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March 2012

REGULATION AND SUPERVISION OF MICROFINANCE INSTITUTIONS: AN EXAMPLE OF COOPERATIVE CREDIT SOCIETY

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Abstract: We study the optimal regulation of a cooperative credit society which has private information on the intrinsic quality of its loan portfolio (adverse selection) and where the cooperative's choice of effort to improve this quality cannot be observed by the regulator (moral hazard). We characterize the optimal contracts offered by the regulator to the credit cooperatives. We have been able to show that the optimal contracts depend on 3 main factors namely: on the accuracy of the supervisor's signal, the likelihood of facing a high quality credit cooperative, and the cost of supervision.

Keywords: Microfinance, Informational asymmetry, optimal incentive contract, regulation, supervision

JEL Classification: G10, G21, G28

1. INTRODUCTION

Microfinance is the provision of a broad range of financial services such as deposits, loans, payment services, money transfers, and insurance to poor and low-income households and, their microenterprises. Microfinance institutions now reach well over 100 million clients and achieve impressive repayment rates on loan (Cull, Demirgüç-kunt, and Morduch (2009a)).
Microfinance services are provided by three types of sources: formal institutions, such as rural banks and cooperatives; semiformal institutions, such as nongovernment organizations; and informal sources such as money lenders and shopkeepers. Microfinance institutions are defined as institutions whose major business is the provision of microfinance services. (Institutional microfinance is defined to include microfinance services provided by both formal and semiformal institutions).

The interest in microfinance has burgeoned during the last three decades: multilateral lending agencies, bilateral donor agencies, developing and developed country governments, and nongovernment organizations all support the development of microfinance. A variety of private banking institutions has also joined this group in recent years. As a result, microfinance services have grown rapidly during the last decade, although from an initial low level, and have come to the forefront of development discussions concerning poverty reduction.

The rapid growth of microfinance has brought increasing calls for regulation, but complying with prudential regulations and the associated supervision can be especially costly for microfinance institutions (Cull, Demirgüç-kunt, and Morduch (2009b)). Christen, Lyman, and Rosenberg (2003) speculate that compliance with prudential regulations could cost a microfinance institution five percent of assets in the first year and 1 percent or more thereafter.

In discussing tradeoffs in regulation of microfinance, Christen, Lyman, and Rosenberg (2003) draw an important distinction between prudential and non-prudential regulation. According to their definition, regulation is prudential when "it is aimed specifically at protecting the financial system as a whole as well as protecting the safety of small deposits in

individual institutions". The assets of microfinance institutions remain substantially less than those of formal providers of financial services, most notably banks, and thus they do not yet pose a risk to the stability of the overall financial system in most countries. However, an increasing share of microfinance institutions take deposits from the public, and many of the depositors are relatively poor. Protecting the safety of those deposits provides a rationale for improved regulation and supervision of microfinance institutions.

We investigate the role of prudential regulation on the profitability and self-sustainability of credit cooperatives. Credit cooperatives as formal financial institutions originated in nineteenth century Germany. These associations operate democratically; each member has one vote. Leadership is voluntary and unpaid, although professionals may be hired for day-to-day operations. Members contribute equity in the form of an initiation fee and regular capital contributions. The amount a member can borrow is based on his or her capital contributions. Profits are distributed to members in the form of dividends based on their equity contribution or retained to increase the organization's capital. This ensures that benefits go to members rather than to external intermediaries and their shareholders.

Cuevas and Fischer (2006) observe that "lack of knowledge of cooperative financial institutions governance, regulation and supervision has been a recurrent obstacle in development finance, resulting in widespread neglect of the cooperative financial institutions sector in spite of its pervasiveness and potential". In addition, there are topics related to organization, governance, legislation, regulation and supervision of cooperative financial institutions over which there is no agreement but over which one is needed if we are to facilitate the growth of these institutions and realize their potential for serving the poor. The issues refer to fundamental questions such as: what are the main strengths and weaknesses of cooperative financial institutions, what is the role of the legal framework in doing this, should the legal framework be a specialized one covering uniformly all cooperative financial institutions or should the system be tiered, should cooperative financial institutions fall under banking authority supervision - most agree that yes, it should - but then how: direct, delegated or auxiliary supervision, see Cuevas and Fischer (2006). What are differences between these schemas, and the effects they have on performance of cooperative financial institutions?

Delegated monitoring is probably the hottest point of the debate and disagreements on regulation and supervision of cooperative financial Institutions (CFIs). The argument that regulation and supervision in microfinance are less important because of its small economic role misjudges the exceptional sensibility of this segment and its possible contribution to financial systems development. Banks and other financial intermediaries are major players in modern economies by exerting a strong influence on risk sharing, capital allocation and economic growth. This important role in the economy stresses the need to safeguard the stability and soundness of the financial system. Recent financial crises in many countries have triggered renewed interest in the structure and conduct of banking regulation. The existence, type and scope of banking and prudential supervision have become topical issues and main subjects of intense academic and policy debates.

The regulation and supervision of Microfinace Institutions (MFIs) should be subsumed in the overriding goal of developing a market-based financial system (Staschen (1999)). Target group demand is not limited to borrowing; it also includes other financial services such as savings, insurance, transfer facilities, etc. Savings facilities are a particulary important question when considering a prudential regulation of MFIs. The prospective target group is many times larger in deposit business than in lending (Staschen (1999)). Where the poor have no access to savings facilities MFIs should also take up deposit business. Another reason for regulating this sector is that MFIs'available funds cannot keep pace with their lending business. To reach as many prospective borrowers as possible MFIs also need to have access

to external finance in addition to their own resources and finance from donors. The question of whether banking regulation is in fact appropriate.

There are three typical regulatory approaches for Microfinance institutions sector (see e.g. Staschen (1999), and Berenbach and Churchill (1997) for a similar classification): the regulation of MFIs by existing banking legislation, regulation by a special MFI law and self-regulation. Statutory regulation and self-regulation differ as to who lays down the rules and how they are stipulated. In government regulation this is the task of the legislator or subordinate administrative agencies. The distinction in statutory regulation between regulation by banking law and by a special MFI law is not a methodological necessity, but it is very helpful to give existing regulatory approaches a structure. In self-regulation the institution to be regulated set their standards themselves, not each on its own (this would be internal self-regulation), but as a group (e.g. through an association), and these are equally binding for all. Self-regulation and statutory regulation are the two extremes demarcating a continuum of regulatory methods. Pure self-regulation (i.e. without any government influence), is rare. More frequent is indirect influence through government bodies (e.g. via state licensing of regulatory institutions. This approach is also termed: indirect supervision or delegated monitoring.

Indirect supervision is a regulatory regime that is unique to cooperative financial institutions (CFIs). In this regime an agent (the delegated or auxiliary supervisor) performs certain tasks associated the supervisory function on behalf of the state authority (the principal supervisor). The agent may be (and usually is) a body specially setup by the network of CFI, but could potentially be any other independent party like an auditing firm or a rating agency. The ultimate responsibility of the functioning of the regime rests squarely with the principal supervisor, and no indirect supervision regime should be expected to work without a commitment of the later to make it work. This is government regulation with delegation of supervisory tasks to a private institution CGAP (2003). Historically this regime grows from the experiences in Germany (and then Europe), starting in the second half of the XIX century, throughout modern times, where it is still the dominant supervision regime.

There is no theoretical or empirical work from which we can draw clear guidelines. The little theoretical work that touches tangentially on the subject provides only arguments why these kinds of arrangements might work. On the empirical side, although there is vast experience out there of the successes and failures of systems that work with and without delegated/ auxiliary monitoring, this information has not been processed in an orderly fashion allowing drawing inference. We are reduced to the fact that there are systems of CFIs that employ the approach and work well. The same can be said of systems operating under direct supervision. Auxiliary/delegated monitoring is also employed in other networks such as those of savings and loans banks (German, Scandinavian countries, and Spain for many years before switching to a direct supervision schema), insurance (Quebec) and health insurance (France, Belgium).

Microfinance institutions (MFIs) can be classified into three rough categories depending on the structure of the liabilities side of their balance sheets. This classification is given by Van Greuning, Gallardo and Randhawa (1999). First category comprises all MFIs which depend on other people's money to finance their lending business. These MFIs are described as credit-only institutions as well. They include financial NGOs. In the second category member's deposits is used to grant loans exclusively to members. Classic examples of this are saving and credit cooperative and/or credit unions. The latter category comprises all MFIs that use the public's money to finance their lending business. These do not include financial institutions that employ forced savings components to secure their lending transactions, however, as long as their clients are net borrowers.

Another type are formal banks with a microfinance window. The regulations of banking legislation automatically apply to their microfinance portfolio, but these are usually poorly adapted to the requirements in this area. This problem has not yet been solved. Each institutional type stands out for an idiosyncratic risk of its own, which has a bearing on the best regulatory framework to choose.

Cooperative financial institutions, albeit highly pervasive in most countries, are among the poorly understood entities that comprise the existing institutional base for financial intermediation. CFIs include diverse member-owned financial intermediaries' referred to as credit unions, savings and credit cooperatives, cooperative banks, and other terms that differ across regions of world. For example, Savings and Cooperatives in East Africa; "Caisses populaires or Caisses d'épargne et de crédit" in West and Central Africa; "Cooperativas de ahorro y crédito" or "Cajas de ahorro y crédito" in Latin A merica; credit unions in the UK, USA and parts of Canada (see, Cuevas and Fischer (2006)).

Their institutional structure and governance, legal and regulatory status, and scale and services portfolio also vary widely across regions and especially between industrialized countries and developing economies. A most basic common denominator is that they collect deposits and do business often solely with members (see Cuevas and Fischer (2006)). CFIs serve many poor people, even though middle-income clients are also among their membership, a feature that in fact allows CFIs to reach poor segments of the population without necessarily compromising their sustainability.

In deposit business there is an asymmetric distribution of information available to the depositors on the one hand and the financial institutions on the other. The focus of this is on the debate associated with indirect supervision, i.e., delegated and auxiliary supervision mechanisms. We examine the role of prudential supervision and information disclosure as a regulatory instrument, and analysis its effects on performance of CFIs concerning incentives and effort. Here, information disclosure refers to the optimal monitoring scheme by the supervising agency taking into account all costs and benefits of such a scheme.

The paper is organized as follows. Section 2 reviews briefly both the empirical and theoretical literature on regulation and supervision. In Section 3, we set out the structure of our model. We also discuss the first-best contract in which overall quality and effort can be observed and verified by the regulator. Supervision and disclosure play no role in this setting. In Section 4, we derive the properties of the optimal incentive contract with informational asymmetry. Some conclusions are drawn in Section 5.

2. PREVIOUS LITERATURE

Previous research on microfinance regulation and prudential supervision focuses on the relationship between financial performance and regulation, treating outreach as a secondary concern (see Cull, Demirgüç-kunt, and Morduch (2009b)). Ndambu (2011) and many others have analyzed the impact of regulation on financial intermediaries (including MFIs) worldwide, deriving potential implications of microfinance supervision in a consistent manner and moving one step beyond countries' anecdotal evidence. Hartarska (2005) finds that regulated microfinance institutions in Central and Eastern Europe and the Newly Independent States have lower return on assets relative to others, and weak evidence that the breadth of outreach may be related to regulation. After controlling for the endogeneity of regulation, Hartarska and Nadolnyak (2007) have conducted a research using a positive approach to assess if regulated MFIs achieve better sustainability and outreach than unregulated MFIs. They find that regulation has no impact on financial performance and weak evidence that regulated microfinance institutions serve less poor borrowers. As a policy

implication, they concluded that MFIs' transformation into regulated financial intermediaries might not lead to improved financial results and outreach. However, they fund institutions collecting savings reaching more borrowers, thus suggesting that regulation might have an indirect benefit if it is the only way allowing MFIs to collect deposits from the public.

Cull, Demirgüc-kunt, and Morduch (2009b) examine the implications for the institutions' profitability and their outreach to small scale borrowers and women. The tests draw on a new database that combines high-quality financial data on 245 of the world's largest microfinance institutions with newly-constructed data on their prudential supervision. Ordinary least squares regressions show that supervision is negatively associated with profitability. Controlling for the non-random assignment of supervision via treatment effects and instrumental variables regressions, the analysis finds that supervision is associated with substantially larger average loan sizes and less lending to women than in ordinary least squares regressions, although it is not significantly associated with profitability. The pattern is consistent with the notion that profit-oriented microfinance institutions absorb the cost of supervision by curtailing outreach to market segments that tend to be more costly. By contrast, microfinance institutions that rely on non-commercial sources of funding, are thus are less profit-oriented, do not adjust loan sizes or lend less to women when supervised, but their profitability is significantly reduced.

Ndambu (2011) discusses the potential impact of regulatory on microfinance in Sub-Saharan Africa using cross section data from the mix market of 192 microfinance institutions from 32 different countries. The results do not show sufficient evidence that the regulatory status increases the sustainability of MFIs nor does the deposit intermediation. However, after controlling for the regulatory capacity, there is clear evidence that countries with a high Official Supervision Power have more sustainable MFIs and it is only after integrating the Official Supervision Power in the model that the deposit intermediation coefficient becomes significant and positively associated with the Operational Self sufficiency.

Though these results are intuitive from an economic perspective, it remains an open question whether the benefits of supervision in terms of better protection of depositors' funds and improved stability in the MFI sector outweigh the reductions in outreach.

This study considers the optimal regulation of a single bank that has private information on the intrinsic quality of its loan portfolio. The credit cooperative is able to raise its total quality above its intrinsic quality by exerting costly managerial effort. Higher overall quality enhances the distribution of returns on the bank's loan portfolio and therefore its expected profits. However, the choice of effort is unobservable to the regulator and cannot be verified. So, in this setting the regulator faces adverse selection and moral hazard which has important consequences for designing the optimal contract. A similar approach is taken in for example Giammarino, Lewis, and Sappington (1993) and Rochet (1992). Our study extends Giammarino, Lewis and Sappington's focus on incentive compatibility requirements by analyzing the regulator's concern for social welfare. The regulator offers the bank a menu of contracts from which the cooperative chooses depending on its characteristics and on the profit sharing scheme between the regulator and the cooperative. In this way contracts are not rigidly imposed on all banks, but induce self-selection by cooperatives through incentive compatibility.

Information asymmetry due to the bank's private information about its costs of operation (selection adverse) and about hidden actions that managers of bank (moral hazard) induce a loss of control for the regulator and limit the effectiveness of its regulatory policy. This loss of control may be mitigated by collecting bank specific information, creating the need for active prudential supervision. Supervising agency acting on behalf of the regulator may be able to resolve the information asymmetry between the regulator and the bank, depending on its competence and ability to gather information. We assume that the supervisor

retrieves a signal imperfectly correlated with the bank's intrinsic quality and that it is able to improve this signal at certain costs. These costs reflect on the one hand the direct costs of devoting more resources to the supervisory task, but on the other hand also the costs attached to increased public concern about the soundness of the inspected bank, when the disclosed information turns out to be bad. In the event that the bank's management is caught shirking, the regulator may react by imposing a punishment to correct this undesired behaviour. The regulator must optimally weigh the costs and benefits of an active prudential supervision policy, which defines an optimal monitoring scheme.

The purpose of this paper is to characterize the optimal contracts offered by the regulator to the credit cooperatives. It is shown that these contracts depend on the accuracy of the supervisor's signal, the likelihood of facing a high quality financial intermediary, and the cost of supervision.

3. THE MODEL

Our analysis sets out from the viewpoint that members of the cooperative credit society need to be protected and represented by a regulator. To protect the interest of members, cooperative societies are placed under state control through registration. While getting registered, a society has to submit details about the members and the business it is to undertake. It has to maintain books of accounts, which are to be audited by government auditors. We consider a regulator-cooperative society two-player hierarchy as a stylized model of a regulated microfinance sector, where the state authority (the principal supervisor) may require the help of a supervising agent (the delegated or auxiliary supervisor) to collect information. The model heavily builds on Giammarino, Lewis, and Sappington (1993), Laffont and Tirole [1993], and Dewatripont and Tirole, (1994). In Giammarino, Lewis, and Sappington (1993), the bank retains its own profits, and the regulator is modelled as presenting a menu of options to the bank, these options linked to the required capital structure depending on the bank's type. Our designed incentive contracts are so to say the "monetary equivalent" of these options.

The specific details of our model are as follows. There are four classes of risk-neutral players: (1) members/depositors that seek loans to finance projects, (2) cooperative credit society that provide intermediation services, (3) a auxiliary supervisor performs certain tasks associated to the supervisory function on behalf of the state authority, and (4) a regulator (the principal supervisor) who is required to insure deposits issued by the cooperative credit society.

The regulation environment is such that the principal supervisor is the residual claimant of the imposed (vertical) hierarchical structure. Every cooperative society in addition to providing services to its member also generates some profit while conducting business. Profits are not earned at the cost of its members. Profit generates is distributed to its members not on the basis of the shares held by the members (like the company form of business), but on the basis of members participation in the business of society. In our model, regulation and supervision of cooperative financial institutions refers to the extent of profit sharing between the regulator, members and cooperative society. In particular, it is assumed that the regulator captures all the profits of the cooperative and compensates the cooperative's management for its exerted effort by offering a contract which specifies a monetary transfer from the regulator to the cooperative society.

The cooperative credit society employs the deposits they receive to finance projects promising a random return, depending on the overall quality of the cooperative's loan portfolio. The cooperative society is able to enhance this overall quality of its loan portfolio

by exerting costly effort. The regulator does not know the cooperative society's exact type in terms of the exogenously given intrinsic quality nor observes its exerted effort. We now turn to each player in more detail.

3.1. The players

3.1.1. Members/Depositors

We assume that each member has access to an investment project. The member is unable to finance the project alone and thus requires an outside source of funding. For simplicity, we assume that cooperative credit society is the only source of funds. Although each investment project requires the same amount of funding from the cooperative credit society, projects differ in their expected returns. We denote by R the average rate of return on all projects financed by the cooperative credit society. If the cooperative society lends a total of L to members who collectively generate an average return of R, the cooperative credit society earns an overall return of RL.

3.1.2. The Cooperative Credit Society

The cooperative credit societies are formed to provide financial support to the members. The society accepts deposits from members and grants them loans at reasonable rates of interest in times of need. Village Service Cooperative Society and Urban Cooperative Bank are examples of cooperative credit society. At the beginning of the period $t = 0$ initial deposits D are used to finance loans L, normalizing $L = D$. In a cooperative society capital is contributed by all the members. However, it can easily raise loans and secure grants from government after its registration.

The Cooperative Society owns no equity. Cooperative is not formed to maximize profit like other forms of business organization. The main purpose of a cooperative society is to provide service to its members. The cooperative credit society offers a standard debt contract to its members at a reasonable price by retaining a small margin of profit. The Cooperative credit society offers an interest rate r to depositors at maturity at $t = 1$. Deposits are not insured and pay zero before maturity. The investment provides an average gross return of RL. The net return on the loans is influenced by the operating economies achieved by the cooperative credit society. We denote by $C(L)$, an increasing, strictly convex function, the cost of processing L of risky loans. Hence the net return on risky loans is $RL - C(L)$. The average gross rate of return R on the loans is random, but its distribution depends on the overall quality q of the loan portfolio. More precisely, higher levels of q shift the distribution of returns in the sense of either first-order stochastic dominance (i.e., reduce the likelihood of low returns) or second-order stochastic dominance (i.e., reduce the variance of returns).

Formally, it is assumed that R is modeled as a random variable with smooth distribution function $G(R/q)$. Technically, we assume the underlying density function has positive support on $\left[\underline{R}, \overline{R}\right]$ and:

The overall quality of cooperative credit society's loan portfolio consists of an exogenous and endogenous part. For simplicity, we assume: $q = q_0 + e$, where q_0 denotes intrinsic quality (exogenous) and e denotes (endogenous) effort exerted by the cooperative's management.

We assume the cooperative credit society knows the exact level of intrinsic quality, while the regulator views intrinsic quality as a random variable on the interval $\left[\underline{q}, \overline{q}\right]$ with

density function $f(q_0)$. And let $F(q_0)$ be the corresponding distribution function, with $\frac{d}{dq_0}\left(\frac{1-F(q_0)}{f(q_0)}\right) \leq 0, \forall q_0 \in [\underline{q}, \bar{q}]$.

The cooperative credit society is able to raise its overall quality above its intrinsic quality by exerting managerial effort e which is costly. We assume that the cooperative management's disutility is given by $\psi(e)$.

The reduction in disutility by lowering effort may represent either the manager's valuation for a low-pressure job of selecting loans or the private benefit received by distributing loans among friends rather than to the best borrowers. A central feature of our model is the cooperative credit society's private information about its influence on the return it receives from the risky projects it finances. The information asymmetry in this model concerns that neither the exact type of the cooperative q_0 nor the exerted effort e is observable to the regulator, but only known to the cooperative.

The expected gross profits on its loan portfolio of a cooperative society are given by:

$$\pi(q_0) = \int_{\underline{R}}^{\bar{R}} [RL(q_0) - C(L(q_0)) - L(q_0)] g(R/q) dR \quad (1)$$

Note that negative gross profits induce default (bankruptcy) since it is assumed that the cooperative society has no own equity. The probability of cooperative society failure as a function of effort is given by $p(e) = \int_{\underline{R}}^{R} g(R/q(q_0) dR$. Finally, realized profits at $t=1$ directly accrue to the regulator. In return the cooperative is compensated for its effort by means of a monetary transfer T. The cooperative society's expected utility U_C amounts to:

$$U_C = T - \psi(e) - P \quad (2)$$

this can be written by

$$U_C(q_0) = T(q_0) - \psi(q - q_0) - P(q_0) \quad (3)$$

Where P denotes the possible punishment imposed on the cooperative society's management by the regulator, whenever suspected of shirking. However, the penalty imposed cannot exceed the net transfer, reflecting the limited liability of the cooperative society's management. We impose $P(q_0) \leq T(q_0)$.

3.1.3. The Delegated monitoring and auxiliary supervision

Generally it is seen that cooperative society does not function efficiently due to lack of managerial talent. The members or their elected representatives are not experienced enough to manage the cooperative society. In our regulatory game the supervisor has the ability to detect false reports of the cooperative society management. In this sense it may prevent the cooperative from shirking since the cooperative faces a penalty if caught lying. Consequently, the costs of regulation may drop and better incentives for low quality cooperative societies may result. Obviously much depend on the supervisor's accuracy to detect shirking behavior. Moreover, it is assumed that the regulator is unable to perform the supervisory task itself.

Indirect supervision is a regulatory regime that is unique to cooperative financial institutions. In this regime an agent (the delegated or auxiliary supervisor) performs certain tasks associated to the supervisory function on behalf of the state authority (the principal supervisor).

This could well be the case because supervision comprise of complex monitoring and auditing activities which require specific skills. Like the regulator the supervisor is uninformed about the cooperative society's true type q_0, but receives a signal θ which is imperfectly correlated with the cooperative society's exerted effort.

The supervisor reports a signal $\theta \in \{q_0, \emptyset\}$ to the regulator. With probability μ the supervisor finds out the true q_0 and with probability $1-\mu$ it finds no new information. This probability μ reflects the signal's precision or accuracy. The supervisor may improve its accuracy, but only by incurring costs. It is assumed that these costs are increasing and convex in μ, $\gamma(\mu) = \frac{\mu^2}{2}$. (4)

3.1.4. The Cooperative Regulator

The inadequacy of capital and various other limitations make cooperative societies dependant on the government for support and patronage in terms of grants, loans subsidies, etc. Due to this, the government sometimes directly interferes in the management of the society and also audits their annual accounts. The regulator's task is to provide deposit insurance while maximizing social welfare. It captures all profits from the cooperative society and designs the contract which it offers to the cooperative's management to compensate for the exerted effort. The contract specifies a monetary transfer T from the regulator to the cooperative, to which the regulator is irrevocably committed to pay just after the returns on the loans materialize at $t=1$. The critical information asymmetry in our model centers on the costs of enhancing the quality of the cooperative credit society's loan portfolio. The functional form of $\psi(e)$ and the relationship between quality and the cooperative society's' efforts ($q = q_0 + e$) are common knowledge. The regulator cannot observe the realization of q_0 nor can the regulator monitor the level of discretionary resources that the manager devotes to quality enhancement. The informational asymmetry implies that no written contract can be contingent on effort directly, but instead must be geared to observable realized total quality of the loan portfolio q.

Without loss of generality, we model the regulator as presenting a menu of linked options $\{q(.), T(.), L(.), P(.)\}$ to the cooperative credit society. The cooperative society is permitted to choose one of these options after observing the environment in which it is operating. Nature chooses the cooperative's type q_0. The cooperative society learns its type. We will denote by $\{q(q_0), T(q_0), L(q_0), P(q_0)\}$ the particular contract that the cooperative will select in equilibrium when q_0 is the realized level of its intrinsic quality. After announcing the contract it has selected, the cooperative society raises the required amount of issues deposits. The funds raised are used to make loans. The cooperative society chooses effort e which determines total quality of the loan portfolio. The supervisor monitors this procedure and prevents the cooperative from operating if the specified quality level is not achieved. If the quality level is achieved, the cooperative remains in operation until $t=1$. The cost of government involvement in the regulation and supervision of cooperative financial institutions is captured by the assumption that the social cost of public funds used to finance the insurance program is $(1+\lambda) > 1$.

Social welfare in our model reflects cooperative credit society profits less the social costs generated by financial distress and social cost of government intervention in the regulation and supervision of cooperative financial institutions. The costs of financial distress are given by the expected negative payoffs during bankruptcy plus the social costs of financial distress which are assumed to be proportional to these losses.

$$C_d(q_0) = (1+b)\int_{\underline{R}}^{R}[RL(q_0) - C(L(q_0)) - L(q_0)]g(R/q(q_0))dR \tag{5}$$

The regulator maximizes expected social welfare W, where

$$W = E[\pi(q_0) - (1+\lambda)(C_d(q_0) + T(q_0) + \gamma(\mu) - P(q_0))] \tag{6}$$

The problem of designing optimal regulation of a single cooperative credit society that has private information on the intrinsic quality of its loan portfolio can be written as:

$$\underset{q,T,L,P}{Max}\int_{\underline{q}}^{\overline{q}}[\pi(q_0) - (1+\lambda)(C_d(q_0) + T(q_0) + \gamma(\mu) - P(q_0))]f(q_0)dq_0 \tag{7}$$

subject to, $\forall q_0, \hat{q}_0 \in [\underline{q}, \overline{q}]$:

$$U_C(q_0, q_0) \geq 0 \tag{8}$$

$$U_C(q_0, q_0) \geq U_C(\hat{q}_0, q_0) \tag{9}$$

The inequalities (8) describe the individual rationality constraints of cooperative society ensure that, for all realizations of intrinsic quality, the cooperative society expects to have nonnegative utility.

The incentive compatibility constraints (9) identify $\{q(q_0), T(q_0), L(q_0), P(q_0)\}$as the contract the cooperative will select when its intrinsic quality level is q_0.

3.2. The Full information benchmark

In this case there are no informational asymmetries. The regulator is able to observe and verify the exact cooperative society's type and its exerted effort. Supervision costs are normalized at zero. The regulator maximizes social welfare in presence of bankruptcy costs. This is the policy that the regulator would implement if he shared the cooperative society's private knowledge of its intrinsic quality level (so that the incentive compatibility constraints were not relevant), and if $\lambda = 0$. Equation (7) can be written:

$$W = \int_{\underline{R}}^{\overline{R}}(-b)[RL(q_0) - C(L(q_0)) - L(q_0)]g(R/q(q_0)dR - \psi(q(q_0) - q_0) - U_C(q_0) \tag{10}$$

The maximizing problem leads to the following proposition.

Proposition 1. Suppose first-order stochastic dominance (FOSD) or second-order stochastic dominance (SOSD) hold. Then the optimal contract under symmetric information is characterized by:

(i): $\forall q_0 \in \left[\underline{q}, \overline{q}\right],\ T(q_0) = \psi(q(q_0) - q_0)$; (11)

(ii): $\int_{\underline{R}}^{\overline{R}} (-b)[RL(q_0) - C(L(q_0)) - L(q_0)] \frac{d}{dq}(g(R/q(q_0))dR) - \psi'(q(q_0) - q_0) = 0$ (12)

(iii): $\int_{\underline{R}}^{\overline{R}} (-b)[R - C'(L^*(q_0) - 1] g(R/q^*(q_0)dR = 0$. (13)

Equation (11) states that at the first-best level of effort, marginal gains of effort and marginal costs of effort are equated. Higher effort induces higher expected utility and lowers the probability of bank failure, but increases the disutility of effort and therefore the required transfer for the cooperative society. The regulator pays the cooperative society just enough to make it accept the contract.

Equation (12) identifies the first-best level of quality for the cooperative's loan portfolio. Increases in quality increase the expected cash flows of the cooperative and reduce the probability of failure. At the first-best level of quality, these marginal gains are equal to the marginal costs of additional quality $\psi'(.)$.

The optimal level of loan activity reflects the usual trade-off between the expected benefits from debt and the social costs of bankruptcy.

4. OPTIMAL REGULATION UNDER INCOMPLETE INFORMATION

In this case, it is assumed that the regulator faces adverse selection and moral hazard. In designing the contract, the regulator cannot condition on effort directly, so transfers have to be made a function of total realized quality (q) of the cooperative's loan portfolio. The regulator is concerned with limiting the cooperative society's information rents because these rents are paid with the distortionary tax system. The regulator must now weigh the gains form inducing optimal effort against the costs of leaving a rent. Using the revelation principle, we may restrict ourselves to so-called direct revelation mechanisms which have to fulfil the incentive compatibility constraints.

The Envelope Theorem to applied to the maximization of (7) with respect to $\hat{q}_0$ implies that

$$\left.\frac{dU_C}{d\hat{q}_0}\right|_{\hat{q}_0 = q_0} = \psi'(q(q_0) - q_0) \quad (14)$$

From (14), $U_C(q_0)$ is strictly creasing in q_0. So the individual rationality constraint is satisfied if $U_C(\underline{q}) \geq 0$. Integrating (14) yield:

$$U_C(q_0) = U_C(\underline{q}) + \int_{\underline{q}}^{q_0} \psi'(q(\tilde{q}), \tilde{q}) d\tilde{q} \quad (15)$$

Using (15), the regulator's objective function can then be written:

$$W = \int_{\underline{q}}^{\bar{q}} [\pi(q_0) - (1+\lambda)(C_d(q_0) + \int_{\underline{q}}^{q_0} \psi'(q(\tilde{q}) - \tilde{q}) d\tilde{q} + \psi(q(q_0) - q_0) + \gamma(\mu))] f(q_0) dq_0 \tag{16}$$

$$- (1+\lambda) U_C(\underline{q})$$

Because $U_C(\underline{q})$ may be set equal to zero without loss of generality, and $F(\underline{q}) = 0$, after integrating by parts (16) can then be written:

$$W = \int_{\underline{q}}^{\bar{q}} \left\{ \int_{\underline{R}}^{\bar{R}} [RL(q_0) - C(L(q_0)) - L(q_0)] g(R/q(q_0) dR \right.$$

$$- (1+\lambda)[(1+b) \int_{\underline{R}}^{\bar{R}} [RL(q_0) - C(L(q_0)) - L(q_0)] g(R/q(q_0) dR + \gamma(\mu) + \psi(q(q_0) - q_0)] \tag{17}$$

$$\left. - (1+\lambda)\psi'(q(q_0) - q_0) \frac{1 - F(q_0)}{f(q_0)} \right\} f(q_0) dq_0$$

The optimal incentive contract is the solution of the pointwise maximization of W with respect to q and L. The results to follow are similar of those Giammarino, Lewis, and Sappington (1993).

4.1. The Optimal incentive contract without supervision

The next proposition reports how the information asymmetry and the social cost of government financing combine to induce departures from the first-best solution.

Proposition 2. Suppose first-order stochastic dominance (FOSD) or second-order stochastic dominance (SOSD) hold. Then the optimal contract under asymmetric information without supervision is characterized by:

(i): $$T(q_o) = \psi(q(q_0) - q_0) + P(q_0) + \int_{\underline{q}}^{q_0} \psi'(q(\tilde{q}) - \tilde{q}) d\tilde{q} \; ; \tag{18}$$

(ii) $$\int_{\underline{R}}^{\bar{R}} [1 - (1+\lambda)(1+b)][RL(q_0) - C(L(q_0)) - L(q_0)] \frac{d}{dq} (g(R/q(q_0)) dR)$$

$$- (1+\lambda)\psi'(q(q_0) - q_0) = (1+\lambda)\psi''(q(q_0) - q_0) \frac{1 - F(q_0)}{f(q_0)} \tag{19}$$

(iii): $$\int_{\underline{R}}^{\bar{R}} [1 - (1+\lambda)(1+b)][R - C'(L^*(q_0) - 1] g(R/q^*(q_0) dR = 0 \, . \tag{20}$$

Proposition 2 shows a familiar result in incentive theory (Laffont and Tirole (1986), (1993)). The informational rents of the cooperative cannot be completely eliminated when the cooperative has private knowledge of q_0 (see equation (19)). Proposition 2 reports how the information asymmetry and the social cost of government financing combine to induce departures from the first-best solution. The departures are designed to limit any gains the credit cooperative might anticipate from understating its intrinsic quality level by choosing from the menu of contracts one that, in equilibrium, will be selected by the credit cooperative when a smaller value of q_0 is realized.

Equation (18) identifies the primary deviation from the first-best solution that the regulator implements is a reduction in the final level of quality that the credit cooperative will achieve for all but the credit cooperative with the highest realization of intrinsic quality. Quality distortions are common in incentive problems of this type. The reduced quality limits the gains to the credit cooperative from understating its intrinsic quality.

4.2. The Optimal incentive contract with supervision

Supervision can either be financed through contributions by the financial institutions under supervision or from the national budget. An advantage of the latter option is that the financial institutions cannot use their contributions to pressure the supervisory agency. Employing a supervising agency enables the government to reduce the costs of regulation which are caused by leaving the high quality cooperative credit society an informational rent. Reducing this informational rent consequently leads to a smaller distortion in the effort level of the low quality cooperative, which in turn reduces the probability of credit cooperative failure. The regulator obtains a truthful report from the supervisor who is able to retrieve a signal about the cooperative's exerted effort.

Because of the possibility that new valuable information is retrieved with probability μ, the incentive compatibility constraint must be modified.

$$T(q_0)-\psi(q(q_0)-q_0)\geq(1-\mu)(T(\hat{q}_0)-\psi(q(\hat{q}_0)-q_0)+\mu(T(\hat{q}_0)-\psi(q(\hat{q}_0)-q_0)-P(\hat{q}_0)) \tag{21}$$

Obviously, since the supervisor cannot collude with the credit cooperative, the optimal punishment is the maximal one, that is, $P(\hat{q}_0)=T(\hat{q}_0)$. Moreover there is no use in supervising when observing a high overall quality. In equilibrium, high overall quality reflects high effort under incentive compatibility. We do not consider the possibility of sending the supervisor on a random basis when observing low overall quality; see Kofman and Lawarrée (1993) on this topic.

Given μ, the maximizing problem becomes:

$$\max_{q,T,L,P}\int_{\underline{q}}^{\bar{q}}[\pi(q_0)-(1+\lambda)(C_d(q_0)+T(q_0)+\gamma(\mu)-P(q_0))]f(q_0)dq_0 \tag{22}$$

subject to:

$$T(q_0)\geq\psi(q(q_0)-q_0) \tag{23}$$

$$T(q_0)-\psi(q(q_0)-q_0)\geq(1-\mu)(T(\hat{q}_0)-\psi(q(\hat{q}_0)-q_0)-\mu(\psi(q(\hat{q}_0)-q_0)) \tag{24}$$

The Lagrangian of this program reads:

$$L(q,L,T,P)=\int_{\underline{q}}^{\bar{q}}[\pi(q_0)-(1+\lambda)(C_d(q_0)+T(q_0)+\gamma(\mu)-P(q_0))]f(q_0)dq_0$$

$$+\eta(T(q_0)-\psi(q(q_0)-q_0) \tag{25}$$

$$+\kappa[T(q_0)-\psi(q(q_0)-q_0)-(1-\mu)(T(\hat{q}_0)-\psi(q(\hat{q}_0)-q_0)+\mu\psi(q(\hat{q}_0)-q_0)]$$

A solution of this problem is giving in the following proposition.

Proposition 3. Suppose first-order stochastic dominance (FOSD) or second-order stochastic dominance (SOSD) hold with $T(\hat{q}_0)=P(\hat{q}_0)$. Then the optimal incentive contract with supervision is characterized by:

(i): $T(q_o)=\psi(q(q_0)-q_0)$; (26)

(ii): $P(\hat{q}_0)=T(\hat{q}_0)=\dfrac{1}{1-\mu}\psi(q(\hat{q}_0)-q_0)$; (27)

(iii):
$$\int_{\underline{R}}^{\bar{R}}[1-(1+\lambda)(1+b)][RL(q_0)-C(L(q_0))-L(q_0)]\frac{d}{dq}(g(R/q(q_0))dR)$$
$$-\eta\psi'(q(q_0)-q_0)+\kappa[-\psi'(q(q_0)-q_0)-(1-2\mu)\psi'(q(\hat{q}_0)-q_0)]=0 \tag{28}$$

(iv): $\int_{\underline{R}}^{\bar{R}}[1-(1+\lambda)(1+b)][R-C'(L^*(q_0)-1]g(R/q^*(q_0)dR=0$. (29)

From Proposition 3 it immediately follows that the effort level is increasing in the probability μ (see Equation 27). Hence, as the accuracy of supervision improves, the distortion of the effort becomes smaller. Obviously, we have $\psi(q(q_0)-q_0)=\psi(q(\hat{q}_0)-q_0)$ for $\mu=0$ (no value of supervision).

5 CONCLUSIONS

In this paper, we introduced a framework for designing and analyzing the properties of the optimal regulation of a single credit cooperative that has private information on the intrinsic quality of its loan portfolio (adverse selection) and where the cooperative's choice of effort to improve this quality cannot be observed by the regulator (moral hazard).

In designing the contract the regulator faces a trade off between inducing proper incentives and the costs of regulation as a consequence of informational asymmetries. This may create a demand for information gathering. If observed overall quality is low the regulator may decide to use a supervising agency. The supervisor collects information and retrieves a signal about the cooperative's intrinsic quality, however not with perfect certainty.

By incurring costs, the supervisor is able to punish the cooperative's management if caught lying. In designing optimal contracts the regulator trades off incentives for efficient cooperative against costs of regulation.

Our analysis here of the optimal contracts specifies monetary transfers from the regulator to the credit cooperative. These monetary transfers are not commonly observed in practice. In the first-best solution, the regulator is able to observe and verify the exact cooperative society's type and its exerted effort. Supervision costs are normalized at zero. The regulator maximizes social welfare in presence of bankruptcy costs. Higher effort induces higher expected utility and lowers the probability of bank failure, but increases the disutility of effort and therefore the required transfer for the cooperative society. The regulator pays the cooperative society just enough to make it accept the contract. Increases in quality increase the expected cash flows of the cooperative and reduce the probability of failure. At the first-best level of quality, these marginal gains are equal to the marginal costs of additional quality. The optimal level of loan activity reflects the usual trade-off between the expected benefits from debt and the social costs of bankruptcy

The informational rents of the cooperative cannot be completely eliminated when the cooperative has private knowledge of intrinsic quality of portfolio. Proposition 2 reports how the information asymmetry and the social cost of government financing combine to induce departures from the first-best solution. The departures are designed to limit any gains the credit cooperative might anticipate from understating its intrinsic quality level by choosing from the menu of contracts one that, in equilibrium, will be selected by the credit cooperative when a smaller value of intrinsic quality is realized. Quality distortions are common in incentive problems of this type. The reduced quality limits the gains to the credit cooperative from understating its intrinsic quality.

The probability of cooperative financial institutions failure is the same for all realization of intrinsic quality (Compare equation (13), (20) , and (29)).

Our study abstracts form several factors that could be included in future research. First, although the interaction between regulator and credit cooperatives is not repeated, qualitative conclusions will continue to hold in many settings with repeated play. Second, we characterize information disclosure by the optimal monitoring scheme. However, the decision whether or not to bring out the information found by the supervisor to the public is not really modelled. The optimal regulation policies in these situations merit further investigation.

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