



Monitoring Cost, Transaction Interlinkage
And the Selection of Optimal Financial Contracts:
An Application to Côte d'Ivoire

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Abstract

The existence of costly monitoring of ex-post output from investment projects is a typical financial market imperfection which hinders the transfer of capital between urban and agrarian sectors within developing countries. In this paper we show, using survey data from rural Côte d'Ivoire, that the practice of interlinking transactions in factor markets by moneylenders is an important means by which monitoring costs can be minimized. Policies such as usury laws generally raise transactions costs, thus reducing the effectiveness of monitoring of financial transactions, whereas measures that promote formal financial intermediation are likely to be more successful.

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1. Introduction

A common feature of many rural agrarian financial markets in developing countries is the simultaneous operation of both a formal and an informal sector. In the formal sector loans are made through intermediaries which pool the assets of investors and lend to many different borrowers. The officials of these intermediaries have little social or economic interaction with borrowers other than through the intermediary. Often the officials and borrowers are not members of the same community. In the informal sector, loans are made by moneylenders. Moneylenders and borrowers are almost inevitably members of the same community and have extensive social and economic interactions with one another.

The contracts available in the formal and informal sectors are very different. Intermediaries are specialized institutions which offer only financial contracts. In the informal sector, however, numerous investigators have found that factor markets are characterized by transaction interlinkages (Bardhan (1980)). The moneylender, in addition to being the supplier of credit, may be the borrower's landlord or employer; he may sell raw materials, such as fertilizer or seed to the borrower; and may buy the borrower's output and then resell it in outside markets. The moneylender may also perform several of these functions simultaneously for the borrower.

Given the very different contracts available in the formal and informal sectors, standard theory would predict that one institution or the other should dominate. But this is not the case. In fact, despite the differences between formal and informal sector contracts, many borrowers continue to raise funds through both sectors. We argue that this paradox can be explained by the existence of monitoring costs coupled with risk averse moneylenders having limited wealth. A monitoring cost is defined to be a cost that must be incurred by an outsider in order to observe the outcome from an investment project. By outsider, we mean an agent who is not directly involved in the operations of the investment project. Monitoring costs lead to information asymmetries which are difficult to deal with directly through markets (Harris and Townsend (1981)). To the extent that borrowers have an incentive to misrepresent the true outcome of investment projects, lenders cannot rely on information provided by them. Thus when monitoring costs are present, financial markets are subject to moral hazard.

Costly monitoring is an important market imperfection in developed as well as developing economies. Monitoring costs are, however, likely to be more important in LDCs than in industrialized countries. This is because markets in developed economies tend to be highly integrated while the poor agrarian markets tend to be fragmented (Bardhan (1983)). This fragmentation has caused LDCs to evolve institutions different from developed countries for dealing with monitoring costs and moral hazard.

We argue, in particular, that transaction interlinkage is an important means by which monitoring costs can be minimized in agrarian markets. In effect, by interlinking transactions in factor markets, the moneylender is transformed from an outsider into an insider. Those borrowers who have high default risk will prefer to borrow in the informal sector. This is true even though formal sector intermediaries have access to lower cost funds. At the same time, moneylenders have limited portfolios that are poorly diversified. They are unwilling to commit large amounts to one project. Thus, even though the moneylender has the lower monitoring cost, the borrower will prefer to also borrow from risk neutral formal sector intermediaries.

The main contribution of this paper is to integrate recent theories from the intermediation literature with theories from the development literature. Others who have argued that interlinkages can be explained by information asymmetries include Braverman and Srinivasan (1981); Braverman and Stiglitz (1982); Bardhan (1983); Mitra (1983); Gangopadhyay and Sengupta (1987); and Datta, et al. (1987). Specifically we emphasize the role of intermediaries as delegated monitors (Diamond (1984);, Ramakrishnan and Thankor (1984);, and Williamson (1986a and 1986b)). We argue that the intermediation process is hampered by market fragmentation typical of agrarian economies. Thus farmers and other borrowers choose to utilize moneylenders in order to fund projects. The model is tested with survey data from rural Cote d'Ivoire. We find that the data is generally consistent with the main conclusions of our model.

The plan of the paper is as follows: The next section discusses the structure of financial institutions in agrarian societies and compares these to financial institutions in developed countries. In Section 3, a two sector agrarian financial market is formally modeled. Section 4 tests the model with data from rural Cote d'Ivoire. The final section contains the conclusions.

2. Financial Intermediation in Developed and Agrarian Economies

Farmers and borrowers who need to finance investment projects will seek funds from low cost lenders. Diamond (1984), in a seminal article, has argued that one way of minimizing monitoring costs is through intermediation. If each individual investor were to lend directly through financial markets, each would have to generate information about the borrower separately and each would have to incur monitoring costs. By pooling resources through a single intermediary, information need only be generated once and monitoring costs are minimized.

An alternative to intermediation would be to sell information in the market place. However, once information is sold, there is no means by which the original generator of the information can prevent the buyer from reselling. In addition, to the extent that the generator of information has an incentive, perhaps because he has been bribed by the borrower, to misrepresent reality, there is a moral hazard. Intermediation, in effect, allows individuals to capture the positive externalities inherent in generating information. To minimize monitoring costs, each borrower should utilize only one intermediary.

While intermediation eliminates the need to monitor each separate borrower, individual investors must still monitor the intermediary. Diamond argues that this problem can be overcome through diversification. Since well diversified intermediaries can be monitored by investors at low cost, they can raise funds at a lower cost than can other lenders (such as moneylenders). Diversification, however, requires that intermediaries have a large portfolio. Thus intermediaries must raise funds from as large a number of individual investors as possible. In the limit, one intermediary will service all borrowers and investors.

Two important assumptions in the Diamond model are that intermediaries have homogeneous information costs and that each intermediary has access to the same enforcement technology. This being so, no intermediary has a cost advantage in generating information on a given borrower and diversification unambiguously lowers total cost by reducing the need for investors to monitor the intermediary. Since markets in developed countries are highly integrated, the assumption of homogeneous information costs, as a first approximation, is plausible for developed economies. Markets in poor agrarian economies, however, are much less integrated. For example, the legal systems in many LDCs are ineffective and contract enforcement is often difficult (Basu 1983). In industrialized countries the existence of effective legal mechanisms for enforcing contract provisions and processing bankruptcies limits the scope for moral hazard on the part of borrowers. Similarly, credit bureaus, which centralize the collection of information and

allow individual lenders to take advantage of economies of scale in information processing, are less common in LDCs than in developed countries.

Because agrarian markets are less integrated, it is costly to learn idiosyncratic information about particular borrowers unless the inquirer is a member of the borrower's community. These high information costs coupled with difficulty in enforcing contracts increase the scope for moral hazard on the part of borrowers and serve as barriers to entry for intermediaries. Even though large well diversified formal sector intermediaries are able to raise funds at low cost, moneylenders, who are in a position to gather information efficiently in local villages, have an advantage in agrarian markets.

Those moneylenders who have repeated transactions with specific borrowers are able to take advantage of economies in information gathering and processing. Transaction interlinkage allows the moneylender to operate at a lower cost than other lenders. By interlinking financial contracts, not only can the moneylender generate a competitive advantage over formal sector intermediaries but also over other potential informal sector lenders. Often the monitoring of financial contracts can be accomplished by a moneylender coincidental with monitoring other contracts. Moreover contract interlinkages provide a means of enforcing contracts not available to formal sector intermediaries. While loans may not be repaid in cash, moneylenders are often in a position to receive repayment through confiscated land or through bonded labor (Basu 1983). For example, a moneylender who is the borrower's employer can enforce a contract simply by withholding wages. While the borrower could seek work with another employer in order to avoid repayment, such an action would be costly (Eswaran and Kotal 1985). Transaction interlinkage is an effective means of minimizing overall information costs in agrarian societies. A deeper question is why poor agrarian economies do not have the institutions which allow them to take full advantage of intermediation. One reason may be that the lower level of capital accumulation means that the capital that does exist is utilized in ways other than the provision of infrastructure for financial markets. Also the lack of human capital, which is an input to both legal and information technologies, is lacking in less developed economies.

3. The optimal Contract

3.1 *The Basic Model*

In this section we develop a model of the financial sector of a poor agrarian economy. We assume the economy consists of a large number of borrowers who may choose loan contracts offered by either formal or informal sector lenders. Financial markets are assumed to be competitive in the sense that there are many potential lenders willing to supply credit in both sectors.

The model is based on ex-post information asymmetries between lenders and borrowers. In particular, rural borrowers are assumed to have access to projects with uncertain return, such as the cultivation and development of a cocoa plantation, for which they need to borrow funds in order to finance operations. Projects are financed through loan contracts which are offered by both formal and informal sector lenders. A loan contract is defined to be a debt instrument which specifies a schedule of loan balances, interest rates and collateral levels. More generally, contracts offered by money lenders would also specify the terms at which other transactions will be executed. We implicitly treat these other contract terms as fixed. This allows us to focus on the main issues of this paper -- choice between contracts offered by intermediaries and money lenders. For an explicit treatment of more general contracts see Gangopadhyay and Sengupto (1987) or Basu (1983). Let b^{FI} denote the amount borrowed from a formal sector financial intermediary, b^{ML} denote the amount borrowed from an informal sector moneylenders and $B = [b^{FI} \ b^{ML}]$ denote the vector of loans undertaken by a borrower. Also let r^{FI} denote the posted interest rate on loans offered by financial intermediaries, r^{ML} denote the posted interest rate on loans offered by moneylenders, and r the vector of posted rates. Define c^{FI} to be the collateral offered to financial intermediaries, c^{ML} to be the collateral offered to moneylenders and let c be the vector of different types of collateral offered. Loan contracts call for a fixed payment in nondefault states and for seizure of all output by the lender in default states. Optimal risk sharing may require that the debt contract allow the borrower to retain some output even in default. Formally, this can be dealt with by allowing collateral to take on negative values without changing the form of our model. Because no monitoring occurs in nondefault states and because the borrower receives no return in default states (and hence the borrower will avoid default if possible), monitoring cost are minimized. This result is proved formally by Gale and Hellwig (1985).

Output is sold in competitive product markets either directly by the borrower or through a broker, who may also be the moneylender. The price is taken to be parametric and is normalized to unity. The borrower's production function is given by

$$Q = q(x, \) \quad q_x, q > 0; q_{xx}, q \quad 0$$

where Q is output from the project and x is a vector of factors which affect output. The elements of x include such variables as the borrower's education, the level of factor inputs (e.g., capital and labor), and the type of technology utilized in production.

The variable θ represents random shocks to production. In order to model asymmetric information, it is assumed that θ can be observed by borrowers as part of the conduct of operations while lenders can observe θ only by incurring monitoring costs. It is assumed that the marginal density function of θ is given by $g(\theta)$ and that the cumulative function is given by $G(\theta)$. Further it is assumed that θ has finite upper and lower supports, denoted $\bar{\theta}$ and $\underline{\theta}$, respectively. The distribution of θ is assumed to be known to all lenders and borrowers.

Formal sector intermediaries have large well diversified portfolios and thus behave as if they are risk neutral. Accordingly intermediaries are assumed to determine the terms of the loan contracts they offer to borrowers so as to maximize expected return. Specifically, the intermediaries maximization problem is given by:

$$\max_{\{r^{FI}, b^{FI}, c^{FI}\}} R = \int_{\underline{\theta}}^{\bar{\theta}} r^{FI} b^{FI} g(\theta) d\theta + \int_{\underline{\theta}}^{\theta^*} [q(x, \theta) + c^{FI} - \mu] g(\theta) d\theta - \mu c^{FI} \quad (1)$$

where μ is the cost of monitoring in default states, r is the opportunity cost of funds to the lender and θ^* is the realization of θ at which default occurs.

The first integral in (1) represents the expected return to loan contracts in nondefault states. In nondefault states the intermediary is repaid the posted interest and principle. The second integral in (1) is the expected return to the loan in default states. In default, the intermediary receives the proceeds from the investment project as well as the value of any collateral. However, in order to determine actual output as well as enforce the contract the intermediary must incur a cost of μ . We make the simplifying assumption that monitoring costs, μ , for intermediaries are constant across borrowers. The last term in (1) is the opportunity cost of funds to the lender.

Unlike intermediaries, informal sector lenders are likely not to be well diversified. A moneylender is likely to have a small portfolio with a large exposure to the borrowers from his local village. It is, therefore, inappropriate to ignore issues concerning risk when modeling informal sector loan contracts. Accordingly, we assume that informal sector lenders design loan contracts so as to maximize utility functions characterized by risk

aversion. In particular, the maximization problem of the typical moneylender is given by:

$$\text{Max } V = \int -v(r^{ML}b^{ML} + w)g(\cdot)d\cdot + \int v(q(x, \cdot) + c^{ML} - \mu(z) + w)g(\cdot)d\cdot. \quad (2)$$

$\{r^{ML}, b^{ML}, c^{ML}\}$

where $v' > 0$, $v'' < 0$, $v(\cdot) = 0$ and $v(0) = \cdot$. The variable w denotes the moneylender's ex-post income from all other sources besides the loan contract and z is a vector of idiosyncratic variables that affect monitoring costs. We assume that z is measured so that $\mu_z < 0$. The restrictions placed on the moneylender's utility function is sufficient to ensure an interior. That is, the contracts offered by the moneylender will always be such that the moneylender consumes a positive amount in all states.

The first integral in (2) is expected utility in nondefault states and the second term is expected utility in default states. In default states, the moneylender must incur a monitoring cost in order to observe output and enforce the loan contract. But, unlike intermediaries, moneylenders face different monitoring costs depending upon the nature of contract interlinkages. It follows that a moneylender will offer a loan contract contingent on the nature and extent of transactions interlinkages between the moneylender and borrower. That is, a moneylender who is also an employer will offer a different contract to his employees than he would to someone who is not his employee. Similarly a moneylender who is also a landlord will offer a different contract to his tenants than to others.

The return to both formal and informal sector loan contracts depend on the value taken by \cdot^* , which is not determined exogenously but depends on the terms of the loan contract. In particular, \cdot^* is given by:

$$\cdot^* = \{ \cdot \mid q(x, \cdot) + c^{FI} + c^{ML} = rB \}. \quad (3)$$

If $\cdot^* > rB$, then the borrower will prefer to pay off the loan and retain the proceeds from the investment project. If $\cdot^* < rB$, then paying off the loan is more costly than simply defaulting, hence the borrower will prefer to default. An increase in \cdot^* increases the probability of default.

By changing the terms of the loan contract offered, lenders can affect the probability of default. Specifically differentiating (3) reveals:

$$\frac{\partial r^j}{\partial q} = \frac{b^j}{q} > 0,$$

$$\frac{\partial b^j}{\partial q} = \frac{r^j}{q} > 0,$$

$$\frac{\partial c^j}{\partial q} = -1/q < 0,$$

and

$$\frac{\partial x}{\partial q} = -q_x/q < 0 \quad \text{for } j = \{FI, ML\} \quad (4)$$

An increase in the posted interest rate or the total loan balance increases the amount owed by the borrower at the time of repayment, and hence, increases the probability of default. An increase in collateral increases the loss to the borrower in default and so reduces the probability of default. The characteristics of the borrower also affect the probability of default by altering the level of output. An increase in x , increases the return to investment and reduces the probability of default.

The borrower's utility is assumed to depend on the level of his consumption in both default and nondefault states and is assumed to exhibit risk aversion. In particular, let y be the borrower's income from all sources other than production, then the typical borrower's expected utility is given by:

$$= \int_0^1 u(y + q(x, z) - rB)g(z)dz + \int_0^1 u(y - c^{FI} - c^{ML})g(z)dz \quad (5)$$

where $u' > 0$, $u'' < 0$, $u(0) = -\infty$ and $u(\infty) = 0$. Just as with moneylenders, the restrictions placed on the borrower's utility function is sufficient to ensure an interior.

3.2 Market Equilibrium and Multiple Lenders

Financial markets are assumed to operate in the following way. Intermediaries and moneylenders design contracts so as to solve either (1) or (2) respectively. In general, these solutions will be a schedule of different values of r , B and c . Each borrower will face a different schedule depending on his individual characteristics. That is, contracts will be contingent on x and z . Let $C^j(x,z) = \{r,B,c\}$ denote the schedule of contracts available to borrower i from lender j . Borrowers, given the menu of contracts available to them, choose the combination of contracts which maximizes their expected utility. While some borrowers will prefer contracts offered by moneylenders or those offered by intermediaries, typically the borrowers will choose a combination of formal and informal sector contracts.

To see this, note that in the appendix it is shown that loan contracts, both those offered by formal sector intermediaries and those offered by risk averse moneylenders, are concave in rB . In fact, concavity implies that contracts may be subject to credit rationing. Credit rationing is said to occur when the lender is unwilling to pay a higher posted interest rate. For a discussion of the credit rationing when lenders are risk neutral, see Williamson (1986a, 1986b). First consider the loan contracts offered by formal sector intermediaries. While an increase in rB increases expected return in nondefault states, it also increases the probability of default and thus increases expected monitoring costs. At low values of rB , the first effect dominates. At higher levels, the second effect dominates.

An increase in rB also increases the probability of default on contracts offered by moneylenders. Informal sector contracts, therefore, are concave for the same reasons that formal sector contracts are subject to credit rationing. In addition, since moneylenders are risk averse, concavity also occurs in the informal sector because the moneylender wants to limit his exposure to risk from a particular borrower. Thus even though the expected return to lending to a borrower is positive, it may be subject to credit rationing in the informal sector.

Given risk averse moneylenders, it is possible that the same borrower will use more than one lender in order to finance his investment project. Suppose a borrower who is in need of a large loan initially contracts in the informal sector. Suppose further that funds required by the borrower are in excess of the credit limit specified by the loan contract. The risk averse moneylender may be unwilling to extend additional credit to the borrower without charging a substantial risk premium. Formal sector intermediaries, however, require no risk premium. Thus intermediaries will be able to lend to the borrower at lower cost. This is true even though monitoring costs for formal sector lenders are greater than those for moneylenders. The moneylender is willing to write a contract which allows the borrower to obtain funds from the formal sector because, while such funds increase the probability of default, they do not increase the moneylenders exposure. Thus some projects may be financed by funds obtained in both sectors.

4 An Empirical Test Using a Discrete Choice Model

4.1 *The formulation of the Empirical Model*

In this section we present the results from some preliminary tests of our model using a discrete choice model. Using (5), it is possible to show that:

$$\text{prob}(C^{ij} = C^{ij*}) = \text{prob}(C^{ij} > C^{ik}) \quad j \neq k \quad (6)$$

which can be estimated using a multinomial logit procedure.

To estimate (6), we use cross sectional survey data on 89 agricultural operators in the republic of Côte d'Ivoire.

4.2 *Data and Variables*

Missing data reduced the sample to 56. The sample is fairly representative of the agricultural practices in Côte d'Ivoire but is not representative of the entire sub-Saharan African continent nor of agricultural practices in the LDCs in general. The survey was conducted during 1991 and was primarily designed for extracting information on rural credit.

A total of 12 explanatory variables and a constant were included in our estimated model in order to capture the impact of x and z variables. In particular, the greater is the probability of default, the more important it is to minimize monitoring costs and hence the more likely it is that a moneylender will offer the preferred contract. The probability of default is decreased by an increase in expected output. To capture this effect, we used OLS to estimate the borrower's production function. The regression results are:

$$\text{PREDICTQ} = 6.31210 + .138499\text{E-}02 \text{ LABOR} - .842595 \text{ LAND OPERATED} \\ + .176678\text{E-}02 \text{ CREDIT} + 2.68020 \text{ EDUCATION} + 5.06641 \text{ CRED3}$$

where PREDICTQ is the expected value of output; LABOR, LAND OPERATED and EDUCATION are as the names indicate; CREDIT is total borrowing by the borrower, a proxy for capital; and CRED3 indicates that the borrower is also an employee of the moneylender.

An increase in the total amount borrowed increases the probability of default. Thus an increase in total borrowing increases the probability of using low monitoring cost moneylenders. To capture this affect we included the variable CREDIT directly as an explanatory variable.

A decrease in collateral decreases the probability of default. Unfortunately measuring collateral on informal sector loans is difficult since informal sector contracts are often implicit. In fact, informal sector loans involve reverse collateralization in the sense that moneylenders will subsidize borrowers in lean years. Our data set does not include data on these implicit provisions. We do, nevertheless, include two variables to reflect collateral. BNAGAST is value of nonagricultural assets. The greater is BNAGAST, the greater are the assets available to serve as collateral and the greater is the collateral. NUMCOL is the number of different types of assets offered as collateral. The more types of collateral offered, the greater the value of total collateral. We suspect that neither BNAGAST nor NUMCOL are good proxies for collateral.

The less are monitoring cost of informal sector lenders as compared to formal sector intermediaries, the more likely are the contracts offered by moneylenders to be preferred. Thus the nature and number of transaction interlinkages affect the probability of a borrower choosing to use a moneylender. To capture the impact of economies of scale in contracting, we also include the number of transaction interlinkages (NOTRANS) as an explanatory variable in our empirical model. Increasing the number of transactions between moneylenders and borrowers reduces monitoring costs and increases the probability that a moneylender will be utilized either exclusively or in combination with intermediaries.

Four different types of transaction interlinkages in credit markets were observed and all were incorporated in the estimation using dummy variables to capture the effect on monitoring costs by moneylenders. The four types of transaction interlinkages are 1) the practice of tying the sale of the final product, cocoa, to the lender (via a forward transaction); 2) purchase of inputs (such as manior, insecticides, etc...) by the borrower from the lender; 3) employment of the borrower by the lender (via a forward transaction); and 4) sharetenancy by the borrower with the lender as landlord. CRED1 through CRED4 are dummy variables for the four types of transaction interlinkages.

The impact of transaction interlinkage on the choice of contract is likely to be complicated. For example, often contracts which tie the sale of final product extension of credit, also guarantee -- implicitly or explicitly -- a minimum price for the final product. Thus the contract is a put option contract, a credit contract and a sales contract all at the same time. To the extent that tying sales to credit provisions reduces monitoring cost, these contracts should increase the use of moneylenders. Also, to the extent that the put option increases the exposure of the moneylender, the willingness of the moneylender to

provide credit should be reduced. Other types of contract interlinkages have similar complicated effects on the choice of contract.

Expected monitoring costs also depend on the social relationship other than through transaction interlinkages within the village and between the borrower and the lender. In an attempt to capture these social relationships we included two variables: *BEDU1* which is the highest level of education obtained by a member of the borrower's household, and *BMEMLBDY* which is a dummy variable to indicate whether the borrower is a member of a local governing body.

An increase in size of loans obtained from the informal sector, all else held constant, increases the probability of a borrower seeking funds from both sources. We include *SZINFRML* to capture this effect.

4.4 *Empirical Results*

We estimate equation (6) using multinomial logit. The results are presented in Table 1. The equations are normalized by assuming that all coefficients in the equation for the formal sector alone are zero. While most coefficients are not significant individually, the overall equations are significant at the 5 percent level. Table 2 gives the classification matrix which indicates that 59 percent of the observations were classified correctly. Most coefficients have the expected sign and magnitudes.

SZINFRML does not have the expected sign although it is insignificant. Neither *BNAGAST* nor *NUMCOL* have the expected signs. In fact *BNAGAST* appears to increase the probability that a moneylender is used. This may be because moneylenders are willing to accept certain assets as collateral that intermediaries are not.

The data supports our main hypothesis that transaction interlinkage is an important determinant of contract choice. We conducted a maximum likelihood test for the joint hypothesis that the transaction interlinkage type dummies are insignificant from zero. We were able to reject the null hypothesis at the 5 percent level.

The empirical results support the predictions of the model. However, the lack of significant coefficients on most variables may be due to two reasons. Monitoring costs may not be an important factor in determining the optimal contract for a borrower, and/or the explanatory variables may not be measured correctly. In particular, as argued above, contracts in the informal sector often contain many implicit provisions. We do not have data on these implicit provisions.

5. Conclusion

Traditional theories of development stress the importance of the size and allocation of the capital stock in the development process. But, as Stiglitz (1989) has argued, if a lack of physical capital were the sole cause of underdevelopment, the return to capital in LDCs would be greater than that in developed countries and market forces would result in capital transfers from richer to poorer countries. There are, however, many examples of financial market imperfections in developing countries which hinder these transfers. Perhaps even more important, market imperfections prevent the effective allocation of capital within the LDCs themselves. Financial market failures are an important explanation of why income level differentials continue to persist between richer and poorer economies and between urban and agrarian sectors within LDCs. Understanding these market failures is necessary if successful development strategies are to be implemented.

In this paper we have sought to study one such market failure - the existence of costly monitoring of ex-post output from investment projects. We have argued that in highly integrated developed economies, these costs are dealt with primarily through intermediation. However, the poor agrarian markets typical of LDCs are highly fragmented. This fragmentation makes it difficult for intermediaries to operate directly in agrarian markets. Moneylenders who are members of the same community as borrowers, however, can generate information on borrowers at low cost through transaction interlinking.

In our model, moneylenders and transaction interlinking are a symptom, and not a cause, of underdevelopment. Thus government policies, such as usury laws, which aim to control or eliminate moneylending, are counter productive. Similarly, the Côte d'Ivoire government policy of discouraging relending of funds borrowed from state operated banks, to the extent it is effective, introduces inefficiencies by forcing borrowers to seek funds from high cost intermediaries. While policies aimed at curbing moneylending are likely to be counter productive, policies which seek to promote the activities of moneylenders, for example, by channeling additional funds for investment projects through moneylenders, are also likely to fail. The same market fragmentation which makes it difficult to monitor borrowers also makes it difficult to monitor moneylenders. Channeling funds through moneylenders, therefore, invites the same kind of moral hazard problems as lending directly to borrowers.

Successful development strategies will not focus on moneylending per se but on reforms of financial and legal institutions so as to promote greater integration of agrarian markets. Such reforms, which would enable intermediaries to operate directly in agrarian

markets, would allow developing economies to take full advantage of increased efficiency achievable through delegated monitoring.

APPENDIX-A

A.1 Formal Sector

Integrating (2) by parts and using the definition of Q^* (superscripts denoting lender are suppressed in the appendix), R can be simplified to

$$R = rb - \mu G(\cdot) - \int_0^{\cdot} q(x, \cdot) G(\cdot) dx - b$$

The first order conditions to the above are

$$R_r = b[1 - G(\cdot) - \mu g(\cdot)/q]$$

$$R_{bFI} = r[1 - G(\cdot) - \mu g(\cdot)/q] -$$

$$R_c = \mu g(\cdot)/q(x, \cdot) + G(\cdot) > 0$$

$$R_m = -G(\cdot) < 0$$

$$R_x = [\mu g(\cdot)/q_x(x, \cdot)]/q(x, \cdot) + [q_x(x, \cdot) + q_{xx}(x, \cdot)]G(\cdot) > 0$$

$$R_{\cdot} = -\mu g(\cdot) - q(x, \cdot)G(\cdot) < 0$$

It is now shown that R is concave in r and b . In particular,

$$R_{rr} = -b^2\{g(\cdot) + [\mu g'(\cdot) - \mu g(\cdot)q']/q^2\}/q \quad (A1)$$

and

$$R_{bb} = -r^2\{g(\cdot) + [\mu g'(\cdot) - \mu g(\cdot)q']/q^2\}/q \quad (A2)$$

As long as $g'(\cdot)$ is not small, (A1) and (A2) will be negative and the return to intermediary contracts will be concave in r and b . A sufficient condition for concavity is $g'(\cdot) > 0$.

A.2 Informal Sector

The model for the informal sector is somewhat more complicated because of risk aversion. In particular,

$$V_r = b \{ \lambda v'(rb + w)g(\theta)d + V^*/q \}$$

$$V_b = r \{ \lambda v'(rb + w)g(\theta)d + V^*/q \} - 1$$

$$V_c = - \lambda v'(q(x, \theta) + c - \mu + w)g(\theta^*)d - V^*/q > 0$$

$$V_\mu = - \lambda v'(q(x, \theta) + c - \mu + w)g(\theta)d < 0$$

$$V_x = q_x \{ - \lambda v'(q(x, \theta) + c - \mu + w)g(\theta^*) - V^*/q \} > 0$$

and

$$V_{q^*} = -v(rb + w)g(\theta^*) + v(q(x, \theta^*) + c - \mu + w)g(\theta^*) < 0$$

where λ is the lagrangian multiplier associated with the moneylender's wealth constraint. The sign of V_{q^*} comes from the definition of θ^* and the fact that v is monotonically increasing. Using the above equations it is easy to confirm the results given in the text.

We want to show that the return to contracts issued by risk averse moneylenders are also have concave returns in terms of utility. That is,

$$V_{rr} = b^2 \{ \lambda [v''(rb + w)g(\theta)d - v'(rb + w)g(\theta^*)/q + [V^*_{rB} - q V^*]/q^2] \} \quad (A3)$$

and

$$V_{bb} = r^2 \{ \lambda [v''(rb + w)g(\theta)d - v'(rb + w)g(\theta^*)/q + [V^*_{rB} - q V^*]/q^2] \}$$

where:

$$V^*_{rB} = -v'(rb + w)g(\theta^*) + v'(q(x, \theta^*) + c - \mu + w)g(\theta^*) - v(rb + w)g'(\theta^*)/q + v(q(x, \theta^*) + c - \mu + w)g'(\theta^*)/q.$$

If V^*_{rB} is negative, (A3) and (A4) will be negative. This condition will be met as long as $g'(\theta^*)$ is not too small. That is, just as with formal sector intermediaries, a sufficient condition for concavity of returns in r and b is $g'(\theta^*) > 0$. Establishing sufficient conditions for concavity of V_{bb} is more difficult.

APPENDIX-B

Background on Côte d'Ivoire -- Institutional Framework

As a member of the Franc Zone, a monetary arrangement grouping together France and 14 African countries, the Côte d'Ivoire monetary and financial policies are governed by Franc Zone regulations. The Banking System is dominated by four large commercial banks established by the French before independence in 1960. These banks provide the bulk of banking services in the country and account for about 70 percent of the total capital in the Banking system. In addition five financing institutions are specialized in lending to agriculture, small and medium scale enterprises, construction, and housing. There are also 2 leasing corporations and 11 new small banks established in recent years. These small banks include the affiliates of two of the larger banks specialized in medium term lending, as well as small agencies and subsidiaries of foreign banks. In addition there is a public institution in effect since 1962, the Societe Nationale de Financement, which takes direct participation in undertakings of national interest as well as in the promotion of small scale enterprises. Another public institution, the Caisse Autonome d'Amortissement manages the public debt, hold and manages public deposits, and mobilizes local resources through issuance of tax-free bonds. A stock exchange has been operating since 1976. The present banking system tends to serve the still largely foreign owned industry, and has hardly played its intermediation role as the banks apply the rule of risk diversification in their credit allocation with short term credit granted strictly against short-terms funds and medium-term credits against medium funds.

During the first 15 years following independence in 1960, the country achieved rapid economic growth as a result of favorable resource endowments and inflows of cheap labor from neighboring Sahelian countries within a stable and outward-looking policy environment. The resulting surpluses were reallocated by the Government in support of a rapid diversification of the economy towards the secondary and tertiary sectors, which in turn induced a rapid urbanization of the population. During the second half of the seventies, the Côte d'Ivoire economy experienced a rapid succession of external shocks which, together with difficulties encountered in mastering the macroeconomics policy framework, led to a rapid deterioration in the economic and financial situation of the country. To redress the situation, the government in 1981 launched with the help of the international community, a series of adjustment reforms aimed at laying the foundation for a resumption of growth in the medium and long terms.

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TABLE 1

Logit Model of Optimal Contract Selection

Log-Likelihood..... -37.233

Variable	Coefficient	Std. Error	T-ratio	Prob/t/≥x
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Contract type: Informal Sector

ONE	.3726	2.3938	.016	.98758
PREDICTQ	-.4882	.8446	-.578	.56321
CREDIT	.8563	.9876	.867	.38590
BNAGAST	.2517	.2716	.927	.35397
NUMCOL	.7610	.9714	.078	.93756
CRED1	-4.1079	1.2447	-3.300	.00097
CRED2	.1198	1.4343	.084	.93340
CRED3	-.9761	1.3733	-.711	.47720
CRED4	1.5278	1.2572	1.215	.22428
NOTRANS	.3220	.1498	2.149	.03163
BEDU1	.3380	.4807	.703	.48189
BMEMLBDY	-.2259	.9785	-.231	.81743
SZINFRML	-.8589	.8723	-.985	.32478

Contract Type: Combination of Formal and Informal

ONE	-19.8488	1407.20	-.014	.98875
PREDICTQ	.8282	1.0637	.078	.93793
CREDIT	.7654	.1048	.730	.46540
BNAGAST	.1670	.2626	.636	.52466
NUMCOL	1.9633	1.2488	1.572	.11593
CRED1	-2.2677	1.3685	-1.657	.09750
CRED2	-.6340	1.8370	-.345	.72998
CRED3	1.2079	1.7474	.691	.48942
CRED4	18.4333	1407.19	.013	.98955
NOTRANS	.2741	.2075	1.321	.18645
BEDU1	.2619	.5790	.452	.65095
BMEMLBDY	-.3450	1.1769	-.293	.76937
SZINFRML	-.7442	.2269	-.328	.74301

Dependent variable: contract type. **Independent variables:** ONE is a constant; PREDICTQ is the predicted value of output; CREDIT is the total amount borrowed; NUMCOL is the number of different types of collateral offered; CRED1 through CRED4 are dummies for type of interlinkages; NOTRANS is the number of transaction interlinkages; BEDU1 is the highest level of education obtained by a member of the borrowers household; BMEMLBDY is a dummy indicating that the borrower is a member of a local governing body; BNAGAST is the value of the borrowers nonagricultural assets; and SZINFRML is the size of loans from the informal sector.

TABLE 2

Frequencies of Actual & Predicted Outcomes

		Predicted			
		TOTAL	Formal	Informal	Both
Actual	TOTAL	56	22	23	11
	Formal	23	19	3	1
	Informal	22	2	17	3
	Both	11	1	3	7