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INCENTIVES, SUPERVISION, AND REGULATION OF MICROFINANCE INSTITUTIONS IN DEVELOPING COUNTRIES

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Abstract: This paper examines the optimal regulation of a microfinance institution (MFI) that possesses private information about the intrinsic quality of its loan portfolio (adverse selection) and exerts unobservable effort to improve this quality (moral hazard). The regulator, in designing optimal contracts, must balance the trade-off between incentivising efficient MFIs and the regulatory cost of providing information rents to high-quality MFIs. We derive the conditions under which optimal incentive contracts can be designed and demonstrate that these contracts depend on the accuracy of supervisory signals, the probability of encountering a high-quality MFI, and the cost of supervision. Importantly, since enhancing supervisory accuracy is itself costly, the optimal monitoring scheme generally allows for a positive probability of MFI failure. The structure of information disclosure is determined by the nature of this optimal monitoring arrangement.

Keywords: Microfinance institution, adverse selection, moral hazard, regulation, supervision, optimal incentive contracts.

JEL Classification: D82, G10, G21, G28

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1. INTRODUCTION

Microfinance—i.e., the provision of financial services to low-income households and micro and small enterprises (MSEs)—offers enormous potential to support the economic activities of the poor and thus contribute to poverty alleviation (Cull *et al*., 2009a). Widespread experiences and research have demonstrated the importance of savings and credit facilities for the poor and MSEs. This underscores the importance of the sound development of microfinance institutions (MFIs) as vital components of investment, employment, and economic growth. Within the framework of a financial system approach, adequate regulation and supervision of the microfinance industry are increasingly gaining attention to ensure the safety of the poor's deposits.

The question of regulating microfinance has been frequently raised in recent years, particularly in relation to the institutionalisation of MFIs, which often highlights gaps or the absence of an appropriate regulatory framework. A paper published in the Microfinance Series *Consensus Guidelines* by CGAP (*Guiding Principles on Regulation and Supervision of Microfinance*, 2011) makes an important contribution by reviewing the state of current thinking, drawing lessons from existing experiences, and assessing the level of consensus on the topic. Above all, it addresses the issue of supervision—often overlooked but essential—as it pertains to the mechanisms needed to enforce regulation.

Nowadays, microfinance is demonstrating a great expansion, specifically in developing countries (Morshed *et al*., 2020; Bansah & Adjei, 2023; Gupta & Sharma, 2023). This expansion in scale and services increases the need for regulation and supervision. The concern of the regulatory authority is the security of the people's deposits and the soundness of the financial market (Chen & Divanbeigi, 2019).

Generally, the main justifications of regulatory interventions are market imperfections. Concerning the financial market, imperfections are identified by adverse selection and moral hazard behaviour as a result of asymmetric information between the parties (Rochet, 1992). Microfinance institutions and their activities, as a relatively new part of the financial system, represent a set of particular characteristics that enhance the need for regulation and supervision even further (Van Gruening *et al*., 1999).

Interest in the regulation and supervision of MFIs has arisen from their growth and their desire to mobilise deposits. The debate surrounding whether MFIs should be regulated and supervised lies in the belief that through regulation, they will become self-sustainable and achieve massive outreach (Cuevas & Fischer, 2006; Berenbach & Churchill, 1997). Through regulation, MFIs can also be integrated into the formal financial sector (Chen & Divanbeigi, 2019). In some developing countries, MFIs have grown to such an extent that the failure of one could result in the loss of confidence in the financial sector, thus attracting regulatory concern.

Regulation is defined by Christen, Lyman, and Rosenberg (2003) as "the set of binding rules governing the conduct of legal entities and individuals, whether they are adopted by a legislative body (laws) or an executive body (regulations)." Moreover, the government is not necessarily the only possible regulatory authority; the term "regulation" can also refer to self-regulation by groups of institutions through associations or networks (Chavez & Gonzalez-Vega, 1993).

Although the terms *regulation* and *supervision* are sometimes used interchangeably, *supervision*, by contrast, refers to external oversight aimed at determining and enforcing compliance with regulation (Vogel *et al.*, 2000). It is implemented through examination practices and monitoring mechanisms that assess the actual risks faced by financial intermediaries. Llewellyn (1986) defines supervision as the process of monitoring whether institutions are conducting their business in accordance with regulations or, more broadly, in a prudent manner. Therefore, regulation typically refers to the rules governing the behaviour of financial institutions, whereas supervision refers to the oversight that ensures compliance with those rules. This distinction becomes especially important when regulatory and supervisory functions are assigned to different agencies, as this may have different policy implications.

Before analysing the various issues involved in implementing a sound regulatory structure, it is essential to distinguish between *prudential* and *non-prudential* regulation. Regulation is considered prudential when it governs the financial soundness of licensed intermediaries, aiming to prevent financial system instability and protect small, unsophisticated depositors from losses. Although this paper focuses on prudential regulation, it is important to note that not all regulatory objectives require prudential measures.

Indeed, non-prudential regulatory issues include consumer protection, fraud and financial crime prevention, interest rate policies, licensing, and tax and accounting compliance (Christen *et al*., 2003). Non-prudential regulation complements prudential regulation but is no less important—particularly in the microfinance sector, which is highly sensitive to consumer protection and interest rate policies due to its focus on low-income populations. While prudential regulation focuses on the safety and soundness of financial institutions, it indirectly serves consumer protection by safeguarding depositors in the event of institutional failure, even if systemic consequences are absent (Llewellyn, 1999). When regulation is discussed in the context of MFIs, it is usually in reference to banking-type regulations, commonly termed *prudential regulation*. Although MFIs have different characteristics and risk profiles compared to traditional financial institutions like banks, deposit-taking MFIs most closely resemble banking institutions.

A current debate in banking regulation centres on the role of information disclosure and the optimal degree of prudential supervision, both of which significantly affect banks' behaviour and financial soundness. The intuition behind supervision and public disclosure of information regarding a bank's risk profile and efficiency is that it may encourage depositors to monitor its performance more carefully, thereby providing management with stronger incentives to engage in less risky activities.

Previous research on microfinance regulation and prudential supervision has largely focused on the relationship between financial performance and regulation, often treating outreach as a secondary concern (see Cull *et al*., 2009b; Ndambu, 2011). These studies have examined the impact of regulation on financial intermediaries, including microfinance institutions (MFIs), across a wide range of countries, providing insights that go beyond anecdotal evidence. Hartarska (2005) found that regulated MFIs in Central and Eastern Europe and the Newly Independent States exhibit lower returns on assets compared to unregulated institutions and provided weak evidence of a link between regulation and outreach breadth. Further, after controlling for the endogeneity of regulation, Hartarska and Nadolnyak (2007) applied a positive analytical approach to assess whether regulated MFIs achieve better sustainability and outreach than their unregulated counterparts. They found no significant impact of regulation on financial performance, and only weak evidence suggesting that regulated MFIs serve fewer poor borrowers. Their policy conclusion was that transforming MFIs into regulated financial intermediaries may not necessarily lead to improved financial results or outreach. However, they did find that institutions authorised to collect savings reached a larger number of borrowers, indicating that regulation may have an indirect benefit by enabling deposit mobilisation.

Elzahi Saaid Ali (2022) investigated the effect of regulation on the sustainability and outreach of MFIs in Sub-Saharan Africa (SSA), using unbalanced panel data from 30 countries between 2002 and 2012 and applying a multilevel estimation technique. He concluded that regulation supports improvements in both sustainability and the breadth of outreach, though not necessarily in depth. Furthermore, MFIs accepting deposits demonstrated better sustainability but tended to serve the marginal poor. The study also found that regulatory quality positively influences both outreach and sustainability.

Zainal *et al.* (2020) explored the effects of regulation and supervision on the social and financial efficiency of MFIs in ASEAN-5 countries. Their findings showed that while bank regulation negatively influenced social efficiency, bank supervision positively affected financial efficiency. These results offer important insights for bank regulators and policymakers aiming to design regulatory frameworks tailored to MFI operations.

This paper analyses the role of prudential supervision and information disclosure as regulatory instruments, and their effects on MFIs' performance—particularly in terms of incentives and effort. Here, information disclosure is conceptualised as the optimal monitoring scheme implemented by the supervisory authority, weighing all associated costs and benefits. Theoretical literature in banking (see Freixas & Rochet, 1998) has extensively discussed the role of banks as delegated monitors and as entities responsible for extracting information from firms. These intermediation roles help mitigate agency and informational failures in capital markets. However, such intermediation introduces new agency problems, such as moral hazard, which in turn necessitate external supervision (see Dewatripont & Tirole, 1994). Our analysis assumes that small depositors and investors require protection and representation by a banking regulator. We conceptualise a two-tier regulatory structure in the microfinance sector, where a regulator may engage a supervisory agency to collect information.

This paper also builds upon models developed by Kofman & Lawarrée (1993), Laffont & Tirole (1993), and Giammarino, Lewis & Sappington (1993). We address both imperfect monitoring and incentive problems by explicitly modelling the profit-maximising behaviour of MFIs, which possess superior information about their environment and activities compared to regulators. MFI regulation is thus viewed as a form of profit-sharing between the regulator and the institution. In our model, the regulator captures all MFI profits and compensates management for its effort through a contract specifying monetary transfers from the regulator to the MFI.

Unlike Giammarino, Lewis, and Sappington (1993), where the bank retains its profits and the regulator offers a menu of capital-based options, we assume no initial equity, which reflects the reality of many MFIs in developing countries that operate with limited resources. Furthermore, our model incorporates donor or government investment. We demonstrate that a supervisory agency can assist the regulator in reducing information asymmetry, thereby lowering distortions in effort and reducing informational rents. Our analysis of the optimal contract details the monetary transfers required from the regulator to the MFI.

This paper is organised as follows: Section 2 specifies the model and characterises the optimal contract under full information. Section 3 derives the optimal contract under both supervision and no supervision scenarios. Section 4 presents a numerical example to illustrate the findings. Section 5 concludes.

2. THE MODEL AND BENCHMARK SOLUTIONS

2.1. Central Elements of the Model

In our model, we considered both adverse selection and moral hazard. The MFI attracts deposits at a fixed interest and invests these in projects promising a random return, depending on the overall quality of the MFI's loan portfolio. The MFI is able to enhance the overall quality of its loan portfolio by exerting costly effort. The regulator does not know the MFI's exact type in terms of the exogenously given intrinsic quality, nor observes its effort.

2.1.1. The MFI

At the beginning of the period, $t = 0$ initial deposits, $D_0 \geq 0$ and donors and/or government investment I are used to finance loans, L_0, that is $L_0 = D_0 + 1$. It is assumed that the MFI owns no equity. Without loss of generality, the MFI offers a standard debt contract that pays r per unit of deposit and investment at maturity at $t = 1$. Deposits are not insured and pay zero before maturity. We denote by $C(L_0)$, an increasing, strictly convex function, the cost of processing L_0 of risky loans. Let R be the average rate of return on all projects financed by the MFI. Hence, the net return on risky loans is $RL_0 - C(L_0)$.

We assume that each borrower has access to an investment project. The borrower is unable to finance the project alone and thus requires an outside source of funding. For simplicity, we assume that MFIs are the only source of funds. Although each investment project requires the same amount of funding from the MFI, projects differ in their expected returns. The average rate of return R on all projects financed by the MFI 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 first-order stochastic dominance (FOSD), that is, reduce the likelihood of low returns. Formally, R is the realisation of a random variable that is distributed with a cumulative density function $f(R/q)$ and a continuous and differentiable density $f(R/q)$ over the support $\left[(\underline{R}/q),(\overline{R}/q)\right]$.

The overall quality of the MFI's loan portfolio consists of an exogenous and an endogenous part. For simplicity, we assume that $q = q_0 + e$, where q_0 denotes exogenous quality and e denotes effort exerted by the MFI's management. Exogenous quality q_0 can take only two values, q_0^l and q_0^h , with $\Delta q_0 = q_0^h - q_0^l > 0$, where q_0^l obtains with probability v and q_0^h with probability $1 - v$. Hence, this defines two types of MFI: the high-quality MFI and the low-quality MFI. Following Giammarino, Lewis and Sappington (1993), the exogenous (intrinsic) quality captures all factors that are beyond the bank's control, such as prevailing economic conditions or relevant characteristics of its customers. The bank/MFI can raise its overall quality q by exerting managerial effort e which decreases the marginal cost for a disutility $\psi(e)$ ($\psi' > 0, \psi'' > 0, \psi''' \geq 0$).

The crucial information asymmetry in this model concerns the exact type of the bank/MFI q_0 nor the exerted effort e is observable to the regulator, but only known to the bank/MFI. However, overall quality q and realised gross profits are publicly observable and verifiable.

We assume that the regulator is benevolent and wishes to maximise social welfare. In doing so, he can provide transfers to the firm, say *t*. These transfers are raised with distortive taxes, which create a social cost $\lambda > 0$.

The expected gross profit on its loan portfolio of a quality-*i* MFI as a function of effort is given by:

$$\pi_i(e) = \int_{\max\{r, \underline{R}/q(q_0^i, e)\}}^{\overline{R}/q(q_0^i, e)} [RL_0 - C(L_0) - rL_0] f(R/q) dR \tag{1}$$

Note that negative gross profits induce default, as it is assumed that the MFI has no equity of its own. The probability of MFI failure as a function of effort is given by:

$$p_i(e) = \int_{\min\{r, \underline{R}/q(q_0^i, e)\}}^{r} f(R/q(q_0^i)) dR \tag{2}$$

It follows that a high-quality MFI needs to exert less effort than a low-quality MFI to avoid MFI failure. That is given by, $p_l(e) \geq p_h(e)$ for all $e \geq 0$.

Finally, realised profits for the period $t = 1$ directly accrue to the regulator. In return, the MFI is compensated for its effort by means of a monetary transfer, *t*. The MFI's expected utility U_{MFI} amounts to

$$U_{MFI} = t_i - \psi(e_i) - E[P] \tag{3}$$

where *P* denotes the possible punishment imposed on the MFI's management by the regulator, whenever suspected of shirking. However, the penalty imposed cannot exceed the net transfer, reflecting the limited liability of the MFI's management. That is, we impose $P \leq t$.

2.1.2. The Supervisor

Informational asymmetries induce a loss of control for the MFI regulator and limit the effectiveness of its regulatory policy. This loss of control may be mitigated by collecting MFI-specific information, creating the need for active prudential supervision. A supervising agency, acting on behalf of the MFI regulator, may be able to resolve the informational asymmetries between the regulator and the MFI, depending on its competence and ability to gather information. We assume that the supervisor retrieves a signal imperfectly correlated with the MFI's intrinsic quality and that it can 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 MFI, when the disclosed information turns out to be bad. In the event that the MFI's management is caught shirking, the regulator may react by imposing a punishment to correct this undesired behaviour.

In our regulatory game, the supervising agency can detect false reports of the MFI's management. In this sense, it may prevent the MFI from shirking since the MFI faces a penalty if caught lying. Consequently, the costs of regulation may drop, and better incentives for low-quality MFIs may result. Obviously, much depends on the supervisor's accuracy in detecting shirking behaviour. Moreover, it is assumed that the regulator is unable to perform the supervisory task itself. This could well be the case because supervision comprises complex monitoring and auditing activities, which require specific skills. Like the regulator, the supervisor is uninformed about the MFI's true type q, but receives a signal σ which is imperfectly correlated with the MFI's exerted effort. This imperfect correlation reflects that a supervising agency probably has no access to all relevant material concerning the MFI's performance; it is only able to examine a sample of the MFI's files and records on which it bases its report to the regulator. It is assumed that the bank also observes the signal σ; the MFI knows which records and files were examined. The supervisor is assumed to always report truthfully.

The supervisor reports a signal σ, $\sigma \in \{q, \varnothing\}$ to the regulator. The supervisor observes $\sigma = q_0$ with probability ξ and nothing with probability $1-\xi$.

So, $\Pr(\sigma = \varnothing) = 1 - \xi$ and $\Pr(\sigma = \varnothing) = 1 - \xi$. The presence of the supervisor tilts the regulatory contract towards higher-powered incentives. This probability ξ 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 ξ, which we model by

$$C_s(\xi) = \frac{\xi^2}{2} \tag{4}$$

These costs may arise from both direct and indirect sources. Direct costs involve the allocation of additional human resources to improve monitoring and auditing. Indirectly, more accurate disclosure of information may trigger public concern if it reveals 'bad news'—for instance, indications of shirking by the MFI's management.

2.1.3. The Regulator's Problem

The role of the regulator is to maximise social welfare. It captures all profits from the MFI and designs the contract which it offers to the MFI's management to compensate for the exerted effort. The contract specifies a monetary transfer t from the regulator to the MFI, to which the regulator is irrevocably committed to pay just after the returns on the loans materialise at $t = 1$. More important is the informational restriction that, although the regulator can, in fact, verify the overall quality q of the loan portfolio, it cannot discern between its individual components, effort e and type q_i. The cost function $\psi(e)$ and the functional relation between overall quality and effort, i.e. $q = q_0 + e$, are common knowledge. The informational asymmetry implies that no written contract can be contingent on effort directly, but instead must be geared to observable realised overall quality.

Social welfare in our model reflects the sum of surplus in society: the consumer's net welfare, the manager's utility and expected MFI profits minus the costs generated by financial distress and costs of supervising. The costs of financial distress are given by the expected negative pay-offs during bankruptcy, plus the social costs of financial distress, which are assumed to be proportional to these losses. (A similar formulation was given by Giammarino *et al.*, 1993). That is, for $i = l, h$,

$$c_i(e) = (1+b)\int_{\min\{r,\underline{R}/q(q_0^i,e)\}}^{r} [RL_0 - C(L_0(q_0)) - rL_0(q_0)]f(R/q(q_0))dR\,,\; b>0 \tag{5}$$

where the parameter b is the proportion of the cost of financial distress.

Let q be the level of overall quality which brings to consumers a utility $S(q)$ with $S' > 0, S'' < 0$. The cost of government involvement in the regulation and supervision of MFIs is captured by the assumption that the social cost of public funds used to finance the insurance program is $(1+\lambda) > 1$. The regulator's objective is to maximise social welfare. The social welfare reflects the sum of consumers' net utility and MFI's utility.

The regulator maximises expected social welfare W, where:

$$W = E[S(q) - (1+\lambda)(c + t + C_S - \pi - P) + U] \tag{6}$$

We assume that the benevolent regulator is utilitarian. The writing of (6) emphasises the fact that giving up a rent π to the bank/MFI is socially costly because it requires funding with taxes, which creates a deadweight loss.

Timing of Events

The timing of the regulatory game is now as follows:

At t = 0:

- The MFI finance the investment project $L_0 = D_0 + I$.
- Nature chooses the MFI's type q. The MFI learns its type.
- The regulator offers a contract specifying a transfer $t(q, \sigma)$ to the MFI as a function of the observed overall quality and the reported signal; the probability ξ of the signal $\sigma = q$, the reimbursement of costs $C_S(\xi)$ to the supervisor, and the punishment P for the management.
- The regulator, (the supervisor) and the MFI sign the contract. The MFI chooses effort e which determines overall quality q.
- If sent by the regulator, the supervisor retrieves the signal σ.

At t = 1:

- Return on the loan portfolio materialises and transfers t are realised; the MFI pays r to depositors and investors if $RL_0 - C(L_0) > rL_0$, otherwise it goes bankrupt and the regulator ceases its residual income.

2.2. The Benchmark Solution

We first introduce a benchmark model, where there are no informational asymmetries. It serves two purposes. On the one hand, it constitutes the foundation of the more general model. On the other hand, it allows us to assess the role of the supervisor. In this case, the regulator is able to observe and verify the exact MFI's type and its exerted effort. Supervision and disclosure play no role in this setting. In the first-best case, the regulator maximises

$$\max_{e_l, e_h, t_l, t_h} v\{S(q(e_l)) - (1+\lambda)(c_l(e_l) + t_l - \pi_l(e_l)) + U_l\}$$
$$+(1-v)\{S(q(e_h)) - (1+\lambda)(c_h(e_h) + t_h - \pi_h(e_h)) + U_h\} \tag{7}$$

subject to

$$t_l \geq \psi(e_l) \text{ and } t_h \geq \psi(e_h) \tag{8}$$

The inequalities (8) describe the individual rationality constraints for both types of MFI ($U_l(e_l) \leq 0$ and Uh(eh) ≥ 0). These constraints state that the MFI need to at least be compensated for the cost of its exerted effort. Without loss, its reservation utility is normalised at zero. The benchmark solution is the policy that the regulator would implement if he shared the MFI's private information about the intrinsic quality level. Maximising social welfare under participation constraint leads to the following proposition.

Proposition 1. *The optimal contract under symmetric information is characterised by:*

$$\psi'(e_i^*) = \frac{1}{1+\lambda} S'(q(e_i^*)) + \pi_i'(e_i^*) - c_i'(e_i^*) \quad i = l, h \tag{9}$$

The corresponding transfers are given by:

$$t_i^* = \psi(e_i^*), \qquad p_i = 0 \tag{10}$$

Proposition 1 states that at the first-best level of effort, marginal gains and marginal costs of effort are equated. Higher effort induces higher expected profits and lowers the probability of MFI failure, but increases the disutility of effort and therefore the required transfer for the MFI.

The regulator pays the manager of MFI just enough to make it accept the contract. That is, the individual rationality constraints are binding for both types of MFIs. In essence, without adverse selection, the moral hazard problem is solved by making the MFI the residual claimant for its own actions. Then, obviously, the MFI chooses the right effort. The probability of MFI failure is zero $p_i = 0$ $i = l, h$ whatever the type of MFI.

3. THE OPTIMAL INCENTIVE CONTRACT WITH INFORMATIONAL ASYMMETRY

In this case, it is assumed that the regulator faces adverse selection and moral hazard; the regulator cannot discern between the MFI's exact type and its effort level. In designing the contract, the regulator cannot condition on effort directly, so transfers have to be made as a function of the total realised quality q of the MFI's loan portfolio. In general, adverse selection allows the high type to enjoy a positive informational rent from its interaction with the regulator, since it can always claim to be of low type, thereby economising on costly effort. Hence, regulation becomes costly, the regulator must weigh the gains from inducing optimal effort against the costs of leaving a rent.

3.1. The Optimal Incentive Contract without Supervision

Now, the regulator maximises

$$\max_{e_l, e_h, t_l, t_h} v\left\{S(q(e_l)) - (1+\lambda)(c_l(e_l) + t_l - \pi_l(e_l)) + U_l\right\}$$
$$+(1-v)\left\{S(q(e_h)) - (1+\lambda)(c_h(e_h) + t_h - \pi_h(e_h)) + U_h\right\} \tag{11}$$

subject to

$$t_l \geq \psi(e_l) \text{ and } t_h \geq \psi(e_h) \tag{12}$$

$$t_l - \psi(e_l) \geq t_h - \psi(e_h - \Delta q_0) \text{ and } t_h - \psi(e_h) \geq t_l - \psi(e_l + \Delta q_0) \tag{13}$$

Inequalities (13) describe the incentive compatibility constraints. These constraints amount to saying that the contract designed for the high (low) quality MFI is the one preferred by the high (low) quality MFI. Incentive compatibility induces self-selection. In essence, by choosing its preferred contract, the bank reveals its type to the regulator. Using the revelation principle, we may restrict ourselves to so-called direct revelation mechanisms which have to fulfil the incentive compatibility constraints.

Let $\phi(e) = \psi(e) - \psi(e - \Delta q_0)$. It is an increasing convex function from our previous assumptions. The incentive constraints can be rewritten:

$$U_l(e_l) \geq U_h(e_h) + \phi(e_h) \text{ and } U_h(e_h) \geq U_l(e_l) - \phi(e_l + \Delta q_0) \tag{14}$$

Optimal regulation is then obtained by maximising expected social welfare under the incentive and participation constraints. It is well known (see Laffont & Tirole, 1986) that, in such a program, the participation constraint of the low-effort bank/MFI ($U_l(e_l) \geq 0$) and the incentive constraint of the high-effort bank/MFI (14) are the binding ones. 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. *The optimal contract under asymmetric information without supervision is characterised by:*

$$\psi'(e_l^{**}) = \frac{1}{1+\lambda} S'(q(e_l^{**})) + \pi_l'(e_l^{**}) - c_l'(e_l^{**}) + \frac{\lambda}{1+\lambda} \frac{(1-\nu)}{\nu} \phi'(e_l^{*} + \Delta q_0) \quad (15)$$

and

$$\psi'(e_h^{**}) = \frac{1}{1+\lambda} S'(q(e_h^{**})) + \pi_h'(e_h^{**}) - c_h'(e_h^{**}) \quad (16)$$

The corresponding transfers are given by:

$$t_l^{**} = \psi(e_l^{**}) \quad (17)$$

and

$$t_h^{**} = \psi(e_h^{**}) - \phi(e_l^{**} + \Delta q \ ) \quad (18)$$

Following this proposition, under asymmetric information, the high type exerts the first-best level of effort and obtains a positive informational rent, while the low type's effort level is distorted away from the first-best level and obtains no rent (see also, Laffont & Tirole, 1986, 1993). In this case, the individual rationality constraint of the low-quality MFI and the incentive compatibility constraint of the high-quality MFI are binding. From (17), we see that for the high-quality MFI, we obtain the same effort level as under complete information (see equation (9)), and from (18), the rent of high type is given by $\phi(e_l^{**})$ and is increasing in the low type's effort level ($\phi(e)$ is an increasing convex function). On the contrary from (15) and (17), we see that the effort level of low-quality MFI is distorted downwards, and obtains no rent. The intuition for the distortion in (15) is then clear. The ability of the high-quality MFI to mimic the low type (due to the existence of asymmetric information) forces the regulator to leave a rent if it wishes to have an active low-quality bank/MFI. However, such a rent is socially costly because of the social cost of public funds.

3.2. The Optimal Incentive Contract with Supervision

Let us continue to assume that the government is benevolent but that it uses a supervising agency to attempt to bridge its information gap. More specifically, employing a supervising agency enables the government to reduce the costs of regulation, which are caused by leaving the high-quality MFI an informational rent. Reducing this informational rent consequently leads to a smaller distortion in the effort level of the low-quality MFI, which in turn reduces the probability of MFI failure. The regulator obtains a truthful report from the supervisor who can retrieve a signal about the MFI's exerted effort. The presence of the supervisor tilts the regulatory contract towards higher-powered incentives. Intuitively, when $\sigma = \varnothing$, the regulator believes that the MFI is efficient with a lower probability, he fears less giving up an information rent, affords a higher level of effort, which increases the rent. Assume that the supervisor observes a signal σ in $\{q_0, \varnothing\}$. This signal σ is not perfect, but its accuracy can be improved at certain costs, $C_S(\xi)$, ξ being the probability of finding out the MFI's true type. If the supervisor indicates that the MFI's management has shirked, the regulator can impose a punishment to correct this undesired behaviour. Because of the possibility that new valuable information is retrieved with probability ξ, the incentive compatibility constraint must be modified.

$$t_h - \psi(e_h) \geq \xi(t_l - \psi(e_l + \Delta q_0) - P) + (1-\xi)(t_l - \psi(e_l + \Delta q_0)) \tag{19}$$

Since the supervisor cannot collude with the credit cooperative, the optimal punishment is the maximal one, that is, $P = t_l$. Moreover, there is no use in supervising when observing a high overall quality. In equilibrium, high overall quality reflects high effort under incentive compatibility[2]. Given ξ, the maximising problem becomes:

$$\max_{e_l, e_h, t_l, t_h} v\{(S(q) - (1+\lambda)[c_l(e_l) + t_l + C_s(\xi) - \pi_l(e_l)] + U_l\}$$
$$+(1-v)\{(S(q) - (1+\lambda)[c_h(e_h) + t_h) - \pi_h(e_h)] + U_h\} \tag{20}$$

subject to

$$t_l \geq \psi(e_l) \tag{21}$$

$$t_h - \psi(e_h) \geq (1-\xi)(t_l - \psi(e_l - \Delta q_0)) - \xi\psi(e_l - \Delta q_0) \tag{22}$$

A solution to this problem is given in the following proposition.

Proposition 3. *The optimal incentive contract with supervision is characterised by:*

$$\psi'(e_l^{***}(\xi)) = \left(\frac{v}{v+(1-v)\xi}\right)\left\{\frac{1}{1+\lambda}(S'(e_l^{***})) + \pi_l'(e_l^{***}) - c_l'(e_l^{***})\right\} - \left(\frac{1-v}{v+(1-v)\xi}\right)\phi'(e_l^{***}) \tag{23}$$

and

$$\psi'(e_h^{***}) = \frac{1}{1+\lambda}(S'(e_h^{***})) + \pi_h'(e_h^{***}) - c_h'(e_h^{***}) \tag{24}$$

The corresponding transfers are given by:

$$t_l^{***}(\xi) = \psi(e_l^{***}(\xi)) \tag{25}$$

$$t_h^{***}(\xi) = \psi(e_h) + \phi(e_l^{***}(\xi)) - \xi(\psi(e_l^{***}(\xi)) \tag{26}$$

From Proposition 3, it immediately follows that the effort level of the low type is increasing in the probability ξ, that is $\partial\psi'(e_l^{***}(\xi))/\partial\xi \succ 0$. Hence, as the accuracy of supervision improves, the distortion of the effort becomes smaller. Obviously, for ξ = 0 (no value of supervision) we have $\psi'(e_l^{***}(0)) = \psi'(e_l^{**})$. Since effort increases with *v*, the probability of bank failure of a low type decrease. However, improving the accuracy of the signal is not without costs. The regulator must weigh the costs and the benefits of supervising.

When facing adverse selection, the MFI regulator cannot offer the first-best contract, since it would leave the high-quality MFI a too high an informational rent. In designing optimal contracts, the regulator trades off incentives for efficient MFI against the costs of regulation. In doing so, the effort level of a low-quality bank is distorted away from the first-best level, which increases the instability of the banking sector as a whole. It follows that the optimal regulatory response to asymmetric information is a shift from 'high-powered' toward 'low-powered' contracts, that is, toward contracts inducing less effort to improve the quality of the MFI's loan portfolio. In this respect, a supervising agency may help the regulator in reducing the informational asymmetry, and consequently leading to smaller distortions of effort and lower informational rents. However, prudential supervision is costly. The analysis reveals that even in the optimal monitoring scheme, there generally exists a positive probability of bank failure. In this sense, full information disclosure in terms of requiring a very high level of accuracy in supervision need not be optimal for the regulator.

In this article, information disclosure is characterised 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. In fact, it is implicitly assumed that the information revealed to the regulator is transmitted to the public. The exogenously specified costs of supervision try to partly capture the (future) cost attached to public concern when reacting to bad information. Still, endogenising this behaviour of depositors in the model as part of the decision-making process facing the regulator would certainly increase its validity.

4. A NUMERICAL EXAMPLE

The distribution of the average rate of return R on all projects financed by the MFI 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 first-order stochastic dominance, that is, reduce the likelihood of low returns. Here, we model that the mean return on the loan portfolio is increasing in the overall quality, but its standard deviation remains constant. Formally, we assume that R is uniformly distributed on the interval $[q-\frac{\mu}{2}, q+\frac{\mu}{2}]$, implying a probability distribution $F(R/q)=\frac{R-q}{\mu}+\frac{1}{2}$ and density $f(R/q)=\frac{1}{\mu}$.

Note that the density is independent of q and observe that conditional expectation and standard deviation are given, respectively, by $E(R/q)=q$ and $\sigma(R/q)=\frac{\mu}{\sqrt{12}}$.

The expected gross profits of a quality-i MFI as a function of effort is given by:

$$\pi_i(e)=\frac{1}{\mu}\int_{\max\left\{r,(q_0^i+e)-\frac{\mu}{2}\right\}}^{(q_0^i+e)+\frac{\mu}{2}}[RL_0-C(L_0)-rL_0]dR \tag{27}$$

which leads to:

$$\pi_i(e)=\frac{1}{2\mu}\left[\left(q_0^i+e+\frac{\mu}{2}\right)-r\right]^2 L_0 \text{ for } e<(r-q_0^i)+\frac{\mu}{2} \tag{28}$$

and

$$\pi_i(e) = \left[\left(q_0^i + e \right) L_0 - C(L_0) - rL_0 \right], \text{ for } e \geq (r - q_0^i) + \frac{\mu}{2} \tag{29}$$

To ensure non-negative returns on the loan portfolio for all effort levels in both states, we restrict $\mu \in [0, 2q]$. The probability of MFI failure as a function of effort is given by:

$$p_i(e) = \frac{1}{\mu} \int_{\min\left\{r, q_0^i + e - \frac{\mu}{2}\right\}}^{r} dR = \max\left\{0, \frac{r - (q_0^i + e)}{\mu} + \frac{1}{2}\right\} \tag{30}$$

The costs of financial distress $c_i(e)$ Is defined by:

$$c_i(e) = \frac{(1+b)}{\mu} \int_{\min\left\{r, q_0^i + e - \frac{\mu}{2}\right\}}^{r} \left(RL_0 - C(L_0) - rL_0 \right) dR \tag{31}$$

We assume that the MFI management's disutility is given by a quadratic function. $\psi(e) = \frac{e^2}{2}$, with $e \geq 0$.

Let the parameter values be $v = 0.5$; $q_0^l = 1$; $q_0^h = 1.5$; $r = 1.1$; $b = 2$; $L_0 = 1$ and $\lambda = 0, 20$.

We normalise the net return on risky loans to unity, that is $R - C = 1$ and we suppose that the utility $S(q)$ is defined by a negative exponential utility function of the form $S(q) = -e^{-q}$.

The optimal contract under symmetric information (benchmark) is characterised by:

Benchmark case

$e_l = 1$	$e_h = 1$
$t_l = 0,5$	$t_h = 0,5$
$p_h = 0$	$p_h = 0$

$$W = 0,346$$

No MFI receives any rent; whatever its type, the regulator pays the MFI just enough to make it sign the contract (i.e. $t_i = \psi(e_i)$, $i = l, h$). The probability of MFI failure is zero.

Contract without supervision

$e_l = 0,625$ $\quad$ $e_h = 1$

$t_l = 0,195$ $\quad$ $t_h = 0,687$

$p_l = 0,06$ $\quad$ $p_h = 0$

$$W = 0,252$$

MFI high type has a positive rent $\phi(0,625) = t_h - \psi(1) = 0,187$. MFI low type obtains no rent, i.e. $t_l = \psi(e_l)$. The probability of MFI failure is still zero for the high type, but rises for the low type. The regulator's expected utility is lower than in the benchmark case. Thus, in conclusion, when facing adverse selection, the costs of regulation increase and the optimal response for the regulator is to shift from a high-powered contract to a contract with lower power. As a consequence, informational asymmetries increase the instability of the MFI sector since $p_l > 0$.

Contract with supervision

$\xi = 0,23$

$e_l = 0,685$ $\quad$ $e_h = 1$

$t_l = 0,235$ $\quad$ $t_h = 0,663$

$p_l = 0,012$ $\quad$ $p_h = 0$

$$W = 0,263$$

By comparing the results to the case without supervision, the low type is provided with better incentives (0,685>0,625), while the rent for the high type is lower (0,663<0,687). Hence, by using a supervising agency, the regulator can afford a higher-powered contract. The probability of MFI failure for the low-quality bank drops to 0,012. This result shows that even in the optimal monitoring scheme, there still exists a positive probability of MFI. Full information disclosure need not be optimal for the regulator.

5. CONCLUSIONS

In this paper, we introduced a framework for designing and analysing the properties of the optimal regulation of a single microfinance institution that has private information on the intrinsic quality of its loan portfolio (adverse selection) and where the MFI'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 MFI's intrinsic quality; however, not with perfect certainty. By incurring costs, the supervisor can punish the MFI's management if caught lying. In designing optimal contracts, the regulator trades off incentives for efficient MFI against the costs of regulation.

The paper provides useful information for guiding microfinance reforms in developing countries. Our analysis here of the optimal contracts specifies monetary transfers from the regulator to the MFI. These monetary transfers are considered subsidies to the MFI, so the incentive mechanism in this paper is another form of smart subsidy. The paper shows that weak legal and regulatory frameworks do not need to be a binding constraint for effective supervision. Policies promoting private incentives and market discipline can overcome some of these deficits. In the first-best solution, the regulator can observe and verify the exact MFI's type and its exerted effort. Supervision costs are normalised at zero. Supervision and disclosure play no role in this setting. We then turn to the optimal incentive contract with informational asymmetry but no supervision agency available. Finally, the optimal incentive contract is characterised by where supervision does play an active role. We study the balance between proper incentives, costs of regulation, probability of bank failure, and costs of active supervision. The content of information disclosure is characterised by the optimal monitoring scheme.

Our study abstracts form several factors that could be included in future research. First, although the interaction between the regulator and MFI is not repeated, qualitative conclusions will continue to hold in many settings with repeated play. Second, we characterise 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 merits further investigation.

APPENDIX

Proof of Proposition 1

The regulator maximises

$$\max_{e_l,e_h,t_l,t_h} v\{(S(q)-(1+\lambda)[c_l(e_l)+t_l-\pi_l(e_l))]+U_l\}+(1-v)\{S(q)-(1+\lambda)[c_h(e_h)+t_h-\pi_h(e_h)]+U_h\}$$

subject to

$$t_l \geq \psi(e_l) \text{ and } t_h \geq \psi(e_h)$$

Note that the regulator's objective function is decreasing in the transfer. t_i, $i = l, h$. Therefore, $t_i = \psi(e_i)$, $i = l, h$. Substituting and differentiating to e_i, $i = l, h$ gives the first order condition $S'(e_i^*) - (1+\lambda)[c_i'(e_i^*) - \pi_i'(e_i^*) + \psi'(e_i^*)] = 0$, $i = l, h$ implying

$$\psi'(e_i^*) = \frac{1}{1+\lambda}(S'(e_i^*)) + \pi_i'(e_i^*) - c_i'(e_i^*) \text{, } i = l, h, \text{, and therefore } t_i^* = \psi(e_i^*)$$

, $i = l, h$. The above maximisation program is convex, so that the second-order conditions need not be checked.

Proof of Proposition 2

The regulator maximises

$$\max_{e_l,e_h,t_l,t_h} v\{S(q)-(1+\lambda)[c_l(e_l)+t_l(e_l)-\pi_l(e_l)]+U_l\}$$
$$+(1-v)\{S(q)-(1+\lambda)[(c_h(e_h)+t_h(e_h)-\pi_h(e_h)]+U_h\}$$

subject to

$$t_l \geq \psi(e_l) \text{ and } t_h \geq \psi(e_h)$$

$$t_h - \psi(e_h) \geq t_l - \psi(e_l - \Delta q_0) \text{ and } t_h - \psi(e_h) \geq t_l - \psi(e_l - \Delta q_0)$$

It is well known that in the optimum, the two constraints bind. Substituting and differentiating to e_i, $i = l, h$, gives two first-order conditions:

$$v\{S'(e_l)-(1+\lambda)[c_l'(e_l)-\pi_l'(e_l)+\psi'(e_l)]\}-(1-v))(1+\lambda)[\psi'(e_l)-\psi'(e_l-\Delta q_0)]=0$$

$$S'(e_h)-(1+\lambda)[(c_h'(e_h)-\pi_h'(e_h)+\psi'(e_h)]=0$$

Implying

$$\psi'(e_l^{**}) = \frac{1}{1+\lambda}(S'(e_l^{**})) + \pi_l^{'}(e_l^{**}) - c_l'(e_l^{**}) - \frac{(1-v)}{v}\phi'(e_l^{**})$$

where $\phi'(e_l^{**}) = \psi'(e_l^{**}) - \psi'(e_l^{**} - \Delta q_0)$
and

$$\psi'(e_h^{**}) = \frac{1}{1+\lambda}(S'(e_h^{**})) + \pi_h^{'}(e_h^{**}) - c_h'(e_h^{**})$$

Using the two binding constraints, we obtain

$$t_l^{**} = \psi(e_l^{**})$$

$$t_h^{**} = \psi(e_h^{**}) + \psi(e_l^{**}) - \psi(e_l^{**} - \Delta q_0)$$

The maximisation program is convex, so that the second-order conditions need not be checked.

Proof of Proposition 3

The regulator maximises

$$\max_{e_l, e_h, t_l, t_h} v\{(S(q) - (1+\lambda)[c_l(e_l) + t_l + C_s(\xi) - \pi_l(e_l)] + U_l\}$$

$$+(1-v)\{(S(q) - (1+\lambda)[c_h(e_h) + t_h - \pi_h(e_h)] + U_h\}$$

subject to

$$t_l \geq \psi(e_l)$$

$$t_h - \psi(e_h) \geq (1-\xi)(t_l - \psi(e_l - \Delta q_0)) - \xi\psi(e_l - \Delta q_0)$$

The approach is the same as previously; in the optimum, the two constraints bind. Substituting and differentiating to e_i, $i = l, h$ gives two first-order conditions in two unknowns. Solving gives $\psi'(e_l^{***})$ and $\psi'(e_h^{***})$. Using the two binding constraints, we obtain t_l^{***} and t_h^{***}.

References

Bansah, E. D., & Adjei, R. K. (2023). Sustainability and outreach in the microfinance sector of Ghana. *Managing Global Transitions, 21*(3), 223–251.

Berenbach, S., & Churchill, C. (1997). *Regulation and supervision of microfinance institutions: Experience from Latin America, Asia and Africa* (Occasional Paper No. 1). The Microfinance Network.

Chavez, R., & Gonzalez-Vega, C. (1993). Should principles of regulation and prudential supervision be different for microenterprise finance organisations? *GEMINI Working Paper*, No. 38.

Chen, R., & Divanbeigi, R. (2019). *Can regulation promote financial inclusion?* (World Bank Policy Research Working Paper No. 8711). World Bank.

Christen, R. P., Lyman, T., & Rosenberg, R. (2003). *Guiding principles for regulation and supervision of microfinance*. Washington, DC: Consultative Group to Assist the Poor.

CGAP. (2011). *Consensus microfinance policy guidance: Regulation and supervision*. Washington, DC: CGAP.

Cordella, T., & Yeyati, E. L. (1998). Public disclosure and bank failures. *IMF Staff Papers*, No. 1. International Monetary Fund.

Cuevas, C. E., & Fischer, K. P. (2006). Regulation and supervision of cooperative institutions: The debate over delegated and auxiliary supervision. *The World Bank Group*, Issue No. 12.

Cull, R., Demirgüç-Kunt, A., & Morduch, J. (2009a). Microfinance meets the market. *Journal of Economic Perspectives, 23*(1), 167–192.

Cull, R., Demirgüç-Kunt, A., & Morduch, J. (2009b). Does regulatory supervision curtail microfinance profitability and outreach? (Policy Research Working Paper No. 4748). The World Bank.

Dewatripont, M., & Tirole, J. (1994). *The prudential regulation of banks*. MIT Press.

Elzahi Saaid Ali, A. (2022). The regulatory and supervisory frameworks of conventional microfinance in Kenya. In *Empowering the poor through financial and social inclusion in Africa: An Islamic perspective* (pp. 87–101). Springer International Publishing.

Freixas, X., & Rochet, J.-C. (1997). *The microeconomics of banking*. MIT Press.

Giammarino, R. M., Lewis, T. R., & Sappington, D. E. M. (1993). An incentive approach to banking regulation. *Journal of Finance, 48*, 1523–1542.

Gupta, P. K., & Sharma, S. (2023). Literature review on effect of microfinance institutions on poverty in South Asian countries and their sustainability. *International Journal of Emerging Markets, 18*(8), 1827–1845.

Hartarska, V. (2005). Governance and performance of microfinance institutions in Central and Eastern Europe and the Newly Independent States. *World Development, 33*(10), 1627–1643.

Hartarska, V., & Nadolnyak, D. (2007). Do regulated microfinance institutions achieve better sustainability and outreach? Cross-country evidence. *Applied Economics, 39*(10–12), 1207–1222.

Kofman, F., & Lawarrée, J. (1993). Collusion in hierarchical agency. *Econometrica, 61*, 629–636.

Laffont, J.-J., & Tirole, J. (1986). Using cost observation to regulate firms. *Journal of Political Economy, 94*(3), 614–641.

Laffont, J.-J., & Tirole, J. (1993). *A theory of incentives in procurement and regulation*. MIT Press.

Llewellyn, D. (1986). *Regulation and supervision of financial institutions*. London: The Institute of Bankers.

Llewellyn, D. (1999). *The economic rationale for financial regulation* (Occasional Paper Series). Financial Services Authority, London.

Morshed, Z., Habib, M., & Jubb, C. (2020). Does regulation influence microfinance institutions to be more client-responsive? *International Journal of Financial Studies, 8*(4), 63.

Ndambu, J. (2011). Does regulation increase microfinance performance in Sub-Saharan Africa? (Technical Note No. 3/2011). Frankfurt School of Finance & Management.

Rochet, J.-C. (1992). Towards a theory of optimal banking regulation. *Cahiers économiques et monétaires*, No. 40. Banque de France.

Van Gruening, H., Gallardo, J., & Randhawa, B. (1999). *A framework for regulating microfinance institutions* (Working Paper No. 206). World Bank.

Vogel, R. C., Gomez, A., & Fitzgerald, T. (2000). *Microfinance regulation and supervision: Concept paper*. Microenterprise Best Practices, USA.

Zainal, N., Kamarudin, F., Hook, L. S., Bakri, M. H., Sufian, F., & Nassir, A. M. (2020). Regulation, supervision and social and financial efficiency of microfinance institutions in ASEAN-5 countries. *Malaysian Journal of Economic Studies, 57*(2), 253–273.