumption of declining risk-aversion with wealth (some "natural" inclination of wealthier people to bear more risk), at least because in imperfect capital markets environments wealth plays an important role as collateral for loans and facilitates *ex-post* consumption smoothing.

Conclusion: larger farmers hold high-Γ investment portfolios and exhibit higher average profits per unit of wealth. It follows the questions: *i.* what could be said with respect to the effectiveness of

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[5] It is also assumed homogeneity of degree 1 on the weather distribution variables (following related literature), and one single source of profit randomness, so that G measures the riskiness of the asset portfolio.

informal mechanisms for risk-spreading, particularly low-income rural credit markets?; *ii.* beyond wealth redistribution, what kind of public sector intervention could help low-income farmers?

INFORMAL CREDIT MARKETS IN RURAL AREAS AS RISK-SPREADING DEVICES

The key influence of wealth on consumption and profit variability may be substituted by informal risk-sharing devices in rural credit markets, *even though* in some way these mechanisms are not *totally* efficient as wealth remains a prerogative to access full insurance.

This assumption goes on the opposite direction of some results in standard literature (see, for example, Townsend (1994), in which potential risk-bearing devices[6] are supposed to provide full insurance and there exists no place for non-exploited possibilities of trade, ruling out results with inefficient resource allocation.

It is worth noting that, although Townsend recognised the role played by real-world institutions, he stated Pareto optimal grounds *a priori* as a benchmark for his analysis. Whatever relaxation of the hypothesis of markets conducting to a "panglossian world", so that markets alone are not capable to produce optimal results, *markets in combination with other institutions will do the job*! We do not in-

tend to show his approach to be useless, but to stress our opinion that *a more straightforward research agenda must depart from explanations in which market failures lead themselves alone to produce optimal "institutions".*

Hoff, Braverman & Stiglitz (1993), for example, achieved the interesting result that institutions arising to cope with missing markets if possibly help to overcome "information problems that preclude complete markets", may on the other hand *aggravate* these problems (p. 3); and Biswanger (1986) provided an extensive discussion of potential obstacles, typical in poor rural areas in developing countries, which prevent the possibility of achieving optimal resource allocations in risky environments.[7]

These obstacles, on its turn, arise whenever economic interactions are characterised by transaction costs and asymmetric information, and do apply to a much wider range of economic problems than the one discussed here. (all the issues of moral hazard and adverse selection, developed in the economics of imperfect information literature)

Applied to credit markets analysis, the sort of incentive problems discussed by Biswanger (1986) led to useful conclusions: *i.* from the point of view of expected return, "interest and collateral are substitutes"; and *ii.* the collateral may be viewed as a risk-sharing device (p. 72). From these conclusions, *it follows that dif-*

[6] Townsend (1994) lists five: "diversification of a given farmer's landholdings into various spatially separated plots and into various crops", "storage of grains", "purchases and sales of assets", "borrowing from village lenders" and "gifts and transfers in family networks". (p. 540)
[7] These obstacles are related, according to the author, to "an identical set of information, incentive, and management problems". (p. 67)

ferent attitudes toward risk will shape the way borrowers and lenders interact, including the possibility of arising institutions that (partially) substitute collateral.

Some institutions may rely on personal linkages between borrowers and lenders, usually in local networks. These includes community controls (social sanctions) and overlapping markets relations (for example, when a lender is also the trader for the crop production from borrowers). Others, like insurance, adds a third party to the transaction, also leading to efficiency gains. *But neither of these will necessarily produce Pareto-optimal outcomes.*

It must be stressed that one of such institutions, the use of insurance for loans, for the crop yield or even for the collateral itself, suffers the same obstacles as a formal credit market so long as the insurance market is also characterised by the possibility of moral hazard and adverse selection, insurance sellers facing the same screening difficulties as the lenders.

The role of another related institution, local moneylenders activities, is explored by Hoff & Stiglitz (1993). Their framework assumed the point of view that interest rates in informal credit markets act as a rationing device, explaining the co-existence of formal and informal sectors in rural credit markets as well as informal credit market segmentation.

From the lenders perspective, this framework stresses the necessity of actions to solve four major questions: *i.* how to provide "insurance against default risk"; *ii.* how to acquire information "regarding the characteristics of loan appli-

cants"; *iii.* how to ensure that borrowers will act in a way "that make repayment most likely"; and *iv.* how to de-velop enforcement actions to increase the "likelihood of repayment by borrowers who are able to do so" (Hoff & Stiglitz, 1993, p. 37). Analytically, the authors identify "indirect" and "direct" mechanisms to solving these problems.

Increases in the rate of interest change the demand composition for loans, increasing the participation of riskier projects. This mechanism enlightens its function as an (indirect) screening mechanism. Thus, informal rural credit market lenders may not sanction increases in the rate of interest due to excess demand, looking for another signals (at least with the same expected cost) to select borrowers. Therefore, with informational constraints, selected borrowers "must enjoy some surplus from obtaining the loans". On the other hand, the "threat of cutting off credit", as well as contractual linkages with other transactions, may be used by lenders as (indirect) incentive and enforcement mechanisms (p. 40). As a whole, these "solutions" led to market segmentation, the personal history of the relationship between lenders and borrowers acts as a major factor determining the rationing of credit.

Direct screening mechanisms play a complementary role, so that living near the borrowers, pertaining to the same community and trading with them in other markets help monitoring and collecting information about them. Also, the presence of such devices explains the co-existence of informal and formal sectors in rural credit markets, since the later

does not access the mechanisms to solve informational problems.

CONCLUDING REMARKS

The arguments provided by Biswanger (1986) and Hoff & Stiglitz (1993) pointed to similar remarks: poorer farmers in risky environments face difficulties to make better use of their scarce resources, in particular due to constraints to access formal credit markets. Informal mechanisms partially solve this problem, as much as they are able (e.g. local money-lenders) to cope with typical information, incentive, and enforcement problems.

However, as discussed by Hoff (1993), Hoff & Stiglitz (1993b), and Anderson & Hoff (1993), a broader consideration of institutional conditions in which farmers are embedded adds important elements to (policy) analysis. First of all, it might be stressed that two key dimensions of institutional environments are decisive with respect to possible outcomes: *i.* the degrees of "transferability" and "security" of individual rights (property rights enforcement issues); and *ii.* institutions are not immutable, and it has to be considered the influence of government interventions might play in creating institutional-responsive processes. In other words, institutional characteristics may contribute to either police success or failure, and shaping institutions to be more responsive in face of government intervention is a policy issue itself.

The characteristics of low-income rural sectors and the role played by infor-mal credit markets, discussed in this paper, open the research agenda to analyses of public policies alternatives. The questions recovered here from related literature lead to at least the following (additional) general remarks regarding public policies focused on this sector:

- direct government intervention in rural credit markets, providing official subsidised programs, is not likely to be successful regarding the poorer farmer's situation, since it is not probable that government agencies will be able to overcome screening, incentives and enforcement problems. It should be most effective for the government to tackle institutional conditions that lay behind these problems, *i.e.*, to act in partnership with decentralised organisations embedded in local community.

- efforts to regularise land registration are likely to be useful if there is not limited institutional "transferability" of rights, or if access to credit does depend on "security" of rights (Hoff, 1993, p. 235);

- redistributive tax-and-transfer programs must not rely exclusively on lump-sum taxes, if output proportional taxes do represent a way to spread risk (Hoff & Stiglitz, 1993b, p. 326);

- technological-enhancing programs must be responsive to local habits, and infrastructure investments from the government must frequently be regarded as a necessary complement to them.

RESUMO

Variações comportamentais entre proprietários rurais diferem de acordo com suas preferências individuais. Num contexto onde a cobertura na contratação de seguro depende da distribuição da riqueza, nós recuperamos de literatura selecionada o que poderia ser esperado, entre pequenos proprietários rurais com baixa renda, do papel desempenhado por mercados de crédito informais como um mecanismo para proteção contra riscos estocásticos.

Palavras-chave: Mercado de crédito; Informações assimétricas; Incerteza.

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