ASPECTS OF FINANCIAL DUALISM IN LESS DEVELOPED COUNTRIES

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Preface

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Contents

Chapter 1

Introduction to the Literature

One significant aspect of the economic dualism that characterises less developed countries (LDCs) is financial dualism. This is manifested through the co-existence of formal-lenders (FLs) and informal-lenders (ILs), in the credit markets of LDCs, which stands in stark contrast to the integrated, organised and efficiently functioning credit markets of the developed countries.

FLs refer to the large institutional lenders, like commercial banks and other government owned banks that are subject to various central bank regulations. The ILs on the other hand are a heterogeneous lot and consist of non-institutional lenders like indigenous bankers, moneylenders, traders, landlords etc., who are outside the gambit of the central bank. In the LDCs not only do the FLs and ILs coexist but also, typically small borrowers both in the agricultural sector and industrial sectors are denied access to formal credit [1, 2]. This segment of borrowers therefore has to rely on informal lenders for meeting most of their credit needs on extremely unfavourable terms resulting in exploitation.

The definitions of the FLs and the ILs stated above give us a preliminary idea of the identity of the formal and informal lenders, i.e. who constitute the FLs and the ILs. However to draw a distinction between the two in terms of the above definitions would be somewhat descriptive and general. Studies of the formal and the informal credit markets reveal that FLs and ILs have

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[1] For a discussion of the share of formal and informal credit in small-scale industries in different countries, see Timberg and Aiyar (1984), Ramachandran et al. (2000), Nanda (1999) for India, Biggs (1991), Ho (1980), Shea et.al. (1995), Kan (2000) for Taiwan and Korea and Webster (1991), Little et al. (1987), Jain (1999), Sathye (1997) for developing countries in general. For rural indebtedness see Malik (1991), Rural Labour Enquiry (1990, 1997).

[2] The reverse scenario is also true. It is not always the case that the poor borrowers are rationed by FLs. Often poor borrowers avoid formal credit (Basu, 1998). Being illiterate, they find the paperwork an insurmountable hurdle. Moreover the bureaucracy and bribes that go with formal credit and the bankers' inflexibility at the time of repayment make it still less attractive. Sarap (1991) and Bates (1981) provide evidence from the state of Orissa in India and Ghana respectively, that in the formal credit market, the extent of bureaucracy and delays vary indirectly with the borrower's wealth. However Udry (1990) on the basis of the Nigerian experience concludes that flexibility in formal credit through granting of state contingent contracts is not enough for the FL to make inroads to the rural informal credit market.

various structural differences such that either of them have advantages vis-à-vis the other in certain aspects and disadvantages in others. This explains their co-existence. Therefore a more analytical way to characterise and distinguish between the two would be to identify and enumerate the specific features in terms of which they can be differentiated. Some of these features are discussed below.

1. Structural Features of Financial Dualism : The empirical literature

There is a large literature that deals with the empirical evidence of the various structural features of the informal credit markets. Tun Wai (1956, 1957) are among the earliest studies of the structure of informal and formal credit markets, respectively, in the developing countries. Hoff and Stiglitz (1990) provide an overview of some of the recent studies of rural credit in developing countries including Pakistan, India, Nigeria, and Thailand. For a description of the informal credit markets of low-income countries in general one could also refer to Von Pischke et al. (1983) and Adams and Fitchett (1992). Timberg and Aiyar (1984) and Varghese (1996) discuss informal credit markets in India. For urban informal credit markets in particular, see Dasgupta and Nayar (1989) and Srivastava (1992)[3].

Some of the features of the informal credit market that have been frequently discussed in this literature, and which stand in contrast to the features of the formal credit markets are, high informal rates of interest; market segmentation; exclusivity; interlinked credit transactions; large interest rate variations; rationing; predominance of consumption and working capital loans; absence of collateral; use of direct screening mechanisms etc. We discuss them in somewhat greater detail below.

Exclusivity: Unlike formal loans informal credit transactions are mostly exclusive dealings. ILs typically dislike situations in which their borrowers are borrowing from more than one source. Aleem's (1993) survey of ILs in Pakistan and also Thai data (Siamwalla et al.,1990) support this.

[3] For other country studies see Cole and Park (1983) for Korea, Patrick and Park (1994) for Japan, Korea and Taiwan and Ghate et al. (1992) for several South East Asian countries.

Segmentation: Informal credit markets often tend to be segmented in contrast to the integrated formal credit markets. Many credit relationships are personalised and take time to build up. The informational constraint is either less acute or absent for this sub-class of potential borrowers. This is unlike the situation in formal credit market where the degree of information asymmetry faced by the FL is the same for all class of borrowers. This leads to clientalisation in the informal credit market. The ILs limit their lending to a fixed clientele and are not willing to lend outside this circle. Moreover repeat lending is very common. An IL lends funds only to those borrowers to whom he has lent before. For data support one may refer to Aleem's (1993) survey and Thai data (Siamwalla et al., 1990).

Interlinkage: A commonly observed feature of the informal credit market is that lenders and borrowers are simultaneously interacting in at least one other market, such as land, output or labour. The terms of transaction in the credit market often depend on the terms and conditions in the other markets. This situation is unlike that in the formal credit market where interlinked credit contracts are uncommon. Interlinkage and segmentation are closely related. Often credit markets are segmented along occupational lines or based on the complementarity of production relationships. One may refer to the study of Phillipines informal credit market by Floro and Yotopoulos (1991), Mansuri's (1997) study of informal credit in Punjab and Sind and Sadoulet's (1992) study of Latin American markets, for evidence pertaining to this feature.

High interest rates and large interest rate variation: Several studies reveal that informal interest on loans exhibit great variation. Aleem's survey of the Chambar region of Pakistan reveals that the average annual rate was as high as 78.7% and varied between 18% to 200% per annum. Siamwalla et al. reported that in most parts of Thailand interest rates in the informal sector varied between 5% and 7% per month. The rates vary by geographic location, the characteristics of the borrower and the source and use of funds. Typically interest on consumption loans is higher than on production loans. In either case however the lowest informal interest rates were higher than the formal interest rate, which shows very little variation.

High explicit interest rates are not necessarily the norm in informal credit transactions. Udry's (1994) study of Nigeria revealed that interest rates on loans among families were low and dependent ex-post on the financial circumstances of both the borrower and the lender. Low or even zero interest rate loans from traders are also not uncommon (Floro and Yotopoulos 1991; Kurup 1976). However it is to be noted that given the interlinked nature of credit transactions, the effective (hidden) interest rate is pretty high.

Local monopoly: Empirical literature is divided on the nature of competition in the informal credit market. It provides mixed evidence. Siamwalla et al. (1990) reported in the context of Thai credit markets that moneylenders were "thick on the ground". Aleem's comment runs along similar lines. According to him the notion of a "single village money lender with monopoly power over clients in the village" does not hold true in the Chambar context. On the other hand, Hoff and Stiglitz (1990) in their review paper point out that there exists a limited number of commercial lenders in the informal credit market, despite high interest rates. Thus while the studies of the informal credit markets reveal that segmentation and exclusivity does not justify pure monopoly, except for some specific cases, the general evidence is that the informal credit markets are far removed from perfect competition[4]. The overall picture that emerges is that informal lenders enjoy local monopoly due to some informational, locational and historical advantage, which they promptly exploit.

Rationing: Informal credit markets are characterised by widespread rationing. Thus borrowers cannot borrow more even if they are willing to pay a higher rate of interest. Rationing may also lead to the complete exclusion of some potential borrowers from credit transactions with some lenders.

2. Theoretical Literature on Credit Markets

Our discussion of the notion of financial dualism suggests that the formal and the informal credit markets constitute two of its integral components. A large part of the existing literature on credit markets considers the two markets in isolation. So an introduction to the literature on financial dualism would perhaps be incomplete, without taking into consideration the theories of the credit market which consider the two markets separately. In this section we will take a look into the theoretical literature on the formal and informal credit markets before delving into the theories of financial dualism.

[4] For more discussion on this topic refer to Besley (1995).

2A. Models of Informal Credit Market

Along with the empirical surveys discussed above there is a large literature that provides theoretical basis to the various observed features of the informal credit markets. One explanation for the very high informal rates of interest runs in terms of the lender's monopoly due to intimate knowledge of borrower's circumstances, which no other competitor has (Bottomley, 1964). This enables the informal lender to earn monopoly profit without fear of entry. It has however been pointed out that monopoly power is not necessarily an explanation of high explicit interest rates, since high interest rates are not the best means of appropriating money-lending profits. Basu (1987) show that all or nothing contracts, flat charges or tie in sales are alternative forms of doing so. Interlinkage is another. Bottomley (1975) provides a theoretical model explaining high rates of interest in terms of lender's risk hypothesis in an otherwise competitive market. In this paper Bottomley argues that in reality both the lender's risk and his monopoly power are responsible for the high rates of interest. So these theories are complementary rather than alternative explanations of reality. An alternative explanation is given by Bhaduri (1977) and Basu (1984) who visualize the high informal interest rates as a veil for transferring collateral.

Large interest rate variations across moneylenders, is very typical to the informal credit market. A common explanation for the large interest rate variation runs in terms of the informational variation and segmentation of the credit market. In the absence of these arbitrage would have smoothed out the differences (Ray, 1998). Also typically interest rate on consumption loans is higher. One explanation for this could be that the demand for consumption loan is often inelastic and these loans are taken during times of distress. The borrower cannot vary the amount of loan required with the rate of interest, unlike in case of production loans. Also these loans being unproductive the risk involved is greater.

Analysis of the factors that lead to the emergence of interlinkage requires an identification of factors that create conditions for the superiority of interlinked contracts over non-interlinked ones. Bell (1988), Hoff et al. (1993) provide a general survey and a comprehensive review of the literature. Braverman and Stiglitz (1982) is one of the seminal papers analysing the nature of interlinked transactions in the rural areas. One may also refer to Basu (1983, 1987) for interesting discussions of the subject. In Braverman and Stiglitz (1982), interlinkage emerges as a response to moral hazard[5]. Basu (1983) views interlinkage as arising from the lender's urge to avoid potential risk. Interlinkage may also arise from the moneylender's attempt to extract the consumer's surplus the borrower would get if the money lender behaved like a traditional text book monopolist. Newbery (1975) shows that in the case where there is no uncertainty and the tenant is subject to unlimited liability, interlinkage is not necessary for achieving a first best allocation. Ray and Sengupta (1989) show that the ability to impose sufficiently non-linear contracts neutralises the superiority of interlinkage. In Banerji (1995) the strict optimality of interlinked contracts arises from the presence of some sort of informational asymmetry in the form of adverse selection. Interlinkage may also arise from its role in preventing distortions that lower the total surplus available to be divided between the borrower and the lender. For models based on this theme one may refer to Basu (1987), Mitra (1983), Braverman and Srinivasan (1981).

In a recent paper Basu, Bell and Bose (2000) have demonstrated that there exist circumstances in which interlinkage is superior. Their model is one of a sequential move game between lender and borrower. In their model they analyse a landlord and a ML as two players making non-cooperative decisions regarding the terms of their respective contracts with a tenant. In the sequential game where the landlord moves first and the tenant has limited liability, they demonstrate that there exists circumstances in which interlinkage is superior, even with non-linear loan contracts, a result that carries over when there is moral hazard. The incorporation of risk aversion yields strict superiority in general. The main result is unaffected by changes in the seniority of claims, but is sensitive to changes in the order of moves. Limited liability ceases to ensure the strict superiority of interlinked contracts if the principal who provides the variable factor of production moves first, even if he has junior claims to the output.

[5] Informational asymmetries, either in the form of adverse selection (unobservable type) or moral hazard (unobservable action) leading to involuntary default and problems of enforcement leading to strategic default (Ghosh and Ray, 1996, 1999) have been frequently used in the literature to explain the various features of the informal credit markets. Ghatak and Pandey (2000) have used joint moral hazard in the choice of effort and risk to show the superiority of sharecropping contracts. For related discussion on contract choice in agriculture, refer to Eswaran and Kotwal (1985), Basu (1992), Kotwal (1985). Braverman and Stiglitz (1982) have allowed for more than one input affecting the distribution of output. However their model does not allow for moral hazard in respect of multiple inputs. The focus is on analysing whether the principal would tax or subsidise the contractible input in

There is also considerable controversy regarding the impact of interlinking on the informal sector interest rates. Scholars have predicted both very high and very low rates. See Gangopadhyay and Sengupta (1987).

The reasons cited so far refer to situations where usury is not banned. As Ray (1998) points out that interlinked transactions provide a way out in situations where there is a ban on explicit usury. With interlinked contracts the lender can take the interest in secondary forms (hidden interest) and advance the loan interest free. This would explain why interest free loans are common in Islamic countries where explicit charging of interest is forbidden under Shaariat law. But this does not explain why interlinkage is widespread even in situations where usury is not banned

Basu and Bell (1991) indicate that the presence of information asymmetries in informal markets is responsible for causing a large number of transactions to remain confined within parties who have personal knowledge of each other. Such personalised transactions have tended to cause 'clientelization' (Geertz, 1978) of informal credit markets or to result in 'fragmentation' of credit markets (Basu, 1983; Bardhan, 1984). However, as Basu and Bell (1991) point out, 'impersonal' transactions between unfamiliar persons may coexist together with personalised transactions within groups. They explore how, if the size of the captive segments are endogenous, we may see a kind of market interlinkage that is used by lenders to expand their captive segments. Mishra (1994) explores conditions under which the market gets carved into segments, each exclusively under the control of an individual moneylender.

The issue of clientalisation and under-supply of informal credit has been discussed in Bose (1998b). According to Bose (1998b), personalised knowledge resulting in 'clientelisation' and a reduction in the volume of credit transactions can reduce the gains of both borrowers and lenders and entail a loss of social welfare. (See Diagne and Zeller, 2001 for an interesting case study.)

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order to induce higher levels of non-contractible input (depending upon whether they are substitutes or complements in production). In their paper interlinkage arises as device for monitoring work effort.

Freixas and Rochet (1997) is a comprehensive introduction to the existing literature on the formal credit market. The literature includes different theories of financial intermediation, namely transaction cost, liquidity, insurance, coalition of borrowers and delegated monitoring. One strand of this literature also discusses the industrial organisation approach to banking, which focuses on the notion that banks provide costly services to the public in terms of management of loans and deposits. Other topics researched in this area include the macroeconomic consequences of financial imperfections, bank runs, systemic risk and its management and banking regulations.

Another major strand of the literature on formal credit markets deals with the policy aspect. The issue at stake is the whether government intervention in credit market is a better strategy than government non-intervention from the point of view of efficient resource mobilisation and allocation and providing access to credit to all classes of borrowers at uniform rates of interest (Besley, 1992). Initially in order to achieve its objectives of generating high levels of savings and investment and creating equal opportunities for all classes of borrowers, the government in developing countries adopted an interventionist approach to credit policy. It led to the nationalisation of commercial banks, an increase in the number of institutional lenders in the public sector, the introduction of interest rate ceilings, directed credit programmes and directed investment. These policies were a partial success (Basu, 1990)[6].

The financial repression resulting from the interventionist approach induced a change in policy in favour of financial liberalisation of the formal credit market through deregulation of formal interest rates and allowing free entry of private sector banks. There is a large literature in this area that considers both the macro and the micro aspect of financial liberalisation. It considers the impact of deregulation on the volume of credit, interest rates, aggregate savings, investment, the extent of rationing, profitability, efficiency in the allocation of credit, growth etc. Mckinnon (1973) and Shaw (1973) present the traditional view of the positive impact of liberalising the financial market. One may also refer to Adams et al. (1984) for a summary of the argument for

[6] Refer to Bell(1990) for WBRPO and ICRISAT estimates for the Indian context. Also see Basu (1984), Bardhan (1984), Binswanger and Khandkar (1995) for observations in support of this viewpoint.

financial liberalisation (also see Bardhan and Udry, 1999). Interest rate ceilings lower the supply and raise the demand for credit. It also discourages savings mobilisation. In the absence of price competition this leads to administrative rationing of small borrowers and cross subsidisation of the rich by the poor. Therefore one possible way of removing the basis for the co-existence of the formal and the informal credit markets (or financial dualism) and the elimination of the major factor price distortion, would be the removal of artificially low nominal interest rate ceilings in the formal credit market, as well as other related steps towards financial liberalisation. This would cause the interest rates to rise to market clearing levels and remove the explicit interest rate subsidy accorded to preferred borrowers, who are powerful enough to gain access to rationed credit. The higher interest rates should generate more domestic savings and investment. This would permit some of the borrowers to shift from the informal to the formal credit market. The more market oriented interest rates should result in a more efficient allocation of the loanable funds to the most productive projects.

The policy of financial liberalisation has not been free of criticisms either. A critique of the Mckinnon - Shaw approach is available in Carlos Diaz-Alexandro (1985). Mckinnon too later shifted his position in Mckinnon (1989, 1991). The argument for financial liberalisation also came under review with developments in the economics of information. The issue at stake was that, given the credit market imperfections, whether non-intervention in the conventional sense of financial liberalisation would expand the size of the formal credit market. In this context one may refer to the models of equilibrium credit rationing based on asymmetric information that have been developed by Stiglitz and Weiss (1981), Gale and Hellwig (1985) and others and the interest rate invariance proposition associated with it[7]. These models made the basic point that in the presence of asymmetric information between borrowers and lenders, there might be a divergence between the interest rates that clear the market and that maximise the lender's return. In that case the competitive credit market may be characterised by credit rationed equilibrium. The lenders will not respond to the excess demand for loans because raising the interest rate causes the quality of the portfolio to worsen. This occurs due to adverse selection whereby sound borrowers are discouraged relative to the unsound borrowers and due to moral hazard wherein all borrowers have an incentive to take higher risks. Thus it followed that in the

[7] For an overview of the theory of credit rationing in developing countries and the implications for financial liberalisation refer to Mookherjee and Ray (2001).

absence of complete information and perfect contract enforcement the free market outcome is inefficient relative to the situation where the information constraint is absent.

The implication of the equilibrium credit rationing models for policy is embodied in the interest rate invariance proposition. This shows the ineffectiveness of conventional measures for affecting the credit market outcome (rather than constituting a case for administered control of interest rate[8]). Thus if the market equilibrium is characterised by credit rationing, interest rate decontrol or tightening of the credit supply will not have any effect on the interest rate as predicted by conventional analysis. Gray and Wu (1995) extend this argument. They show that tightening the credit supply can cause interest rates to fall rather than increase, if credit is rationed by restricting the size of loans rather than the number of loans (as in the Stiglitz and Weiss (1981) model). The Gray and Wu model therefore establishes a case where credit rationing may cause the standard credit policies to have destabilising effects on the credit market.

More recently, Stiglitz (1994) has isolated seven major market failures that imply a potential role for state interventions within the context of liberalised financial markets. He argues that "much of the rationale for liberalising the financial markets is based neither on sound economic understanding of how these (LDC financial markets) work nor on the potential scope for government intervention". The seven market failures Stiglitz identified , are the following: the public goods nature of monitoring financial institutions; externalities of monitoring, selection and lending; externalities of financial disruption; missing and incomplete markets; imperfect competition; inefficiency of competitive markets in the financial sector; uninformed investors. In each of the seven cases, Stiglitz argues, there is scope for state intervention in regulating financial institutions, creating new institutions to fill gaps in the kinds of credit provided by the private institutions, providing consumer protection, ensuring bank solvency, encouraging fair competition and ultimately improving the allocation of financial resources and promoting macroeconomic stability.

The empirical evidence on the experiences of different countries that have experimented with financial liberalisation is also varied. Although there is evidence that interest rate decontrol can

[8] Note that the government may actually worsen the situation by setting the interest rate ceiling lower than that corresponding to the credit rationed equilibrium.

promote greater savings and investment and more rapid economic growth (for countries such as Thailand, Turkey and Kenya) but the evidence of the effects of financial reform in Chile during the 1970's reveals many shortcomings of the process. Finally, whether financial liberalisation will help to solve the problem of channelling credit to the small entrepreneurs both on the farm and in the marginal or unorganised manufacturing sector in the urban areas, the evidence is still ambiguous.

2C. Models of formal – informal interaction

Models of formal - informal interaction are becoming increasingly popular in current research on credit markets and analysis of credit policy in developing countries. One area where these have been extensively used are the models based on vertical formal - informal links. These models present an alternative to the policy of "horizontal" displacement of the ILs by FLs which is achieved through an expansion in subsidised formal credit directed to borrowers in the informal sector (see Kochar, 1991, for an analysis of the horizontal scenario). The policy highlighted in these models is to encourage informal lending and induce competition among the ILs through the establishment of vertical formal - informal links. The theoretical models of Hoff and Stiglitz (1998), Bose (1998a), Floro and Ray (1997), provide important insights into the possible effects[9], which is likely to be mixed.

In fact, as the theoretical analysis of Hoff and Stiglitz (1994, 1998) demonstrate, the nature of enforcement costs in the informal credit market can result in the counter-intuitive situation where the cheap credit policy causes an increase, rather than a decrease, in the interest rate. Hoff and Stiglitz (1994) base their analysis of a cheap credit policy on the assumption of an externality-like effect of the entry of new moneylenders on enforcement costs (also see Kranton, 1996; Kranton and Swamy, 1999; Watson, 1996 for related models). An expansion in cheap formal credit by encouraging entry of new lenders increases the alternative sources of credit for the borrowers in the informal sector. This raises the difficulty of ensuring exclusive dealings, which is an important enforcement leverage used by the ILs. If the resulting effect on enforcement costs is sufficiently strong, it may cause the informal interest rate to increase.

[9] For a review of the Philippine experience, refer to Agabin (1988, 1989). For the nature and structure of vertical formal - informal links in Philippines credit market refer to Ghate (1992), Esguerra (1987), Von Pischke (1991), Geron (1989), Larson (1988).

Bose (1998) has developed a model, which incorporates convex enforcement costs and informational asymmetry across lenders. The enforcement costs limits the lending activity of each moneylender. In such a situation, an expansion in cheap formal credit enables the more informed lenders to expand selectively by adding only the less risky borrowers to their clientele. This worsens the mix of the residual pool of clients available to the less informed lenders (the composition effect). This in turn increases the rate of default on their loans, so that these lenders no longer find it profitable to continue their lending operations. Thus the negative effect generated by higher probability of default may more than offset the positive effect of lower opportunity costs of funds and, under certain conditions, result in the counter-intuitive changes in the decision variables.

Bose's (1998a) analysis of the adverse consequences of a cheap credit policy does not depend on the trader-lender link and the ease of entry, which are the crucial features of the Hoff-Stiglitz model. Hence the model is applicable to less commercialised regions, where trader - lender linkages are not common. Interlinked credit contracts are typical to rural credit markets in areas where agriculture is highly commercialised (Bell, 1990). In less commercialised regions the source of credit is a small (and relatively unchanging) group of rural moneylenders who belong either to the same village or to nearby ones. This is the situation modelled in Bose (1998a).

Floro and Ray (1997), emphasise the importance of understanding the nature of interaction among the ILs in order to study the impact of any credit policy. Their paper shows that the impact of an expansion of formal credit, on the welfare of borrowers depends crucially on whether such policy induces greater competition among the ILs or encourages collusive practices[10] (whereby ILs co-operate by not invading each others territory).

Another recent approach to policy has been that of microfinance, which takes advantage of available local information by designing credit organisations based on peer monitoring. For related literature see Stiglitz (1990), Ghatak (1996), Morduch (1998) and also the special issue of Journal of Development Economics (1999) on group lending. For potential drawbacks of the group-lending programmes see Woolock (1996), Madajewicz (1996). Thus the new credit policies leave scope for state intervention without direct regulation of the FLs as implied by the

[10] For evidence on collusive behaviour see Umali (1990).

conventional notion of state intervention. The peer monitoring literature, however, does not really figure in as using models based on formal - informal interaction. Rather it is an attempt at making institutional lending mimic and exploit some of the features of informal lending.

Models of formal - informal interaction have also been used to highlight the various features of the informal and formal credit markets. Jain (1999) for example uses his model to identify the conditions under which the FLs will offer non-exclusive contracts. His model allows for strategic interaction between the FL and the IL through partial funding as a method of screening used by the FL. Because of the informational advantage that the IL enjoys only the good borrowers are likely to have access to informal credit. Thus FLs can screen borrowers by rationing credit and forcing borrowers to resort to the IL for the remainder of the loan required. The implications of interest rate ceilings and government regulation of informal sector activity has been considered.

Among the models, which address the problem of FLs "horizontally" displacing the ILs, one may cite Bell (1990). He has developed a model of interaction between the formal and informal lenders under a variety of assumptions regarding the exclusivity of formal loan contracts and the degree of competitiveness in the informal credit market. He uses his model to analyse how the terms of an informal loan are determined and how those terms would be affected if the ILs faced competition from a state agency. He also examines how the welfare of the borrowers and the informal lenders would be affected by the arrival of these state agencies on the scene. However the model does not consider the effects of financial liberalisation.

Sarkar and Ghosh (1992) have analysed the implications of credit policy in the context of a developing economy characterised by industrial dualism and vertical specialisation. They show that a policy, which reduces the rate of interest paid by the small borrowers also, tends to reduce aggregate output and employment in the industrial sector.

Chakrabarty and Chaudhuri (2001) have looked into the efficiency implications of an expansion in the supply of formal credit in terms of a model of interaction between formal and informal sector credit institutions in the presence of interlinkage. They allow the landlord to write interlinked contracts. They show that when the formal sector is rationed, the landlord does provide optimal credit to the high type tenant but provides sub-optimal credit to the low type. In fact in this set up, increasing the amount of fixed credit that is available from the formal sector (directly to the tenants and not via the ILs), has the perverse effect of simply increasing the utility of the landlord without effecting the tenants. One way of reducing this monopoly power would be to make the supply of formal credit flexible, not rationed. So even if the formal sector subsidises the availability of credit, providing more credit at higher interest rates has the effect that now the monopolist moneylender in setting his interest rate has to consider the feedback effect on the formal sector. With this flexibility, the amount of credit given by the landlord to both types of the tenants is higher than in the case where formal credit is fixed.

3. Genesis of Financial Dualism

The literature discussed so far talks about the extant financial dualism, its consequences and policies to mitigate such dualism, in the context of developing countries. One might take a step back and look into the genesis of such dualism more closely. Looking at the literature in this area, we find a flavour of this process in the history of the development of modern banking in the developed countries of Europe, especially U.K., Germany (Deane, 1979; Johnson, 2000) and also the experience of the developing countries like India (Myint, 1973; Kaushal, 1979 and Bhattacharyya, 1989) and the African countries (Bauer, 1963)[11].

4. Scope of the Thesis

The past decade has witnessed a revival of the debate on state intervention versus non-intervention as the optimal credit policy, especially in the context of developing countries. Referring to our discussion of the literature in section 2, we find that the existing models of formal - informal interaction or financial dualism have not explicitly addressed the issue of financial liberalisation. These models have focussed on other issues like analysing the efficacy of an expansion in subsidised formal credit to target groups in the informal sector, either

[11] See also Baker (1994), Cairncross (1982), Jain (1929), Kindleberger (1984), Monteith (2000), Panadikar (1956), Muranjan (1940), Nevin (1964), Presnell (1956), Rau (1930), Ray (1961), RBI (1970), Tripathi and Mishra (1985), Weinstein and Yafeh (1995), Whale (1968) for related discussions.

directly or via the ILs and explaining the various features of formal and informal lending, like use of non-exclusive loan contracts by FLs for screening borrowers. On the other hand the existing models of financial liberalisation focus only on the formal credit market. These models do not consider the dualistic structure of credit markets, which is crucial for LDCs.

One of the main concerns of this thesis is to address the issue of financial liberalisation, in the context of credit market that is characterised by financial dualism. Specifically, we ask whether financial liberalisation will help to mitigate financial dualism, by reducing the size of the informal credit market and lowering informal interest rates. Chapters 3 and 4 deal with this issue by focussing on two different aspects of financial liberalisation viz., deregulation of the formal interest-rate and fostering competition by allowing free entry of private sector banks, into the formal credit market. The strategic interaction between the FLs and the ILs play a crucial role in the models developed. The policy implication that emerges from the models developed in chapters 3 and 4 is that, while deregulation of the formal interest rate under certain circumstances, can even cause informal lending to increase, allowing free entry would help to curb informal lending more effectively (for a certain range of interest rates).

Our discussion of the literature also suggests that earlier theorising on financial dualism did not address the question, how does financial dualism emerge or what is the source of financial dualism? This is the other major concern of this thesis. Chapter 5 deals with this issue, and shows the endogenous formation of financial dualism starting from a given initial distribution of wealth-holders, in terms of a theoretical model. As the country experiences suggest (refer to discussion in section 3), the history of modern banking can be traced to the formation of the joint stock banks, which stand in contrast to the native bankers. Typically the joint stock banks are initially formed by the local rich and attract deposits. The depositors belong to the middle wealth segment. The native bankers on the other hand are hardly ever in a position to receive deposits. Chapter 5 tries to model this process or capture this phenomenon in the context of an economy that characterises a traditional society. Starting with a given initial distribution of wealth holders (who are potential lenders) it shows the emergence of the formal sector consisting of joint stock banks and informal sector consisting of indigenous bankers. In other words it highlights the endogenous creation of financial dualism.

An analysis of the effectiveness of financial liberalisation in mitigating financial dualism and curbing informal lending must be preceded by an analysis of whether such an outcome is welfare enhancing. Hence the thesis starts with asking the welfare question, whether financial dualism is efficient. In other words if the informal credit market shrinks will it increase welfare? Chapter 2 of the thesis addresses this issue, in terms of a model in which financial dualism is reflected in the differences in ex-post loan monitoring cost across lenders, which is a commonly observed feature of the credit markets in LDCs. Ex-post information asymmetry that shows up as positive monitoring cost has been used in the literature to explain the phenomenon of equilibrium credit rationing. The focus of this chapter is however different from that cited above. This chapter is primarily concerned with the issue of adverse effect of informal lending on expected output and welfare, in terms of a model in which financial dualism is reflected in the differences in ex-post loan monitoring cost.

Our discussion of the literature in section 2 reveals that the existing theories have addressed the issue of the undesirability of ILs in terms of the high rates of interest charged by the ILs and in terms of the under supply of credit. In Chapter 2 the welfare issue is addressed in terms of the effect of informal lending on expected output and total surplus. It reaches the conclusion that informal loans induce low effort and result in lower expected output and is therefore not desirable. The impact of formal lending on total surplus is beneficial under certain contract forms. It also follows from the analysis that informal interest-rate is higher than the formal interest-rate, which is a commonly observed feature of the credit markets of LDCs. However given that the IL is the low cost type while the FL is the high cost type the result is not intuitively obvious. Essentially the high monitoring cost will induce the formal lender to choose a lower rate of interest to reduce the possibility of monitoring and hence the expected monitoring cost. The lower interest rate in turn induces the entrepreneurs to put in more effort, which results in higher expected output.

To conclude, in this thesis we have focussed on a few of the important areas of research dealing with credit markets in the LDCs. Specifically, this thesis is a theoretical exercise that raises three issues about financial dualism. The thesis starts with asking the welfare question, whether financial dualism is efficient. The thesis then proceeds to discuss whether financial liberalisation will help to mitigate financial dualism. The thesis concludes by addressing the question, how does financial dualism emerges or what is the source of financial dualism. This agenda is by no means exhaustive. In particular the twin issues of interlinkage and peer monitoring have received considerable attention in the existing literature. We refrain from dealing with these topics again.

Chapter 2

Dual Credit Markets, Expected Output and Welfare

1. Introduction

The structural heterogeneity of the credit markets in LDCs is very often reflected in the co-existence of lenders with differences in transaction costs. Specifically, informal lenders (ILs) having low transaction cost co-exists with formal lenders (FLs) having high transaction cost. Recall that FLs refer to the large institutional lenders, like commercial banks and other government owned banks that are subject to various central bank regulations. The ILs on the other hand are a heterogeneous lot and consist of non-institutional lenders like indigenous bankers, money-lenders, traders, landlords etc., who are outside the gambit of the central bank

A significant component of the transaction cost is the cost of monitoring loans, for bad debts. Since borrowers in informal markets are generally known parties under continuous surveillance, it makes the state verification cost low and also makes recovery possible without having to go to the courts. To quote Hoff and Stiglitz (1990),

" In developing countries potential lenders vary greatly in their costs of … monitoring. For some lenders, such costs are low; information is a by-product of living near the borrower or being part of the same kinship group… Thus, village lenders often do considerable monitoring, while banks may find it virtually impossible to do so….".

Ramachandran et al. (2000), in their survey of rural credit in Gokulapuram village in Tamilnadu observe that the money-lenders enjoy great power and wield a lot of influence. The fear of public disgrace brought upon by the money-lenders and lack of alternative employment opportunities is a great deterrent against default on loans, by the borrowers, who are socially and economically in a much weaker position. Unlike in the informal sector, the relationship between the FL and its clients is not personalised. The high operating cost and the elaborate procedural complexities that the FL has to go through in case of default makes the loan recovery cost very high.

A question that is inevitably raised in the context of the credit markets in most LDCs, is whether the financial dualism that characterises it, is efficient. In other words if the informal credit market shrinks, will it increase welfare? The literature on informal credit discusses the welfare issue mainly in terms of the high rates of interest charged by ILs. Hoff and Stiglitz (1990) provide an overview of some of the empirical surveys of the informal credit markets in Pakistan, India, Nigeria and Thailand. These studies provide empirical support to the hypothesis that ILs charge exploitatively high rates of interest much to the misery of the borrowers. The study conducted by Ramachandran et al. (2000) reports similar findings. There is also a large theoretical literature that has analysed the adverse welfare implications of informal credit from the same point of view. Bottomley (1975), Bhaduri (1977), Basu (1984) are well-cited papers in the literature in this area. They offer alternative explanations[1] for the high rates of interest charged by the ILs. Bhaduri and Basu view the high informal interest rates as a veil for transferring collateral, rather than the outcome of the higher risk faced by the ILs on agricultural loans, as argued by Bottomley. Bose (1998b) has addressed the issue from a different angle. He attributes the inefficiency of the IL to the low volume of credit generated by the IL because of clientalisation.

A totally different approach is to look at informal credit as filling the gap between demand and supply of formal credit, especially with regard to the small-scale sector. The informal credit is then viewed as playing a positive role in promoting growth in the small-scale sector (which is an important potential growth sector in developing or newly industrialising countries as the experience of the Eastern European and Asian counties suggest) and overall growth in national income. Kan (2000) provides empirical support for this hypothesis from Taiwan[2]. Thus, in this approach the IL is not the usurious moneylender as envisaged in the literature cited above.

This chapter addresses the issue of adverse effect of informal lending on expected output and welfare, in terms of a model in which financial dualism is reflected in the differences in ex-post loan monitoring cost. It reaches the conclusion that informal loans induce low effort and result in lower expected output whereas the impact of formal lending on total surplus is beneficial under certain contract forms. It also follows from the analysis that informal interest-rate is higher than the formal interest-rate, which is a commonly observed feature of the credit markets

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[1] For more discussion on this area refer to Chapter 1.
[2] See also Dessus et al. (1995), Ho (1980).

of LDCs. However given that the IL is the low cost type while the FL is the high cost type the result is not intuitively obvious. The high monitoring cost induces the FL to choose a lower rate of interest to reduce the possibility of monitoring and hence the expected monitoring cost. The lower interest rate in turn induces the entrepreneurs to put in more effort, which results in higher expected output. The total surplus resulting from the formal loans is however lower when the loan contracts are standard debt contracts. Total surplus realised from formal loans will be greater, if the FLs choose a collaterised contract, which the ILs do not find profitable to choose.

Ex-post information asymmetry that shows up as positive monitoring cost has been used in the literature to explain the phenomenon of equilibrium credit rationing. Gale and Hellwig (1985) used a costly state verification set up with variable loan size for highlighting credit market equilibrium where credit is rationed by restricting the size of loans. Williamson (1986, 1987), in his paper, used ex-post monitoring cost for modelling credit market equilibrium characterised by number rationing[3]. The focus of this chapter is however different from that in the literature cited above. This chapter is primarily concerned with addressing the issue of the inefficiency of financial dualism. The costly state verification set up with differences in state verification cost across lenders is crucial in revealing the rationale of choice of different contract forms by the FLs and ILs and hence revealing the beneficial impact of formal lending.

Structurally the model shares several important features with Williamson's (1987) model. In Williamson's model as in this model, ex-ante information asymmetry between borrowers and lenders is ruled out by assumption. Borrowers are identical and lenders have perfect knowledge about the probability distribution of the returns from the borrowers' projects. Ex-post information asymmetry is incorporated in terms of a positive monitoring cost for observing output. Loan size is fixed at unity. However unlike in Williamson, this model assumes away differences in opportunity returns to the lenders. On the other hand it introduces lender differentiation in terms of monitoring cost.

The plan of this chapter is as follows. Section 2A develops the conceptual framework. Section 2B describes the payoff functions. Section 2C briefly discusses the nature of credit market

[3] This stands in contrast to the credit market situation modeled by Stiglitz and Weiss (1981), and Keeton (1979), where ex-ante information asymmetry plays a key role in inducing number rationing.

equilibrium when output is independent of effort. Section 3 presents a model of optimal contracting with endogenous effort. Section 3A discusses the nature of the profit functions of the agents. The optimal contracts are discussed in section 3B. Section 4 considers the welfare effects of formal lending in terms of a model of production uncertainty in which expected output increases with effort. Section 5 analyses the effect of formal and informal lending on total surplus under alternative contractual mechanism. Finally section 6 presents conclusions.

2.Analysis of the Model in the Absence of Effort

2A. Conceptual framework

There are two types of agents, entrepreneurs and lenders, who are risk neutral. Each lender is endowed with one unit of an investment good. The entrepreneurs do not have any endowments of their own. They only have access to a risky project of unit size, which yields a random output $q \in [0, \bar{q}]$. Let $f(q)$ and $F(q)$ be the p.d.f. and c.d.f. respectively, corresponding to q.

The entrepreneurs must borrow the investment good from the lenders in order to undertake the project. Loan demand per entrepreneur is fixed at unity. The loan market is characterised by ex-post information asymmetry. The realised output q is observable only to the entrepreneurs. The lenders must incur a monitoring cost in order to observe the output. Now suppose that lenders are differentiated in terms of their monitoring cost. Let γ_F and γ_I be the monitoring cost of the formal lenders (FL) and informal lenders (IL) respectively, with $\gamma_F > \gamma_I$.

At the beginning of the period the entrepreneurs borrow the investment good from the lenders in exchange for a contract. We assume that the loan contract is a standard debt contract. Thus the contract specifies a fixed gross interest rate r, which the entrepreneurs have to pay to the lender at the end of the period, after production has taken place. The contract further specifies that, in case the entrepreneurs fail to pay r, the lender will monitor and take away the entire realised output $q \gtreqless r$. However, in order to do so, the lenders will have to incur a monitoring cost for observing output.

Note that here, for each state of nature either the lender monitors with probability one or he does not monitor at all. Hence here for some states of nature monitoring occurs with probability one and for others it occurs with probability zero. This is unlike the situation of costly state verification considered by Mookherjee and Png (1994). In their model, for each state of nature that is reported by the agent, monitoring occurs with a fixed probability that is less than one. This probability is chosen to maximise the objective function. That is for any state of nature that is signalled, monitoring may or may not take place.

The contracting problem that is involved here is a standard one. In the existing literature, the optimal contract is derived as a solution to the maximisation problem in which the entrepreneur's expected profit is the objective to be maximised subject to the lender's participation[4]. There is also a huge literature in which the lender is the principal and the entrepreneur is the agent. In the developing countries the lenders enjoy a dominant position vis-à-vis the entrepreneurs. The number of entrepreneurs is large in relation to the number of lenders. Therefore the appropriate formulation of the optimal contracting problem would be to regard the lender as the principal whose profit is the objective to be maximised subject to the entrepreneurs (agents) receiving their reservation utility. Given the information asymmetry the optimal contract in either case must satisfy the incentive compatibility or truth telling constraint[5] of the entrepreneur. This is in addition to the agent's participation and the feasibility constraints. The switch in roles of the entrepreneur and lender, as principal and agent however does not affect the optimality of the debt contract.

Note that here the FL is also a profit maximiser with a free interest rate. This is unlike the situation where the FL has to implement a regulated interest rate. We make this assumption here, since our objective is to compare the relative efficiency of the two types of lenders.

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[4] On principal-agent problems, see Grossman and Hart (1983) and Mascollel et al. (1995).

[5] Since it is not incentive compatible to lie when $q \geq r_j$, therefore the entrepreneurs will default only when $q < r_j$. Thus the debt contract satisfies the incentive compatibility condition.

2B. Payoff Functions

We consider a model of a localised credit market with just one FL and one IL. As mentioned above, both the FL and the IL maximise their profit by choosing the rate of interest optimally. We assume that the aggregate demand for loans is large in relation to the supply of formal loans. Note that here the lenders need not compete, as the market is supply constrained. In other words, we need not consider the possibility of Bertrand competition between the FL and the IL, which would have left the lenders with zero profits.

Given that the loan contracts are standard debt contracts, and assuming that q is uniformly distributed over the interval $[0,\bar{q}]$, the lenders profit function may now be written as:

$$\Pi_l^j(r_j,\gamma_j) = \frac{1}{\bar{q}}\int_0^{r_j} q\,dq + \frac{r_j}{\bar{q}}\int_{r_j}^{\bar{q}} dq - \frac{1}{\bar{q}}\int_0^{r_j} \gamma_j\,dq \qquad \text{for } j = F, I.$$

$$= r_j - \frac{r_j^2}{2\bar{q}} - \frac{\gamma_j r_j}{\bar{q}} \tag{1}$$

The entrepreneur's profit function is given by,

$$\Pi_e^j(r_j) = \frac{1}{\bar{q}}\int_0^{\bar{q}} q\,dq - \frac{1}{\bar{q}}\int_0^{r_j} q\,dq - \frac{r_j}{\bar{q}}\int_{r_j}^{q} dq$$

$$= \frac{\bar{q}}{2} + \frac{r_j^2}{2\bar{q}} - r_j \tag{2}$$

The sum of the first two terms in the lenders profit function stated in (1), is the expected loan repayment. Given r_j, the probability of default and hence the probability that the lender will have to monitor is $r_j/\bar{q}$. Thus the third term in (1) is the lenders' expected monitoring cost. Equation (2) represents the entrepreneur's profit function, which is the difference between expected output, equal to $\bar{q}/2$ and expected loan repayment.

Using standard calculus it is easily demonstrated that the Π_l function is concave in r_j and reaches its maximum at $r_j^* = \bar{q} - \gamma_j < \bar{q}$. The Π_e function is decreasing in r_j. As r_j increases, the lenders receive more when the entrepreneurs are successful. This increases the lender's expected return. But as r_j increases, it increases the probability of default as well, leading to an increase in the expected monitoring cost. This tends to reduce the lender's expected return. The net effect is positive at low r_j and becomes negative at high r_j, making the Π_l^j curve inverted-U shaped. The negative slope of the Π_e^j curve follows, because with an increase in r_j, expected loan repayment increases while expected output remains the same.

Figure 1 below shows Π_l as a function of r, for the FL and the IL, given γ_F and γ_I. Now $\partial\Pi_l^j/\partial\gamma_j = -F(r_j) < 0$. For the FL, whose monitoring cost is γ_F, the expected monitoring cost corresponding to any r_F is higher. Thus the $\Pi_l^F(r_F,\gamma_F)$ curve lies below the $\Pi_l^I(r_I,\gamma_I)$ curve. This makes the expected loan repayment net of expected monitoring cost, Π_l lower. Moreover with higher monitoring cost, an increase in r_F causes the expected monitoring cost to increase at a faster rate. This causes the negative effect of r_F increase to dominate at a lower r_F. Thus the maxima of the Π_l^F curve will lie to the left of the maxima of the Π_l^I curve. Hence $r_F{}^* < r_I{}^*$.

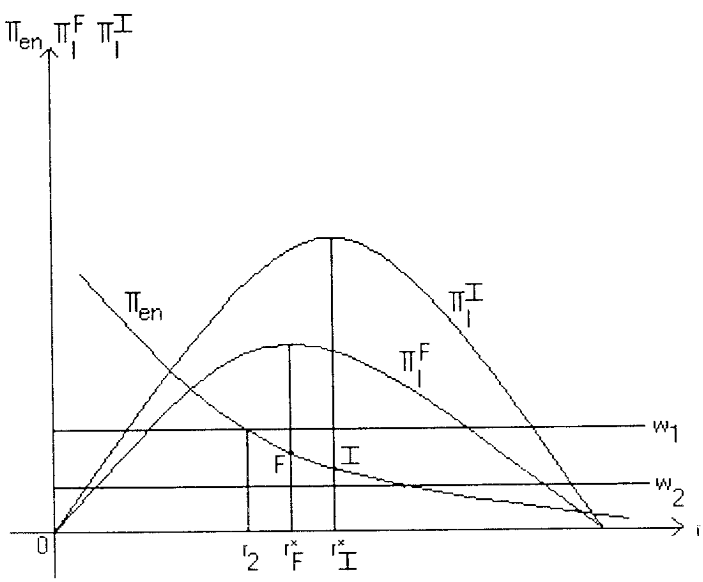

FIG.1

2C.Equilibrium

The lender's optimisation problem may now be stated as:

$$\underset{r_l}{Max} \quad \Pi_l^j(r_j, \gamma_j) \quad .$$

$$\text{subject to} \qquad \Pi_e^j(r_j) \geq \overline{w} \qquad \text{for } j = F, I$$

where the inequality represents the entrepreneur's participation constraint.

The loan market equilibrium is discussed in terms of figure 1 where the relative position of the payoff curves has already been discussed in the in the previous sub-section. We first consider the case where the entrepreneurs' reservation utility is $\overline{w}_2$. This makes the entrepreneur's participation constraint non-binding at r_F* and r_I*. Thus in equilibrium, the FL will always choose r_F*, yielding an amount of payoff represented by the line segment r_F*F to the entrepreneurs.

With credit rationing[6] in the formal sector, given that the maxima of the Π_l^I curve lies more to the right, the equilibrium rate of interest for the IL would be $r_I* > r_F*$. In other words the FL whose monitoring cost is high will choose a lower rate of interest to make monitoring less likely. The entrepreneurs borrowing from the IL will earn an expected return $|r_I*I| < |r_F*F|$. In the absence of credit rationing in the formal sector the equilibrium rate of interest chosen by the IL would be r_F*.

Let us now consider the case where the entrepreneur's reservation utility is sufficiently high, say at $\overline{w}_1$. This makes both r_F* and r_I* infeasible. Thus in equilibrium both the FL and the IL would choose $\bar{r}_2$, leaving the entrepreneur's just at their reservation payoff. Note that, in this model, productivity is not affected by the rate of interest. From the above discussion we have the following proposition:

[6] There exists credit rationing in the sense that the FL would not increase r_F beyond r_F* even if there is an excess demand for loans.

Proposition 1: Suppose (i) there exist high monitoring cost and low monitoring cost lenders and identical entrepreneurs, (ii) output is entirely random and observable only to the entrepreneur, and (iii) lenders are profit maximisers subject to yielding a reservation utility to entrepreneurs. Then $r_F^E \leq r_I^E$ where r_j^E is the equilibrium rate of interest charged by lender of type j, $j = F, I$. Thus in equilibrium the interest rate charged by the IL (who is low cost) would be at least as high as that charged by the FL (who is high cost).

Essentially, the high monitoring cost induces the FL to choose a lower rate of interest to reduce the possibility of monitoring and hence the expected monitoring cost.

3. Contracting Problem with Endogenous Effort

3A. Payoff functions

We will now study a more realistic model of production uncertainty to study the welfare effects of formal lending.

Let us assume that the distribution function of q is not exogenously given. It is also affected by the entrepreneur's effort [7] e, which is observable to the lender and is contractible. The lender does not have to incur any monitoring cost for observing effort. So, now the loan contract specifies the level of effort e along with the gross interest rate r. The sequencing of the model is same as before. As in the previous section we assume that the realised output q, is not observable to the lender. The lender has to incur a monitoring cost γ_j, $j = F, H$ in case he wants to observe output, with $\gamma_F > \gamma_I$. Note that since effort is contractible, the incentive problem and hence the optimality of the debt contract remains unchanged.

Let the expected output be an increasing function of e with diminishing marginal returns. We further assume that effort causes disutility $c(e)$ to the entrepreneur with, $c'(e) > 0, c''(e) > 0$. Thus any change in effort affects the entrepreneur's expected residual output after loan

[7] Note that e may be interpreted in general as any complementary input.

repayment and his disutility from effort as well. We consider a uniform distribution for q conditional on effort, $f(q,e)=1/\bar{q}$, $\bar{q}=h(e)$, $h'(e)>0, h''(e)<0$. So, higher effort increases the upper limit of output. In other words, effort increases expected output $\frac{\bar{q}}{2}$. Hence, the optimal choice problem now reduces to:

$$\underset{e_j,r_j}{Max}\,\Pi_l^j = r_j - \frac{r_j^2}{2h(e_j)} - \frac{\gamma_j r_j}{h(e_j)} \tag{3}$$

subject to $$\Pi_e^j = \frac{h(e_j)}{2} + \frac{r_j^2}{2h(e_j)} - r_j - c(e_j) \geq \overline{w} \quad \text{for } j = F, I \tag{4}$$

The lender's profit function in (3) expresses the difference between expected loan repayment and expected monitoring cost as before. However the expected loan repayment and expected monitoring cost are now affected by effort as well. The expected output is given by $h(e_j)/2$. The inequality in (4) represents the entrepreneur's participation constraint. Since effort causes disutility to the entrepreneur, therefore the entrepreneur's profit function on the left-hand side of inequality (4) now includes an additional term, $c(e_j)$ representing disutility from effort. This has to be deducted from expected output from the project along with expected loan repayment to arrive at the entrepreneur's payoff.

Below we make a remark, about the shape of the isoprofit contours of the entrepreneurs, which will be used subsequently to characterise the equilibrium discussed in proposition 2. Since the profit function of the entrepreneur is independent of γ_j, therefore the iso-profit contours of the entrepreneur would be identical irrespective of whether they borrow from the FL or the IL. Hence for notational simplicity we drop the subscript j attached to r and e.

Remark 1: The slope of the Π_e contours drawn in (e,r) space is:

$$\frac{dr}{de} = -\frac{\partial\Pi_e/\partial e}{\partial\Pi_e/\partial r} = -\frac{\frac{1}{2}h'(e)\{1-F(r)^2\}-c'(e)}{F(r)-1} \underset{>}{\overset{<}{=}} 0 \text{ according as,}$$

$$c'(e) \underset{<}{\overset{>}{=}} \tfrac{1}{2}h'(e)\{1-F(r)^2\}.$$

Thus if an increase in e leads to a large increase in disutility from effort that more than offsets the increase in the entrepreneur's residual output after loan repayment, then an increase in e will reduce the entrepreneurs expected return.

Since $c''(e) > 0$, it means the disutility effect of an increase in effort gets stronger the higher the level of effort. This implies that at higher levels of effort the increased disutility from increased effort might more than offset the increase in the entrepreneur's residual output after loan repayment. Thus the expected return to the entrepreneur might fall with an increase in effort. Further given that the entrepreneur's profit is decreasing in r, the Π_e contours are likely to have a positive slope at low levels of effort and become negatively sloped at high levels of effort. It would also follow that the Π_e contours corresponding to higher values of Π_e will lie lower.

3B. Optimal Contract

In order to find out the optimal contracts (e_F^E, r_F^E) and (e_I^E, r_I^E) of the FL and the IL respectively, we solve the lender's optimisation problem stated in (3) and (4). We solve this problem for a general γ. The FL's (IL's) optimal contract is obtained if we substitute γ by $\gamma_F (\gamma_I)$. The Lagrangean for the lenders' optimisation problem is,

$$Z(e,r,\lambda) = r - \frac{r^2}{2h(e)} - \frac{\gamma r}{h(e)} - \lambda\left[w - \frac{h(e)}{2} - \frac{r^2}{2h(e)} + r + c(e)\right] \tag{5a}$$

The Kuhn-Tucker conditions are given by:

$$\frac{\partial Z}{\partial e} = \frac{h'(e)r}{h^2(e)}\left(\frac{r}{2} + \gamma\right) - \lambda\left(-\frac{h'(e)}{2} + \frac{r^2 h'(e)}{2h^2(e)} + c'(e)\right) \leq 0 \qquad e \geq 0, \quad e\frac{\partial Z}{\partial e} = 0 \tag{5b}$$

$$\frac{\partial Z}{\partial r} = 1 - \frac{r+\gamma}{h(e)} - \lambda\left(-\frac{r}{h(e)} + 1\right) \leq 0 \qquad r \geq 0, \quad r\frac{\partial Z}{\partial r} = 0 \tag{5c}$$

$$\frac{\partial Z}{\partial \lambda} = w - \frac{h(e)}{2} - \frac{r^2}{2h(e)} + r + c(e) \leq 0 \qquad \lambda \geq 0, \quad \lambda\frac{\partial Z}{\partial \lambda} = 0 \tag{5d}$$

Now we prove certain lemmas.

Lemma 1: $\lambda^E > 0$ for $e^E, r^E > 0$ i.e. for non-trivial solution the participation constraint is always binding in equilibrium.

Proof: Suppose not. Then $\lambda^E = 0$ and $e^E, r^E > 0$.

Now for $e^E > 0$ and $\lambda^E = 0$, from the Kuhn-Tucker conditions we have, $\frac{\partial Z}{\partial e} = \frac{h'(e)r}{h^2(e)}\left(\frac{r}{2} + \gamma\right) = 0 \Rightarrow h'(e) = 0$. This contradicts the assumption that $h'(e) > 0$.

This proves lemma 1.

Lemma 2: $\left.\frac{dr}{de}\right|_{\Pi_e} = \left.\frac{dr}{de}\right|_{\Pi_l} < 0$ at (e^E, r^E). The entrepreneur's iso-profit contour corresponding to his reservation utility, i.e. the entrpreneur's participation constraint must be negatively sloped at the equilibrium point. Hence the lender's iso-profit contour must be negatively sloped at the equilibrium point.

Proof: Π_e initially increases and then decreases with e. This follows from $c''(e) > 0, h''(e) < 0$. As the level of effort increases, the marginal disutility from effort eventually offsets the increase in the entrepreneur's residual output after loan repayment (vide Remark 1). Thus for any choice of r, there exists two values of e, say e_1 and e_2, $e_1 < e_2$, such that $\Pi_e(r, e_1) = \Pi_e(r, e_2)$ and $c'(e_k) \leq$ or $> \frac{1}{2}h'(e_k)\{1 - F(r)^2\}$ at $k = 1,2$ respectively. Note that Π_l is increasing in e. Thus for any choice of r the lender would always choose $e_2 > e_1$. However at e_2, $\left.\frac{dr}{de}\right|_{\Pi_e} < 0$.

This follows from,

$$-\frac{\partial \Pi_e / \partial e}{\partial \Pi_e / \partial r} = -\frac{\frac{1}{2}h'(e)\{1 - F(r)^2\} - c'(e)}{F(r) - 1} \lesseqgtr 0, \text{ according as, } c'(e) \gtreqless \tfrac{1}{2}h'(e)\{1 - F(r)^2\}.$$

Now in equilibrium, $\left.\frac{dr}{de}\right|_{\Pi_e} = \left.\frac{dr}{de}\right|_{\Pi_l}$.

This proves lemma 2.

We now focus on the profit function of the lender, Π_l.

The slope of the iso-profit contours of the lenders, in the (e,r) space is given by $\left.\frac{dr}{de}\right|_{\Pi_l} = -\frac{\partial \Pi_l / \partial e}{\partial \Pi_l / \partial r}$. Now $\frac{\partial \Pi_l}{\partial e} = \frac{r^2}{h^2(e)}\frac{h'(e)}{2} + \frac{r\gamma\, h'(e)}{h^2(e)} > 0$ at all (e,r). Further $\frac{\partial \Pi_l}{\partial r} = \left(1 - \frac{r+\gamma}{h(e)}\right) \gtreqless 0$ according as $r \lesseqgtr h(e) - \gamma = r^*(e)$, given e. Thus $\left.\frac{dr}{de}\right|_{\Pi_l} <$ or $>$ 0 according as $r <$ or $> r^*(e)$, given e. Thus for any given e, the iso-profit contours are negatively sloped below $r^*(e)$ and positively sloped above $r^*(e)$. Note that the tangents to the iso-profit contours of the lenders become vertical at $(e, r^*(e))$. The equilibrium contract will however lie on the negatively sloped portion of the Π_l contours. This follows from lemma 2.

Remark 2: The lender's iso-profit contours are C-shaped.

Remark 3: $r^*(e)$ maximises $\Pi_l(e,r)$ for a given e. (The second order condition for a maximum is satisfied at r^* since the derivative $\frac{\partial^2 \Pi_l}{\partial r^2} = -\frac{1}{h(e)} < 0$). Further note that e is the minimum effort required to achieve $\Pi_l^* = \Pi_l((e, r^*(e))$. Hence the iso-profit contours of the lenders corresponding to Π_l^*, will lie at or to the right of this minimum e, as illustrated in figure 3.

Figure 2 below provides an alternative illustration of $r^*(e)$.

Each curve in figure 2 shows Π_l as a function of r, for a given e. The maxima of Π_l curves corresponding to higher effort will lie more to the right. At a higher level of effort the probability of success is higher. Thus the increase in expected loan repayment corresponding to any increase in r will be higher. Hence the increase in expected monitoring cost would dominate the rise in expected loan repayment at a higher r. Note that the points 'a' and 'b' in figure 2, correspond to the points in (e,r) space at which the iso-profit contours of the lenders corresponding to Π_{l1}^* and Π_{l2}^* (for effort level e_1 and e_2 respectively) will become vertical.

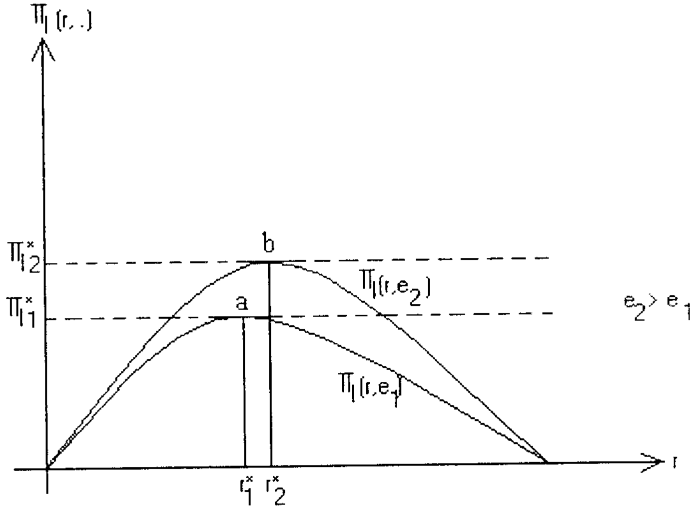

FIG. 2

Now the equation of the locus of points in (e,r) space at which the tangents to the lender's iso-profit contours become vertical is given by

$$r^*(e) = h(e) - \gamma \qquad (6)$$

We now use equation (6) to compare the iso-profit contours for the FL and the IL in the following lemma.

Lemma 3: For each profit level, the iso-profit contour of the FL will lie below that of the IL.

Proof: Since $\gamma_F > \gamma_I$ therefore, substituting γ_F and γ_I for γ in equation (6), yields $r_I^* = h(e_I) - \gamma_I > r_F^* = h(e_F) - \gamma_F$, if $e_F = e_I$. In other words the locus of points at which the tangents to the FL's iso-profit contours are vertical will lie below the locus corresponding to the IL.

Hence lemma 3 follows.

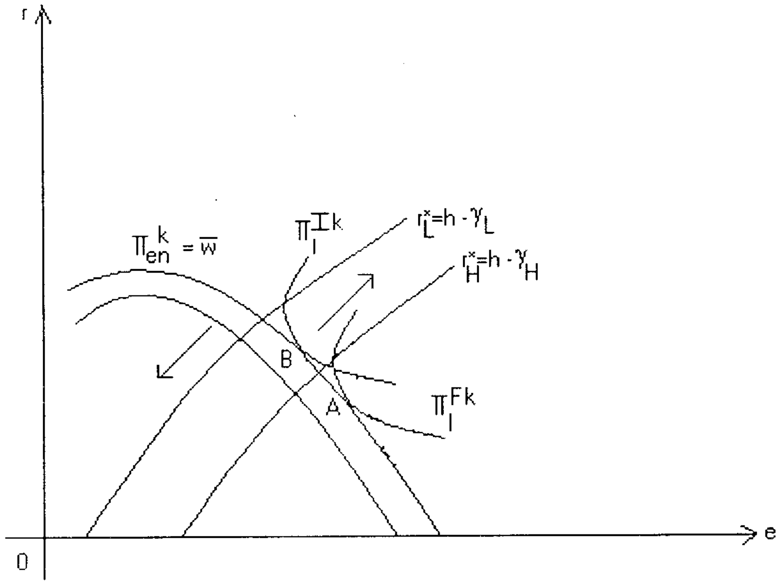

FIG.3

Now consider the contract (e_0, r_0) satisfying $r_0 = h(e_0) - \gamma_I$. Let $\Pi_l^I(e_0, r_0) = \Pi_l^0$. Again consider the contract (e_0, r_1) where $r_1 = h(e_0) - \gamma_F$. From equation (3) we have the lender's profit decreasing in γ_j. Hence $\Pi_l^F < \Pi_l^I$ at all $r_F = r_I$, if $e_F = e_I$. Moreover from equation (6) we know that $r_F{}^*(e) < r_I{}^*(e)$. This means that $\underset{r_F}{Max}\,\Pi_l^F < \underset{r_I}{Max}\,\Pi_l^I$. In other words, from equation (6) and equation (3), we find that for any given level of effort the profit maximising interest rate and the maximum profit of the high cost lender would be lower than that of the low cost lender. Hence $\Pi_l^F(e_0, h(e_0) - \gamma_F) < \Pi_l^0$. It follows that the iso-profit contour of the high-cost lender that lies vertically below that of the low cost lender will correspond to a lower level of profit. Hence we have the following remark.

Remark 4: For each profit level the iso-profit contour of the high cost lender will lie to the right of that of the low cost lender.

Lemma 4: The lenders iso-profit contours are convex in the region where they are negatively sloped.

Proof: See Appendix.

Proposition 2: In equilibrium, $e_F^E > e_I^E$ and $r_F^E < r_I^E$. In other words, the equilibrium contract offered by the FL (who is high cost) will specify a higher level of effort and a lower rate of interest, compared to the contract offered by the IL (who is low cost). The entrepreneurs will receive just their reservation utility, irrespective of the source of loan.

Proof: From lemmas 1 and 2 it follows that the equilibrium contracts must lie on the negatively sloped portion of the iso-profit contour representing the entrepreneur's participation constraint. From lemmas 3 and 4 it would follow that the point of tangency of the FLs iso-profit contour with the entrepreneur's participation constraint must correspond to a higher level of effort and a lower interest rate.

The inverse relationship between equilibrium rate of interest and effort level may be explained in terms of figure 4.

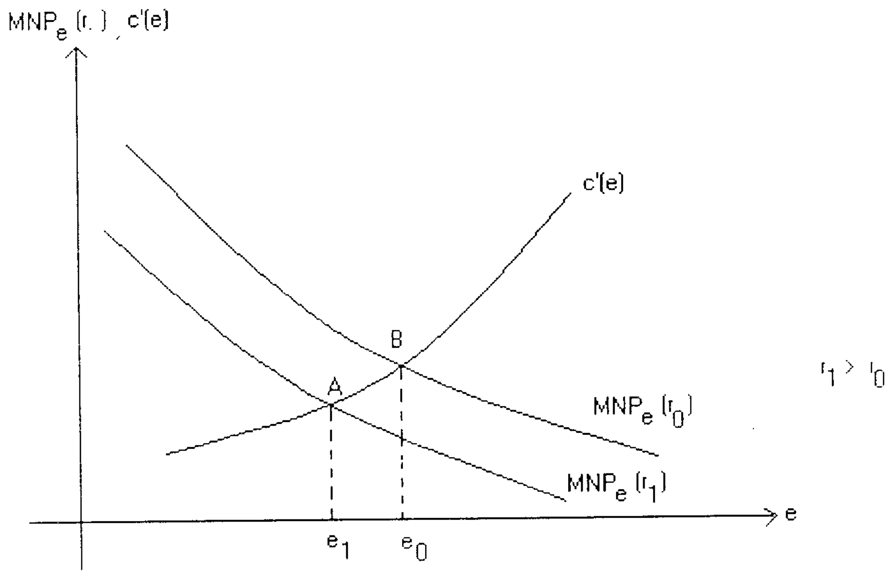

FIG. 4

For a given rate of interest r, an increase in effort causes expected output to increase faster than the expected loan repayment. This leaves the entrepreneur with a larger surplus output at higher effort. In other words the marginal net product from effort MNP_e, which is the difference between expected output and expected loan repayment, is positive. However $\frac{\partial \text{MNP}_e}{\partial r} = \frac{\partial(E(LR))}{\partial e} = -h'(e)F(r)f(r) < 0$.

Thus a higher the rate of interest, reduces the marginal net product from effort. This is because the rate of increase in expected output is independent of r. However, a higher r would imply a larger increase in expected loan repayment as e increases. This is due to both the effect on probability of success and repayment effect. Not only will the entrepreneurs have to pay more if they are successful, but the probability of success also increases.

Now given r, the entrepreneur's effort choice must be such that, it would equate the MNP_e and the marginal disutility from effort. This requires that $\frac{\partial}{\partial e}(E(q)) - \frac{\partial}{\partial e}(E(LR)) = c'(e)$, where $E(q)$ and $E(LR)$ represent expected output and expected loan repayment respectively.

As stated above a higher r reduces the entrepreneur's marginal net product from effort. Hence given $c''(e) > 0$, a higher r would induce entrepreneurs to choose a lower e in equilibrium. Here the implicit assumption is that $c''(e) > \partial \text{MNP}_e / \partial e$. The MNP_e may be increasing or decreasing in e. Violation of the inequality would imply that the entrepreneur's payoff is convex in effort, which is unrealistic.

4. Welfare Effects of Formal Lending

So far, our analysis has been concerned mainly with the equilibrium interest rate and effort level chosen by the FL and the IL, when the formal credit market is supply constrained and the loan contracts are standard debt contracts. We now focus our attention on the impact of formal and informal lending on expected output and total surplus. First we look at the effect on output. We then consider the implication for overall welfare.

Since expected output is an increasing function of effort we have the following result which follows directly from proposition 2.

Proposition 3: Formal loans induce larger expected output.

Now, total surplus from the project is the sum of the profit earned by the entrepreneur and the lender. Hence denoting the total surplus by S, we have

$$S = \Pi_e + \Pi_l. \tag{7a}$$

Substituting for Π_l and Π_e using (3) and (4) respectively and simplifying we have,

$$S = \frac{h(e)}{2} - c(e) - \frac{\gamma r}{h(e)} \tag{7b}$$

Thus total surplus is expected output from the project less the entrepreneur's disutility from effort less the expected monitoring cost borne by the lender.

Here our objective is to compare the total surplus accruing from projects, funded by the FL and the IL. The exercise boils down to looking at the effect of differences in loan monitoring cost of the FL and the IL on total surplus. We first make the following observation.

Remark 5: The difference in value of total surplus accruing from the projects funded by the FL and the IL is equal to the difference in profits earned by the FL and the IL in equilibrium.

This follows directly from the definition of total surplus given by (7), as the entrepreneur's participation constraint in (4) is always binding i.e. $\Pi_e = \overline{w}$ in equilibrium.

Now suppose the ILs choose $r_I = r_F^E$, Then, to satisfy the incentive compatibility constraint of the entrepreneur, the IL must choose $e_I = e_F^E$. Since $\gamma_F > \gamma_I$, therefore, using (3), $\Pi_I^F(e_F^E, r_F^E; \gamma_F) < \Pi_I^I(e_F^E, r_F^E; \gamma_I) < \Pi_I^I(e_I^E, r_I^E; \gamma_I)$. The second inequality follows from the fact that (e_I^E, r_I^E) is the optimal contract of the IL. Hence, using remark 5, we have the following result.

Proposition 4: Formal lending leads to lower total surplus compared to informal lending.

5. Alternative Contractual Mechanism without Monitoring

Now suppose the FLs offer a collateralised loan contract that specifies $C_F = r_F = \Pi_I^F(e_F^E, r_F^E; \gamma_F)$, where C_F is the value of collateral and r_F is gross interest on loan. In other words, the FLs give loans against a collateral whose value is equal to maximum profit that the FLs would have earned with monitoring. Effort is no longer contracted and is chosen by the entrepreneur.

With the fixed repayment contract, the entrepreneur's profit, if he borrows from the FL is given by

$$\Pi_e^F = \frac{h(e)}{2} - C_F - c(e) \tag{8}$$

where $h(e)/2$ is expected output, C_F total loan repayment and $c(e)$ is the entrepreneur's disutility from effort.

The entrepreneurs choose the level of effort so as to maximise their profit. The first order condition for maximum profit is given by

$$\frac{h'(e)}{2} = c'(e) \tag{9}$$

Solving this for effort yields the first best level of effort, e^*. The entrepreneur's profit in this case is

$$\Pi_e^* = \frac{h(e^*)}{2} - C_F - c(e^*) \tag{10}$$

The total surplus is given by

$$S = \Pi_I^F + \Pi_e^* = \frac{h(e^*)}{2} - c(e^*) \tag{11}$$

It is easy to check that $S > \frac{h(e_F^E)}{2} - c(e_F^E) - \frac{\gamma_F r_F^E}{h(e_F^E)}$ (12)

Thus, effectively a collaterised contract increases efficiency of the entrepreneur, and also maximises total surplus. In the standard principal-agent problem where both the principal and the agent are risk neutral, the first best can be achieved through a contract, which makes the agent internalise all the risk.

Now suppose FLs choose the fixed payment contract where $C_F = r_F = \Pi_I^F(e_F^E, r_F^E; \gamma_F)$. All entrepreneurs with $C_i \geq C_F$ become eligible for formal loans and go to FL as they would earn more from the fixed payment contract offered by the FL compared to the contract with monitoring and contractible effort offered by the IL. Note that the expression for Π_e^* in (10) is greater than $\Pi_e^F(e_F^E, r_F^E)$ as given by the left-hand side of inequality (4) as C_F is less than expected loan repayment and e^* is first best level of effort.

If the ILs choose the fixed repayment contract as well, then $C_I > C_F$ as $C_I = r_I = \Pi_I^I(e_I^E, r_I^E; \gamma_I)$ and $\Pi_I^I(e_I^E, r_I^E; \gamma_I) > \Pi_I^F(e_F^E, r_F^E; \gamma_F)$. In this case, the entrepreneurs would again choose first best level of effort, e^*, as obtained from (9), which would maximise total expected output less disutility from effort. However, the amount of loan repayment being greater, the profit earned by the entrepreneur would be less than what they would earn from the formal contract. This would imply that entrepreneurs with $C_i \geq C_F$ would prefer borrowing from the FL rather than the IL. Hence ILs won't get any borrowers, as entrepreneurs with $C_i \geq C_I > C_F$ now prefer the FL. The ILs would thus earn zero profits if they choose the fixed repayment contract.

On the other hand, if the ILs choose the contract with monitoring and contractible effort, they would earn a profit equal to C_I. Thus the ILs will be better off by choosing the contract with monitoring.

Proposition 5: When we allow for the possibility of a collaterised contract, (i) the FLs will choose the collaterised contract and the ILs will choose the contract with monitoring. (ii) Total surplus in case of formal sector credit will be higher. In this situation an expansion of formal credit will be welfare enhancing.

6. Conclusion

In this chapter we develop a model of production uncertainty and costly state verification, in which lenders are differentiated in terms of their ex-post monitoring cost. Differences in the cost of monitoring loans especially for bad debts is a commonly observed feature of the credit markets in the LDCs. The differences in loan monitoring cost reflect the more fundamental structural differences, namely, the difference in the degree of information asymmetry and bargaining power between the FLs and the ILs with respect to the entrepreneurs. The ILs, because of their strategic position and their personalised relationship with their clientele, exert a stronger influence (enjoy greater bargaining power) and are in a much better position to recover loans than the FLs. The FLs, unlike the IL, have to go through the legal procedure for recovering loans.

The optimal contracts are derived for the FL and the IL for a credit market that is supply constrained. It is shown that the higher monitoring costs of the FL will actually induce it to charge a lower rate of interest in order to avoid the possibility of default and monitoring. That informal interest-rate is higher than the formal interest-rate is a commonly observed feature of the credit markets of LDCs. However, given that the IL is the low cost type while the FL is the high cost type, the result is not intuitively obvious. We reach the conclusion that informal loans induce low effort and result in lower expected output whereas the impact of formal lending on total surplus is beneficial under certain contract forms. The total surplus resulting from the formal loans is lower when the loan contracts are standard debt contracts with monitoring. Total surplus realised from formal loans will be greater, if the FLs choose a collaterised contract, which the ILs do not find profitable to choose.

Appendix.

Lemma 4: The lenders iso-profit contours are convex in the region where they are negatively sloped.

Proof. $\frac{d}{de}\left(\left.\frac{dr}{de}\right|_{\Pi_l}\right)=\frac{d}{de}\left[-\frac{\partial\Pi_l/\partial e}{\partial\Pi_l/\partial r}\right]$

$$=-\frac{1}{(\partial\Pi_l/\partial r)^2}\left(\frac{\partial\Pi_l}{\partial r}\frac{d}{de}\left(\frac{\partial\Pi_l}{\partial e}\right)-\frac{\partial\Pi_l}{\partial e}\frac{d}{de}\left(\frac{\partial\Pi_l}{\partial r}\right)\right) \tag{1}$$

Note that when $\frac{dr}{de}<0\Rightarrow\frac{\partial\Pi_l}{\partial r}>0$. (2)

Now, $\frac{\partial}{\partial r}\left(\frac{\partial\Pi_l}{\partial e}\right)=\frac{\partial}{\partial r}\left[\frac{h'(e)}{h^2(e)}\left\{\gamma r+\frac{r^2}{2}\right\}\right]=\frac{h'(e)}{h^2(e)}\{\gamma+r\}>0$.

Further,

$$\frac{\partial}{\partial e}\left(\frac{\partial\Pi_l}{\partial e}\right)=\frac{\partial}{\partial e}\left[\frac{h'(e)}{h^2(e)}\left\{\gamma r+\frac{r^2}{2}\right\}\right]=\left\{\gamma r+\frac{r^2}{2}\right\}\frac{h^2(e)h''(e)-h'(e)2h(e)h'(e)}{h^4(e)}<0.$$

Hence $\frac{d}{de}\left(\frac{\partial\Pi_l}{\partial e}\right)=\left\{\frac{\partial}{\partial r}\left(\frac{\partial\Pi_l}{\partial e}\right)\frac{dr}{de}+\frac{\partial}{\partial e}\left(\frac{\partial\Pi_l}{\partial e}\right)\right\}<0$ (3)

Again since $\frac{\partial^2\Pi_l}{\partial r^2}<0$ and $\frac{\partial}{\partial e}\left(\frac{\partial\Pi_l}{\partial r}\right)>0$, therefore,

$$\frac{d}{de}\left(\frac{\partial\Pi_l}{\partial r}\right)=\left[\frac{\partial}{\partial r}\left(\frac{\partial\Pi_l}{\partial r}\right)\frac{dr}{de}+\frac{\partial}{\partial e}\left(\frac{\partial\Pi_l}{\partial r}\right)\right]>0. \tag{4}$$

Thus from the signs of the derivatives in (2), (3) and (4), it would follow that the expression for the derivative in (1) is greater than zero. This proves lemma 4.

Chapter 3

Deregulation in the Formal Credit Market and its Impact on Informal Credit

1. Introduction

The past decade has witnessed a revival of the debate on state intervention versus non-intervention as the optimal credit policy, especially in the context of developing countries.[1] Initially it was believed, that state intervention through nationalisation and regulation of commercial banks would help to mitigate the financial dualism that infested the credit markets in most developing countries. That the policy was a partial success is evidenced by several independent studies, which contradict the official claim that the growth of formal credit has put the informal lender (IL) "in place". The studies reveal that small borrowers (less wealthy or collateral poor) both in the agricultural and the industrial sectors continue to depend heavily on informal credit as most often they are denied access to formal credit.[2]

The shift in policy in favour of government non-intervention in the wake of the financial repression resulting from interventionist approach has also been subject to debate. Initially the switch to financial liberalisation was motivated by the belief that government control reduces both the quantity and quality of investment. Interest rate control is one of the principal features of government intervention. It was argued that interest rate controls, in fact, make the rationing constraints in the formal credit market more acute for the small borrowers and result in cross subsidisation of the rich by the poor. Interest rate deregulation would thus help to remedy the malady created by such controls.

The failure of the interventionist approach was explained in terms of some of the inherent structural differences of the FL and the IL. The higher loan transaction cost per borrower for the FL resulting from their more elaborate establishments and procedures is a case in point. Also

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[1] For a detailed discussion of the issues and a reference list refer to chapter 1.
[2] For a discussion of the causes of failure of formal credit in reaching out to the poor *op.cit.*

larger borrowers face lower probability of project failure. Together they imply that larger loans are more profitable for the FL. Further, due to the acute information asymmetry faced by the FL, the formal contracts are mostly collateralised contracts. Also, only very specific forms of collateral are acceptable. This meant that FLs could not reach out to the poor (Ray, 1998).

Our review of the literature in chapter 1 reveals that much of the existing literature on financial liberalisation is concerned only with the formal credit market[3]. Moreover the focus is on the impact of deregulation on aggregate savings, investment and growth, the volume of credit, interest rates, the extent of rationing, profitability and efficiency in the allocation of credit rather than on the effectiveness of financial liberalisation in channeling formal credit to the small borrower. On the other hand the models of the credit market in developing countries that take into consideration the dual nature of the credit market have not addressed the issue of financial liberalisation. A more complete approach to the problem of financial liberalisation in the context of developing countries would be to construct models that explicitly take into consideration the strategic interaction between the FL and the IL. In this chapter we do so by developing a model of financial liberalisation in the context of a dual credit market.

Cheap credit, it was hoped, would lower the dependence on the rural money lenders, or (if the dichotomy persisted) would at least provide a beneficial trickle down effect of reducing the usurious rate of interest in the informal credit market by lowering the costs of funds to the lenders. However, as a number of studies (Basu, 1984; Bell, 1990; Hoff and Stiglitz, 1990; Siamwalla et. al. 1990) point out, this policy of providing cheap credit has failed to achieve its desired results. The rural moneylenders continue to dominate the informal sector, and there is evidence that the interest rate charged by them have been relatively unaffected.

This chapter attempts to assess the efficacy of financial liberalisation as the optimal credit policy, for reducing the importance of the IL, as a source of credit for small borrowers in developing countries. In chapter 2 we analysed the circumstances under which formal lending may be more conducive to welfare compared to informal lending. The implications of formal lending for expected output and total surplus under different contract forms and differences in loan recovery cost were inferred. This chapter constitutes the next step to the argument

[3] See Denizer (1997). The credit rationing models of Jaffee and Russell (1976), Stiglitz and Weiss (1981, 1986), Bester (1985), and Mildey and Riley (1988) do not consider the existence of the informal sector.

developed in chapter 2. It analyses the effectiveness of the policy of financial liberalisation for expanding the reach of formal credit, especially to the small borrowers.

Financial liberalisation is a comprehensive term. This chapter focuses on only one aspect of liberalisation; that of interest rate deregulation. Specifically it considers whether deregulation of formal interest will necessarily lead to a contraction in the size of the informal credit market. The strategic interaction between the FL and the IL is modeled as a sequential move game (for relevant theory, see Aliprantis and Chakraborti, 2000) in which the FL takes into consideration the IL's behaviour (choice of contract)–whether to segment or to compete – while choosing its strategy. The FL and the IL have been differentiated in terms of information asymmetry. The IL, unlike the FL, does face the possibility of strategic default. The fact that the ILs enjoy informational advantage has considerable empirical support[4]. The order of moves is also significant in revealing a structural difference between the FL and the IL. The FL being subject to regulatory constraints and procedural norms cannot alter his offers quickly, unlike the IL who can observe the FL and react instantaneously.

Unlike Jain (1999) in this chapter we do not consider the problem of screening. The production function is the same for all the entrepreneurs. The focus of this chapter is thus different from that of Jain, who has used his framework to characterise the conditions under which the FL will use non-exclusive contracts for screening bad borrowers. The effect of various kinds of government intervention has then been considered as an application of the model. Also note, that this chapter does not consider the effects of an expansion in the availability of subsidised formal credit directed to end users in the informal sector, as in Chakrabarty and Chaudhuri (2001). Here we are primarily concerned with the effect of deregulation of formal interest rate on the size of the informal sector. We do so in terms of a framework in which borrowers are differentiated in terms of their capacity to pay collateral, which is observable, and all loan contracts are exclusive.

Our analysis reveals that for certain ranges of interest rate ceilings deregulation of the formal interest rate may actually result in the counter intuitive situation where the size of the formal credit market shrinks and informal credit expands. Thus a policy of financial liberalisation is not necessarily effective in making the benefits of formal credit reach the poorest strata of society.

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[4] See Jain (1999), Udry (1990), Bose (1999).

The plan of this chapter is as follows. Section 2A states the assumptions regarding the basic framework. Section 2B briefly discusses credit market equilibrium with a fully informed monopolist IL. This would be the scenario before the entry of the FL. Section 3 discusses the nature of equilibrium in the presence of formal lending. Section 3A considers credit market equilibrium with just one FL. This enables us to understand how the FL's problem gets differentiated from that of the IL due to the presence of information asymmetry. Finally in section 3B the case of strategic interaction between an informed IL and an uninformed FL has been discussed. Here, the discussion in section 3A is carried a step further. It shows how the FL's problem gets further modified if the FL takes into account the strategic behaviour of the IL. Section 4 considers the implications of interest rate deregulation in the formal sector. Finally section 5 presents the conclusions.

2. The Model

2A. Assumptions

There exist two types of agents – entrepreneurs and lenders, who are risk neutral. The entrepreneurs have access to a project, whose size is fixed at unity. The project return is characterised by a two point production function, according to which output q is realised with probability p if the project is successful, and output zero is realised with probability $(1-p)$ if the project fails. Thus the uncertainty in project returns is purely exogenous. Further, the production function is the same for all entrepreneurs. There is no type or effort variety. Hence there is no adverse selection problem either.

The entrepreneurs must borrow the investment goods in order to undertake the project. The contracts offered by the lenders are collateralised[5] loan contracts which require that, either the entrepreneurs pay $r \in [0, q]$ which is the gross interest on the loans or in case of default they part with C, which is the amount of collateral as specified in the contract. The entrepreneurs are

[5] The investment good is qualitatively different from the collateral.

however differentiated in terms of their capacity to pay collateral C_i[6,7] which is uniformly distributed over the interval $[0, \overline{C}]$. C_i being divisible, it represents the maximum amount of collateral that may be offered by the *i*th entrepreneur, e_i.

The loan contracts also involve a fixed transaction cost of T (inclusive of screening and enforcement cost and the transaction cost of selling collateral in case of default) per borrower. To keep the notation simple we assume that T includes the principal or amount of loan per borrower, which is of unit size by assumption. Thus $T > 1$.

The lenders are of two types – formal and informal. Unlike FLs (institutional lenders like commercial banks), the ILs (indigenous bankers, moneylenders) can observe q. Hence the ILs do not face any possibility of strategic default by the entrepreneurs on the loans extended by them. The FLs however are subject to strategic default, as they cannot observe q. It is further assumed that FLs initially face an interest rate ceiling at $\bar{r}$. We then examine the effect of deregulation of the formal interest rate on the size and interest rates in the formal and informal credit markets .The ILs are free to choose the interest rate.

Entry into informal lending is not free or easy due to the existence of personal knowledge about borrowers on part of the lender, large resources required for incurring screening costs, giving loans etc. Thus we assume that there exists only one IL in a locality or in other words the ILs enjoys a local monopoly.

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[6] Alternatively, C_i could be an index of quality rather than the quantity of collateral. This would be in keeping with the fact that FLs often accept collateral in specific forms.

[7] This model does not consider information asymmetry between the lenders and entrepreneurs regarding the quantity, quality or valuation etc. of collateral. Here the collateral is observable to all. The focus is on the implications of differences in the degree of information asymmetry regarding the realised output q.
We assume that the collateral is marketable. The market value of the collateral is positive. However to sell the collateral either of the agents will have to incur a transaction cost. We assume that the transaction cost of selling the collateral by an individual entrepreneur is higher compared to the transaction cost borne by the lender. This could be due to lack of marketing ability of the borrower or the fact that the borrower does not enjoy the scale effect enjoyed by the lender who engage in many such dealings as a routine matter; and hence are better informed and enjoy greater bargaining power. The transaction cost of selling the collateral in case of default is included in T. This means that the entrepreneur will never be interested in selling off the collateral and investing the money rather than taking loans for financing projects.

2B. Equilibrium with a fully informed monopolist IL

We first consider credit market equilibrium in the absence of formal lending. Thus we consider the equilibrium with a fully informed monopolist IL.

Given the project return function and the unit loan demand functions of the entrepreneurs, the expected profit functions may be written as:

$$\pi_l = C(1-p) + rp - T \tag{1}$$

$$\pi_e = pq - C(1-p) - rp \tag{2}$$

where π_l and π_e represent the lender's expected profit per borrower and the entrepreneur's expected profit from the project respectively.The total surplus from the project is thus,

$$S = \pi_l + \pi_e = pq - T > 0 \tag{3}$$

Let Π_l represent the aggregate expected profit of the lender. Therefore we have,

$$\Pi_l = \pi_l(r,C)\int_C^{\bar{C}} \frac{1}{\bar{C}}dt = [C(1-p) + rp - T]\frac{\bar{C} - C}{\bar{C}} \tag{4}$$

The ILs equilibrium contract (C_E, r_E) is a solution to the optimisation problem[8],

$$\underset{r,\,c}{Max}\,\Pi_l$$

$$s.t.\ \pi_e \geq 0 \tag{5a}$$

$$C \in [0,\bar{C}]\ ,\ r \in [0,q] \tag{5b}$$

where (5a) represents the participation constraint of the entrepreneur.

We now specify the equilibrium choice of C and r by the IL in the following proposition.

[8] This is a static maximisation problem in which we are concerned with the maximisation of a *flow* of profit during a period rather than a *stock* carried over from the past. Thus the residual collateral is not taken into consideration in the entrepreneur's pay-off function.

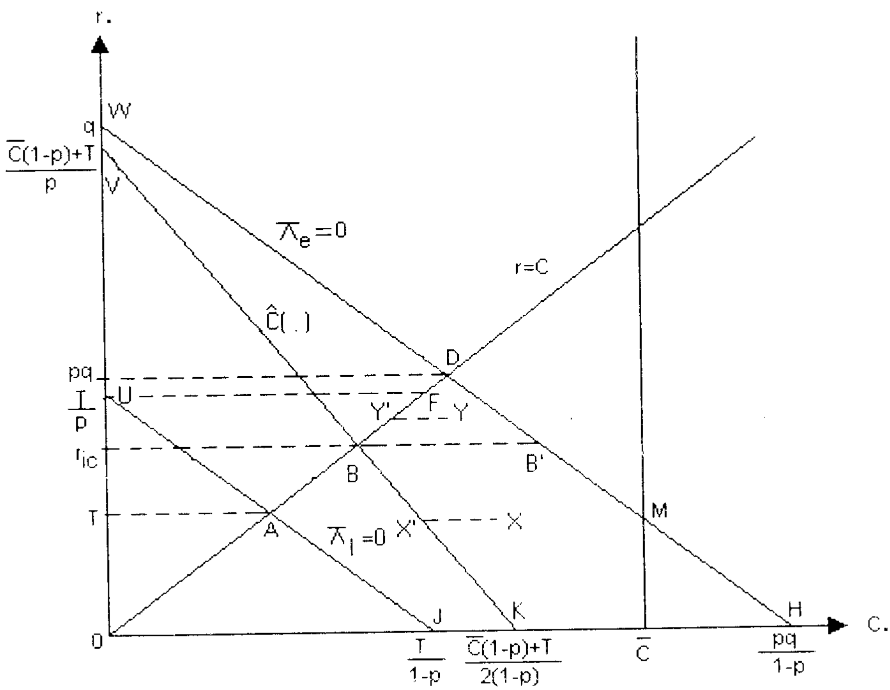
Proposition 1: In equilibrium the IL would choose $C_E = 0$ and $r_E = q$.

Proof: The entrepreneur's participation constraint (5a) must be binding in equilibrium, because if not, then (5a) must be satisfied as a strict inequality. Then for any C, we can increase r such that the inequality in (5a) still holds while the value of the objective function increases. Thus we can continue increasing r till equality in (5a) holds. This will happen for some $r < q$ as at $r = q$ inequality will be reversed.

Substituting $pq = C(1-p) + rp$ into the objective function we have, $\Pi_I = (pq - T)\frac{\overline{C} - C}{\overline{C}}$, which is decreasing in C. Therefore $C_E = 0$. Substituting $C_E = 0$ into the original objective function we have $\Pi_I = rp - T$ which is increasing in r. Therefore $r_E = q$.

The intuition behind proposition 1 is straightforward. Since the IL does not face the problem of strategic default, therefore the IL would find it profitable to make clean advances. This would give the IL access to all entrepreneurs who are potential borrowers. Moreover being a monopolist, the ILs would choose the highest possible interest rate, that is choose $r = q$ and leave the entrepreneurs with no surplus in excess of their reservation utility.

FIG 1.



In figure 1 the area $WO\bar{C}M$[9] represents the IL's feasible set of contracts, as summarised by conditions (5a) and (5b). The straight line UJ is the locus of points representing the (C,r) pairs for which the lender's profit per borrower is zero. The straight line WH is the locus of points representing the (C,r) pairs for which the entrepreneurs earn zero profits. Point W represents IL,'s equilibrium contract. We find that in equilibrium the IL makes clean advances, which would make the loans accessible to all classes of entrepreneurs and leave the entrepreneurs at their reservation utility.

3.Equilibrium in the Presence of Formal Lending

3A. FL's problem in the absence of the IL

We assume that entry into formal credit market is restricted by law. Thus we consider the case where there is only one FL in a locality. To ease our understanding we begin by analysing the FL's problem in the absence of the IL. So in this section our focus is on credit market equilibrium with an uninformed monopolist FL.

Note that constraints in (5a) and (5b) are valid, for the formal credit market as well. But in order to differentiate between the IL and FL, we use the subscript *'F'* with C and r to denote the FL's choice of the same. Thus the formal contract is denoted by (C_F, r_F). The FL's aggregate expected profit, the FL's expected profit per borrower and the entrepreneur's expected profit from the project if he borrows from the FL are denoted by Π_{lF}, π_{lF} and π_{eF} respectively.

The FL, unlike the IL, has to take into account the possibility of strategic default on the loans extended by it. The FL's profit per borrower would be the same as that of the IL as long as $C_F \geq r_F$. However when $C_F < r_F$ the FL's profit per borrower would no longer be given by equation (6a) (which is the same as (1)); his profit per borrower will now be given by equation (6b) below.

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[9] Effectively the IL's choice set is represented by the area $WUJ\bar{C}M$, since the IL would never choose a contract that lies to the left of or on the $\pi_l = 0$ contour at which the lender's profit per borrower would be non-positive.

$$\pi_{lF} = C_F(1-p) + r_F p - T \qquad C_F \geq r_F \tag{6a}$$

$$= C_F - T \qquad C_F < r_F \tag{6b}$$

Hence the entrepreneur's profit function, if he borrows from the FL is given by,

$$\pi_{eF} = pq - C_F(1-p) + r_F p \qquad C_F \geq r_F \tag{7a}$$

$$= pq - C_F \qquad C_F < r_F \tag{7b}$$

The FL's equilibrium contract will be given by some (C_F, r_F) pair in this region such that it will maximise his aggregate profit $\Pi_{lF} = \pi_{lF} \dfrac{\overline{C} - C_F}{\overline{C}}$.

<u>*Definition 1:*</u> Let us define $\hat{C}(r_F)$ as the locus of the lender's optimal choice of C_F for a given choice of r_F, corresponding to (6a).

In order to derive $\hat{C}(r_F)$ we set the derivative of the aggregate profit function corresponding to (6a), $\dfrac{\partial \Pi_{lF}}{\partial C_F} = 0$. This yields,

$$\hat{C}(r_F) = \frac{1}{2} \frac{\{\overline{C}(1-p) + T - r_F p\}}{1-p} \tag{8a}$$

Note that the second order condition for a maximum is satisfied by $\hat{C}(r_F)$, since

$$\frac{\partial^2 \Pi_{lF}}{\partial C_F{}^2} = -\frac{2(1-p)}{\overline{C}} < 0 \tag{8b}$$

From the expression for $\hat{C}(r_F)$ in (8a) we find that $\hat{C}(r_F)$ is decreasing in r_F. Thus as r_F increases, more borrowers become eligible for loans.

Setting $C_F = \hat{C}(r_F)$, in the FL's aggregate profit function corresponding to (6a), yields Π^*_{lF}. This is the FL's aggregate expected profit, after choosing C_F optimally for a given choice of r_F, when $C_F \geq r_F$. That is $\Pi^*_{lF} = \Pi_{lF}(\hat{C}(r_F), r_F)$.

We now prove several lemmas that will help us in our later discussion.

Lemma 1: $\Pi^*_{IF} = \Pi_{IF}(\hat{C}(r_F), r_F)$ is increasing in r_F.

Proof: Substituting for $\hat{C}(r_F)$ in equation (4) yields,

$$\Pi^*_{IF} = \Pi_{IF}(\hat{C}(r_F), r_F) = \frac{1}{2}\{\overline{C}(1-p) + r_F p - T\}\frac{\overline{C} - \hat{C}(r_F)}{\overline{C}} \quad (9)$$

Differentiating equation (9) with respect to r_F one can check that Π^*_{IF} is increasing in r_F. This completes proof of Lemma 1.

Here, in order to solve the FL's optimisation problem we begin by considering the impact of C_F on the objective function Π_{IF} (corresponding to (6a)). From the expression for Π_{IF} it is obvious that a change in C_F has two opposing effects on Π_{IF}. An increase in C_F, for instance, with r_F remaining constant, will raise Π_{IF} by increasing the lender's expected profit per borrower, but it would also lower Π_{IF} by reducing the number of borrowers eligible for loans. This trade off yields an optimal value $\hat{C}(r_F)$ of C_F at which Π_{IF} is maximum. Now a higher r_F implies that the lender earns a higher expected profit per borrower, for any given C_F. This enables the lender to accommodate more borrowers (lower C_F), by sacrificing some of the profit earned per entrepreneur (because of a lower C_F) without reducing the aggregate profit earned by him. This means that at higher r_F, the trade off will lead to a lower optimal $\hat{C}$ as in figure 1. Further we find that as we move up along the $\hat{C}(.)$ curve, not only the number of borrowers eligible for loans increase, we move to higher π_{IF} contours as well. So the lender's expected profit per borrower corresponding to $\hat{C}(r_F)$ (the first term in the product in (9)) is increasing in r_F as well. Thus aggregate profit of the lender will increase along $\hat{C}(.)$ as r_F increases as shown in lemma 1.

In figure 1 the $\hat{C}(r_F)$ curve lies between lies between $\pi_{IF} = 0$ and $\pi_e = 0$ contours. This follows from the assumptions stated below.

$$T < \bar{C}(1-p) < pq - T \tag{10a}$$

$$\bar{C} > pq \tag{10b}$$

Above assumptions imply that,

$$T < \frac{pq}{2} < \frac{\bar{C}}{2} \tag{10c}$$

To have a meaningful problem of borrowing and lending, it is necessary that the lenders be interested in realising the surplus from the project rather than taking the collateral. Condition (10a) ensures this. This holds even though the value of collateral that may be obtained from the richest segment of the entrepreneurs exceeds the expected return from the project as stated in condition (10b). There exist collateral rich entrepreneurs but still the lender would find increasing r_F to be more attractive. Condition (10a) also ensures that the transaction cost per loan is less than the repayment in case of default multiplied by the probability of default, for the richest borrower, but not necessarily so for entrepreneurs with a small amount of collateral. The implication with regard to transaction cost is summarised in (10c). The above assumptions ensure that there are no discontinuities in the locus of optimal choices.

We now consider the incentive compatibility constraint given in (6) and define the following.

<u>*Definition 2:*</u> Let r_{ic} be the rate of interest such that $\hat{C}(r_{ic}) = r_{ic}$.

Hence r_{ic} is a solution to the equation $r_F = C_F$ and equation (8a). This corresponds to the point B in figure 1. Thus we have,

$$r_{ic} = \frac{\bar{C}(1-p)+T}{2-p} \in (T, pq) \tag{11a}$$

This implies that,

$$r_{ic} \gtrless \frac{T}{p} \text{ according as } \frac{\bar{C}}{2} \gtrless \frac{T}{p}. \tag{11b}$$

We next consider the following lemmas with regard to certain subsets of the feasible set.

Lemma 2: The contract (C_F, r_F) with $C_F = r_F = r_{ic}$ is the best contract among all feasible contracts with $r_F \leq r_{ic}$.

Proof: Consider any contract (C_{FX}, r_{FX}) such that $r_{FX} \leq r_{ic}$, $C_{FX} \neq \hat{C}(r_{FX})$, $\pi_e \geq 0$, $C_{FX} \in [0, \overline{C}]$ and $\pi_{IF} > 0$[10]. Then from definition 1 it follows that $\Pi_l(C_{FX}, r_{FX})$ $< \Pi_l(\hat{C}(r_{FX}), r_{FX})$. Further from lemma 1, since $\Pi_l(\hat{C}(r_F), r_F)$ is increasing in r_F, therefore it follows that $\Pi_l(\hat{C}(r_{ic}), r_{ic}) \geq \Pi_l(\hat{C}(r_{FX}), r_{FX})$ for all $r_{FX} \leq r_{ic}$. This proves lemma 2.

Diagrammatically, let KB represent the segment of $\hat{C}(.)$ curve corresponding to $r_F \leq C_F$, in figure 1. Consider a contract represented by point X in the region enclosed between $JADM\overline{C}$. Then X is inferior to X' on KB which is inferior to B. Thus point B represents the best contract in the region $JADM\overline{C}$.

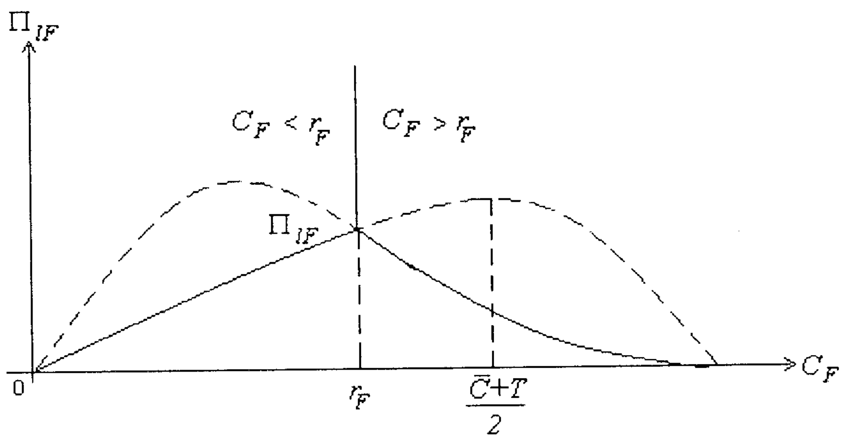

Figure A: showing non-differentiability of the objective function in Lemma 3

[10] A lender would never choose a contract such that $\pi_l \leq 0$.

Lemma 3: For any choice of $r_F > r_{ic}$ the contract (C_F, r_F) with $C_F = r_F$ yields higher Π_{IF} compared to other feasible contracts with $C_F \neq r_F$. In other words $C_F = r_F$ is the locus of the FL's optimal choice of C_F for a given choice of $r_F > r_{ic}$.

Proof: From definition 2 and condition (8b) it follows that for $r_F > r_{ic}$, $\hat{C}(r_F) < r_F$. Therefore for all contracts (C_F, r_F) with $r_F \geq r_{ic}$ and $C_F > r_F \Rightarrow C_F > \hat{C}(r_F)$, the aggregate profit of the FL would be decreasing in C_F. (Note that the derivative of the Π_{IF} function corresponding to (6a) is negative for $C_F > \hat{C}(r_F)$).

Again for all contracts (C_F, r_F) with $r_F \geq r_{ic}$ and $C_F < r_F$, the aggregate profit of the FL would be increasing in C_F. (Note that the derivative of the Π_{IF} function corresponding to (6b) is positive for $C_F > r_F \in \left(r_{ic}, \dfrac{C+T}{2} \right)$; the maximum is reached at $C_F = \dfrac{C+T}{2}$. (We do not consider the case $r_F > \dfrac{C+T}{2}$ as it is uninteresting).

Finally note that for all contracts (C_F, r_F) with $r_F \geq r_{ic}$ and $C_F = r_F$, the FL's aggregate profit functions corresponding to (6a) and (6b) are identical.

Hence proof of lemma follows.

Note that, the overall objective function becomes non-differentiable at $C_F = r_F$. The nature of the problem is diagrammatically shown in fig. A.

In figure 1, for a given choice of $r_F > r_{ic}$, Π_{IF} is maximum on the $C_F = r_F$ line. Thus for any contract Y on the horizontal line corresponding to r_F, the contract Y' on the segment BD yields higher Π_{IF}.

<u>*Definition 3:*</u> Let (C_F, r_F) with $C_F = r_F = r^*$ be the best contract among all contracts for which $r_F = C_F$.

Thus r^* is obtained by maximising $\Pi_{IF} = (r_F - T)\frac{\overline{C} - r_F}{\overline{C}}$. From the first order condition for a maximum[11] we have,

$$r^* = \frac{T + \overline{C}}{2} \in (T, \overline{C}) \tag{12}$$

Comparing r^* and r_{ic}, since $T < \overline{C}$, it follows that

$$r^* > r_{ic} \tag{13}$$

Further from the assumption[12] that $(pq - T) > \overline{C}/2$ it follows that

$$r^* < pq \tag{14}$$

Diagrammatically the contract with $C_F = r_F = r^*$ will lie on the incentive compatibility constraint between B and D.

We now state the following theorem.

Theorem 1: In the absence of the IL and interest rate ceiling the FL's equilibrium contract (C_{FE}, r_{FE}) is given by $C_{FE} = r_{FE} = r^* \in (r_{ic}, pq)$.

Proof: From definitions 2 and 3 and result (13), it follows that the contract (C_F, r_F) with $C_F = r_F = r^*$ yields higher Π_{IF} compared to the contract with $C_F = r_F = r_{ic}$. Hence using lemma 2, it follows that contract with $C_F = r_F = r^*$ yields higher Π_{IF} compared to all feasible contracts with $r_F \le r_{ic}$. Using definition 3 and lemma 3, it further follows that the contract with $C_F = r_F = r^*$ yields higher Π_{IF} compared to all feasible contracts with $r_F > r_{ic}$. Therefore we conclude that the FL's equilibrium contract is given by $C_{FE} = r_{FE} = r^*$.

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[11] The second order condition is satisfied since $\frac{\partial^2 \Pi_{IF}}{\partial r_F^{\,2}} = -\frac{2}{\overline{C}} < 0$.

[12] Thus we assume that the total surplus from the project is greater than the average value of collateral but smaller than the highest value of collateral. In other words we assume that the surplus from the project is large enough , so that the lenders are better off giving a share in the surplus to the entrepreneurs.

Note that, if the FL is faced with an interest rate ceiling at $\bar{r}$, then the FL's equilibrium contract will be given by, (C_{FE}, r_{FE}) such that

$$r_F = \min(r^*, \bar{r}) \text{ and } C_{FE} = \hat{C}(r_{FE}) \quad \text{when} \quad \bar{r} \leq r_{ic}$$
$$C_{FE} = \bar{r} \quad \text{when} \quad \bar{r} > r_{ic}$$

3B. FL's problem in the presence of the IL

We now come to the more interesting case where there is one FL and one IL in a locality. We model this as a sequential move game between an FL and an IL in which the FL moves first followed by the IL. The FL being subject to regulatory constraints, can not alter his offers quickly unlike the IL who can observe the actions of the FL and react instantaneously. We solve this game by backward induction and the solution obtained would be a sub-game perfect Nash equilibrium (SPNE).

Specification of the Contract Space

In stage 1, the FL chooses an action g_k, which specifies a contract (C_{Fk}, r_{Fk}). Let G denote the action space of the FL. Then $G = \{g_k = (C_{Fk}, r_{Fk}) : C_{Fk}, r_{Fk} \geq 0\}$. Henceforward we omit the subscript F for the FL's profit expressions.

In stage 2, the IL after observing the FL's action chooses a strategy $s_j(.)$ which specifies an action or contract $s_j(g_k) = (C_{jk}, r_{jk})$, with $C_{jk}, r_{jk} \geq 0$, for every possible action g_k of the FL. Let S denote the strategy space of the IL, and let A_k denote the IL's action space corresponding to S for a given g_k. Then $S = \{s_j(.)\}$ and $A_k = \{s_j(g_k) = (C_{jk}, r_{jk}) : C_{jk}, r_{jk} \geq 0\}$. Let us define $\pi_{lk} = \pi_l(g_k) = \pi_l(C_{Fk}, r_{Fk})$, as the FL's profit per borrower, where (C_{Fk}, r_{Fk}) is the formal contract. Further let $\pi_l^{jk} = \pi_l(s_j(g_k)) = \pi_l(C_{jk}, r_{jk})$ denote the IL's profit per borrower, where (C_{jk}, r_{jk}) denotes the informal contract. Figure 2 below represents the subsets $A_{ik}, i=1,2,3,4$ of the action space of the IL corresponding to the strategy sub-spaces

$S_i, i = 1,2,3,4$ for a given g_k. Given the formal contract, C_{Fk} defines the vertical line above C_{Fk} in figure 2. C_{Fk}, r_{Fk} together define the constant line π_{Ik}. These two lines specify the subsets $A_{ik}, i=1,2,3,4$ as shown in the figure. Below we formally define the subsets $S_i, i = 1,2,3,4$ of the strategy space for the IL hence implied.

$$S_1 = \{s_j : s_j(g_k) = (C_{jk}, r_{jk}) \text{ where } C_{jk} \geq C_{Fk} \;\&\; r_{jk} \text{ s.t. } \pi_I(C_{jk}, r_{jk}) \geq \pi_{Ik}\}$$

$$S_2 = \{s_j : s_j(g_k) = (C_{jk}, r_{jk}) \text{ where } C_{jk} > C_{Fk} \;\&\; r_{jk} \text{ s.t. } \pi_I(C_{jk}, r_{jk}) < \pi_{Ik}\}$$

$$S_3 = \{s_j : s_j(g_k) = (C_{jk}, r_{jk}) \text{ where } C_{jk} < C_{Fk} \;\&\; r_{jk} \text{ s.t. } \pi_I(C_{jk}, r_{jk}) \geq \pi_{Ik}\}$$

$$S_4 = \{s_j : s_j(g_k) = (C_{jk}, r_{jk}) \text{ where } C_{jk} \leq C_{Fk} \;\&\; r_{jk} \text{ s.t. } \pi_I(C_{jk}, r_{jk}) < \pi_{Ik}\}$$

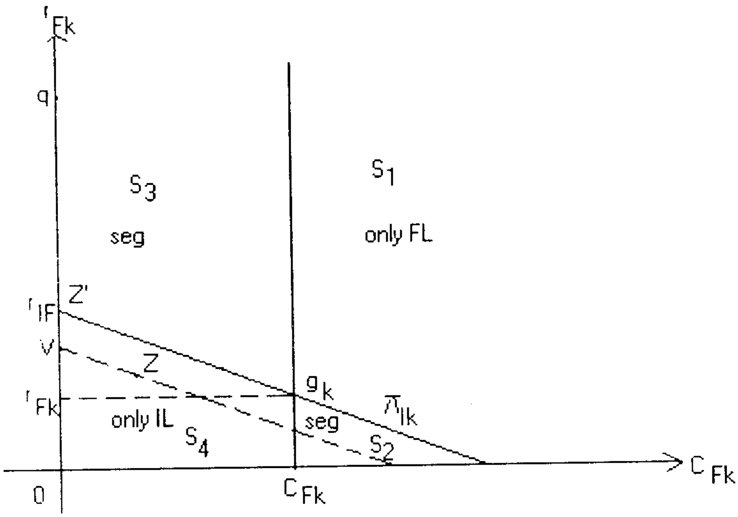

FIG 2.

IL's Decision Problem in Stage 2

In order to obtain the SPNE of the game we begin by solving the IL's problem in stage 2. Now for each $s_j \in S_1$, and any $s' \in S_1^c$, s' will dominate s_j as the IL's expected payoff would be zero for all $s_j \in S_1$ and positive for all $s' \in S_1^c$. In other words,

$$\Pi_l(g_k, s_j(g_k)) = 0 \quad \forall s_j \in S_1$$

$$\text{and} \quad \Pi_l(g_k, s'(g_k)) > 0 \quad \forall s' \in S_1^c$$

With the IL choosing $s_j \in S_1$, the formal contract would leave the entrepreneurs at least[13] as well off as the informal contract with $\pi_e(g_k) \geq \pi_e(s_j(g_k))$. This follows as $\pi_l(C_{jk}, r_{jk}) \geq \pi_{lk}$ and the social surplus is constant. It would correspond to a lower value of the collateral as well, since $C_{Fk} \leq C_{jk}$ .This would imply that all the entrepreneurs who are eligible for loans from the IL, would also be eligible for loans from the FL. Thus only the FL would survive in the market giving loans to $\frac{\overline{C} - C_{Fk}}{\overline{C}}$ proportion of entrepreneurs.

We next consider the strategy sub-space S_2. Now all $s_j \in S_2$ are dominated by some $s'' \in S_4$. Let us consider for example the strategy, $s''(g_k)$ such that,

$\pi_l(s''(g_k)) \equiv \pi_l(C_k^{''}, r_k^{''}) = \pi_l(C_{jk}, r_{jk}) \equiv \pi_l(s_j(g_k))$ *and* $C_k^{''} < C_{Fk}$ *where* $s_j(.) \in S_2$ Now since $s_j(.) \in S_2$, therefore $C_{jk} > C_{Fk} > C_k^{''}$. This implies that the expected payoff to the IL from $s''(.) \in x''$ is greater than the expected payoff from $s_j(.) \in S_2$, as is shown below.

$\Pi_l(g_k, s''(.)) = \pi_l(C_k^{''}, r_k^{''}) \frac{\overline{C} - C_k^{''}}{\overline{C}} > \pi_l(C_{jk}, r_{jk}) \frac{\overline{C} - C_{jk}}{\overline{C}} = \Pi_l(g_k, s_j(.))$ where Π_l is the aggregate expected profit of the IL.

However $s'' \in S_4$. (This is because $\pi_l(s''(.)) = \pi_l(s_j(.)) < \pi_{lk}$ as $s_j \in S_2$. Moreover $C_k^{''} < C_{Fk}$).

Thus we find that all $s_j \in S_2$ are dominated by some $s'' \in S_4$.

From the preceding discussion we arrive at the following conclusion.

Remark 1: The IL will never choose a strategy $s_j \in S_1 \cup S_2$.

[13] In case of identical payoff to the entrepreneur the FL is preferred because of individual perception.

In other words the IL may choose a strategy $s_j(.) = (C_{jk}, r_{jk})$ in S_3 or S_4. In case the IL chooses $s_j \in S_3$, the market will get *segmented* .The FL will lend to entrepreneurs with $C_i \in [C_{Fk}, \overline{C}]$. Among the entrepreneurs with $C_i < C_{Fk}$ the IL will give loans to all entrepreneurs with $C_i \in [C_{jk}, C_{Fk})$. This will happen, as the formal contract would correspond to larger collateral. It would yield a higher profit to the entrepreneurs as well. This follows from the definition of S_3 and the constancy of the social surplus. Alternatively the IL may choose a strategy $s_j(.)$ in S_4 *competing* for borrowers with the FL and drive him out of the market. This is because for all informal contracts $s_j(.) \in S_4$ the entrepreneurs earn more profit compared to the formal contract g_k. This follows directly from the fact that $\pi_I^{jk} = \pi_I(C_{jk}, r_{jk}) \geq \pi_{Ik}$ and equation (3). Moreover since $C_{jk} < C_{Fk}$ therefore only the IL will survive in the market giving loans to all entrepreneurs with $C_i \in [C_{jk}, \overline{C}]$.

Dominant Strategy

Let $s_3^* \in S_3$ denote the IL's best response strategy in the strategy sub-space S_3. Then $s_3^* = (0, q)$. The proof is along similar lines as proof of Proposition 1. The IL's expected payoff in this case would be,

$$\Pi_I(g_k, s_3^*) = \Pi_{seg} = (pq - T)\frac{C_{Fk}}{\overline{C}}. \tag{15a}$$

The corresponding payoff to the FL in this case would be

$$\Pi_{IF}(g_k, s_3^*) = \pi_I(C_{Fk}, r_{Fk})\frac{\overline{C} - C_{Fk}}{\overline{C}} \tag{15b}$$

Essentially the IL would charge an interest rate that would leave the entrepreneurs at their reservation payoff of zero and earn $(pq - T)$ per borrower. In that case the IL would be better off by making clean advances, as his aggregate expected profit would be increasing linearly in the number of loans. By making clean advances, the IL gets access to the entire residual market. All the entrepreneurs who gets rationed by the FL, i.e., entrepreneurs with $C_i \in [0, C_{Fk})$, get loans from the IL.

Let $s_4^* \in S_4$ denote the IL's best response strategy in the strategy sub-space S_4. Then $s_4^* = (0, r_4), r_4 \to r_{IF}$ from below, where $r_{IF} = \dfrac{C_{Fk}(1-p) + r_{Fk}p}{p}$. In order to prove this let us consider any contract $s_j(g_k) = (C_{jk}, r_{jk}) \in S_4$. Now consider the contract $s_m(g_k) = (C_{mk}, r_{mk})$ s.t. $\pi_I(C_{mk}, r_{mk}) = \pi_I(C_{jk}, r_{jk})$ and $C_{mk} = 0$. The contract $(C_{mk}, r_{mk}) \in S_4$ as $\pi_I(C_{mk}, r_{mk}) = \pi_I(C_{jk}, r_{jk}) < \pi_{Ik}$ and $C_{mk} = 0 < C_{Fk}$.

Further, $\Pi_I(g_k, s_m(g_k)) = \pi_I(0, r_{mk}) > \pi_I(C_{jk}, r_{jk})\dfrac{\overline{C} - C_{jk}}{\overline{C}} = \Pi_I(g_k, s_j(g_k))$ where $\pi_I(0, r_{mk}) = r_{mk} - T$. Thus for any contract $(C_{jk}, r_{jk}) \in S_4$, $C_{jk} > 0$, there exists a contract $(0, r_{mk}) \in S_4$ such that $(0, r_{mk})$ dominates (C_{jk}, r_{jk}).

Again let us consider the contract, $s_4^* = (0, r_4)$. Then $\pi_I(0, r_4) \to \pi_{Ik}$ from below. Therefore, $\lim_{r_4 \to r_{IF}-} \Pi_I(g_k; (0, r_4)) = \lim_{r_4 \to r_{IF}-} \pi_I(0, r_4) > \pi_I(0, r_{mk}) = \Pi_I(g_k; (0, r_{mk}))$ since, in the limit $r_4 > r_{mk}$ $\forall r_{mk}$. Hence it follows that $s_4^* \in S_4$ denote the IL's best response strategy in the strategy sub-space S_4.

Diagrammatically, for any contract $Z \in S_4$, the corresponding contract $V \in S_4$ dominates Z. Again the contract V is dominated by the contract Z' (refer to figure 2). Intuitively the informal contract $s_4^*(g_k)$ would leave the entrepreneurs just as well off as the formal contract g_k and would also enable the IL to have access to the entire market. Hence the IL's expected payoff if it chooses to compete with the FL is,

$$\Pi_I(g_k, s_4^*) = \Pi_{comp} = C_{Fk}(1-p) + r_{Fk}p - T \qquad (16a)$$

The corresponding payoff to the FL would be ,

$$\Pi_{IF}(g_k, s_4^*) = 0 \qquad (16b)$$

Remark 2(a): Comparing (15a) and (16a) we find that given the formal contract $g_k = (C_{Fk}, r_{Fk})$, the IL would choose to segment or compete with the FL according as $\Pi_{seg} = \Pi_I(g_k, s_3^*) >$ or $\leq \Pi_{comp} = \Pi_I(g_k, s_4^*)$.

FL's Decision Problem in Stage 1

In stage 1, when choosing its optimal contract, the FL would take into consideration the optimal response of the IL, consequent upon its actions.

Remark 2(b): Thus the FL would never choose a contract such that the IL's optimal strategy is to choose s_4^*.

In order to derive the SPNE we now prove certain lemmas. Lemmas 4 and 6 are related to remark 3 above. Lemmas 5 and 7 are related to certain subsets of the feasible set of strategies for the FL.

<u>*Definition 4:*</u> Suppose the IL chooses to segment the market in stage 2. Then let $\hat{C}(r_{Fk})$ be the locus of the FL's optimal choice of C_{Fk} for a given choice of r_{Fk}, in stage 1.

In other words $\hat{C}(r_{Fk})$ is such that $\Pi_{IF}(\hat{g}_k, s_3^*) > \Pi_{IF}(g_k, s_3^*)$ where $\hat{g}_k = (\hat{C}(r_{Fk}), r_{Fk})$ and $g_k = (C_{Fk}, r_{Fk})$. So the formal contract $(\hat{C}(r_{Fk}), r_{Fk})$ yields a higher payoff to the FL compared to other feasible contracts (C_{Fk}, r_{Fk}), if the IL chooses to segment the market in stage 2.

Now, the FL's profit, if the IL chooses to segment the market (equation (15b)) is the same as the FL's profit in the absence of the IL. Therefore comparing with definitions 1 and 4 we find that $\hat{C}(r_{Fk}) = \hat{C}(r_F)$.

We now consider the following lemma to delineate the competition and segmentation zones using definition (4).

Lemma 4: There is an $r_0 \in \left(\frac{T}{p}, \frac{\overline{C}(1-p)+T}{p}\right)$, such that for formal contracts (C_{Fk}, r_{Fk}) with $C_{Fk} = \hat{C}(r_{Fk})$, and $r_{Fk} < r_0$, segmentation (choosing s_3^*) is a better strategy for the IL lender in stage 2.

Proof: Given the formal contract $(\hat{C}(r_{Fk}), r_{Fk})$, the IL's $\Pi_I(\hat{g}_k, s_3^*) \gtreqless \Pi_I(\hat{g}_k, s_4^*)$, that is, $\Pi_{seg} \gtreqless \Pi_{comp}$ according as,

$$(pq-T)[\overline{C}(1-p)-r_{Fk}p+T] \gtreqless \overline{C}(1-p)[\overline{C}(1-p)+r_{Fk}p-T] \qquad (17)$$

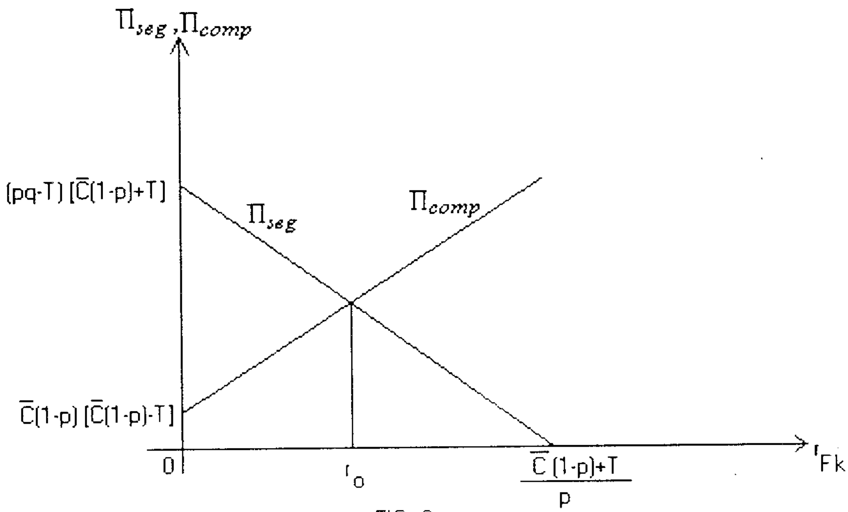

FIG. 3

The LHS of inequality (17) is decreasing in r_{Fk} while the RHS is increasing in r_{Fk} (refer to figure 3 above). Further for $r_{Fk} = 0$, the functional value of LHS is greater than the functional value on the RHS as $\overline{C}(1-p) < (pq-T)$ by assumption. Moreover the horizontal axis intercept of the function on the LHS, is given by $r_{Fk} = \frac{\overline{C}(1-p)+T}{p}$. Thus there exists an

$r_0 < \dfrac{\overline{C}(1-p)+T}{p}$ such that for $r_{Fk} < r_0$, segmentation (choosing s_3^*) is a better strategy for the IL lender in stage 2.

Now since $\overline{C}(1-p) < pq - T$ by assumption, therefore from (17) it follows that a sufficient condition for $\Pi_{seg} > \Pi_{comp} \Leftrightarrow \Pi_I(\hat{g}_k, s_3^*) > \Pi_I(\hat{g}_k, s_4^*)$ is that,

$\overline{C}(1-p) - r_{Fk}p + T \geq \overline{C}(1-p) + r_{Fk} - T \Rightarrow r_{Fk} \leq \dfrac{T}{p}$. Hence it follows that $r_0 > \dfrac{T}{p}$.

Definition 5: Let r_{ic}^k be the rate of interest such that it is a solution to the equation $r_{Fk} = C_{Fk}$ and the locus $\hat{C}(r_{Fk})$. From definition (2) and definition (4) it would follow that r_{ic}^k corresponds to r_{ic}.

Remark 3: Given lemma 4, and assuming $\dfrac{\overline{C}}{2} < \dfrac{T}{p}$, it would follow using (10a) and definition (5) that $r_0 > r_{ic}$. Thus for formal contracts with $C_{Fk} = \hat{C}(r_{Fk})$ and $r_{Fk} \leq r_{ic}$, the IL's optimal strategy would be to choose s_3^*. Diagrammatically for formal contracts lying on KB the IL would always segment.

Lemma 5: The formal contract $g_k = (C_{Fk}, r_{Fk})$ with $C_{Fk} = r_{Fk} = r_{ic}$ dominates all other feasible contracts with $r_{Fk} \leq r_{ic}$ (even in the presence of the IL).

Proof: Given the FL's choice of $g_k = (C_{Fk}, r_{Fk})$ with $r_{Fk} \leq r_{ic}$, in stage 1, the IL may choose either s_3^* or s_4^*. If the IL chooses s_4^* (chooses to compete), the FL's expected payoff $\Pi_{IF}(g_k, s_4^*) = 0$ for $C_{Fk} \gtreqless \hat{C}(r_{Fk})$.

On the other hand if the IL chooses s_3^* (chooses to segment), then the FL's expected payoff $\Pi_{IF}(g_k, s_3^*)$ is maximum at $C_{Fk} = \hat{C}(r_{Fk})$. This follows from definition 4. Thus for any choice of $r_{Fk} \leq r_{ic}$ the formal contract $g_k = (C_{Fk}, r_{Fk})$, with $C_{Fk} = \hat{C}(r_{Fk})$ dominates the feasible contracts (C_{Fk}, r_{Fk}) with $C_{Fk} \neq \hat{C}(r_{Fk})$.

Further applying arguments analogous to lemma 1, we have,

$$\Pi_{IF}\left((\hat{C}(r_{ic}), r_{ic}); s_3^*\right) \geq \Pi_{IF}\left((\hat{C}(r_{Fk}), r_{Fk}); s_3^*\right) \;\; \forall r_{Fk} \leq r_{ic}.$$

This completes proof of lemma 5.

We now consider a lemma that analyses the optimal choices (segmentation or competition) for the IL when the formal contract lies on the $C_F = r_F$ line.

Lemma 6: There exists an $\tilde{r}_0 = \dfrac{\overline{C}T}{\overline{C} + T - pq} \in (T/p, pq)$ such that for formal contracts $g_k = (C_{Fk}, r_{Fk})$ with $C_{Fk} = r_{Fk} < \tilde{r}_0$, segmentation (choosing s_3^*) is a better strategy for the IL in stage 2.

Proof: Given the FL's choice $g_k = (C_{Fk}, r_{Fk})$ with $C_{Fk} = r_{Fk}$, the IL's $\Pi_{seg} \underset{<}{\overset{>}{=}} \Pi_{comp}$ according as, $\Pi_I(g_k, s_3^*) > \Pi_I(g_k, s_4^*)$, or according as,

$$(pq - T)\frac{r_{Fk}}{\overline{C}} \underset{<}{\overset{>}{=}} (r_{Fk} - T) \tag{18}$$

Both the LHS and the RHS of the above inequality are increasing in r_{Fk}, but the function on the LHS is flatter than that on the RHS as $\dfrac{pq - T}{\overline{C}} < 1$ and cuts the function on the RHS from above. Refer to figure 4 below.

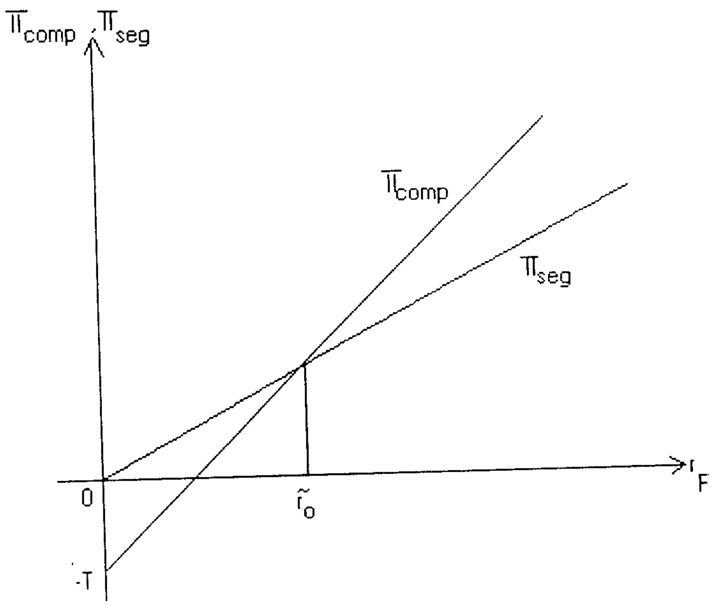

FIG 4

Thus there exists an $\tilde{r}_0 = \dfrac{\overline{C}T}{\overline{C} + T - pq}$ such that for formal contracts $g_k = (C_{Fk}, r_{Fk})$ with $C_{Fk} = r_{Fk} < \tilde{r}_0$, segmentation (choosing s_3^*) is a better strategy for the IL in stage 2. Further it follows from the assumptions stated in (10) that $\tilde{r}_0 \in (T/p, pq)$.

Remark 4: Given lemma 6 and assuming $\dfrac{\overline{C}}{2} < \dfrac{T}{p}$ it follows, using equation (11a), that $\tilde{r}_0 > r_{ic}$.

Diagrammatically $\tilde{r}_0$ will be located on FD.

Lemma 7: For any choice of $r_{Fk} > r_{ic}$, the contract (C_{Fk}, r_{Fk}) with $C_{Fk} = r_{Fk}$ dominates the feasible contracts with $C_{Fk} > r_{Fk}$.

Proof: Given the FL's choice (C_{Fk}, r_{Fk}), the IL may either choose s_3^* (i.e. choose to segment) or choose s_4^* (i.e. choose to compete). If the IL chooses s_4^*, then $\Pi_{IF} = 0$ irrespective of whether $C_{Fk} \geq r_{Fk}$.

If however the IL chooses s_3^*, then $\Pi_{IF}((C_{Fk}, r_{Fk}); s_3^*)$ is the same as the FL's profit in the absence of the IL. Hence, from lemma 3, it follows that $\Pi_{IF}((C_{Fk}, r_{Fk}); s_3^*)$ is maximum at $C_{Fk} = r_{Fk}$. This proves lemma 7.

<u>*Definition 6:*</u> Suppose the IL chooses to segment (i.e. choose s_3^*). Then let r^{**} be such that the FL's profit $\Pi_{IF}((C_{Fk}, r_{Fk}); s_3^*)$ from the contract (C_{Fk}, r_{Fk}) with $C_{Fk} = r_{Fk} = r^{**}$ is maximum. Comparing this with the definition of r^* we find $r^{**} = r^*$.

Now we state the principal theorem of this section using definition 6. This theorem completely describes the optimal contract of the FL and the IL.

<u>***Theorem 2:***</u> The SPNE of a sequential move game between a FL and an IL consists of a pair of contracts $(0, q)$ for the IL and (C_{FE}, r_{FE}) for the FL with

$$C_{FE} = r_{FE} = \min(r^{**}, \widetilde{r}_0) \in (r_{ic}, pq).$$

Proof: Remark 2(b) shows that in equilibrium the IL would always choose s_3^*. Thus the IL's equilibrium contract would be $(0, q)$.

Remark 4 and definition 6 show that $\widetilde{r}_0 > \dfrac{T}{p} > r_{ic}$ and $r^{**} > r_{ic}$. Thus, it follows that $\Pi_{IF}((\widetilde{r}_0, \widetilde{r}_0); s_3^*) > \Pi_{IF}((r_{ic}, r_{ic}); s_3^*)$ and $\Pi_{IF}((r^{**}, r^{**}); s_3^*) > \Pi_{IF}((r_{ic}, r_{ic}); s_3^*)$.

From the definition of $\widetilde{r}_0$ and r^{**}, (using Lemma 6 and Definition 6) it would follow that the formal contract (C_{Fk}, r_{Fk}) with $C_{Fk} = r_{Fk} = \min(\widetilde{r}_0, r^{**})$ yields higher Π_{IF} compared to the contract with $C_{Fk} = r_{Fk} = r_{ic}$.

Hence using Lemma 5 it follows that the formal contract with $C_{Fk} = r_{Fk} = \min(\widetilde{r}_0, r^{**})$ yields higher Π_{IF} compared to all feasible contracts with $r_{Fk} \leq r_{ic}$. Using Lemma 7 it further follows that the formal contract with $C_{Fk} = r_{Fk} = \min(\widetilde{r}_0, r^{**})$ yields higher Π_{IF} compared to all feasible contracts with $r_{Fk} > r_{ic}$. Therefore we conclude that the FL's equilibrium contract is given by (C_{FE}, r_{FE}) with

$$C_{FE} = r_{FE} = \min(r^{**}, \widetilde{r}_0) \in (r_{ic}, pq).$$

However if the FL faced with an interest rate ceiling at $\bar{r}$, then the FL's equilibrium interest rate will be given by $r_{FE} = \min(r^{**}, \widetilde{r}_0, \bar{r})$ with $C_{FE} = \hat{C}(\bar{r}) < \bar{r}$ for $\bar{r} < r_{ic}$. Thus the incentive compatibility constraint is not binding in equilibrium if $r_{FE} = \bar{r} < r_{ic}$.

Diagrammatically we find that, in the absence of interest rate ceiling the FL's equilibrium contract will lie on segment BD (refer to figure 1). Now $r^{**} < \dfrac{\overline{C}(1-p)+T}{2(1-p)}$ i.e. it will lie to the left of point K. This implies that the equilibrium contract of the FL will lie to the left of K.

Thus we arrive at the equilibrium pair of contracts of the sequential move game for both parties using the method of backward induction. The solution consisting of a pair of contracts, $(0, q)$ for the IL and $C_{FE} = r_{FE} = \min(r^{**}, \widetilde{r}_0)$ for the FL. This would constitute a SPNE of the above game.

Thus again in this situation the FL optimally chooses a collaterised contract and the IL does not find it optimal. This corroborates the findings in chapter 2 in an alternative set up.

4. Effect of Interest Rate Deregulation

It follows from the preceding discussion that there is a range of interest rates such that if the interest rate ceiling lies in that range then deregulation of the formal interest rate will cause informal lending to expand and formal lending to contract[14].

Suppose initially the financial repression is not very severe and the size of the formal sector not very small. Then as the formal interest rate increases following deregulation and the FL earns a higher profit per borrower, the FL can afford to have fewer borrowers. They achieve this by restricting their lending only to the very rich i.e. ask for large collateral, in order to avoid strategic default and yet earn higher aggregate profit. Hence in this case the size of the formal credit market contracts if interest rate is deregulated.

On the other hand if initially the financial repression is very severe ($\bar{r}$ very low) with FL's lending only to the very rich (C_{Fk} very high), deregulation will cause formal lending to increase and informal lending to decrease. This is because with increase in formal interest rate and profit earned per borrower following deregulation, the FL can accommodate more borrowers i.e. lower C_{Fk} without jeopardising the incentive compatibility constraint. So we have the following result:

Proposition 2: Deregulation causes formal lending to expand (contract) and informal lending to contract (expand) if the financial repression is (not) severe.

5. Conclusion

In this paper an attempt has been made to analyse the impact of deregulation of the formal interest rate on the size of the informal credit market. This is significant in the context of the revived debate on liberalisation versus state intervention in credit markets as the optimal credit

[14] The result stated in remarks 3 and 4 and proposition 2 are based on the assumption that $\bar{C}/2 < T/p$. However with the inequality reversed, the result would still hold under certain technical conditions not very interesting or easily interpretable. In case the conditions are violated, the formal market expands but the results fail to be comparable with the earlier discussion. An alternative approach to the solution of the IL's choice problem in general may be deduced from the discussion in the next chapter.

policy, especially in the developing countries .The governments in these countries are not concerned only with ensuring a greater mobilisation of savings and an efficient allocation of credit. Another objective has been to ensure equity, by making sure that small borrowers have access to the required institutional credit as an alternative to informal credit (which is normally exploitative).

The conclusion is reached that given the acute information asymmetry faced by the FL, deregulation need not necessarily curb informal lending. The effectiveness of the policy will depend on the degree of financial repression. Specifically it is shown that there is a range of interest rates such that if the interest rate ceiling lies in that range then deregulation of the formal interest rate will cause informal lending to increase and formal lending to contract. This result therefore qualifies the conventional argument in favour of deregulation.

Appendix

(a) $\tilde{r}_0 \lesseqgtr r^*$, according as,

$$\frac{\bar{C}T}{\bar{C} - pq + T} \lesseqgtr \frac{T + \bar{C}}{2}$$

$$\Rightarrow pq(T + \bar{C}) \lesseqgtr \bar{C}^2 + T^2$$

$$\Rightarrow \quad pq \lesseqgtr \bar{C} + T - \frac{2\bar{C}T}{\bar{C} + T}$$

$$\Rightarrow \quad (pq - T) \lesseqgtr \bar{C} - \frac{2\bar{C}T}{\bar{C} + T}$$

(b) Assuming $r_{ic} > \frac{T}{p}$, $\tilde{r}_0 \gtreqless r_{ic}$ according as,

$$T(pq - T) \gtreqless \bar{C}(1 - p)(\bar{C} - pq)$$

Therefore necessary condition for $\tilde{r}_0 > r_{ic}$ is $r^* < pq$.

A sufficient condition for $\tilde{r}_0 > r_{ic}$ is $pq > \bar{C} - T$

or $pq - T > \bar{C} - 2T$

(c) Assuming $r_{ic} > \frac{T}{p}$, $r_0 \gtreqless r_{ic}$, according as,

$$(\bar{C}(1 - p) + T)(pq - T) \gtreqless \bar{C}(1 - p)(\bar{C} - T)$$

Thus necessary condition for $r_0 > r_{ic}$ is, $T > 0$ and

a sufficient condition is $\frac{\bar{C}}{2} \le \frac{T}{p} \Leftrightarrow r_{ic} \le \frac{T}{p}$.

(d) $r^* \gtrless \frac{T}{p}$ according as $\frac{\bar{C} + T}{2} \gtrless \frac{T}{p}$

(e) $\tilde{r}_0 \gtreqless \frac{\bar{C}(1 - p) + T}{2(1 - p)}$ according as,

$$\bar{C}T(1 - p) \gtreqless (\bar{C} - pq)(\bar{C}(1 - p) + T) + T^2$$

Chapter 4

Entry of Formal Lenders and the Size of the Informal Credit Market

1. Introduction

In chapter 3 we analysed the effect of financial liberalisation on the size of the informal credit market by focusing on one aspect of liberalisation, viz. deregulation of formal interest rate. It reaches the conclusion that if the financial repression is not very severe, deregulation need not necessarily lead to a contraction in the size of the informal credit market. Here we consider the other aspect, viz. allowing free entry of private sector banks into the formal credit market. It is shown that at a high, administered interest rate entry is less effective in reducing size of informal credit market. Entry of FLs cannot eliminate the informal credit market altogether, although it will be relatively more effective compared to deregulation of the interest rate.

To recollect, in chapter 3 the interaction between the FL and the IL is modelled as a sequential move game between two players, viz. a FL and an IL. The FL moves first and the IL moves after observing the FL. The contracts (C,r) offered by the lenders are collateralised debt contracts. Here r represents the gross interest on loans, which are of unit size by assumption. C denotes the size of collateral. The simultaneous choice of C and r is made by the players sequentially in a deregulated environment. Prior to deregulation the FLs choice of r is restricted by the interest rate ceiling. The IL however, is free to choose r. The sequence of moves reflects a fundamental structural difference between a FL and an IL. The FL being subject to various regulatory and procedural norms cannot alter his offers quickly, unlike the IL who can react instantaneously. Hence, it is more likely that the IL reacts to the FL's move and that the FL takes that into consideration when designing its contract, rather than considering the IL's move as given.

Again restricting the game to just two players, i.e. just one FL and one IL is based on the observation that the ILs normally enjoy a local monopoly. Entry into informal lending is not free or easy due to the existence of personal knowledge about borrowers on part of the lender, large resources required for incurring screening costs, giving loans etc. Thus we assume that there exists only one IL in a locality. Moreover since the focus of chapter 3 was on deregulation rather than entry, consideration of just one FL is not restrictive. Neither is it unrealistic if we base our analysis on a local market.

In this chapter the strategic interaction occurs at two levels. The paper analyses the impact of an expansion in the number of FLs on the size of the formal and informal credit markets measured in terms of their market shares. In our model therefore, we consider a credit market with n FLs and m ILs. Thus not only does it consider the formal–informal interaction as in chapter 3 but it also considers the interaction among the n FLs. This is modeled as a two-stage game in which the n FLs move simultaneously in stage 1. The m ILs move in stage 2, after observing the formal contract. The strategic interaction here involves both simultaneous and sequential decision-making. Each of the n FLs must take into consideration the strategic behaviour of the ILs as also the behaviour of the other FLs. The strategic interaction among the m ILs does not arise since each of the ILs is a local monopolist. This makes ILs' markets separated, unlike the FLs who face the same pool of borrowers.

The plan of this chapter is as follows. Section 2 states the assumptions regarding the basic framework and briefly discusses credit market equilibrium with m ILs. Sections 3 and 4 lay out the model and characterise credit market equilibrium in the presence of FLs. Section 3 considers credit market equilibrium with n FLs only. This section highlights how the FL's problem gets differentiated from that of the IL, due to the strategic interaction among the FLs and the presence of information asymmetry between the entrepreneur and the FL. Section 3A describes the nature of competition and specifies the payoff functions. The existence and nature of equilibrium is analysed in section 3B. Finally in section 4, the case of strategic interaction between m informed ILs and n uninformed FLs has been discussed. Here, the discussion in section 3 is carried a step further. It shows how the FL's problem gets further modified if the FL takes into account the strategic behaviour of the ILs. Section 4A discusses the IL's decision problem in stage 2. The consequences for credit market equilibrium and free entry of FLs is analysed in section 4B and 4B.1. Finally section 5 presents the conclusions.

2. The Model

We consider a situation where there is free entry and exit in the credit market by FLs. We consider a model in which there are n FLs and m ILs. Each IL enjoys local monopoly power, on account of his informational advantage, over a group of entrepreneurs (e), and would not lend outside his known group of entrepreneurs. The FLs however do not enjoy any such informational advantage with regard to particular groups and are willing to lend to borrowers from any group.

The entrepreneurs in each group are uniformly distributed over the interval $[0, \overline{C}]$, according to their capacity to pay collateral C_j, which is divisible. The production conditions are the same as in chapter 3. Each entrepreneur has access to a project whose size is fixed at unity, yielding a random return of q with probability p, and zero with probability $(1-p)$. The entrepreneurs must borrow the investment good from the lenders in order to undertake the project as they do not have any endowments of their own. The contracts are collateralised debt contracts. Thus the entrepreneurs either pay r, which is the gross interest on loans, when the project is successful. In case the project fails they part with the collateral C, as specified in the contract. The contracts also involve a fixed transaction cost of T per borrower. To keep the notation simple we assume that T is inclusive of the principal or the amount of loan which by assumption is unity. Thus $T > 1$. All the agents are risk neutral and are interested in maximising their expected profits.

The structural difference between the FL and the IL is also reflected in the degree of information asymmetry they face. The IL can observe the output q from the project. Hence the possibility of strategic default by the entrepreneurs on informal loans does not arise. In other words the ILs would always receive r with probability p and C with probability $(1-p)$ whether the value of $C \in [0, \overline{C}]$ chosen by the IL is greater or less than the r chosen by him. The FL however faces the problem of moral hazard as it cannot observe q and thus must rely on collateral for avoiding strategic default by the entrepreneur as is discussed in section 3A below.

In order to ease our understanding we first consider credit market equilibrium in the absence of FLs, i.e. when there are m ILs only. Thus we have m identical but separated markets. This situation is therefore an m th order replication of the case of one IL discussed in chapter 3. The equilibrium in this case would consist of each IL giving clean advances, i.e. choosing $C = 0$ and fixing the rate of interest so as to take away the entire surplus from the projects, i.e. choosing $r = q$. Since the IL does not face the possibility of strategic default by the entrepreneur, therefore he need not ask for collateral. This would also give him access to the whole market. Moreover being a monopolist the IL would take away the entire surplus.

3. Strategic Interaction Among Formal Lenders

3A. The Model of Interaction

We want to analyse credit market equilibrium in the presence of FLs. However before considering the strategic interaction between FLs and ILs, we analyse credit market equilibrium with n FLs only. With m ILs, there were m identical but separated local markets. With n FLs however, such separation is not possible as the FLs cannot distinguish between borrowers from different groups. Hence each FL faces the aggregate group (same pool) of borrowers. This implies that one must take into consideration the strategic interaction among the FLs when analysing credit market equilibrium with n FLs only.

In order to highlight the effects of entry we assume that the formal rate of interest is administered, $\bar{r} < q$. We further assume that the FLs engage in quantity competition, i.e. they compete in the number of loans[1] (loan size is fixed at unity by assumption). The value of collateral in the formal sector C_F is then determined accordingly from the loan market clearing condition, which requires that

$$L^s = \sum_i L_i = L^d. \qquad (1)$$

This situation can be visualised as some central banking authority playing the role of the Walrasian auctioneer, announcing the value of C_F.

[1] Competition in terms of size of collateral would have given the standard Bertrand result which is less intersting.

Here L_i is the total loan supplied by the *i*th FL and L^d is the aggregate demand for loans faced by the FL as specified below in equation (2a).

$$L^d = \frac{(\overline{C} - C_F)m}{\overline{C}}. \tag{2a}$$

This is because given C_F, all the entrepreneurs belonging to the m different groups with collateral greater than C_F qualify for loans.

From equation (2) the loan demand function in inverse form may be obtained as

$$C_F = \frac{\overline{C}(m - L^d)}{m} \tag{2b}$$

Now in order to specify the payoff function of the *i*th FL we must note that, unlike the IL, the FLs cannot observe whether the project has been successful or not. This gives rise to the possibility of strategic default by the entrepreneur. Hence the FLs' profit per borrower will depend on whether the market clearing value of collateral satisfies the incentive compatibility constraint or not.

So, according as the market clearing value of collateral C_F is $\geq \bar{r}$ or $< \bar{r}$, the entrepreneurs will or will not have the incentive to repay $\bar{r}$, when the project is successful. In the latter case, strategic default by the entrepreneurs is bound to occur. This would imply that the FL receives only C_F irrespective of whether the project is successful or not. On the other hand, when $C_F \geq \bar{r}$, the entrepreneurs would prefer paying $\bar{r}$ if the project is successful, and would part with C_F, only if the project fails. Thus given $\bar{r}$ the market clearing value of collateral affects the FLs' profit per borrower in two ways. It not only affects the return to the lender when the project fails, but it also affects the lender's earning from a loan when the corresponding projects are successful.

We may now state the payoff function of the *i*th FL as follows. The aggregate profit of the *i*th FL is,

$$\Pi_{li} = (\bar{r}p + C_F(1-p) - T)L_i \qquad \forall \quad C_F \geq \bar{r} \qquad (3a)$$

$$= (C_F - T)L_i \qquad \forall \quad C_F < \bar{r} \qquad (3b)$$

where $C_F = \dfrac{\bar{C}(m - \sum L_i)}{m}$ is the market clearing value of collateral, obtained from equations (1) and (2a) above.

3B.Equilibrium

3B.1 Existence

In order to find out the equilibrium loan supply by the *i*th lender we need to compute the Nash equilibrium in L_i's. We assume that the FLs are faced with a given administered rate of interest $\bar{r} < q$. The size of the formal credit market n is also, for now, given.

Let $\bar{r} > T$[2]. Let $\bar{L}_i$ be such that, for $L_i \leq \bar{L}_i$, $C_F \geq \bar{r}$ and for $L_i > \bar{L}_i$, $C_F < \bar{r}$. To solve for L_i we substitute nL_i for $\sum_i L_i$ in (1) and set $C_F = \bar{r}$ in (2) yielding

$$\bar{L}_i = \frac{m}{n}\frac{(\bar{C} - \bar{r})}{\bar{C}}. \qquad (4)$$

Now given $\bar{r}$ and n, L_i must belong to either of the two intervals $[0, \bar{L}_i]$ or $\left(\bar{L}_i, \dfrac{(\bar{C}-T)m}{\bar{C}}\right]$.

Note that $\bar{L}_i < \dfrac{(\bar{C}-T)m}{\bar{C}}$ for $\bar{r} > T$. Hence in order to find out the equilibrium loan supply, we need to check for the existence of and find the Nash equilibrium in loan supply in the intervals $[0, \bar{L}_i]$ and $\left(\bar{L}_i, \dfrac{(\bar{C}-T)m}{\bar{C}}\right]$.

[2] For $\bar{r} < T$, the incentive compatibility constraint is no longer binding. The FLs' profit per borrower and hence their aggregate profits are reduced to zero at $C_F > \bar{r}$.

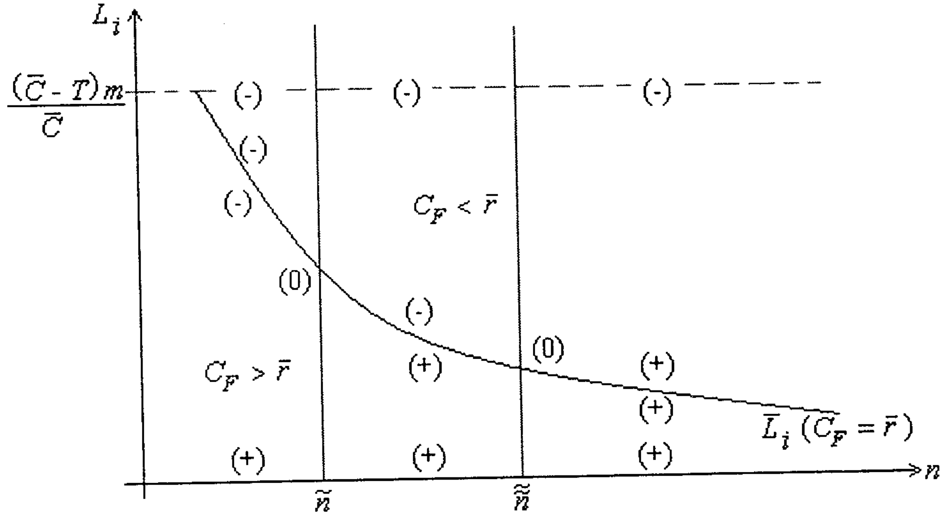

FIG.1

Now suppose all the FLs choose the same $L_i \in [0, \bar{L}_i]$. We want to check whether there exists an $L_i \in [0, \bar{L}_i]$ such that L_i is Nash equilibrium. Then from the definition of $\bar{L}_i$ it would follow that the payoff to the ith FL is given by equation (3a). Differentiating (3a) with regard to L_i yields,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \bar{r}p + C_F(1-p) - T - L_i \frac{\partial C_F}{\partial L_i}$$

Substituting for C_F and $\frac{\partial C_F}{\partial L_i}$ yields,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \bar{r}p - T + \frac{\bar{C}(1-p)(m - nL_i)}{m} - L_i \frac{\bar{C}}{m}$$

$$= \bar{r}p - T + \bar{C}(1-p) - \frac{\bar{C}}{m} L_i[n(1-p)+1] \qquad (5a)$$

The necessary condition for Nash equilibrium requires that the expression in (5a) should be equal to zero.

Now at $L_i = 0$, $\dfrac{\partial \Pi_{li}}{\partial L_i} = \bar{r}p + \bar{C}(1-p) - T > 0$ for all n. (5b)

At $L_i = \bar{L}_i > 0$, $\dfrac{\partial \Pi_{li}}{\partial L_i} = \left[\dfrac{\bar{r}-T}{\bar{C}-\bar{r}} - \dfrac{(1-p)}{n}\right](\bar{C}-\bar{r}) \lesseqgtr 0$

according as $n \lesseqgtr \dfrac{(\bar{C}-\bar{r})(1-p)}{\bar{r}-T} = \tilde{n}$.[3] (5c)

Further the expression for the derivative in (5a) is continuous in L_i. Therefore by intermediate value theorem, it would follow that for $n < \tilde{n}$ there exists $L_i^* \in (0, \bar{L}_i)$ such that $\dfrac{\partial \Pi_{li}}{\partial L_i} = 0$ at $L_i = L_i^*$. Hence we have the following:

Remark 1: There exist Nash equilibrium in loan supplies in the interval $(0, \bar{L}_i)$ for $n < \tilde{n}$.

Note that the second order condition for a maximum, is satisfied since further differentiation of the derivative in (5a) yields,

$$\frac{\partial^2 \Pi_{li}}{\partial L_i^2} = -\frac{2\bar{C}(1-p)}{m} < 0 \qquad (5d)$$

However for $n \geq \tilde{n}$, there does not exist $L_i \in (0, \bar{L}_i)$ such that $\dfrac{\partial \Pi_{li}}{\partial L_i} = 0$ for all i. Hence there does not exist Nash equilibrium in loan supplies in the interval $(0, \bar{L}_i)$ for $n \geq \tilde{n}$ (details follow).

Figure 1 summarises the above discussion. For any given n, the points lying on or below the $\bar{L}_i$ curve represent the L_i's that would yield a payoff to the lenders given by equation (3a). The plus and minus signs within parentheses, below the $\bar{L}_i$ curve, represent the sign of the derivative of the profit function in (3a), as given by (5a). The zero within brackets means that the value of the derivative is zero. The (+) signs lying close to the horizontal axis show that the derivative of the profit function in (3a) is positive, at $L_i = 0$ for all n. The signs within

[3] Note that the derivatives in (5b) and (5c) are the right hand derivative and the left-hand derivative respectively of the payoff function in (3a), as 0 and $\bar{L}_i$ are boundary points of the domain for the payoff function in (3a).

brackets lying just below the $\overline{L}_i$ curve show the sign of the derivative at $L_i = \overline{L}_i$, for different ranges of values of n, as given by (5c). For $n < \tilde{n}$, the derivative changes sign as L_i increases from zero to $\overline{L}_i$. Thus for $n < \tilde{n}$, there must be some $L_i \in (0; \overline{L}_i)$ where the value of the derivative must become equal to zero. For $n \geq \tilde{n}$ however, this does not hold as the value of the derivative is positive over the entire range of values of L_i in the interval $(0, \overline{L}_i)$. Note that at $n = \tilde{n}$, the value of the derivative is zero at $\overline{L}_i$.

Now suppose all the FLs choose the same $L_i \in \left(\overline{L}_i , \frac{(\overline{C} - T)m}{\overline{C}} \right]$. Once again we want to check whether there exists $L_i \in \left(\overline{L}_i , \frac{(\overline{C} - T)m}{\overline{C}} \right]$ such that L_i is Nash equilibrium. From the definition of $\overline{L}_i$ it would follow that the payoff to the ith FL is given by equation (3b). Differentiating Π_{li} with regard to L_i yields,

$$\frac{\partial \Pi_{li}}{\partial L_i} = (C_F - T) + L_i \frac{\partial C_F}{\partial L_i}$$

Substituting for C_F and $\frac{\partial C_F}{\partial L_i}$ we have,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \frac{\overline{C}(m - nL_i)}{m} - T - L_i \frac{\overline{C}}{m}$$

$$= \overline{C} - T - (1+n)\frac{\overline{C}}{m} L_i \qquad (6a)$$

Now at $L_i = \overline{L}_i$, the derivative in (6a) is ,

$$\frac{\partial \Pi_{li}}{\partial L_i} = \left[\frac{\overline{r} - T}{\overline{C} - \overline{r}} - \frac{1}{n} \right] (\overline{C} - \overline{r}) \lesseqgtr 0 \text{ according as } n \lesseqgtr \frac{\overline{C} - \overline{r}}{\overline{r} - T} = \tilde{\tilde{n}} \qquad (6b)$$

At $L_i = \frac{(\overline{C}-T)m}{\overline{C}}$, the derivative in (6a) is $\frac{\partial \Pi_{li}}{\partial L_i} = n(T-\overline{C}) < 0$ for all n[4]. (6c)

Hence for $n \leq \tilde{\tilde{n}}$, $\frac{\partial \Pi_{li}}{\partial L_i} < 0$ at all $L_i \in \left(\overline{L}_i , \frac{(\overline{C}-T)m}{\overline{C}} \right]$. The necessary condition for existence of Nash equilibrium in loan supplies requires that $\frac{\partial \Pi_{li}}{\partial L_i} = 0$. So for $n \leq \tilde{\tilde{n}}$, $L_i \in \left(\overline{L}_i , \frac{(\overline{C}-T)m}{\overline{C}} \right]$ can not constitute Nash equilibrium (more about this follow).

Now the expression for $\frac{\partial \Pi_{li}}{\partial L_i}$ in (6a) is continuous in L_i. Further for $n > \tilde{\tilde{n}}$, $\frac{\partial \Pi_{li}}{\partial L_i} < 0$ at $L_i = \frac{(\overline{C}-T)m}{\overline{C}}$ and $\frac{\partial \Pi_{li}}{\partial L_i} > 0$ at $L_i = \overline{L}_i$. Therefore by intermediate value theorem for $n > \tilde{\tilde{n}}$, there exists some $L_i^{**} \in \left(\overline{L}_i , \frac{(\overline{C}-T)m}{\overline{C}} \right)$ such that the value of the derivative is zero.

Hence again we have the following:

Remark 2: There exist Nash equilibrium in loan supplies in the interval $\left(\overline{L}_i , \frac{(\overline{C}-T)m}{\overline{C}} \right)$ for $n > \tilde{\tilde{n}}$.

The second order condition for a maximum is satisfied, since further differentiation of the derivative in (6a) yields,

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[4] Once again the derivatives in (6b) and (6c) are the right hand and left hand derivatives respectively, at $\overline{L}_i$ and $\frac{(\overline{C}-T)m}{\overline{C}}$ as these are the boundary points of the payoff function in (3b). Note that the expressions for the left-hand derivative and the right hand derivative of the payoff function at $L_i = \overline{L}_i$, given by (5b) and (6c), are different. However the value of the payoff function in (3a) and (3b) is the same at $L_i = \overline{L}_i$. Hence the payoff function is continuous but non-differentiable at $\overline{L}_i$.

$$\frac{\partial^2 \Pi_{li}}{\partial L_i^2} = -\frac{2\overline{C}}{m} < 0 \tag{6d}$$

Referring to figure 1, for loan supplies represented by points lying above the $\overline{L}_i$ curve, the corresponding payoff function is given by equation (3b). The signs within parentheses lying above the curve represent the sign of the derivative $\frac{\partial \Pi_{li}}{\partial L_i}$ of the profit function in (3b), as given by (6a). The (-) signs along the broken line indicates that the derivative of the profit function in (3b) is positive, at $L_i = \frac{(\overline{C}-T)m}{\overline{C}}$ for all n. The signs within brackets lying just above the $\overline{L}_i$ curve show the sign of the derivative at $L_i = \overline{L}_i$, for different ranges of values of n, as given by (6b). For $n > \tilde{\tilde{n}}$, the derivative changes sign as L_i increases from $\overline{L}_i$ to $\frac{(\overline{C}-T)m}{\overline{C}}$. Thus there must be some $L_i \in \left(\overline{L}_i, \frac{(\overline{C}-T)m}{\overline{C}}\right)$ where the value of the derivative must become equal to zero. On the other hand for $n \le \tilde{\tilde{n}}$, there can be no L_i in the interval mentioned above at which the derivative will be zero, as the derivative has a negative sign over the entire range. Again note that at $n = \tilde{\tilde{n}}$, the value of the derivative is zero at $\overline{L}_i$.

Comparing (5c) and (6b) we find that $\tilde{n} < \tilde{\tilde{n}}$. We will now investigate what will be the Nash equilibrium value of loan supply when $n \in [\tilde{n}, \tilde{\tilde{n}}]$, given $\bar{r}$.

Let us consider $n \in [\tilde{n}, \tilde{\tilde{n}}]$ and $L_i = \overline{L}_i$. At $n = \tilde{\tilde{n}}$ the derivative in (6b) is zero. At $n = \tilde{n}$ the derivative in (5c) is zero. Hence $\overline{L}_i$ constitutes Nash equilibrium in loan supplies at $n = \tilde{n}$ and $n = \tilde{\tilde{n}}$. For $n \in (\tilde{n}, \tilde{\tilde{n}})$, the derivatives in (5c) and (6b), which are left-hand derivative and right hand derivative of the payoff function at $L_i = \overline{L}_i$, are of opposite signs, although the values of the payoff functions in (3a) and (3b) are the same. This means that the payoff function is continuous but non-differentiable at $L_i = \overline{L}_i$. However from our earlier discussion[5] we know that for $n \in (\widetilde{n}, \widetilde{\widetilde{n}})$, the function is increasing in L_i at $L_i < \overline{L}_i$ and decreasing in L_i at $L_i > \overline{L}_i$. Therefore by continuity a maximum is ensured at $L_i = \overline{L}_i$, (with a kinked graph) for $n \in (\widetilde{n}, \widetilde{\widetilde{n}})$. Hence we have the following remark:

Remark 3: For $\bar{r} > T$ and $n \in [\widetilde{n}, \widetilde{\widetilde{n}}]$, $\overline{L}_i$ constitutes a Nash equilibrium in loan supplies.

3B.2 Optimal Loan Supplies

So far we have focussed only on the existence of Nash equilibrium in loan supplies, for different ranges of n. We will now find out what the equilibrium loan supplies are and check whether they satisfy the feasibility and participation constraints.

Setting (5a) equal to zero yields the optimal number of loan supply, when $n < \widetilde{n}$.

$$L_i^* = \frac{L^{s*}}{n} = \frac{m}{n+1} \frac{\{\bar{r}p + \overline{C}(1-p) - T\}}{\overline{C}(1-p)} \quad (7)$$

The market-clearing value of the collateral in the formal credit market may be obtained from equation (2a) as,

$$C_F^* = \frac{\overline{C}(m - L^{s*})}{m}$$

$$= \overline{C}\ [1 - \frac{n}{n+1} \frac{\{\bar{r}p + \overline{C}(1-p) - T\}}{\overline{C}(1-p)}] \quad (8a)$$

Interestingly, C_F^* is independent of m. C_F^* is however sensitive to $\overline{C}$, and hence to the distribution or average collateral endowment of borrowers. The presence of richer borrowers will cause C_F^* to increase and make borrowing by the poor more difficult as (6b) shows. As

[5] Note that the value of the derivative in (5a) is negative at $L_i > \overline{L}_i$ and the value of the derivative in (6a) positive at $L_i < \overline{L}_i$.

there is no supply constraint on the part of the FLs and there are no interactions among borrowers and ILs in different markets it does not signify how many markets (m) there are. It is only the borrowing power or the ability to pay or produce collateral of the borrowers that determine the optimal value of collateral.[6]

Comparative statics yields,

$$\frac{\partial C_F^*}{\partial \overline{C}} = \frac{1}{n+1} > 0 \tag{8b}$$

$$\frac{\partial C_F^*}{\partial \overline{r}} = -\frac{np}{(n+1)(1-p)} < 0 \tag{8c}$$

$$\frac{\partial C_F^*}{\partial n} = -\frac{\overline{r}p + \overline{C}(1-p) - T}{(1-p)} \frac{1}{(n+1)^2} < 0 \tag{8d}$$

From (8c) and (8d) it follows that the market-clearing value of collateral in formal credit market varies inversely both with the administered rate of interest and the number of FLs. In other words with entry in formal credit market and increase in the administered rate of interest, the size of the formal credit market will increase as borrowers with relatively smaller amounts of collateral become eligible for formal loans.

Let us now check the feasibility of the optimisation programme. The payoff function in (3a) is valid only if $C_F^* \geq \overline{r}$. In addition to the incentive compatibility condition, stated in (3a) we have the following feasibility constraints on C_F^*:

$$C_F^* \in [0, \overline{C}] \tag{3'a}$$

$$\pi_1(C_F^*, \overline{r}) = \overline{r}p + C_F^*(1-p) - T \geq 0 \tag{3'b}$$

$$\pi_e(C_F^*, \overline{r}) = pq - \overline{r}p - C_F^*(1-p) \geq 0 \tag{3'c}$$

[6] Consideration of m ILs keeps the analysis sufficiently general. The separation of the ILs markets seems in keeping with the observed features of the credit markets in developing countries. The analysis does not change much, except for changes in loan supplies, if we set $m = 1$.

We need not elaborate on (3'a). (3'b) and (3'c) represent the participation constraints of the FLs and the entrepreneurs respectively. Here π_l represents the FLs profit per borrower and π_e represents the entrepreneurs profit.

$C_F^* \le \overline{C}$, for all $\bar{r} \in [0, q]$ and all n since $T < \overline{C}(1-p)$ by assumption. Further, C_F^* satisfies (3'b) and (3'c) for all $\bar{r} \in [0, q]$ and all n, with the equality sign holding in (3'b) as $n \to \infty$. These follow, from the assumptions $T < \overline{C}(1-p)$ and $\overline{C}(1-p) < pq - T$ respectively.

Now C_F^* is the market clearing value of collateral corresponding to the aggregate loan supply L_i^* when $n \le \tilde{n}$. Since $L_i^* \in [0, \overline{L}_i]$. Therefore it also follows that $C_F^* \ge \bar{r}$ for all $n < \tilde{n} = \dfrac{\overline{C} - \bar{r}}{\bar{r} - T}$. Our objective is to check whether the condition is fulfilled for all $\bar{r} > T$. Once again we ignore the case where $\bar{r} \le T$.

Note that $\tilde{n} < 1$ for $\bar{r} > \hat{r}$ where $\hat{r} = \dfrac{\overline{C}(1-p)+T}{2-p} \in (T, pq)$[7]. This means that for $\bar{r} > \hat{r}$ the C_F^* does not satisfy the incentive compatibility condition for any $n \ge 1$. Hence for $\bar{r} > \hat{r}$, L_i^* cannot be equilibrium loan supply.

We next consider the case where the Nash equilibrium in loan supplies is given by $L_i^{**} \in \left(\overline{L}_i, \dfrac{(\overline{C} - T)m}{\overline{C}} \right)$. Again setting the derivative in (6a) equal to zero yields the optimal number of loans for the FLs when $n > \tilde{\tilde{n}}$, given by

$$L_i^{**} = \frac{L^{S**}}{n} = \frac{m}{n+1} \frac{\{\overline{C} - T\}}{\overline{C}} \tag{9}$$

The market-clearing value of the collateral in the formal credit market may be obtained from equation (2a) as before:

[7] In fact $\hat{r} \in (T, T/p)$ where $T/p < pq$ assuming $\overline{C}/2 < T/p$.

$$C_F^{**} = \frac{\overline{C}(m - L^{s**})}{m}$$

$$= \frac{\overline{C} + nT}{n+1} \qquad (10)$$

As in the earlier case, C_F^{**} is independent of m, varies directly with $\overline{C}$, and inversely with n. That C_F^{**} is independent of $\bar{r}$ is not surprising given (3b). Further $C_F^{**} \to T$ as $n \to \infty$; $C_F^{**} = \frac{\overline{C}+T}{2}$ at $n = 1$. It follows that for $n \geq 1$, $C_F^{**} \in \left(T, \frac{\overline{C}+T}{2}\right]$. Hence note that $C_F^{**} < pq$ since by assumption $\frac{\overline{C}}{2} < pq - T \Leftrightarrow \frac{\overline{C}+T}{2} < pq$.

Now, the fact that $C_F^{**} \to T$ as $n \to \infty$ is intuitively clear as FLs' profit per borrower will become negative if C_F^{**} fell below T. In fact as $n \to \infty$, $L_i^{**} \to 0$. In other words when the number of FLs become very large, individual loan supplies become very small so as to keep $C_F^{**} > T$.

Once again we check for the feasibility of the optimisation programme when the objective is given by (3b). The payoff function in (3b) is valid when the market clearing value of C_F satisfies $C_F^{**} < \bar{r}$. In addition to the condition, stated in (3b), we have the following feasibility constraints on C_F^{**}:

$$C_F^{**} \in [0, \overline{C}] \qquad (3\text{''a})$$

$$\pi_1(C_F^{**}, \bar{r}) = C_F^{**} - T \geq 0 \qquad (3\text{''b})$$

$$\pi_e(C_F^{*}, \bar{r}) = pq - C_F^{**} \geq 0 \qquad (3\text{''c})$$

(3"a) is the same as before; (3"b) and (3"c) represent the participation constraints of the FLs and the entrepreneurs respectively, when strategic default is inevitable. Since for $n \geq 1$, $C_F^{**} \in (T, pq)$, therefore C_F^{**} satisfies (3"a) ,(3"b) and (3"c) for all $\bar{r} \in [0, q]$ and all $n \geq 1$.

C_F^{**} is the market clearing value of collateral corresponding to the aggregate loan supply L_i^{**} when $n \geq \tilde{n}$. Since $L_i^{**} \in [\overline{L}_i, \frac{(\overline{C}-T)m}{\overline{C}}]$. Therefore $C_F^* < \bar{r}$ for all $n > \tilde{\tilde{n}} = \frac{\overline{C}-\bar{r}}{\bar{r}-T}(1-p)$.

We already noted that for $n \geq 1$, $C_F^{**} \in (T, pq)$. Hence for $\bar{r} \leq T$, C_F^{**} does not satisfy $C_F^{**} < \bar{r}$, for any n. It follows that for $\bar{r} \leq T$, L_i^{**} cannot be equilibrium loan supply. It also follows that for $\bar{r} \geq pq$, C_F^{**} satisfies $C_F^{**} < \bar{r}$, for all $n \geq 1$. This is in keeping with the fact that $\tilde{\tilde{n}} < 1$ for $\bar{r} \geq pq$. Thus for $\bar{r} \geq pq$, L_i^{**} constitutes Nash equilibrium for all $n \geq 1$.

The following proposition summarises the discussion in this section:

Proposition 1: Consider a credit market with n FLs facing an administered rate of interest $\bar{r} \in [0, q]$ and competing in the number of loans L_i.

(I) Let $\bar{r} \in (T, \hat{r})$. Then the optimal loan supply of the ith FL (using the Nash equilibrium concept) (L_E) and the market clearing value of collateral (C_{FE}) is given by the following equations for different ranges of values of n, as determined by $\tilde{n} \equiv \frac{(\overline{C}-\bar{r})(1-p)}{\bar{r}-T}$ and $\tilde{\tilde{n}} \equiv \frac{\overline{C}-\bar{r}}{\bar{r}-T}$.

a) For $n < \tilde{n}$, $L_i^* = \frac{m}{n+1}\frac{\{\bar{r}p + \overline{C}(1-p) - T\}}{\overline{C}(1-p)}$, $\quad C_F^* = \overline{C}\ [1 - \frac{n}{n+1}\frac{\{\bar{r}p + \overline{C}(1-p) - T\}}{\overline{C}(1-p)}]$.

b) For $n > \tilde{\tilde{n}}$, $L_i^{**} = \frac{L^{s**}}{n} = \frac{m}{n+1}\frac{\{\overline{C}-T\}}{\overline{C}}$, $\quad C_F^{**} = \frac{\overline{C}+nT}{n+1}$

c) For $n \in [\tilde{n}, \tilde{\tilde{n}}]$, $\overline{L}_i = \frac{m}{n}\frac{(\overline{C}-\bar{r})}{\overline{C}}$, $\quad C_F = \bar{r}$.

(II) For $\bar{r} \in [0,T]$ the equilibrium loan supply and value of collateral is given by L_i^* and C_F^* respectively, for all n.

(III) For $\bar{r} \in \left[\hat{r}, \frac{\bar{C}+T}{2}\right)$ the equilibrium loan supply and value of collateral is given by $\bar{L}_i$ and $\bar{r}$ respectively, for $n \in (1, \tilde{\tilde{n}}]$ and given by L_i^{**} and C_F^{**} for $n > \tilde{\tilde{n}}$.

(IV) For $\bar{r} \in \left[\frac{\bar{C}+T}{2}, q\right]$ the equilibrium loan supply and value of collateral is given by L_i^{**} and C_F^{**} for all $n \geq 1$ (here $\tilde{\tilde{n}} < 1$).

The results stated in the above proposition for the interesting case $\bar{r} \in (T, \hat{r})$ are discussed below:

The size of the formal credit market here refers to the number of borrowers who have access to formal credit. In other words it refers to the number of entrepreneurs who can offer collateral at least as large as C_F or entrepreneurs with $C_j \in [C_F, \bar{C}]$. Thus the size of the formal credit market increases with a decrease in market clearing C_F.

Here we are considering a credit market with n FLs facing an administered rate of interest $\bar{r}$ and competing in the number of loans. Then it is shown that there exist an

$$\tilde{n} \equiv \frac{(\bar{C}-\bar{r})(1-p)}{\bar{r}-T} \quad \text{and} \quad \tilde{\tilde{n}} \equiv \frac{\bar{C}-\bar{r}}{\bar{r}-T} \quad \text{such that ,}$$

a) for $n \leq \tilde{n}$, the size of the formal credit market increases as the number of FLs increases. The maximum size is attained when $n = \tilde{n}$ with FLs giving loans to all entrepreneurs who can offer collateral at least as large as $\bar{r}$. (In other words in equilibrium the FLs will not offer loans to entrepreneurs who do not satisfy the incentive compatibility condition.) This is also the maximum size of the formal credit market for $n \leq \tilde{\tilde{n}}$ ($\tilde{\tilde{n}} > \tilde{n}$).

b) For $n \geq \tilde{\tilde{n}}$, as the number of FLs increase, the size of the formal credit market increases with the market clearing value of collateral falling below $\bar{r}$. In the limit as $n \to \infty$ the equilibrium value of C_F approaches T. This is natural since the FLs will never choose to supply a number of loans large enough to make the market clearing value of collateral fall short of T. With $C_F < \bar{r}$, it would make the FLs return per borrower $(C_F - T)$ negative.

c) For every $n \in [\tilde{n}, \tilde{\tilde{n}}]$ the size of the formal credit market is constant at the size corresponding to $\tilde{n}$. Thus as n increases from $\tilde{n}$ to $\tilde{\tilde{n}}$ the size of the formal credit market remains unchanged with the market clearing value of C_F being just equal to $\bar{r}$.

Hence an increase in the number of FLs does not necessarily imply greater credit access in terms of collateral poor borrowers being eligible for formal loans. If initially $n \in (\tilde{n}, \tilde{\tilde{n}})$, then further increase in the number of FLs to $n < \tilde{\tilde{n}}$ is ineffective as it will not relax the credit constraint for the collateral poor borrowers. In fact by reducing the number of FLs to $\tilde{n}$ the same size of the market could be achieved by fewer FLs in operation. This is depicted in fig.2b, with fig.2a showing the number of loans supplied by each FL in equilibrium.

When the number of FLs exceeds $\tilde{\tilde{n}}$, the size of the formal credit market increases further with entrepreneurs having collateral less than $\bar{r}$ qualifying for loans. In other words, when there are a large number of FLs $(n > \tilde{\tilde{n}})$, and there is further increase in their number, the FLs find it optimal to allow for strategic default (and take the collateral) rather than shrinking the loan supply.

For $\tilde{n} < n < \tilde{\tilde{n}}$, contracting loan supply along L_i^* would lead to an excess supply of loans. This would cause the market clearing C_F to be lower than $\bar{r}$, making strategic default inevitable. Hence choosing loan supply along L_i^* is no longer optimal. Under the circumstances, as their number increases, the FLs adjust their individual loan supplies in a manner so that aggregate loan supply remains constant and equals the aggregate loan demand at $C_F = \bar{r}$. In other words they reduce their individual loan supplies so that the market clearing C_F remains at $\bar{r}$. Recall that this is the zone ($n \in (\tilde{n}, \tilde{\tilde{n}})$) in which the objective function in (3) reaches its maximum at a point at which it is continuous but non-differentiable.

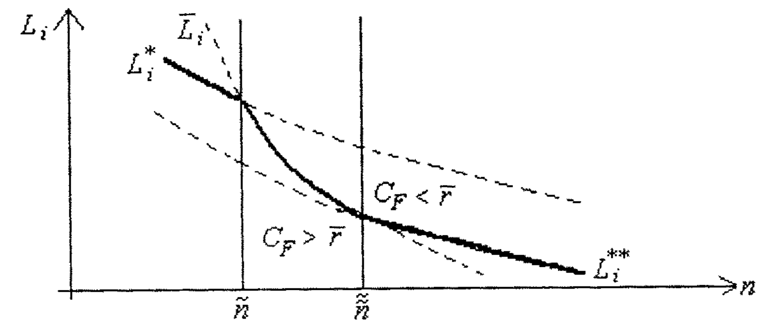

FIG. 2a

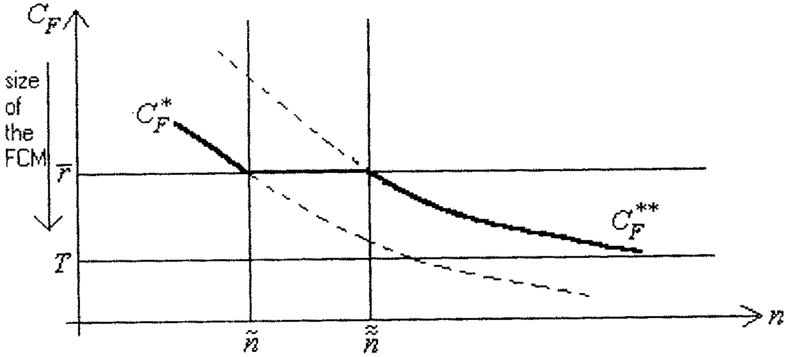

FIG.2b

4. Strategic Interaction between Formal Lenders and Informal Lenders

We will now consider the interesting case of strategic interaction between m informed ILs and n uninformed FLs. The formal-informal interaction here involves both simultaneous and sequential decision-making. The n FLs move simultaneously (choose their loan supplies). The m ILs move after observing the formal contract. As in chapter 3, the sequence of moves reflects a structural difference between FLs and ILs. The FL being subject to regulatory constraints, can not alter his offers quickly unlike the IL who can observe the actions of the FL and react instantaneously. Since our objective is to analyse the effect of free entry of FLs we continue assuming that the formal rate of interest is administered. As in the previous section the FLs engage in quantity competition. The value of collateral in the formal sector is then determined accordingly from the loan market clearing condition.

The ILs make their offer after observing the formal contract. Unlike the FLs the ILs are unregulated and optimally choose both r and C. The IL's problem does not differ from that discussed in chapter 3. This is because each of the m ILs is only one of his type in his local market and they do not have to face competition from other ILs when choosing their strategy. Moreover, the IL being virtually a monopolist in the residual local market (the only source of credit for the borrowers in his locality who get rationed in the formal credit market) choosing the size of collateral is equivalent to choosing the number of loans. Hence effectively, there does not exist any difference between price and quantity competition, for the IL. Modeling the IL's problem in terms of the number of loans would ensure symmetry in the notation for FL and the IL, but effectively nothing changes if we solve the IL's problem in terms of C.

As mentioned above the formal-informal interaction involves sequential decision making with n FLs choosing their loan supplies in stage 1 and the m ILs choosing their contracts in stage 2. Thus in order to obtain the solution (sub-game perfect Nash equilibrium) to the above gave we solve it by backward induction. Hence we begin by considering the IL's choice problem in stage 2.

4A. Informal Lender's Decision Problem in Stage Two

From our discussion in Chapter 3, we know that given the contract offered by the FLs, the ILs face the option of either segmenting the market or competing with the FLs

Figure3 below reproduces figure 2 of chapter 3 with slight modifications in the legends.

Given the formal contract (C_F, r_F) with $C_F > r_F$, the IL would choose either the contract $(0, q)$ and segment the market or he would choose $(0, r_{IF})$ and compete for borrowers, with the FL. The profits earned by the FL and the IL, when the IL chooses to segment the market or compete are stated below in (11a) and (12a). Since the FL faces an administered rate of interest, $r_F = \bar{r}$. C_F is the market clearing value of collateral for the formal sector, determined from equations (1) and (2).

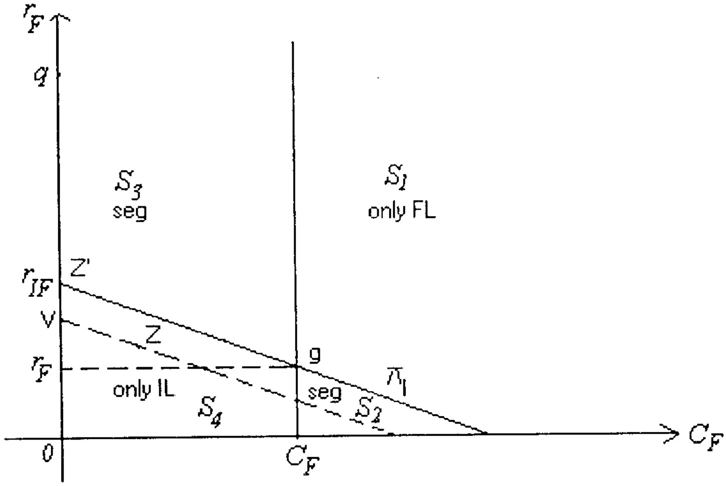

FIG 3.

If the market clearing value of collateral in the formal sector C_F happens to be less than $\bar{r}$, then the contract chosen by the IL, if he decides to segment the market, will be $(0,q)$. On the other hand if the IL decides to compete then he would choose $\left(0,\frac{C_F}{p}\right)$. When $C_F < \bar{r}$, then the return to the entrepreneurs from the formal contract is $(pq - C_F)$. Hence to compete, the IL must offer a contract that would yield a profit to the entrepreneurs at least as large as $(pq - C_F)$. This means that the IL can earn at most $(C_F - T)$ per borrower since total surplus is $(pq - T)$. Thus the IL must choose (C,r) such that his profit per borrower is $rp + C(1-p) - T = C_F - T$. However by making clean advances, that is choosing $C = 0$ and $r = \frac{C_F}{p}$, the IL is able to get access to the entire market as well, while earning $(C_F - T)$ per borrower. We may now state the ILs' profit from segmentation and competition given $(C_F, \bar{r})$.

If the IL chooses to segment the market, then the maximum profit that he can earn, is

$$\Pi_{seg} = \frac{C_F}{\bar{C}}(pq - T) \qquad (11a)$$

The corresponding payoff to the FL in this case would be

$$\Pi_{IF} = \pi_I(C_F, r_F)\frac{\overline{C} - C_F}{\overline{C}} \tag{11b}$$

On the other hand if the ILs choose to compete, then the maximum profit he can earn is

$$\Pi_{comp} = \bar{r}p + C_F(1-p) - T \qquad C_L \geq \bar{r} \tag{12a}$$

$$= C_F - T \qquad C_L < \bar{r} \tag{12b}$$

The corresponding payoff in this case to the FL would be zero.

Given the formal contract, the IL would choose to segment the market or to compete depending upon which strategy is more profitable. Comparison of (11a) and (12a) yields that, given $\bar{r}$ and n, and $C_F \geq \bar{r}$, $\Pi_{seg} \gtrless \Pi_{comp}$, according as $C_F \gtrless \frac{(\bar{r}p - T)\overline{C}}{(pq-T)-(1-p)\overline{C}} = C_0$. However note that, since the function in (12a) above is defined only for $C_F \geq \bar{r}$, therefore C_0 will exist (i.e. $C_0(\bar{r}) \geq \bar{r}$) iff $\bar{r} \geq \frac{T\overline{C}}{(\overline{C} - pq) + T} \equiv \bar{\bar{r}} \in \left(\frac{T}{p}, pq\right)$. Alternatively, the slope of the Π_{seg} function as obtained from (11a) is $\frac{pq-T}{\overline{C}}$. This is greater than $(1-p)$, which is the slope of the Π_{comp} function in (12a). Therefore C_0 will exist (i.e. $C_0(\bar{r}) \geq \bar{r}$) iff $\Pi_{comp} \geq \Pi_{seg}$ at $C_F = \bar{r} \Rightarrow \bar{r} - T \geq \frac{\bar{r}}{\overline{C}}(pq-T) \Rightarrow \bar{r} \geq \bar{\bar{r}}$. This is illustrated in figure 4, by the segments of Π_{comp} and Π_{seg} curves that lie to the right of the dotted line corresponding to $C_F = \bar{r}$. To the right of $\bar{r}$, the Π_{seg} curve is steeper than the Π_{comp} curve. Further at $C_F = \bar{r}$, $\Pi_{comp} \geq \Pi_{seg}$ for $\bar{r} > \bar{\bar{r}}$. Hence Π_{seg} curve intersects the Π_{comp} curve from below. Finally note that C_0 is increasing in $\bar{r}$, since $\frac{\partial C_0}{\partial \bar{r}} = \frac{p\overline{C}}{(pq-T)-\overline{C}(1-p)} > 1$ as $pq - T < \overline{C}$ by assumption. This is illustrated in figure 5 by the line segment FH.

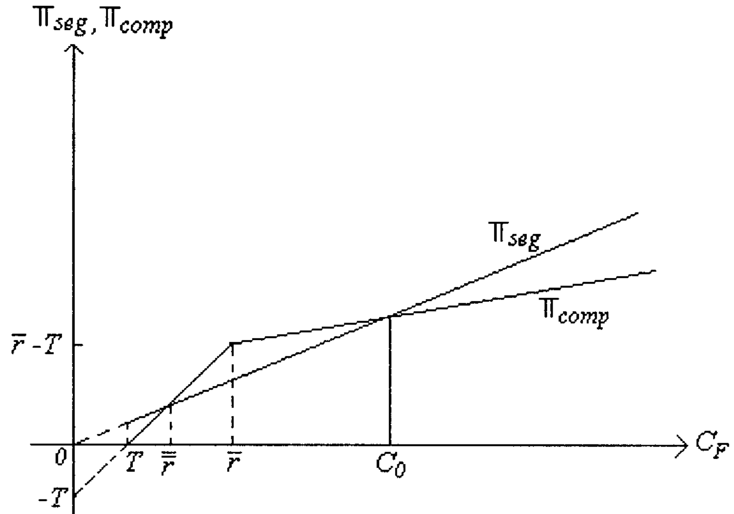

FIG 4.

For $C_F < \bar{r}$, the IL's profit from competition is given by equation (12b). Hence using equations (11a) and (12b), we get that given $\bar{r}$ and n, and $C_F < \bar{r}$, $\Pi_{seg} \stackrel{>}{\underset{<}{-}} \Pi_{comp}$, according as $C_F \stackrel{<}{\underset{>}{-}} \dfrac{T\overline{C}}{(\overline{C} - pq) + T} \equiv \bar{\bar{r}}$. For $C_F < \bar{r}$, the slope of the Π_{comp} curve is T which is greater than the slope of the Π_{seg} curve. Also note that at $C_F = T$, Π_{comp} is zero while $\Pi_{seg} > 0$. Therefore $\Pi_{seg} \stackrel{>}{\underset{<}{-}} \Pi_{comp}$, according as $C_F \stackrel{<}{\underset{>}{-}} \bar{\bar{r}}$. This is illustrated in figure 4, by the segments of the curves corresponding to $C_F \in [T, \bar{r})$. The segments of the curves lying to the left of T are not relevant since C_F cannot be less than T.

4B. Free Entry of Formal Lenders

From the preceding analysis we know that if the IL chooses to compete with the FL, after observing the formal contract $(C_F, \bar{r})$, then the FLs' profit would be zero. Now in stage1, when choosing their optimal loan supplies, the FLs would take into consideration the optimal response of the IL consequent upon its actions. Note that in stage1, the FLs' equilibrium loan supply and hence the market clearing value of collateral in the formal sector depends on both $\bar{r}$ and n. This means that given $\bar{r}$, the formal contract $(C_F(\bar{r},n),\ \bar{r})$ essentially depends on n, the number of FLs operating in the market. This in turn means that given $\bar{r}$, whether the IL wishes to segment the market or to compete will depend on n. If given $\bar{r}$, n is such that the ILs find it profitable to compete then the FLs are driven out of the market and only the ILs survive.

Figure 5 illustrates possible credit market equilibria for different values of $\bar{r}$ and n. In figure 5, the vertical line segment AA' at $C_F = T$ indicates that in the limit $C_F \to T$ as $n \to \infty$.

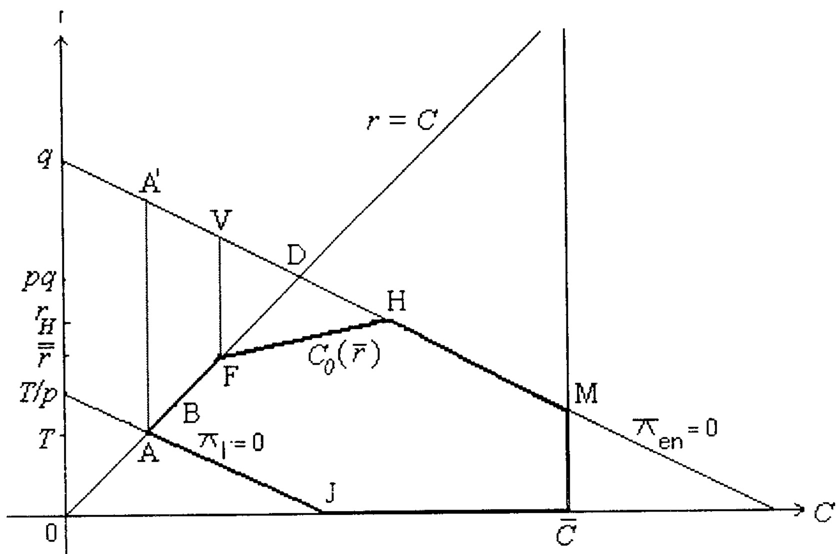

FIG 5

The line segment FH represents the $C_0(\bar{r})$ curve as defined in the previous section. Thus for all formal contracts that satisfy the incentive compatibility constraint (i.e. $C_F \geq \bar{r}$) and that lie to the right of or below the line segment FH, the ILs would find it profitable to segment the market. On the other hand if the formal contract happens to satisfy the incentive compatibility constraint and lies to the left of line segment FH, then the ILs would find it profitable to compete and drive the FLs out of the market.

For formal contracts that lie to the left of the $r = C$ line, $C_F = \bar{\bar{r}}$ (defined in the previous subsection), is the critical value of C_F, at which the ILs are indifferent between segmentation and competition. The vertical line segment FV at $C_F = \bar{\bar{r}}$ demarcates the two zones. For formal contracts that lie to the left of the incentive compatibility constraint and also lie to the left of or on the segment FV the ILs would prefer to segment the market. If they happen to lie to the right of the line segment FV, then the ILs would compete.

What happens if we allow for free entry of private sector banks into the formal sector? We first consider the situation where $\bar{r} \in [T, \bar{\bar{r}}]$. We ignore the case where $\bar{r} < T$ as this is not interesting. For $\bar{r} \in [T, \bar{\bar{r}}]$, the ILs would always prefer segmenting the market, whatever be the market clearing value of collateral in the formal sector. Given $\bar{r} \in [T, \bar{\bar{r}}]$, as the number of FLs increase, C_F will keep falling till the incentive compatibility constraint becomes binding. This happens when $n = \tilde{n}$ (defined in section 3). However as the FLs continue to earn positive profits entry will continue to take place. But in this zone entry will not affect C_F till n reaches $\tilde{\tilde{n}}$. Entry beyond $\tilde{\tilde{n}}$ will once again cause C_F to fall further, below $\bar{r}$. As $n \to \infty$, $C_F \to T$ and the FLs profits will tend to zero. Thus we have the following result.

Remark 4: Free entry of FLs will cause the size of the formal credit market to increase and the informal credit market to shrink. For $\bar{r} \in [T, \bar{\bar{r}}]$, the FLs will give loans to all borrowers with collateral at least as large as T. Note that for $n > \tilde{\tilde{n}}$, strategic default becomes inevitable in the formal sector. The ILs would segment the market giving loans to borrowers with collateral $C \in [0, T)$.

If $\bar{r} \in (\bar{\bar{r}}, r_H)$, entry will continue till $C_F = C_0 > \bar{r}$. Further entry of FLs will not take place, as this would induce the ILs to compete and drive the FLs out of the market. Thus allowing entry will not be very effective in reducing the size of the informal credit market. Finally note that for $\bar{r} > r_H$, the formal credit market will cease to exist.

Remark 5: For $\bar{r} \in (\bar{\bar{r}}, r_H)$ entry will increase the size of the formal credit market till $C_F = C_0 > \bar{r}$.

It is however interesting to note that free entry of FLs cannot eliminate the informal credit altogether. The credit market will remain segmented. The FLs will give loans to all entrepreneurs with collateral endowment at least as large as C_F. The ILs will give loans to all entrepreneurs who get rationed in the formal credit market and will behave as monopolist in the residual market. Thus the ILs would choose $r = q$.

The following proposition summarises this subsection.

Proposition 2: (a) Free entry of FLs is less effective in reducing the size of the informal credit market, at a high administered rate of interest ($\bar{r} \in (\bar{\bar{r}}, r_H)$) than at a low administered rate of interest ($\bar{r} \in [T, \bar{\bar{r}}]$). For $\bar{r} > r_H$ the formal credit market will cease to exist.

(b) For $\bar{r} \in [T, \bar{\bar{r}}]$ entry will cause the size of the formal credit market to increase till $C_F = T$. The FLs merely give loans in return for collateral, as strategic default becomes inevitable ($C_F < \bar{r}$).

(c) However, for a certain range of $n \in (\tilde{n}, \tilde{\tilde{n}})$, entry may be totally ineffective. (If entries are sequential and takes time, then for a while, no effect on formal lending may be visible.)

4C. Deregulation of Interest Rate vs. Free Entry

The debate on state intervention versus non-intervention in the context of the credit markets in LDCs centers on the issue that, given the credit market imperfections, whether financial liberalisation can lower informal interest rates and curb informal lending. In chapter 3 we looked into the effect of deregulation of the formal interest rate on the size of the informal credit market. This chapter investigates the effect of allowing free entry of private sector banks, into the formal sector, on the size of the informal credit market. It would now be interesting to compare the two alternative instruments of financial liberalisation in terms of their effectiveness in curbing informal lending.

Suppose to start with there is one FL and one IL in a locality. The FL faces an administered rate of interest $\bar{r}$. Now if the government decides to deregulate the interest rate, then the equilibrium contract of the FL would be given by some point on the $r = C$ curve, above $r_{ic} = \frac{\bar{C}(1-p)+T}{2-p}$ and at or below $\bar{\bar{r}}$[8]. Diagrammatically (figure 5), the formal contract would lie on the segment BF (excluding point B), of the $r = C$ curve. Therefore with interest rate deregulation and absence of free entry, the size of the formal credit market is restricted by the incentive compatibility constraint, with $C_F = r_F \in (r_{ic}, \bar{\bar{r}})$. Depending on what the administered rate of interest was initially, interest rate deregulation would cause the size of the formal credit market to increase or decrease relative to its initial size.

Now suppose instead of deregulating $\bar{r}$, the government allows free entry of private sector banks into the formal credit market. For $\bar{r} \in [T, \bar{\bar{r}}]$, free entry causes the size of the formal credit market to expand to $C_F = T < r_{ic}$. Thus diagrammatically, the vertical line segment AA' restricts the size of the formal credit market. We may therefore conclude that for $\bar{r} \in [T, \bar{\bar{r}}]$, entry is more effective than deregulation of interest rate, in curbing informal lending.

If the administered rate of interest in the formal sector is initially high ($\bar{r} > \bar{\bar{r}}$), then we know that, expansion of the formal credit market through entry of FLs is limited by $C_0(\bar{r}) > \bar{\bar{r}}$ .In figure 5, the line segment FH indicates the limit to the expansion of the formal credit market with free entry. Hence we may conclude that, interest rate deregulation in the absence of free entry, would be more effective in curbing informal lending than holding the formal rate of interest fixed at $\bar{r} > \bar{\bar{r}}$ and allowing free entry.

We may summarise the discussion of this subsection in the following proposition.

Proposition 3: Free entry of FLs cannot eliminate the informal credit market altogether. although it will be relatively more effective compared to deregulation of the interest rate.

[8] Note that $\bar{\bar{r}} = \tilde{r}_0$. Refer to chapter 3 for definition of $\tilde{r}_0$.

5. Conclusion

This chapter considers the effects of entry of formal lenders on the size of the informal credit market in terms of a market consisting of m ILs and n FLs. The strategic interaction among the FLs and between the FLs and the ILs has been modeled in terms of a game that involves both simultaneous and sequential decision making. The FLs move simultaneously. The ILs move after observing the formal contract which is the outcome of FLs' action. The ILs enjoy local monopoly power, on account of their informational advantage, over a group of entrepreneurs (e), and would not lend outside their known group of entrepreneurs. The FLs however do not enjoy any such informational advantage with regard to particular groups and are willing to lend to borrowers from any group. All the agents are risk neutral and are interested in maximising their expected profits. The FLs optimally choose the number of loans, given the administered rate of interest. In case of project failure, the FLs acquire the collateral. Unlike the FLs the ILs are unregulated and optimally choose both the interest rate and the collateral. We establish the existence of a market equilibrium under such conditions and explicitly compute the optimal loan size as the solution to a two stage game between the FLs and the ILs. It is shown that at a high administered interest rate entry of FLs is less effective in reducing size of informal credit market than for lower rates. Entry of FLs cannot eliminate the informal credit market altogether, although it will be relatively more effective compared to deregulation of the interest rate.

Chapter 5

Endogenous Formation of Financial Dualism

1. Introduction

Why do we observe different types of financial institutions in the credit markets of many countries that are in their early phase of development? Why do indigenous banks consisting of sole proprietorship and partnership firms co-exist with larger privately owned joint stock commercial banks with a much larger capital base? The indigenous banks usually engage in local lending while the joint stock banks constitute nation-wide network and have a much broader area of operation both geographically and across industry. Again the joint stock banks typically accept deposits, unlike the indigenous bankers. This raises the question, why is it that some wealth holders prefer keeping deposits with banks for a fixed certain return rather than engaging in local banking like other wealth holders or becoming share holders of the larger joint stock bank?

These are some of the issues that this chapter tries to address. The above observation find historical and contemporary support in the country experiences of industrially advanced countries like UK and Germany in their early stages of development in the 18^{th} and 19^{th} centuries and India in the early 20^{th} century.

In the rapidly industrialising England of the eighteenth century, investments were required for new projects and new entrepreneurs. The bankers were often knowledgeable people who knew the tricks of trade. Often they themselves were wealthy tradesmen doing banking as profitable sideline. Because these banks were small, their success depended heavily on maintaining depositor confidence and personal connections. For this, they needed to maintain a sound and well-diversified investment portfolio.

But banking laws in eighteenth century England forbade a bank from having more than six partners. For a newly industrialising economy this proved to be critical. In 1825, seventy-three of England's 770 banks failed. Banking laws had to be changed quickly and under the new laws, joint stock banking proliferated in England in a big way. Banking services became available countrywide and it was apparent that there is strength in numbers. Instead of paying other banks for investment services in other parts of the country, it was better to merge. Some of the nation-wide networks formed thus during this period. Banks became specialised in regional ventures but, at the same time, by wide networking, they were not entirely dependent on any one area or industry, improving the diversification of bank operations.

Germany went through a similar expansion in the mid-18th century and they also flourished in a similar way in the wake of legislative reforms. During the 19th century, Germany evolved from a financially chaotic country with not even a currency of its own to one with a joint stock banking system which also specialised in investment banking. If one glances through the banking history of India during the British rule, one would find similar instances with wealthy landowners or lawyers setting up small private banks in the 18th century which relied on personal standings and were very susceptible to runs[1]. The regulation reforms came in 1860 and subsequently, some of the present day big banks were born in India.

In this chapter we develop a theoretical model that matches the country experiences cited above. We consider an economy consisting of wealth holders with varying endowments of an investment good and potential entrepreneurs with project plans. Each wealth holder has a neighbouring entrepreneur about whose project he has complete information. The wealth holders can invest in the neighbouring entrepreneur's project (home project) or they can diversify their portfolio by investing in other projects also. However he can not monitor the other projects. To quote Deane (1979)

"Bankers often originated in industry or trade, or for example in the legal profession... Often too, tax collectors became bankers. ...One of the consequences of this heterogeneous banking system was that when the pioneers of the industrial revolution went in search of capital, they could hope to find local bankers who had access to enough personal knowledge about the borrower on the one hand, and enough practical knowledge of the trade or industry concerned on the other, to be able to take risks which a less personally involved banker would find incalculable and therefore out of range."

[1] It was never easy to do banking business to the *mufassil*. In fact, despite the lack of easy credit sources, it was always a problem to find enough borrowers. And deposits had to be collected by exercising personal contacts.

The only way the wealth holders can diversify is by colluding with the other lenders. We assume that there is a court of law but it is very costly in terms of time and expenses involved for an individual wealth holder to move the court. This leads to risk diversification through multilateral investments, which involve exchange of information among wealth holders about their respective home projects. Given that such collusions can be formed, other isolated wealth holders may be tempted to keep deposits with these collusions. Although moving the court individually is costly, a group of depositors may still be able to take effective advantage of the court of law. It is to be noted however that the presence of a court of law does not rule out the possibility of bank runs. The formal model describing this economy is given in section 2.

In the context of such a model, which replicates the kind of economy that characterises a traditional society, we show how financial dualism might emerge. We show the conditions that would be conducive to the formation of the native system of banking, constituting the informal credit market, along with the larger joint stock banks. These joint stock banks, unlike the indigenous bankers, are also deposit taking institutions, and the forerunners of the modern commercial banks constituting the formal credit market.

Our analysis of the collusion formation problem, in section 3, is based on the assumption that only people of similar stature collude. We show that two extreme sizes, "large" collusions and "small" collusions will arise, where large and small refer to the number of wealth holders forming the collusion. In section 4, we show that if a collusion is quite large then other people, that is smaller wealth holders from the middle wealth class will find it profitable to invest their money with the colluding group and get a certain return. The collusion may also profit from this. So this is mutually beneficial. Thus, we have deposit taking joint stock banks owned by large number of large shareholders (and small shareholders) [2]. However "large" collusions can be formed only by the very wealthy. Thus joint stock banks will be born if enough such very rich people can collude. One segment of the wealth holders, specifically the wealth holders belonging to the lowest strata will however still find it profitable to form small collusions giving

[2] J.C. Das (1927) argued, in the wake of several bank failures, that the only way of making banks accountable and restoring public confidence would be to start a new technique, by which, instead of accepting deposits against interest, banks should give out preferential shares in small amounts to the general public. The public then would not withdraw money suddenly, causing runs, and would want their money to remain invested for longer periods and greater dividends. In other words, Das argued for the public to own banks rather than a handful of businessmen.

birth to local cartels, of the type found in the informal sector. This segment of wealth holders will continue financing local projects (as local moneylenders and indigenous partnership banks) rather than keeping their wealth as deposits with the "large" collusion or bank.

On the other hand, in the absence of sufficient number of wealthy individuals, only small collusions will be formed. We may think of these as the native or indigenous bankers consisting of sole-proprietorship and partnership banking firms formed by the local rich who carry on banking as a profitable side business, in a traditional society[3].

We discuss the robustness of our results with respect to our assumption of equal contributions from wealth holders in a collusion in Section 5. Finally section 6 concludes.

2. Model and Assumptions

We consider an economy consisting of wealth holders and entrepreneurs. The wealth holders are distributed over the interval $[0,\overline{W}]$ according to their endowment of investment good or loanable funds W. Let $f(W)$ and $F(W)$ denote the density and distribution functions of loanable funds respectively. The entrepreneurs do not have any endowments of their own but only have access to a project. The projects yield a random return of q with probability p and 0 with probability $(1-p)$ per unit of loanable funds invested in a project. Thus project returns are identical across entrepreneurs. We assume that the projects are of variable size and exhibit constant returns to scale. Moreover we assume that there exists indivisibility in investment, the smallest unit of additional investment being one. The size of a project can therefore take only integer values greater than or equal to one.

The entrepreneurs must borrow the investment good from the wealth holders in order to undertake their projects. Each entrepreneur has a new identical project each year and contracts are written for one period only. We assume that typically, each wealth holder has inside

[3] There is a large literature on the endogenous growth of financial intermediation – i.e. how financial intermediaries are formed endogenously (Ramkrishnan and Thakor, 1984). But we are not concerned with this issue, as this does not distinguish between various types of financial intermediaries.

information about one project, acquired over years, through long acquaintance with the entrepreneur. We call this project the wealth holder's home project. Letting s denote the size of a project, this effectively means that the insider can observe whether qs or zero output has been realised. For the remaining projects for which the wealth holder is an outsider, the cost of personal monitoring is infinity.

We assume that wealth holders are risk averse. Now the wealth holders are faced with four investment alternatives: (i) invest only in home project (ii) unilateral diversification (iii) multilateral diversification through formation of collusion (iv) keeping deposits with another collusion. We now explain these alternatives investment strategies stated above.

Firstly, an wealth holder could lend his funds only for his home project. He then earns a gross interest of r per unit of loanable funds if the project is successful and zero otherwise. Here $r = \alpha q$ where $\alpha \in (0,1)$ is exogenously given[4]. The bargaining power arises through the personal relationship between the entrepreneur and the wealth holder and the fact that the outside opportunities for both the parties are either limited or costly.

Alternatively, the wealth holder could diversify his investments across other projects as well. In that case the wealth holder under consideration will have to rely on other wealth holders for information about their home projects for which he is an outsider. This however leaves the possibility of strategic default by other wealth holders. In this model strategic default is defined as follows. Suppose wealth holder i invests in wealth holder j's home project. Then if j lies, he gets away with the lie with probability θ. He gets caught with probability $(1-\theta)$. That is, we assume that there exists some leakage of information, which occurs with probability $(1-\theta)$.

However the information would make a difference to wealth holder i, only if there is a court of law or some form of punishment or credible threat. In the absence of any form of punishment, i is not made any better off even if he finds out that j has lied as he is not able to recover his loan in either case. We assume that there is a court of law but that it is not very efficient in terms of effort, time and expenses involved for the plaintiff. Specifically, the cost borne is too high for

[4] α may be determined as a Nash bargaining solution between the wealth holder and the entrepreneur.

any individual wealth holder to move the court. Under the circumstances, risk diversification by one wealth holder, say wealth holder i, is bound to lead to strategic default by the other wealth holders, and yield a payoff of zero to wealth holder i. Hence it would never be profitable for a wealth holder to diversify risk unilaterally.

The third possible investment strategy for the wealth holders is risk diversification through formation of collusion. Now suppose that the wealth holders form a collusion. Let us consider a collusion of m wealth holders, $m \in \{2,3,4,.....\}$. Each wealth holder has inside information about one project. Each wealth holder invests $k = w/m$ units of loanable funds in each of the m projects. Since there exist indivisibility in investment, $k \in \{1,2,3,...\}$, which is the set of positive integers. Here w denotes each wealth holder's contribution of loanable funds to the collusion. Hence $w \leq W$. Note that since $w = km$, therefore $w \in \{2,3,......\}$. A collusion is thus characterised by the ordered pair (m, w) or (m, k). This is on the assumption that the investment per wealth holder is the same. The analysis in sections 3 and 4 are based on this assumption. The consequence of relaxing this assumption is discussed in section 5.

Since a collusion involves multilateral investments, it leaves each wealth holder with the scope to impose some punishment on the defaulting wealth holders who get caught. Consider for example the following environment:

In case wealth holder j defaults and gets caught the other wealth holders give wealth holder j his due share. However, wealth holder j has to distribute a fraction c of his total earnings as compensation amongst the members belonging to the collusion over and above giving them their due share[5].

The question arises as to why the defaulting party would be willing to pay a fraction 'c' of his payoff as compensation, as there does not exist any compulsion for doing so. Once again, a court of law exists. Talking in terms of the actual punishment imposed, the defaulting party should be indifferent between the court and outside the court options. But they have to bear the

[5] Alternatively, we could consider the case in which wealth holder j has to pay the other wealth holders their due share. The other wealth holders however pay wealth holder j only the fraction $(1-c)$ of his due share, and retain the fraction c.

social cost as well, if they go to the court, because of the social stigma associated with it or its role in making information catch public attention. At the same time the court is not very attractive to the plaintiff either because it is extremely costly in real and nominal terms. So they are always better off settling things outside the court, as this does not involve any expenses involved in enforcing the punishment. So the court is a worse option for both parties.

Here the court of law plays an important role not as an efficient instrument of justice, for the imposition of punishment and ensuring recovery of loans. Its importance lies in making information public[6]. The defaulting wealth holder will comply with the punishment imposed by the collusion and pay the compensation, once information leaks and he is exposed or is caught lying; as, otherwise he faces a greater threat, like social ex-communication, if the court becomes involved and makes the information public.

The possibility of loss of goodwill or social standing is a large cost for the wealth holders. This is especially true for a traditional society, which has just embarked on the path of modernisation, where social anonymity is still not significant. One might consider for example the kind of society that characterised pre-independent India, in the nineteenth and twentieth century. Here the wealth holding class consists of men of important social standing either by birth or by profession, for example highly successful professionals like lawyers and doctors.

The mere existence of a punishment strategy does not necessarily imply that it will take away the incentive to default for each wealth holder belonging to the collusion. In other words, because collusion leaves scope for punishment for default it does not necessarily mean that the collusion will be sustainable. Thus a collusion would enable the wealth holders to take advantage of risk diversification by exchanging inside information about their respective home projects provided truth telling by all wealth holders can be implemented as a Nash equilibrium.

This brings us to the fourth investment alternative. As long as formation of a sustainable collusion is possible, the other wealth holders have the option of keeping deposits with the collusion in exchange for a certain return. Thus we have two different groups of wealth holders

[6] For a traditional society, where social anonymity is still not significant, the social cost of non-compliance, even if the dispute is not taken to the court, is likely to be substantial.

being associated with the collusion in two different capacities. The first consists of the wealth holders who form the collusion and are essentially shareholders earning an uncertain return on their investments. Each such wealth holder holds a share contract since his return varies with the number of projects that are successful. Here by projects we refer only to those projects that come within the realm of the collusion. The total return to the collusion (bank) gets distributed among the wealth holders depending upon their share. With equal shares each wealth holder gets the fraction $1/m$ of the total. The other group consists of the depositors who keep their wealth with the collusion and earn a certain return.

Here again there is the possibility that the "collusion" might default on payment of interest to depositors. Now there are two possibilities with regard to the nature of default: involuntary default and strategic default. As far as the first possibility is concerned the crucial question is about the depositors' confidence in the banks ability to pay. This depends, among other things, on the bank's capacity to diversify risk. Prevention of strategic default (from occurring with certainty) would require a court of law. It is to be noted that the existence of a court of law or depositor insurance is neither necessary nor sufficient condition for sustaining depositor confidence or avoiding bank runs. One can cite instances of bank runs even in the presence of a court of law or depositor insurance. Again deposit keeping came into vogue before depositor insurance or laws relating to depositors' rights (Kaushal, 1979).

Here we assume that there is a court of law. Further unlike in case of an individual approaching the court, the court is more effective (in terms of cost, effort and time involved) in imparting justice, when the party concerned consists of a whole body of depositors.

So, to summarise the above discussion, there are effectively three investment options:
(a) Investing in home project, (b) forming a self-enforcing collusion as shareholders[7] and (c) keeping deposits with a collusion (here the court is important for enforcing contracts).

[7] A collusion can also be sustained in a repeated game, but we don't take that route here in our static one period model. For such models see Dutta et al. (1989), Ghosh and Ray (1999).

3. Formation of Collusions

In order to find out whether collusion (m,k) is sustainable or not we compare the payoffs from telling truth and finking for one lender, given that his project is successful and all other lenders are telling the truth[8]. Alternatively we could compare the gain in expected utility from finking when he gets away with it with the loss in expected utility from finking when he gets caught.

Let $u(.)$ be the utility derived from returns to investment. We assume $u(0)=0, u'>0$ and $u''<0$. The last sign restriction follows from the assumption of risk aversion. Let $x \in \{1,2,......,m\}$ denote the number of projects[9] that are successful out of m projects. Then x is Binomially distributed with parameters m and p (in symbols $x \sim B(m,p)$).

Now when wealth holder j tells the truth he retains kr, which is the return to his share of investment in his home project. He distributes the rest, $(m-1)kr$ among the rest of the wealth holders, who are shareholders in his home project. More over he receives kr from each of the other $(x-1)$ lenders whose home projects have been successful. Thus the utility derived by him is $u(xkr)$.

If j lies and doesn't get caught then he retains the entire return from his home project i.e. mkr. This includes the returns on his share, kr and the other lenders' share $(m-1)kr$ as well. Moreover he receives $(x-1)kr$ from the other lenders. Thus utility derived is $u((m+x-1)kr)$

On the other hand if j gets caught he distributes $(m-1)kr$ out of the returns from his home project. He receives kr from each of the other $(x-1)$ lenders, whose home projects have been successful, so that he is left with xkr. But as compensation he has to pay the fraction c of xkr to other members of the collusion. So the utility derived by him is $u((1-c)xkr)$.

[8] Considering the payoffs from lying and truth telling when the project for which the lender under consideration has inside information is unsuccessful is not required, as payoffs are the same. Hence the terms cancel on both sides.

[9] We need not consider $x=0$ since $u(0)=0$ by assumption.

We may summarise the preceding discussion as follows:

Remark 1: The utility derived by lender j from telling the truth when there are x successes including lender j's home project and all other wealth holders are telling the truth is $u(xkr)$. Lender j's payoff when he finks and gets away with it is $u((m+x-1)kr)$ and his payoff if he gets caught is $u((1-c)xkr)$. Thus for x successes, lender j's gain in utility from finking is $\{u((m+x-1)kr)-u(xkr)\}$ and his loss in utility from finking is $\{u(xkr)-u((1-c)xkr)\}$.

Now the conditional probability of occurrence of x successes given that lender j's project is successful is $P(x,m) = {}^{m-1}C_{x-1} p^{x-1}(1-p)^{m-x}$. The joint probability of occurrence of x successes given that lender j's project is successful *and* lender j lies and gets away with it is $\theta P(x,m)$. Replacing θ with $(1-\theta)$ would yield the corresponding joint probability of x successes *and* lender j lying and getting caught.

Let $E[U(G)]$ and $E[U(L)]$ denote respectively, the expected utility gain and expected utility loss from finking by lender j when there are m lenders. This assumes that lender j's project is successful[10] and that all other lenders are telling the truth. Then we may express $E[U(G)]$ and $E[U(L)]$ as follows.

Definition 1: $$E[U(G)] = \sum_{x=1}^{m} \theta \; {}^{m-1}C_{x-1} p^{x-1}(1-p)^{m-x}\left[u((m+x-1)kr)-u(xkr)\right]$$

$$= \theta E_m\left[u((m+x-1)kr)-u(xkr)\right]$$

[10] The probability that j's home project is successful is p. Therefore the joint probability of occurrence of x successes including j's home project is $p\,P(x,m)$. Hence the probability that he derives $U(G_{m,x})$ and $U(L_{m,x})$ is $\theta\, p\, P(x,m)$ and $(1-\theta)\, p\, P(x,m)$ respectively. But when comparing $E[(U(G)]$ and $E[(U(L)]$, p cancels on both sides. Hence we need to consider only the conditional probability rather than the joint probability.

Definition 2: $E[U(L)] = \sum_{x=1}^{m} (1-\theta)^{m-1} C_{x-1} p^{x-1} (1-p)^{m-x} [u(xkr) - u((1-c)xkr)]$

$$= (1-\theta) E_m [u(xkr) - u((1-c)xkr)].$$

In both the above definitions E_m denotes conditional expectation.

Below we state a definition and a theorem, from Marshall and Olkin (1979, Chapter 3) which we use subsequently for proving certain lemmas.

Definition (A.1) : A real valued function ϕ defined on a set $A \subset R^n$ is said to be Schur–convex on A if

$$x \prec y \text{ on } A \Rightarrow \phi(x) \leq \phi(y).$$

If in addition, $\phi(x) < \phi(y)$ whenever $x \prec y$ but x is not a permutation of y, then ϕ is said to be strictly Schur–convex on A. If $A = R^n$, then ϕ is said to be Schur–convex or strictly Schur–convex. Similarly, ϕ is said to be Schur–concave on A if

$$x \prec y \text{ on } A \Rightarrow \phi(x) \geq \phi(y),$$

and ϕ is strictly Schur–concave on A if strict inequality $\phi(x) > \phi(y)$ holds when x is not a permutation of y.

Of course, ϕ is Schur–concave if and only if $-\phi$ is Schur–convex.

Theorem (J.2): Suppose that Θ is an interval of integers and μ is counting measure. Further suppose for $M = 1,2,.....,$ and nonnegative integer x, $\alpha(M,x) = \begin{pmatrix} M \\ x \end{pmatrix}$. Then the function ψ defined for $\theta_i \in \Theta$, $i = 1,...n$, by

$$\psi(\theta) = \int \prod \alpha(x_i, \theta_i)\, \phi(x) \prod d\mu(x_i)$$

is Schur-convex whenever ϕ is Shur-convex.

Similarly, if ϕ is Schur-concave, then ψ is Schur-convex.

We will now state certain lemmas regarding $E[U(G)]$ and $E[U(L)]$.

Lemma 1: Let relative risk aversion be less than one. Then $E[U(L)]$ is increasing in m.

Proof: Now $\frac{d}{dx}[u(xkr)-u((1-c)xkr)=\frac{1}{x}\{u'(xkr)xkr-u'((1-c)xkr)(1-c)xkr\}>0$

iff $u'(z)z$ is increasing in z. This requires that $u'(z)+u''(z)z>0 \Leftrightarrow -\frac{z\,u''(z)}{u'(z)}<1$.

Hence for relative risk aversion less than one $[u(xkr)-u((1-c)xkr)]$ is strictly Schur–convex in x. Further since $x \sim B(m,p)$, therefore $E_m[u(xkr)-u((1-c)xkr)]$ is strictly Schur-convex[11] in m.
Hence result follows.

As the constant "k" operates only as a scale factor in the relevant region, in subsequent discussion for the sake of notational simplicity, we omit k in the utility expressions.

Now from definition 1 and by using Mean Value Theorem we have,
$E[U(G)]=E_m[(m-1)r\,u'(\xi(x,m))]$ where $xr<\xi<(m+x-1)r$.
Hence denoting $E_m[u'(\xi(x,m))]$ by $\psi(m)$ we have $E[U(G)]=(m-1)r\,\psi(m)$.

Lemma 2: u' is strictly Schur-concave (decreasing) in x.
Proof: By Mean Value Theorem it follows that :

$$U(G_{m,x})=u((m+x-1)r)-u(xr)=(m-1)r\,u'(\xi(x,m))$$

$$U(G_{m,x+1})=u((m+x)r)-u((x+1)r)=(m-1)r\,u'(\xi(x+1,m))$$

By concavity of $u(.)$ we have,

$$u((m+x-1)r)-u(xr)>u((m+x)r)-u((x+1)r)$$

$$\Rightarrow u'(\xi(x,m))>u'(\xi(x+1,m))$$

By concavity of $u(.)$ we have

$$\xi(x,m)<\xi(x+1,m)$$

Therefore ξ is increasing in x.

This implies that u' is decreasing in x i.e. $u(.(x))$ is concave in x.

[11] Refer to Marshall and Olkin, definition A.1 and theorem J.2 (stated above).

Lemma 3: $u'(.)$ is decreasing in m.

Proof: By Mean Value Theorem we have,

$$u(G_{m,x}) = u\big((m+x-1)r\big) - u(xr) = (m-1)r\, u'\big(\xi(x,m)\big)$$

$$\Rightarrow \frac{u\big((m+x-1)r\big) - u(xr)}{(m-1)r} = u'\big(\xi(x,m)\big)$$

$$u(G_{m+1,x}) = u\big((m+x)r\big) - u(xr) = mr\, u'\big(\xi(x,m+1)\big)$$

$$\Rightarrow \frac{u\big((m+x)r\big) - u(xr)}{mr} = u'\big(\xi(x,m+1)\big)$$

By concavity of $u(.)$ we have,

$$\frac{u\big((m+x-1)r\big) - u(xr)}{(m-1)r} > \frac{u\big((m+x)r\big) - u(xr)}{mr}$$

$$\Rightarrow u'\big(\xi(x,m)\big) > u'\big(\xi(x,m+1)\big)$$

By concavity of $u(.)$ we have,

$$\xi(x,m) < \xi(x,m+1)$$

Hence ξ is increasing in m.

This implies that u' is decreasing in m i.e. $u(.(x))$ is concave in m.

Lemma 4: $\psi(m)$ is decreasing in m.

Proof: From lemma 2, $u'(.)$ is strictly Schur-concave in x. Further from lemma 3, $u'(.)$ is also decreasing in m. Hence $\psi(m)$ is strictly Schur-concave[12] in m.

Lemma 5: $E[U(G)]$ is initially increasing and then is decreasing in m eventually, for finite m.

Proof: Differentiating[13] $E[U(G)] = (m-1)r\,\psi(m)$, with respect to m, yields

$$\frac{dE[U(G)]}{dm} = (m-1)r\,\psi'(m) + r\,\psi(m)$$

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[12] *Op.cit.* This theorem will still remain applicable and hold even more strongly for $u(.)$ increasing in m. Details of this demonstration are routine but tedious and we omit them here.

[13] Here we use the differential notation, for expositional simplicity. The actual derivation in terms of successive differences would only complicate the algebra and not add qualitatively to our findings.

Now, for $m = 2$, $\dfrac{dE[U(G)]}{dm} = r\{\psi'(m) + \psi(m)\}$

$$= r\{E_m[u''(.)] + o(p^{m-1}) + E_m[u'(.)]$$

$$= r\{E_m[u''(.) + u'(.)] + o(p^{m-1})$$

This is analogous to the change in order of integration and differentiation as in the Leibnitz rule. Note that the magnitude of the term $o(p^{m-1})$ will be of very small compared to the other two terms.

Now relative risk aversion is less than one by assumption i.e. $-\dfrac{z\,u''(z)}{u'(z)} < 1$. Further $z > 1$, since $x, k \geq 1$, $m \geq 2$ and $r > 2$ and z is given by the functions xkr or $(m + x - 1)kr$ as we are considering $E[U(G)]$. Hence $-\dfrac{u''(z)}{u'(z)} < 1 \Rightarrow u''(z) + u'(z) > 0$. Therefore for $m = 2$, $\dfrac{dE[U(G)]}{dm} > 0$.

Again $\dfrac{dE[U(G)]}{dm} < 0$ iff $-\dfrac{\psi'(m)}{\psi(m)} > \dfrac{1}{m-1}$.

As $m \to \infty$, $\dfrac{1}{m-1} \to 0$. For strictly concave $u(.)$, as $m \to \infty$, $\dfrac{\psi'(m)}{\psi(m)}$ is strictly bounded away from zero. Hence the above condition is satisfied for finite m.

Thus lemma 5 holds for strictly concave $u(.)$.

Lemma 6: Suppose relative risk aversion is less than one. Further let $c < \dfrac{\theta}{1-\theta}\,\dfrac{1}{p+1}$ where $c, p \in (0,1)$. Then for any given m, as w tends to infinity, the collusion (m, w) becomes non-sustainable.

Proof: $\dfrac{\partial E[U(G)]}{\partial w} = \displaystyle\sum_{x=1}^{m} \theta\, P(x,m) \frac{\partial}{\partial w}\left[u\left((m+x-1)\frac{wr}{m} \right) - u\left(\frac{xwr}{m} \right) \right]$

$$= \sum_{x=1}^{m} \theta\, P(x,m) \left[u'\left((m+x-1)\frac{wr}{m} \right)(m+x-1)\frac{r}{m} - u'\left(\frac{xwr}{m} \right)\frac{xr}{m} \right] \geq 0$$

and $\frac{\partial E[U(L)]}{\partial w} = \sum_{x=1}^{m} (1-\theta)\, P'(x,m)\left[u'\left(\frac{xwr}{m}\right)\frac{xr}{m} - u'\left((1-c)\frac{xwr}{m}\right)\frac{(1-c)xr}{m}\right] \geq 0$

since $-\frac{z\,u''(z)}{u'(z)} < 1$ by assumption. Thus both $E[U(G)]$ and $E[U(L)]$ are increasing in w, for a given m.

Now let $u'(z) \to \varepsilon > 0$ (ε is an arbitrary small number) as $z \to \infty$. Then as $w \to \infty$,

$$\frac{\partial E[U(G)]}{\partial w} \to \sum_{x=1}^{m} \theta\, P(x,m)\frac{\varepsilon(m-1)r}{m} = \frac{\theta\varepsilon(m-1)r}{m} \quad \text{(since } \sum_{x=1}^{m} P(x,m) = 1\text{)}$$

and
$$\frac{\partial E[U(L)]}{\partial w} \to \sum_{x=1}^{m} (1-\theta)\, P(x,m)\frac{\varepsilon\, cxr}{m}$$

$$= \frac{(1-\theta)\,\varepsilon\, cr}{m}\sum_{x=1}^{m} P(x,m)\, x$$

$$= \frac{(1-\theta)\varepsilon\, cr}{m}\sum_{x-1=0}^{m-1} {}^{m-1}C_{x-1}\, p^{x-1}(1-p)^{m-x}\{(x-1)+1\}$$

$$= \frac{(1-\theta)\varepsilon\, cr}{m}[(m-1)p+1]$$

Comparing slopes as $w \to \infty$,

$$\frac{\partial E[U(G)]}{\partial w} \gtrless \frac{\partial E[U(L)]}{\partial w} \quad \text{according as} \quad \frac{(m-1)}{(m-1)p+1} \gtrless \frac{(1-\theta)}{\theta}c.$$

Now at $m = 2$, $\frac{(m-1)}{(m-1)p+1} = \frac{1}{p+1} < 1$ and as $m \to \infty$, it tends to $\frac{1}{p} > 1$. Since $\frac{(m-1)}{(m-1)p+1}$ is increasing in m, therefore for $\frac{\partial E[U(G)]}{\partial w} > \frac{\partial E[U(L)]}{\partial w}$ as $w \to \infty$, it is sufficient that $c < \frac{\theta}{1-\theta}\,\frac{1}{p+1}$.

Thus proof of lemma 6 follows.

Below we make an observation before stating proposition 1.

Remark 2: Consider the case where $m = 2$, $c = 1/2$ and $k = 1$. Then $E[U(G)] > E[U(L)]$ is equivalent to

$$\theta\,[p(u(3r) - u(2r)) + u(2r) - u(r/2)] < (1 - p)\{u(r) - u(r/2)\} + p\{u(2r) - u(r)\}.$$

We may now the state the following proposition.

Proposition 1: For alternative parametric specifications, for every $k \geq 1$, we can have one of the following possibilities.

(i) a collusion of m lenders will not be sustainable for any $m \geq 2$.

(ii) there exists a range of values of m, $[\underline{m}_k, \overline{m}_k]$ such that a collusion of m lenders will not be sustainable for $m \in [\underline{m}_k, \overline{m}_k]$. In other words a collusion of m lenders will be sustainable only for $m < \underline{m}_k$ or for $m > \overline{m}_k$. For this situation, we have two alternative sub-cases.

(a) $\underline{m}_k = 2$.

(b) $2 < \underline{m}_k < \overline{m}_k$.

Proof: From lemma 1, we have $E[U(L)]$ increasing in m. From lemma 5, we have $E[U(G)]$ is initially increasing and then decreasing in m eventually, for finite m. Now for $m = 2$,

$E[U(G)] \gtreqless E[U(L)]$ according as the condition stated in remark 2.

Therefore if at $m = 2, E[U(G)] > E[U(L)]$, then $E[U(G)]$ must cross $E[U(L)]$ curve once. Hence $\overline{m}_k$ exists and $\underline{m}_k = 2$. This is the case stated in (ii)(a).

Again if at $m = 2$, $E[U(G)] < E[U(L)]$, then $E[U(G)]$ will cross $E[U(L)]$ curve twice (using lemma 5) if $\overline{m}_k$ exists and in that case $\overline{m}_k > 2$. This is the case (ii)(b).

Corollary 1: (a) $\overline{m}_k$ is non-decreasing in w or k. Thus as k increases either $\overline{m}_k$ remains constant (constant relative risk aversion) or it increases. Further the slope of the curve must not be greater than $1/k_0$ as w tends to infinity. In other words the curve must approach $k = w/m$ asymptotically.

(b) $\underline{m}_k$ is non- increasing in k.

(c) As $k \to \infty, \overline{m}_k \to \infty$.

Proof: Follows from lemma 6. For (c) note that $k = w/m$

Corollary 2: $\overline{m}_k$ and $\underline{m}_k$ is unique for every k.

Proof: Follows from lemmas 5 and 6.

Thus the loci of points representing the collusions $(\overline{m}_k, k)$ and $(\underline{m}_k, k)$ must cut each ray only once.

The above proposition can be explained as follows. The first case, where the range of possible collusion sizes is a null set, we will see only local lending (we discuss this again in next section). The second situation is of more importance to us. The first subcase describes the situation where small collusions ($m \le \overline{m}_k$) are nonsustainable. So collusions will be formed in equilibrium only if a large number of wealth holders come together. The other subcase and which is the most comprehensive one tells us that collusions of only very small ($m \le \underline{m}_k$) and large ($m \ge \overline{m}_k$) sizes may be observed. We discuss this possibility in greater detail throughout the rest of the paper because of its interesting implications.

4. Emergence of the Formal and the Informal Sectors or Financial Dualism

So far we have identified the sets of collusions (m, k) that are sustainable and non-sustainable. We need not concern ourselves with the latter as these will never be formed. Henceforth we will focus only on the collusions that are sustainable. Below we specify several subsets of the set of the sustainable collusions S, (which is represented by the shaded region in figure 1).

$A = \{(m, w) : w \le w_B \text{ and } m \le \underline{m}_1 (= w_B)\}$

$B = \{(m, w) : w_B < w < w_C \text{ and } m \le \underline{m}_k\}$

$C = \{(m, w) : w \ge w_C \text{ and } m \le \underline{m}_k\}$

$D = \{(m, w) : w \ge w_C \text{ and } m \ge \overline{m}_k$

Note that $S = A \cup B \cup C \cup D$. Further the sets A, B, C, D are mutually exclusive and exhaustive.

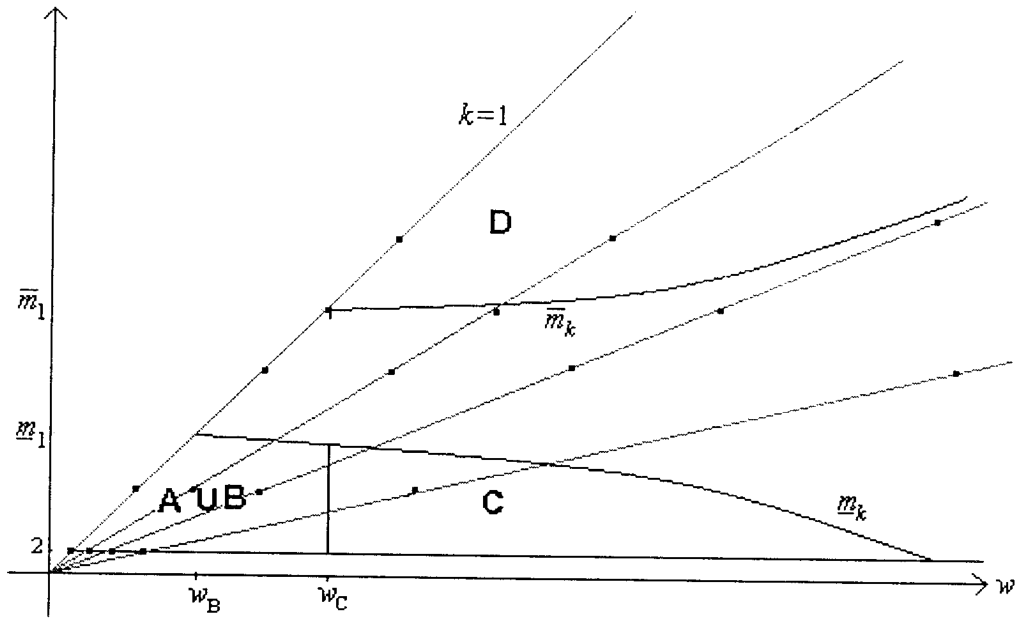

Figure 1

In figure 1 the dark points belonging to the regions marked AUB, C, and D represents the set of sustainable collusions. It is to be noted that the collusion space (m, w) consists of a set of discrete points along each ray. As would be obvious from figure 1, the collusions belonging to zone C and D are formed only by the very rich wealth holders whose wealth exceeds w_c. However, the collusions in D are much larger than those in C and consist of much larger number of rich wealth holders. Therefore, rich wealth holders can form a collusion in D only if there are sufficiently large number of them. The collusions in AUB[14] are formed by wealth holders with wealth less than w_c and are smaller in size compared to those in D. Note that smaller collusions can be formed either by rich or relatively poor wealth holders. However, only the rich can form the large collusions in D.

[14] Since the collusions in A and those in B do not differ with respect to our later analysis, therefore we consider the union of these two sets.

We may now state certain lemmas.

Lemma 7: Individuals with $W \geq w_C$ will prefer forming collusions $(m,w) \in D$ rather than C.

Proof: The expected utility from the return on money invested in collusion by an individual wealth holder is $E_m[u(xkr)]$, where $k = w/m$. Now $E_m[xkr] = wrp$ which is constant as m increases. Further $Var[xkr] = (wr)^2 \dfrac{p(1-p)}{m}$, which is decreasing in m. Hence for any given w, $E_m[u(xkr)]$ is increasing in m (since wealth holders are risk averse).

Hence proof of lemma follows.

Thus forming larger collusions is more desirable than forming smaller collusions. Now suppose the initial distribution of wealth is such that the number of individuals with wealth $W \geq w_C$, is sufficiently large, so that $\sum_{W=w_C}^{\overline{W}} f(W) \geq \overline{m}_1$. We however assume that the number of rich wealth holders is not large enough to allow the formation of many large collusions in D that is, $f(W) < \overline{m}_k$. In that case one can have the following remark:

Remark 3: Richer wealth holders will form one single large collusion in D. The less wealthy, that is individuals with wealth less than w_C will form small collusions, in A or B.

We denote the size of the collusions corresponding to the different zones indicated in figure 1 by $m_i, i = A, B, C, D$. Given that the rich wealth holders form collusion in D, the individuals with wealth $W < w_C$, face a fourth investment alternative; these individuals may now keep deposits with the collusion in D, for a certain return r_d, the gross interest on deposits[15]. From now on, for ease of exposition, we refer to the large collusion mentioned above, possibly deposit taking, as the bank.

[15] Note that the wealth holders forming collusions in A or B will not keep deposits with collusions formed in C.

Now $E_{m_D}\left[u\left(\frac{xwr}{m_D}\right)\right]$ is the maximum that the bank can earn, from a deposit of w. Again $E_{m_i}\left[u\left(\frac{xwr}{m_i}\right)\right]$, $i = A, B$ is what the individuals with wealth $W < w_C$ could have earned by forming a collusion in A or B. Hence this is the minimum that the bank must pay to the wealth holders with $W < w_C$ in order to attract deposits from them or the depositor's reservation payoff. Let $\bar{r}_d : E_{m_D}\left[u\left(\frac{xwr}{m_D}\right)\right] = u(wr_d)$ and $\underline{r_d} : E_{m_i}\left[u\left(\frac{xwr}{m_i}\right)\right] = u(wr_d)$.

Remark 4: The admissible range of gross rate of interest on deposits is $r_d \in \left[\underline{r_d}, \bar{r}_d\right.$.

Now given that the wealth holders with $W < w_C$ have the option of keeping deposits with the bank for a certain rate of return, r_d, the wealth holders constituting the smaller collusions in A or B will ask for a risk premium from the entrepreneurs. Let $z\,(> r)$ be the rate of return (inclusive of risk premium) charged by the collusion from the entrepreneur. In the absence of deposit keeping, the rate of return on loans $r\ (= \alpha q)$ was determined by Nash bargaining, between the entrepreneur and lender.

Then $z : E_{m_i}\left[u\left(\frac{xwz}{m_i}\right)\right] = u(wr_d)$ given the r_d chosen by the bank. Now z is increasing in r_d. Further for any given r_d, z is increasing in w assuming increasing relative risk aversion. Question is whether $z \gtrless q$? This is crucial since the wealth holders constituting the smaller collusions in A or B, will find keeping deposits with the bank attractive iff $E_{m_i}\left[u\left(\frac{xwq}{m_i}\right)\right] < u(wr_d) \Rightarrow z > q$.

Remark 5: Bank deposits are optimal for the smaller wealth holder iff the interest rate inclusive of risk premium z is greater than q.

We first check for the existence of an optimal interest on deposits for the banks. Now as r_d falls the banks earn more per depositor. On the other hand as r_d falls, the number of depositors and the banks total deposits decrease. Since z is increasing in both w and r_d therefore as r_d falls, the critical level of w, above which wealth holders become depositors, increases. This trade off yields optimal value of $r_d = r_d^*$ at which the banks profit is maximum.

At $r_d = \bar{r}_d$, the bank's profit per unit of deposit is equal to zero. Again at $r_d = \underline{r_d}$ the wealth holders constituting the smaller collusions in A or B are not made any better off by keeping deposits with the bank and hence would prefer forming the collusion and giving loans to the local or home projects. In that case the bank's receive zero deposits, and it's aggregate profits are zero.

Remark 6: For the bank an optimal interest rate on deposits exists and is given by some $r_d^* \in (\bar{r}_d, \underline{r_d})$.

We will now check whether given any r_d, the interest rates, inclusive of risk premium, z, that is charged by the collusions in A and B from the local or home projects, exceed or fall short of q. That is to check whether $E_{m_i}\left[u\left(\frac{xwz}{m_i}\right)\right] = u(wr_d)$ at $z \gtreqless q$? Since the left-hand side of the equality is increasing in z, therefore it is sufficient to check whether at $z = q$ the left hand side is less than, equal to or greater than the right hand side.

We will first check this for $r_d = \bar{r}_d = p\alpha q - \varepsilon$. (Note that as $m_D \to \infty$, $\bar{r}_d(m_D) \to pr$. Hence $\bar{r}_d = pr - \varepsilon$, for large and finite m.) That is we check this for the highest possible value of r_d. Also we consider the case, $m_i = 2$ which implies $w = k\,2$. Then our objective is to check whether, for a given k, $pu(2kq) + (1-p)u(kq) \lesseqgtr u(2kp\alpha q)$?

Let us consider the following class of utility functions:

$$u(v) = (A+v)^{\beta} \qquad 0<\beta<1, \ A \gtreqless 0 \ \text{ and } \ v > \max[-A,0]$$

We consider the case of $A>0$, for which the coefficient of relative risk aversion $r_R < 1$ and $dr_R/dv > 0$. Thus we assume relative risk aversion is increasing in wealth.

For the above utility function we check whether the following inequality holds.

$$p(A+2kq)^{\beta} + (1-p)(A+kq)^{\beta} < (A+2p\alpha\, kq)^{\beta} \tag{1}$$

Multiplying through inequality (1) by $(1/k)^{\beta}$, yields,

$$p\left(\frac{A}{k}+2q\right)^{\beta} + (1-p)\left(\frac{A}{k}+q\right)^{\beta} < \left(\frac{A}{k}+2p\alpha\, kq\right)^{\beta}$$

As $k \to \infty$, $A/k \to 0$. Using this and simplifying the above inequality may be expressed as,

$$2^{\beta}\left\{(p\alpha)^{\beta} - p\right\} > 1-p$$

Expressing p as $(1-\varepsilon)$ and α as $(1-\eta)$, where ε and η are arbitrarily small positive numbers, we may substitute $(1-\varepsilon-\eta)$ for $p\alpha$, since $\varepsilon\eta \to 0$.

The above inequality may now be expressed as,

$$2^{\beta}\left\{(1-\varepsilon-\eta)^{\beta} - 1 + \varepsilon\right\} > \varepsilon$$

Considering the first two terms only, of the Binomial Expansion of $\{1+\beta(\varepsilon+\eta)\}^{\beta}$, and ignoring the remaining terms as $(\varepsilon+\eta)$ and β, both are very small numbers, we have,

$$2^{\beta}\left\{\varepsilon - \beta(\varepsilon+\eta)\right\} > \varepsilon$$

Since $2^{\beta} > 1$ therefore the above inequality will hold if $\beta(\varepsilon+\eta)$ is very small. That is the inequality will hold if p and α are large and β is small. This requires that the probability of success of the project be high and the wealth holder's share in output of the home project be high (implying that the wealth holder enjoys a lot of bargaining power). Moreover this requires that the degree of relative risk aversion is high. This is expected for large k since relative risk aversion is increasing in wealth by assumption. Thus for large k, $z > q$. Since the entrepreneurs can pay at most q, therefore, these wealth holders will prefer keeping deposits with the collusion in D, which we may refer to as a "bank". Thus we have:

Remark 7: Moderate wealth holders (k reasonably large) will prefer keeping deposits with bank rather than lending locally.

We now analyse the case when k is small. Specifically we consider $k = 1$. Multiplying through inequality (1) by $(1/A)^{\beta}$ yields,

$$p\left(1+\frac{2q}{A}\right)^{\beta}+(1-p)\left(1+\frac{q}{A}\right)^{\beta}<\left(1+\frac{2p\alpha q}{A}\right)^{\beta}$$

For large A, $2q/A$ is small. In that case considering the first two terms of the Binomial expansion of $\left(1+\frac{2q}{A}\right)^{\beta}$ suffices, since the remaining terms in the expansion will be of very small magnitude. Hence putting $\left(1+\frac{2q}{A}\right)^{\beta}=1+\frac{2q\beta}{A}$, the above inequality, after simplification, may be expressed as, $2p+(1-p)<2p\alpha$. Since $\alpha<1$, this inequality does not hold.

Hence, for $k = 1$, the inequality in (1) gets reversed to ">". Thus for $k = 1$, $z < q$. So we have the following remark:

Remark 8: There exists a value of k (or at least one value of k) such that, the wealth holders with $w = k2$ will find it profitable to engage in local lending and finance the home projects, rather than keep deposits with the bank. We christen these lenders as informal lenders.

The above analysis is based on $r_d = \bar{r}_d$. The argument may be extended and will hold more strongly for $r_d < \bar{r}_d$ (since z varies directly with w and inversely with r_d).

Thus for the wealth holders constituting small collusions (partnerships), we get two cases. For one segment of wealth holders, those belonging to the lowest spectrum, the wealth holders will continue financing local home projects. These wealth holders will constitute the local informal lenders. There will be another segment of wealth holders, the relatively richer segment (the middle segment) who will keep deposits with the larger collusions formed by the richest segment of the wealth holders. These wealth holders will constitute the formal credit market.

Proposition 2: We see the emergence of financial dualism with large wealthy collusions acting as deposit taking banks and smaller wealth holders either acting as local lenders or keeping deposits with the bank.

To summarise the intuition behind our results in the last two sections, we start with a given distribution of wealth holders each with a home project. Given that the wealth holders do not have any information about other projects, unilateral diversification is not feasible. We then consider the possibility of wealth holders diversifying their portfolios by investing multilaterally and exchanging inside information about their respective home projects to avoid default by entrepreneurs.

Now the wealth holders can realise the benefit from forming such collusions (that is earn more than what they would by just investing in home projects) only if truthful revelation of information can be implemented as a self-enforcing arrangement. We allow for the possibility of sustainable collusions by incorporating payment of compensation as a punishment for default (as court is the less attractive option).

With larger numbers forming the collusion, monetary gain if a member gets away with cheating increases. However, given that the agents are risk averse, the utility gain is weaker than monetary gain; after a point when the monetary gain has become very large, the utility gain actually start becoming smaller. The monetary loss and hence utility loss, if the wealth holder gets caught after cheating, increases as more members form the collusion. Our analysis shows that truthful revelation of information will take place and hence sustainable collusions can be formed only when few wealth holders form small collusions or a large number of wealth holders form very large collusions.

Now given that investment is indivisible, large collusions can be formed only by the very rich who have enough wealth to invest in all the projects. However, sustainable small collusions can be formed either by the rich or by the poor. Given that number of rich wealth holders is small, we would see the existence of small ILs who engage in local lending and the relatively rich forming the local bankers. (For example, the country banks of England or early modern bankers in India.)

If the number of rich wealth holders is large (or enough such rich wealth holders come together, who might be initially spread across geographical regions) then a large collusion in the nature of joint stock banking is born.

Now given that such a large collusion exists with a large number of projects under its sponsorship - and hence with a well diversified investment base- the other wealth holders who were previously forming small collusions will now have the option of taking advantage of risk diversification by keeping deposits with the large collusion and earning a certain return. (This latter option would not be present if the rich were forming small collusions.)

Given that the banks have a broad investment base, they can always offer a return that is higher than r and still make a profit. Further, given this opportunity of earning a fixed and certain return, the small wealth holders who are members of small collusions would ask the entrepreneur to pay a return greater than r, as risk premium, which the entrepreneurs may or may not find it feasible to pay. Assuming that the degree of risk aversion is increasing in wealth, the relatively richer among this class of small wealth holders would ask for higher risk premia, compared to the poorer ones, which may be infeasible for the entrepreneur. This class of wealth holders would therefore keep deposits with the bank whereas the lowest segment of wealth holders would continue to lend locally as members of small collusions.

5. Robustness Considerations

So far we have been considering whether individuals with the same amount of wealth will find forming a collusion incentive compatible or not. In this section we consider the possibility of collusion between wealth holders investing different amounts. Specifically we raise the question whether wealth holders with different amounts of wealth can form sustainable collusions. Here one can establish the following.

Lemma 8: A collusion among wealth holders who contribute widely different amounts is not sustainable.

Proof: Let us consider a collusion of m wealth holders such that all the m wealth holders' investment per project is k. The $E[U(G)]$ and $E[U(L)]$ from finking are $\theta\, E_m\left[u\big((m+x-1)kr\big)-u(xkr)\right]$ and $(1-\theta)E_m[u(xkr)-u\big((1-c)xkr\big)]$ respectively (refer to definitions 1 and 2).

Now given m, suppose wealth holders $i=2$, …,m now invest $k_i\ (\geq k)$, per project. Let $h_i = k_i - k \geq 0, i = 2,\ldots,m$. The expected utility gain from finking to the wealth holder investing k per project is

$E[U_1(G)] \;=\; \theta\, E_m\left[u\left(\left((m+x-1)k+\sum_2^m h_i\right)r\right)-u(xkr)\right] > E[U(G)]$. The expected utility loss is $E[U_1(L)] = E[U(L)]$.

Now suppose the collusion (m,k) is non-sustainable, that is $E[U(G)] > E[U(L)]$. It follows that $E[U_1(G)] > E[U_1(L)]$. In other words, suppose a wealth holder investing k per project has the incentive to fink when the investment per project for all the lenders is identical and equal to k. It follows that he has greater incentive to fink if the investment per project for the remaining $(m-1)$ wealth holders is $k_i > k$.

Now suppose the collusion (m,k) is initially, with equal contributions, sustainable, that is $E[U(G)] < E[U(L)]$. Then, when the others' contributions increase, $E[U_1(G)]$ will increase with $\sum_2^m h_i$. As the utility function is assumed to be increasing throughout, $E[U_1(G)]$ will become greater than $E[U_1(L)]$ for some value of $\sum_2^m h_i$. Thus, an initially sustainable collusion will become unsustainable when the aggregate excess wealth of the others, over the poorest wealth holder, cross a certain limit.

Note that the trigger is $\sum_{2}^{m} h_i$. So, the transition will take place whether one of the partners contributes a very large additional amount or all $(m-1)$ wealth holders contribute moderately large additional amounts each.

From the above demonstration, it is easy to see that the same transition will take place if instead of some partners' wealth increasing, some peoples' wealth decrease. Hence, if the variation among the contributions of the wealth holders is too large, then a sustainable collusion can not be formed.

As a consequence of the above lemma, one can state the following.

Proposition 3: Rich will not collude with the significantly poor.

Proof: Any rich wealth holder, when faced with a choice of partners in a collusion, will calculate the aggregate excess wealth as in Lemma 8. If a potential partner has a much lower contribution to make, then this aggregate will cross the threshold. Hence, this rich wealth holder will desist from forming such a collusion.

From proposition 3, it would follow that our earlier analysis in sections 3 and 4 would hold even if we relax the assumption that only wealth holders of equal wealth form a (possible) collusion. In that case the set of collusions will no longer consist of discrete points corresponding to $m = 2,3,...$ along each ray. The set of all possible collusions now consist of the earlier set along with the convex combinations for a given m, described by $(m,(k_1,...,k_m))$ where k_i is the contribution of wealth holder i. The collusion space (m,k) will now be a subset of the new collusion space where all the elements of the vector $(k_1,...,k_m)$ are equal. However, as our analysis reveals, even if we allow for collusion among wealth holders contributing different amounts, this variation ($\sum_{2}^{m} h_i$) can not be very large for sustainability. This would not qualitatively alter the rest of our analysis but would necessitate messy algebra. We desist from these details here and only note that now the set of sustainable collusions will include some partnerships with moderately unequal contributions.

6. Conclusion

Starting with a given initial distribution of wealth holders (who are potential lenders) we show the emergence of the formal sector consisting of joint stock banks and informal sector consisting of indigenous bankers. Under certain parametric configurations, we show the possible existence of a large sustainable collusion of wealth holders emerging as the joint stock bank along with informal lending by smaller collusions. Some of the poorer wealth holders will find it attractive to keep deposits with these joint stock banks. Under alternative assumptions one may see only informal lending.

In other words, we highlight the endogenous creation of financial dualism. This captures the experience of the developed countries in Europe, especially U.K. and Germany, during their early days of development and also the experience of the developing countries like India. As these country experiences suggest, the history of modern banking can be traced to the formation of the joint stock banks, which stand in contrast to the native bankers. Typically the joint stock banks are initially formed by the local rich and attract deposits. The depositors belonging to the middle wealth segment. The native bankers on the other hand are hardly ever in a position to receive deposits. This is the formation of financial dualism that we model in this chapter.

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