Of Pirates and Moneylenders: Product market competition and the depth of lending relationships in a rural market in Chile

Jonathan Conning*

Abstract

It is often suggested that interlinked and monitored loan contract terms such as those used by trader-lenders in rural markets serve as collateral substitutes and therefore should benefit asset-poor borrowers in particular. Yet, empirically this is not always true. For example, most of the new monitored finance from contract farming firms and agro-industry traders during Chile's recent agricultural boom went to medium and large commercial farmers and traditional forms of monitored finance for collateral poor farmers from informal trader-moneylenders actually may have declined. Based on interviews and historical accounts of this market and the analysis of a theoretical model, this paper argues that lenders may have been forced to reduce tied-credit to small farmers in several crops because increased product market competition exacerbated the problem of "pirates sales" or post-harvest opportunistic default. This further restricted the already narrow set of enforceable property claims upon which monitored credit contracts to solve *ex-ante* moral hazard contracting problems could have been fashioned. This problem was avoided in crops where product markets are more concentrated and in export activities where crop liens are easier to establish with better capitalized farmers. The model points to an important connection between the nature of market competition and the depth of lending relationships that appears to be important in many other contexts.

JEL Codes: O16, O17, D82, N26

Keywords: Financial intermediation, monitored lending, moral hazard and costly state verification, Chile.

---

* Department of Economics, Williams College, Williamstown, MA. email: jconning@williams.edu. I would like to thank T.N. Srinivasan, Gabriel Fuentes, Soren Hauge and seminar participants at Université Toulouse, Universidad di Tella, and Williams College for useful comments and suggestions on earlier drafts of this paper. The usual disclaimers apply. Comments welcome.

1 Introduction

Recent models of financial intermediation have emphasized that when markets are incomplete a firm's liquid asset holdings may be an important determinant of the firm's access to bank loans versus more direct forms of finance such as bonds (Freixas and Rochet, 1999). While these models successfully account for important stylized facts in the pattern of financial contracting according to borrowers' asset class, they have only just begun to explain important variations in financial organization across countries or across sectors within a country. Why for example has monitored lending played a more dominant role in countries such as Japan and Germany compared to other large industrial countries such as the United States or the United Kingdom at similar levels of income per capita? Why are the terms of bank loans to small business borrowers so often sector-specific rather than simply adjusted to characteristics of the borrower and their asset holdings? Does increased credit and product market competition improve or harm small business access to credit markets?

Chilean agriculture offers a rich set of recent experiences within which to study the rise of intermediaries, the development of new financial markets and contractual forms and their impact on economic growth and equity. The aim of this paper is to examine salient aspects of the development of this market so as to shine some insight on some of these broader questions. The discussion is built around a model that explores the optimal menu of contracts that emerges from analyzing the interaction of two financial contracting problems that are usually treated separately: (1) an

analysis of the problem of ex-post moral hazard and the use of termination threats as analyzed for instance by Bolton and Scharfstein (1990), and (2) an analysis of the problem of ex-ante moral hazard in the use of borrowed funds and the role of collateral and monitoring by intermediaries in the spirit of Holmstrom and Tirole (1997) and Conning (1999).

The analysis is inspired by a case study of the market for rural finance in Chile conducted by the author in the mid-nineties. Spurred by far reaching economic liberalization and an agricultural export boom, the Chilean countryside experienced greatly increased product market competition and the rise of many new financial intermediaries and contract forms. Heavily monitored production finance offered by exporting firms and agroindustrial companies via contract farming arrangements became a dominant form of production finance during this period.[1,2] These firms operate today in much the same way as more informal trader-moneylenders have

[1]Like trade credit in other sectors, this type of finance is 'informal finance' in the sense that Chile's financial oversight authorities do not directly supervise or measure its flow. CEPAL (1992) estimates that in 1990 approximately 40,000 Chilean farmers received finance from contract farming operations compared to less than 30,000 who borrowed from banks (there are an estimated 250,000 farm enterprises in Chile). Marchant (1995) employs several different indirect measures to conclude that after retained earnings, trader finance provides the largest source of finance for Chilean agriculture. He also finds that this share has been rising steadily relative to bank finance.

[2]Throughout this paper, I will label bank loans as relatively uninformed (not-monitored) forms of finance, while loans from traders, contract farming firms, and informal moneylenders will be monitored loans. This is in contrast to the labeling adopted by most of the literature on monitored finance (e.g. Diamond (1984), Hoshi et al (1992), and Holmstrom and Tirole (1997)), which considers banks as providing monitored loans. While bank loan officers in Chile do sometimes visit farm borrowers these visits usually occur prior to loan approval and appear to be aimed largely at appraising the value of collateral assets and not to monitoring the project during execution. Loans are heavily collateralized and are available mainly only to medium and larger farmers.

operated in Chile and elsewhere in the world since time immemorial: by advancing credit to farmers early in the growing season in exchange for claims to all or part of the crop at harvest.

The explosive overall expansion of monitored finance masks, however, important variations in the financing options available from crop to crop and to different strata of farmers. The pattern of access in fact poses a serious puzzle to existing models of monitored lending and interlinked transactions, which typically predict that monitored and interlinked contracts act as collateral substitutes and therefore should be particularly advantageous in improving credit access for small farmers. The puzzle, however, is that in fact most new monitored finance has gone to better capitalized medium and larger commercial farmers in the export sector (mainly fresh fruit exports). The available historical evidence suggests furthermore that tied credit for small farmers from more traditional informal trader-moneylenders actually became less prevalent in certain crops at the same time that interlinked contracting boomed for other sectors and better capitalized farmers.[3] There are, however, hopeful and illuminating exceptions to what otherwise might appear to be a generalized pattern of exclusion. Monitored finance for small farmers is, for example, common in crops such as sugar beet, tobacco, and tomatoes for agroindustry.

What then determines whether financial intermediaries are willing to offer inter-

[3]Cox (1990), Carter and Mesbah (1993), Echeñique (1993), Korovkin (1992) and Ortega (1992) all describe the early stages of the Chilean agro export boom as a period of 'exclusionary' growth.

linked and/or monitored finance to small farmers in different crops? Market participants were fairly quick to explain the problem in their own words. Product market traders said they were reluctant to offer tied and monitored credit to small farmers in certain crops because of their fear of "pirates sales" or post-harvest opportunistic default. Pirate sales occur when farmers surreptitiously sell produce on the market which they might previously have pledged to a trader-lender. In many traditional small farmer crops (e.g. wheat, maize and beans) a large number of product market buyers makes the potential problem of pirate sales so severe that monitored credit from traders has in fact completely dissappeared. Farmers in these crops have few financing opportunities other than collateral-based (bank) loans, which are normally not accessible, or use of retained earnings or informal finance from family and friends.

In stark contrast to this situation are the cases of crops with a single monopsony buyer where the problem pirate sales is not an issue at all. Crop pledges are self-enforcing in these crops, leaving the product buyer, with plenty of room to design innovative tied and monitored credit arrangements for small farmers. In Chile this is the case for example with sugar beet and tobacco, where buyers finance eighty percent and more of farmer's production finance needs.[4] An intermediate situation occurs in crops such as rice or horticultural products for the city market, where the product market is more oligopsonic. In these markets a primary role of the intermediary

[4]In the case study district of San Clemente (Province of Talca), Chile the sugar beet company IANSA often finances more than 100 percent of some small farmers' sugar beet production needs. A 'second credit account' is made available which small farmers often use to buy farm machinery and inputs for other crops.

monitoring agents is to police pirate sales, as the following account makes clear:

> *During his visits the company agent endeavors to discover with discretion if the cultivator is selling his production to other firms or intermediaries in violation of the contract arrangement. This is necessary because of the widespread and, apparently, increasing phenomenon of "pirating"... Serious and frequent examples of pirating occur especially at the beginning of the harvest season. In this period between January and February many truckers circulate in the countryside offering farmers cash payment for a part of farmers' production. In this way the pirates sell early-season produce in the Santiago market, and quite likely also to other agroindustries... The firm's response strategy is based fundamentally on preventive control and the threat of terminating any form of financial, technical or commercial cooperation with the farmer...* Di Girolamo (1991; pp.236-237).

The remaining sections of the paper aim to formalize and document these ideas. After a short description of the market for rural finance in the case study area and discussion of some of the actual methods of monitored lending, the theoretical analysis of the problem of moral hazard in the use of borrowed funds is carried out under the assumption that project outcomes are fully verifiable (i.e., crop pledges can be costlessly enforced). This section explains the role of non-crop collateral and monitoring as a collateral substitute.

The problem of ex-post moral hazard is then introduced. In contrast to other approaches, which have assumed that non-verifiable profits are diverted dollar for dollar by the borrower, the analysis assumes that diverted produce may sell at a discount outside the contract. The size of this discount will depend on the number of potential product buyers in the market and on the cost of legal enforcement. A menu of optimal contracts with different collateral requirements and monitoring intensities

is derived that determines a pattern of credit access across borrowers.[5] More competitive product markets and/or more lax legal enforcement signal a higher price for diverted output and hence an increase in the requirement of non-crop collateral to make crop pledges self-enforcing. But this in turn makes more difficult any efforts to broaden access to small farmers by using monitoring as a collateral substitute to address the problem of ex-ante moral hazard. Hence monitored lending is less likely encountered in sectors with stiffer product market competition.

The model is extended to a multi-period setting in which contingent renewal threats are shown to help reduce the collateral requirements that restricted small farmer access in the static case. The essential tradeoff between the two types of contracting problems persists, however, and the credit market therefore remains fragmented. The final sections of the paper provide more detailed description of the Chilean case study and conclude with some lessons that might be applied to other contexts.

2 Crop and non-crop Collateral and Monitoring

It will be important to distinguish between crop- and non-crop collateral. When "the crop itself" is said to be serving as collateral, the lender usually has been able to

[5] Other analyses of ex-post moral hazard have ignored the role of non-crop collateral and focused instead on costly audit technologies (Townsend (1979) or Gale and Hellwig (1985)) or termination threats (Bolton and Scharfstein (1990)) to provide incentives to compel borrowers to repay lenders. The role of each of these additional mechanisms is discussed below.

establish a property claim over all or a part of the farmer's eventual harvest. In the language of agricultural finance, the lender is assumed to have been able to establish a *crop lien*. A crop lien gives the lender legal control rights over the use and destination of the farmer's harvest even while it does not necessarily confer actual possession of the crop. An enforceable crop lien can be as effective as actual possession, however, because it allows the lender to hold the farmer's crop hostage: the farmer himself, or perhaps another crop buyer, will in general be willing to pay up to the full market value of the crop as ransom to the lender in order to have the lien released.

Many agricultural lenders will insist upon non-crop collateral guarantees in addition to a crop lien. For example, bank loan officers typically insist upon obtaining land mortgage or chattel mortgage over animals, farm machinery, or other forms of property. Lenders may insist upon non-crop collateral because they do not trust the lien, or do not value it very highly. They might fear that the farmer will be able to conceal or divert part of the harvest. But even when they can establish a perfect crop lien lenders may insist on additional guarantees because of the problem of moral hazard in the use of borrowed funds (or because of adverse selection, although this seems less likely in a rural setting).

The problem of moral hazard arises because the expected value of a crop harvest (and hence the expected value of a lender's property claims over project outcomes) may depend on the unobserved level of diligence with which a farmer executes the project. To provide incentives for the borrower to be sufficiently diligent, lenders may

demand the guarantee of non-crop collateral to guarantee repayment in the event of low harvest returns.

In comparison to other financial intermediaries in most developing countries, banks are very poorly informed lenders. This is particularly so in the context of rural lending. Bank offices are typically in large towns or county capitals. Loan officers only occasionally venture into the rural areas where agricultural production actually takes place. The problem of moral hazard is a serious one for these lenders, and for this reason banks typically insist on establishing not only legal crop liens but substantial non-crop guarantees such as land or chattel mortgages.

Loans provided by trader-lenders and contract farming firms[6] on the other hand typically involve far less collateral per dollar borrowed than bank loans, and at times no collateral pledge other than the crop itself. This is because their loans are usually very heavily monitored during the course of growing season and prior to repayment. Contract farming firms, for example, typically advance credit in installments carefully timed to match the farmer's likely needs in different tasks throughout the crop season. The release of an installment may be held up or sized down in response to a farmer's actions up to that date as perceived by the company extension agent. A significant fraction of the loans are in-kind: seed, fertilizer, or a voucher for transport services will be delivered to the farmer rather than cash, and agents will often visit the farmer

[6]Except where I wish to draw a distinction, in the rest of the paper I will often use the single term trader-lender to refer to a lender who operates as do contract farming firms and more traditional informal trader-lenders who provide credit advances in exchange for a crop pledge.

during the time when this fertilizer or other inputs are being applied. While this is ostensibly to provide technical assistance, many contract farming firms readily admit that these procedures are also designed to insure that inputs and cash advances are not diverted to other crops or private uses that might benefit the farmer but over which the company cannot establish legal claim.

Such monitoring and control activities have proven to be quite successful at ameliorating the problem of moral hazard in the use of borrowed funds. But they are also costly. Monitored lending is in general an expensive form of lending compared to collateral enforcement. To recover the cost of such monitoring and extension activities, lenders typically either explicitly quote higher interest rates in their contracts or raise interest rates implicitly via the price at which tied inputs are sold or farm produce is bought.

3 The Model

Consider a rural economy with a large number of farmer-entrepreneurs. Each entrepreneur has access to a crop production technology requiring a lump sum investment of I . For simplicity, consider projects with only two possible crop outcomes. Either the crop is a success x_s, or a failure, in which case it is valued at $x_f < x_s$. The entrepreneur is assumed to choose between two possible levels of diligence on the project (or equivalently, between two production techniques) which affect the expected return. The borrower's level of diligence might refer, for example, to the quantity and quality

of seed and fertilizer inputs actually applied to the project, and/or the farmer's labor effort. When the farmer chooses to be fully diligent, the project succeeds with probability $\overline{\pi}$ and fails with probability $(1-\overline{\pi})$ for an expected project return of $E(x|\overline{\pi}) = \overline{\pi}x_s + (1-\overline{\pi})x_f$. On the other hand, when the entrepreneur is not diligent the project succeeds with probability $\underline{\pi} < \overline{\pi}$, for a lower expected crop harvest of $E(x|\underline{\pi})$. For the moment it is assumed that crop liens can be perfectly and costlessly enforced or, in other words, that project returns x_i are costlessly verifiable.

Although non-diligence in production lowers the expected harvest return, it may also allow the entrepreneur to divert effort or funds away from the financed project toward other uses that generate private benefits. If the borrower's level of diligence is not observable to the lender, a potential problem of moral hazard emerges. The problem is that, depending on the terms of the financial contract, the entrepreneur may not bear the full negative consequence of non-diligence in terms of lowered expected project returns because part of these may be passed onto the lender. On the other hand, the borrower can capture the full value of the private benefit from non-diligence. Assume that there is no private benefit when the borrower is diligent, and that the private benefit under non-diligence $B(c)$ can be influenced by $c \geq 0$, the level of resources that an intermediary has spent on monitoring and control activities. For example, a lender's frequent visits to the farmer's field or the delivery of loans in kind in the form of fertilizer or seed lowers the borrower's scope for diverting funds and resources to other uses. As in Holmstrom and Tirole (1997), the costly monitoring

activity will itself be subject to moral hazard when carried out by a delegate monitor or intermediary on behalf of an uninformed outside lender.

The function $B(c)$ indicates how the borrower's opportunity cost of being diligent can be modified by the lender's monitoring activities. It is reasonable to assume that there are diminishing returns to the monitoring activity:

Assumption 1: *The borrower's private benefit from choosing the low action* $B(c)$ *satisfies* $B_c < 0$ *and* $B_{cc} > 0$.

Assume that investment funds I not used in production or lending could earn a gross return γI if left in a bank deposit. Entrepreneurs are assumed to be identical in all respects except for their initial holding of collateral wealth, indicated by their second-period value A. These are by definition *liquid* assets or assets whose value is relatively easy to establish and to transfer to an outside investor. A could represent assets such as the entrepreneur's land, home, or equipment – assets which are perhaps in use in the first period but which could easily be liquidated in the second period if needed. So long as the return from keeping these assets in other uses exceeds the entrepreneur's cost of funds, even an entrepreneur with a very large collateral asset holding A may decide to borrow funds I from the market.

3.1 Exogenously enforced Crop Liens

There are two types of lender on the market: uninformed lenders such as banks who rely primarily on collateral based enforcement of their loans, and monitoring lenders who lend against less collateral per peso borrowed than do banks, but who must actively monitor their borrowers during the course of the growing season. The analysis will later distinguish between two types of monitoring lenders: intermediary lenders, who lend to farmers out out of their own equity and from funds leveraged from outside lenders, and pure moneylenders, who lend entirely out of their own equity. Let $I^m \geq 0$ be the finance provided to a borrower out of the monitoring lender's own equity, and $I^u \geq 0$, the remaining contribution from the un-informed bank lender. We must have $I = I^m + I^u$ for a project to be fully financed.

When crop liens are assumed to be costlessly enforced, the contract design problem is to choose how to divide optimally the available property claims generated by each verifiable harvest outcome x_i between a return to the borrower s_i, a return to the monitoring intermediary w_i and a return to an uninformed lender $R_i = x_i - s_i - w_i$. This division must be chosen in a way such that both the borrower and the intermediary monitor have incentives to take their unobserved action choices, and in a way such that all parties are willing to participate. The sequence of events is as follows. First, the parties agree to the terms of a contract and the lenders deliver their loan amounts (I^m and/or I^u) to the borrower. At the start of the production cycle, the monitor commits to a monitoring strategy c. In response to

these conditions, the farm borrower chooses his unobserved production diligence level $\overline{\pi}$ or $\underline{\pi}$. Production uncertainty is resolved at harvest, and property claims over the realized project outcome are divided according to the terms of the contract. Assuming a competitive lending market with free entry into both the uninformed and monitored lending activities, an optimal contract $\{s_i, w_i, R_i\}$ for a borrower with collateral assets A is found by solving the following program:

$$\begin{aligned}
&\max_{w_i\,,\,s_i,\,c} E(s_i|\overline{\pi}) \\
&E(R_i|\overline{\pi}) \geq \gamma I^u && (1)\\
&E(w_i|\overline{\pi}) - c \geq \gamma I^m && (2)\\
&E(s_i|\overline{\pi}) \geq E(s_i|\underline{\pi}) + B(c) && (3)\\
&E(w_i|\overline{\pi}) - c \geq E(w_i|\underline{\pi}) && (4)\\
&s_i \geq -A \qquad\qquad i = 1, 2 && (5)\\
&I^m + I^u = I, \quad I^m \geq 0, \quad I^u \geq 0,
\end{aligned}$$

Constraint (1) is the bank lender's participation constraint. It requires that she earn at least as much from expected repayments as she could earn from leaving the same investment funds I^u in the competitive interest rate on competitive bank deposits summarized in the gross return γ. Similarly, (2) is the intermediary's participation constraint, which requires that the expected value of repayments w_i to an intermediary who lends amount I^m and monitors at cost c be at least as large as what she could have earned from a similar bank deposit. The borrower's incentive compatibility constraint (3) requires that the borrower earn at least as much from choosing the high action than from the inefficient low action. Noting that $E(s_i|\pi) = \pi s_s + (1-\pi)s_f$.

Writing this constraint out and rearranging leads to the more compact:

$$s_s - s_f \geq \frac{B(c)}{\Delta\pi}$$

where $\Delta\pi = (\overline{\pi} - \underline{\pi})$. This expression tells us that an incentive compatible loan contract requires that the borrower earn sufficiently more from a successful outcome than from a failure to have the incentive to want to raise the probability of success by choosing higher actions. On the other hand, the borrower's limited liability constraints (5) state that total repayments from the borrower to the lenders following any given project outcome x_i cannot exceed the value of that outcome plus all of the borrower's available collateral assets A, so $R_i + w_i \leq x_i + A$. Inequality (5) is obtained by substituting the relation $R_i + w_i = x_i - s_i$ into this last inequality.

Four possible lending regimes emerge as solutions to the optimization problem. Which loan contract type and monitoring intensity is optimal or best matched to a particular type of borrower will depend on the level of collateral assets A that borrower has to offer:

Proposition 1 *Define the Minimum Collateral Requirement function* $\underline{A}(c)$ *over the domain* $(0, \infty)$

$$\underline{A}(c) = \overline{\pi}\frac{B(c)}{\Delta\pi} - E(x|\overline{\pi}) + \gamma I + c \tag{6}$$

and define the cutoff level $\overline{c}$ *from the relation* $\overline{\pi}\frac{B_c(\overline{c})}{\Delta\pi} = -1$ *and let* $\widehat{c} = \frac{\gamma I}{\underline{\pi}}$. *The Optimum Monitoring Intensity* $c(A)$ *for a borrower with assets* A *is defined implicitly by* $\underline{A}(c) = A$ *over the domain* $(0, \overline{c})$. *Borrowers will be matched to different loan types*

according to their initial level of collateral assets as follows:

Loan Type	***Collateral Assets***	***Loan Amounts***
Non-monitored Loans *(e.g. Banks)*	$A \geq \underline{A}(0)$	$(I^u = I\,,\, I^m = 0)$
Intermediated Monitored Loans *(e.g. contract farming firms)*	$\underline{A}(0) > A \geq \underline{A}(\widehat{c})$	$(I^u > 0\,,\, I^m > 0)$
Directly Monitored Loans *(e.g. traditional moneylender traders)*	$\underline{A}(\widehat{c}) > A \geq \underline{A}(\overline{c})$	$(I^u = 0\,,\, I^m = I)$
Excluded from loan market *(self-finance or abandon production)*	$\underline{A}(\overline{c}) > A$	$(I^u = 0\,,\, I^m = 0)$

where I^m is the loan required from the monitoring intermediary and is given by $\gamma I^m = \overline{\pi}\frac{c(A)}{\Delta\pi} - c(A)$ over the asset range $A \in [\underline{A}(\overline{c}), \underline{A}(0))$ and zero otherwise, and $I^m + I^u = I$.

The proposition can be understood as follows. Consider first the contract offered by an uninformed lender, such as a bank, without the presence of an additional intermediary lender. Since there is no intermediary involved, we can drop constraints (2) and (4) and set $w_f = w_s = c = 0$. From the incentive compatibility constraint (3) and the borrower's (implicit) participation constraint, it is clear that if collateral is to be required at all, it will be in the failure state. It is also evident that when collateral use is at a minimum, the borrower's incentive compatibility constraint (3) must bind because this makes the failure repayment level $R_f = x_f - s_f$ as low as feasible (and when s_f is as large as feasible collateral is at a minimum). The binding incentive compatibility constraint gives us the relation $s_s = s_f + \frac{B(0)}{\Delta\pi}$ and therefore $E(s_i|\overline{\pi}) = s_f + \overline{\pi}\frac{B(0)}{\Delta\pi}$. This last expression is the minimum expected return – or the *enforcement rent* – that must be left to the borrower if the incentive compatibility

constraint is to bind. Substituting this into the investor's break-even condition yields:

$$E(R_i|\overline{\pi}) = E(x|\overline{\pi}) - s_f - \overline{\pi}\frac{B(0)}{\Delta\pi} \geq \gamma I$$

The lowest repayment $R_f = x_f - s_f$ such that the above constraint holds exactly and the investor just breaks even defines a minimum cutoff $\underline{A}(0) = -\ s_f$ given by:

$$\underline{A}(0) = \overline{\pi}\frac{B(0)}{\Delta\pi} - E(x|\overline{\pi}) + \gamma I \tag{7}$$

This is the minimum collateral requirement. No bank would be willing to lend to a borrower who could not post at least $\underline{A}(0)$ collateral, because the bank could not trust such a borrower to have a sufficient incentive not to pursue private benefits that harm the value of expected repayments. The proposition thus states that borrowers with assets $A \geq \underline{A}(0)$ will have access to loans that require minimum collateral requirements of exactly $\underline{A}(0)$ and will earn $E(s_i|\overline{\pi}) = -\underline{A}(0) + \overline{\pi}\frac{B(0)}{\Delta\pi} = E(x|\overline{\pi}) - \gamma I$ in expected value — the expected project outcome net of the minimum expected repayments required for the investor to participate. The cost of funds to the borrower who borrows from a bank is therefore exactly the bank's opportunity cost of funds, or the lowest market rate. Borrowers with insufficient assets A to meet these requirements will be excluded from pure-collateral based loans but may still be able to obtain finance through more expensive monitored loans.

Under the free entry assumption intermediary profits are driven to zero, so the

intermediary's break-even constraint should hold as an equality. Any contract of the form w_f, $w_s = w_f + \frac{c}{\Delta\pi}$ will satisfy the intermediary's monitoring incentive compatibility constraint (4). Consider the case where the intermediary's liability in the borrower's project is limited to the amount of intermediary capital put at risk, or that $w_f = -\gamma I^m$. Substituting into the intermediary's binding participation constraint (2) and rearranging in a similar fashion to what was done to obtain (7) yields an expression for the minimum required intermediary loan for any level of monitoring intensity c:

$$\gamma I^m = \overline{\pi}\frac{c}{\Delta\pi} - c \tag{8}$$

The monitoring intermediary lender return is thus $-\gamma I^m - c = -\overline{\pi}\frac{c}{\Delta\pi}$ when the project fails (i.e., she loses the full opportunity value of her investment plus the monitoring expense c), and $\frac{c}{\Delta\pi} - \gamma I^m - c = (1-\overline{\pi})\frac{c}{\Delta\pi}$ when the project succeeds, for an expected return that is just enough to cover the monitoring expense and opportunity cost of funds. By lending I^m the intermediary establishes a stake in the borrower's project that provides her with the incentive to monitor making the uninformed lender willing to step in and make the remaining investment $I^u = I - I^m$. This is the sense in which the monitoring lender is also an intermediary: she facilitates or intermediates funding from other less informed sources. To solve for the minimum collateral requirement when there is a monitoring intermediary is straightforward. Simply substitute (8) and $E(s_i|\overline{\pi}) = s_f + \frac{B(c)}{\Delta\pi}$ (from the borrower's incentive compatibility constraint)

into the investor's participation constraint (1), and rearrange terms as before to obtain the minimum collateral requirement $\underline{A}(c)$ in 6. The minimum collateral requirement on an uninformed loan in (7) appears therefore as just a special case of this more general collateral hurdle with monitoring intensity set at zero.

Whether monitoring actually lowers the minimum collateral requirement on a loan depends on the nature the monitoring technology. There are two effects. On the one hand, monitoring lowers the borrower's private benefits from side activities. This relaxes the borrower's incentive compatibility constraint and hence the enforcement rent that must be left with the borrower by $\overline{\pi}\frac{B_c(c)}{\Delta\pi}$, lowering the collateral requirement. Monitoring is a costly activity, however, and every extra dollar's worth of monitoring reduces the expected total project surplus from which repayments can be made by one dollar. This second effect raises the collateral requirement. If $\overline{\pi}\frac{B_c(0)}{\Delta\pi} > -1$ then the first dollar spent on monitoring will have the net effect of lowering the collateral hurdle. Because of the assumption of diminishing returns to monitoring ($B_{cc} > 0$), however, there is some monitoring intensity level $\overline{c}$ at which $\overline{\pi}\frac{B_c(\overline{c})}{\Delta\pi} = -1$. Beyond $\overline{c}$ no further monitoring is worthwhile, as the marginal benefit of an extra dollar of monitoring always exceeds its marginal cost. Figure 1 illustrates how the minimum collateral requirement might fall over the range $(0, \overline{c})$ and rise thereafter.

Figure 1 about here

Corollary 2 *Collateral poor borrowers obtain a larger proportion of their finance via monitored lending arrangements and pay a higher implicit interest rate.*

Since monitoring uses real resources, monitored lending is always more expensive

than uninformed lending. It follows that only collateral-poor borrowers with assets below the bank collateral requirement $\underline{A}(0)$ would turn to monitored finance. To economize on the cost of borrowing, borrowers will choose loans with the minimum monitoring required to satisfy incentives and lower the collateral requirement to their available asset level A. The optimal level of monitoring is therefore that level at which $\underline{A}(c) = A$, or $c(A) = \underline{A}^{-1}(A)$. The expected return to a monitored borrower is easily calculated to be $E(s_i|\overline{\pi}) = E(x|\overline{\pi}) - \gamma I - c(A)$, where $c(A)$ is the optimum monitoring intensity. Since the borrower repays $\gamma I + c(A)$ on I borrowed, the implicit interest rate per dollar borrowed on a loan of size I is $\gamma + \frac{c(A)}{I}$ which is decreasing in the borrower's collateral wealth A.

Poorer borrowers also use a larger proportion of monitored lending I^m in their total financing package since by (8), $\gamma I^m = \overline{\pi}\frac{c(A)}{\Delta\pi} - c(A)$ is non-decreasing in $c(A)$ and therefore non-increasing in A. The difference between two types of monitored lending emerges. As we move to borrowers with fewer and fewer collateral assets, monitoring intensity will rise until it has reached a point $\widehat{c}$ defined by $\gamma I^m = \overline{\pi}\frac{\widehat{c}}{\Delta\pi} - \widehat{c} = \gamma I$. At this point so much monitoring is required that the intermediary's stake in the borrower's project I^m equals the full investment I. As A is further decreased, monitoring intensity eventually reaches level $\overline{c}$, beyond which further monitoring simply becomes unprofitable. This defines an absolute minimum collateral requirement $\underline{A}(\overline{c})$, below which borrowers will be excluded entirely from the loan market. The monitoring lender will be lending I entirely out of her own equity for borrowers with assets

between $\underline{A}(\overline{c})$ and $\underline{A}(\widehat{c})$. Studies of rural credit markets have characterized informal moneylenders precisely in the terms predicted by the model: moneylenders lend primarily out of own equity, they monitor and screen borrowers intensely, and they charge high interest rates (Aleem, 1994; Bell, 1994).[7]

3.2 Imperfect Crop Liens

> *One type of farmer who finds it difficult to borrow from non-resident traders is the cassava grower, for the simple reason that cassava, unlike other crops, can be harvested at any time between four and fourteen months after planting. Without a fixed harvest period, the enforcement problem becomes very difficult.* Siamwalla et al. (1990; p. 282).

The last section assumed that lenders are able to seize whatever portion of the farmer's harvest is needed to secure a contractually agreed upon repayment level. The crop itself was assumed to serve as partial collateral for the loan. The analysis then turned on how much additional *non-crop* collateral was required to solve the problem of ex-ante moral hazard in the use of borrowed funds. The lender was assumed to have been able to establish and enforce a perfect crop lien over the borrower's harvest.

This section extends the model to situations where perfect crop liens cannot be established because of the difficulties involved in verifying actual harvest outcomes. It is convenient to now think of the contract as involving two terms: (1) a price at which the trader-lender agrees to purchase the farmer's delivered crop (without loss of generality normalized to unity), and (2) a loan repayment level R_i which is

[7] It has been assumed that the borrower's own participation constraint does not bind before monitoring level $\overline{c}$ is reached. If the farmer's has a reservation utility given by K, then his binding participation constraint $E(s_i|\overline{\pi}) = E(x_i|\overline{\pi}) - \gamma I - c = K$ defines a cutoff level $c^k = E(x_i|\overline{\pi}) - \gamma I - K$. It has been assumed therefore that $\overline{c} \leq c^k$.

contingent, not on the actual harvest outcome as before, but on the size of the harvest that the borrower *reports and delivers* to the lender. Lenders and outside enforcement authorities can only verify that the project's outcome did not fall below the lowest failure outcome x_f. They can compel the borrower to pay up to that amount, but cannot verify or force repayments from outcomes above this size.

Farm borrowers are tempted to under-report successful harvests for two reasons. First, this may allow them to get away with a lower loan repayment in the success state. The lender, and the courts, will have difficulty establishing whether a borrower who reports a low harvest outcome is opportunistically pretending to be unable to repay, or whether the project did in fact fail despite the borrower's best intentions (in which case he may truly be unable to repay and forgiveness should be allowed). A second related reason is that by under-reporting the producer may hope to earn income from diverting the concealed harvest $\Delta x \equiv (x_s - x_f)$ to other profitable uses. He might, for example, secretly sell the non-reported produce to a "pirate" buyer or divert the concealed harvest for home consumption. Assume that each unit of diverted harvest earns an amount θ for the producer. Note that because of the possibility of opportunistic loan default, it may be in a farmer's best interest to divert produce even when the price he can obtain for produce sold outside the contract is lower than what he is paid within the contract; that is, even if $\theta < 1$.

Parameter θ can be thought of as a measure of the state of development of the legal and institutional mechanisms available for detecting and punishing contract

non-compliance in the sector. One would expect θ to fall as the physical costs of hiding and surreptitiously selling produce rise, and as the chances of being caught and credibly punished increase. Under the extreme assumption that any diversion is immediately detected and costlessly and effectively punished, θ will equal zero.

A related interpretation, and the one stressed here, is that θ is a measure of the extent of competition in the product market on which the trader and farmer operate. When the market for produce is highly competitive, there will be many potential "pirate buyers" and diverted produce will likely command a price θ that will approximate the unitary contract price. Most analyses in the literature on costly state verification, beginning with Townsend (1979), have implicitly adopted this unitary price assumption. In contrast, when produce markets are more highly concentrated, there will be fewer potential illegal outlets for the harvest the farmer has pledged as collateral and pirate sales will likely be easier to detect and punish.[8] In the extreme case of a single monopoly buyer, and where produce has no value in home consumption (e.g. many industrial crops), there will be no place to divert produce and θ will be zero.

The only relevant truth reporting constraint for the two outcome case at hand requires that the borrower not under-report successful harvests.[9] Given θ, when the

[8]The trader-lenders in a concentrated market are also more likely to arrive at cartel-like arrangements to not pirate each other's client's harvests and possibly to segment their operating territories. Basu and Bell (1992), Hoff and Stiglitz (1997) and Floro and Ray (1997) discuss models of monopolistic competition between trader-lenders with fragmented territories.

[9]Technically we require two truth telling constraints: one to provide the farmer with

borrower obtains a harvest x_s, and he truthfully reports and delivers it to the trader, his net return under the contract will be $x_s - R_s$, the amount he earns from selling x_s units of harvest to the trader at the contract specified unitary price minus the monetary repayment R_s due to the lender for that reported project outcome. If, on the other hand, the farmer chooses to under-report a successful harvest outcome, his total return will be $x_f - R_f + \theta\Delta x$,the amount $x_f - R_f$ the farmer earns from selling x_f to the trader net of the repayment R_f due for that reported outcome, plus $\theta\Delta x$, the peso amount the farmer earns from diverting $\Delta x \equiv (x_s - x_f)$ units to pirate sales outside the contract. The truth reporting constraint can therefore be expressed as:

$$(x_s - R_s) \geq (x_f - R_f) + \theta(x_s - x_f) \tag{9}$$

Using the relation $s_s = x_s - R_s$ and $s_f = x_f - R_f$ the constraint can be rearranged into the more convenient compact form:

$$(s_s - s_f) \geq \theta\Delta x \tag{10}$$

where $\Delta x = (x_s - x_f)$. The optimal financial contract for a borrower with collateral assets A is now given by the solution to the previously analyzed programming problem (1) - (5) with the addition of the new constraint (10). The borrower may now be

incentive to truthfully report success states as stated in (9), and another to truthfully report failure states. It is easily shown however that when the first constraint is met this second constraint automatically holds in the optimal program, so we need only focus on the first.

tempted to augment his return by pursuing private benefits $B(c)$ and/or by diverting a portion of his crop in the post-harvest repayment period.

Recall that the action incentive compatibility constraint (3) could be rewritten as:

$$(s_s - s_f) \geq \frac{B(c)}{\Delta\pi} \tag{11}$$

Which of these two constraints (10) or (11) binds first will depend on the value of the parameters and exogenous variables $\theta, x_s, x_f, \Delta\pi$, as well as on the monitoring technology captured in $B(c)$. The optimal contract is summarized in the following proposition:

Proposition 3 *When $\theta \geq \frac{B(0)}{\Delta x \Delta\pi}$ (large θ, competitive product market) there will be no scope for monitored loan contracts and the minimum collateral requirement on loan contracts will be given by*

$$\underline{A}^T(\theta) = \theta\overline{\pi}\Delta x - [E(x_i|\overline{\pi}) - \gamma I] \tag{12}$$

Otherwise, when $\theta < \frac{B(0)}{\Delta x \Delta\pi}$ and $\overline{\pi}\frac{B_c(\overline{c})}{\Delta\pi} = -1$ (small θ, concentrated product market) there will be scope for monitored loan contracts for borrowers with assets in the range $\left[\max(\underline{A}(\overline{c}), \underline{A}^T(\theta)), \underline{A}(0)\right]$), where $\underline{A}(c)$ is defined as in (6).

A central implication of this result is that, beginning from a situation where monitoring contracts are available, as θ rises – perhaps because the product market becomes more competitive, or because for some other reason crop liens become more difficult to enforce – informal moneylenders (those who lend primarily out of own equity to poorer farmers) will be the first type of lender to drop out of the market. As θ continues to rise, intermediary monitored lending activities also become more difficult. In both cases this is because truth reporting constraint (10) binds before the

action incentive constraint. This result would seem to explain the apparent puzzle of trader-moneylenders dropping out of the market in Chile.

The collateral requirement $\underline{A}^T(\theta)$ is obtained in an analogous fashion to the way $\underline{A}(c)$ was derived in the last section: starting from the observation that the truth telling constraint must bind if collateral use is to be minimized,[10] substitute the binding truth telling constraint into the investor's break-even condition and solve for the smallest value of $\underline{A}^T(\theta) = -s_f$ at which the investor can just break even. This defines the minimum collateral requirement in (12). The optimal collateral minimizing contract when the ex-post moral hazard problem is binding is therefore:

$$\begin{aligned} s_f &= E(x_i|\overline{\pi}) - \gamma I - \overline{\pi}\theta\Delta x \\ s_s &= E(x_i|\overline{\pi}) - \gamma I + (1-\overline{\pi})\theta\Delta x \end{aligned} \tag{13}$$

and the lender's return following each outcome is:

$$\begin{aligned} R_f &= \gamma I - \overline{\pi}(1-\theta)\Delta x \\ R_s &= \gamma I + (1-\overline{\pi})(1-\theta)\Delta x \end{aligned} \tag{14}$$

When θ is high and crop liens are difficult to establish, the post-harvest truth reporting constraint (10) is more likely to bind before the action incentive constraint (11) requiring that $\underline{A}^T(\theta)$ be set at a relatively high level, which in turn limits how far a monitoring strategy can be pushed to lower $\underline{A}(c)$. Monitoring can be increased

[10] Suppose not. Then (10) does not bind in the optimal collateral minimizing contract. Now raise s_f (lower the minimum collateral requirement) and lower s_s while maintaining $E(R_i|\overline{\pi}) = \gamma I$ until constraint (10) binds exactly. Both the lender and the borrower receive the same expected return as in the original contract, but the collateral requirement has been lowered. This establishes the contradiction.

no further than that allowed by $\underline{A}(c) = \underline{A}^T(\theta)$, since if $\underline{A}(c)$ were pushed any further the borrower would have an incentive to misreport. Figure 2 depicts an extreme situation where $\underline{A}^T(\theta) > \underline{A}(0)$ so the problem of ex-post moral hazard is so severe as to eliminate any scope for worthwhile monitoring activities prior to harvest. This will be the case whenever the truth reporting constraint (10) binds before the action incentive constraint (11) at zero monitoring, or when $\theta \geq \frac{B(0)}{\Delta x \Delta \pi}$. Figure 3 depicts an intermediate situation where $\underline{A}^T(\theta)$ is below $\underline{A}(0)$ and there is scope for monitoring.

To clarify the nature of the problem, it is useful to focus on situations where the problem of ex-post moral hazard always bites first ((10) binds before (11)). The following proposition summarizes what kind of projects a lender would finance using only the crop harvest as collateral (i.e., without additional non-crop collateral):

Proposition 4 *Assume that* $\theta \geq \frac{B(0)}{\Delta x \Delta \pi}$ *so there is no scope for monitored lending. Then,*

- When $\theta = 0$, indicating that markets are concentrated and/or for other reasons crop liens can be enforced at zero cost, $\underline{A}^T(0) = \gamma I - E(x_i|\overline{\pi})$ and lenders will be willing to finance <u>all</u> profitable investment projects using only the expected harvest as collateral.
- When $\theta = 1$, indicating markets are competitive and crop liens cannot be enforced, $\underline{A}^T(1) = \gamma I - x_f$ and lenders will only be willing to finance those profitable investment projects where the lowest verifiable harvest outcome x_f is large enough to cover the full value of the loan obligation γI.

It is easy to extend this proposition to intermediate cases where the problem of ex-ante moral hazard becomes an issue for borrowers in certain asset ranges. The main lesson is that the problem of ex-post moral hazard imposes substantial limits on the set of feasible contracts available to address other agency problems.

Rather than solve for the minimum collateral requirement for a loan of fixed size I, one can instead solve for the maximum variable investment amount $I(\theta, A)$ an investor would be willing to lend to a farmer who has fixed collateral assets A. Proceeding once again under the assumption that the truth reporting constraint binds before the action incentive constraint so there is no scope for monitoring, one can arrive at the following corollary to the above proposition:

Corollary 5 *The maximum loan size that lenders are willing to provide against non-crop collateral assets A becomes larger the more concentrated the sector is (the lower θ is) :*

$$I(\theta, A) = \frac{1}{\gamma}\left[A - \overline{\pi}\theta\Delta x + E(x_i|\overline{\pi})\right] \tag{15}$$

In the special case where $\theta = 0$ and the borrower has no non-crop collateral ($A = 0$), lenders are willing to offer full financing up to the present discounted value of the project returns $I(0,0) = \frac{1}{\gamma}E(x_i|\overline{\pi})$.

When $\theta = 1$ and the borrower has no non-crop collateral ($A = 0$) lenders will only offer credit up to the present discounted value of the lowest verifiable outcome, or $I(1,0) = \frac{1}{\gamma}x_f$.

Credit relationships will be deeper in more concentrated markets or where for other reasons crop liens can be more easily enforced. This result is obtained by using (12) to solve for the maximum variable investment amount an investor would be willing to lend to a borrower with fixed collateral assets A. Since $\Delta x > 0$, $I(\theta, A)$ is decreasing in θ.

3.3 Extensions: ex-post monitoring and audits

Thus far the term monitoring has been used to refer to activities directed at mitigating the problem of ex-ante moral hazard. It is evident, however, that lenders may be

willing to pay for monitoring activities and audits that help to mitigate the problem of ex-post moral hazard as well. Monitoring at the time of harvest would have the effect of directly lowering the value of θ that the farmer might be able to receive from diverted produce. As suggested by the quote by di Girolamo at the start of the paper, such practices are widespread and form an important part of the role that field agents for contract farming firms must play.

There is already a large literature on costly state verification (CSV), starting from Townsend's (1979) article, that has examined that question in detail. In those models, the lender is given the option of using a costly verification audit technology that can force the borrower to pay out the full contractually agreed upon amount under the true state (see also Gale and Hellwig (1985) and Diamond (1984)). The main result is that under a standard set of assumptions, the optimal contract that minimizes verification costs will look like a standard debt contract (SDC), with the borrower repaying the lender a fixed amount for all reported outcomes above some threshold level, and "defaulting," being audited, and turning over the entire value of the project outcomes below that threshold. Most papers in this literature assume that that crop liens are in effect completely unenforceable ($\theta = 1$) to begin with, but that they become perfectly enforced when a fixed verification or audit fee is paid. In the more realistic situation analyzed here, θ can lie between 0 and 1 so the optimal contract need no longer require fixed payments across reported states.

4 Contingent Renewal Contracts

> *The worrying practice of product leakage has in recent years led to an evolution in the contract mechanism... Some firms have established strawberry production contracts with sharecroppers for a ten year period. The recovered experience indicates, however, that important product leakage still takes place... According to the firm, important leakages still took place in 80% of the cases.* CEPAL, 1992, p. 40.

It has often been suggested that the problem of limited enforcement can be ameliorated or made to disappear when interactions are repeated. Informal trader-moneylenders might, for example, be able to enforce exclusive claims over a farm borrower's harvest by threatening the withdrawal of future lending opportunities in the event of actual or suspected contract non-compliance.

While this view is intuitively compelling and partly correct, it can also be overstated easily. The argument should be examined critically, both theoretically and in the particular circumstances of the Chilean case study. Looking at the record first, in recent decades the Chilean countryside has been anything but a settled place. The entire property rights structure has been radically transformed, first via an agrarian reform process that created turmoil for a decade lasting through the mid seventies, and later with the profound adjustments and reorientation in production brought about by the country's post-1973 liberalization and the ups and downs of the new export economy. These events have led to both sudden breakdowns and continued evolutionary changes in the underlying contractual structure of the economy. The highly competitive market for intermediation services and the still very active farm land market suggest that substantial entry and exit from the agricultural sector con-

tinues. Taken together, these factors help to explain why the sort of informal borrowing relationships established between farmers and trader-moneylenders in other countries, which were known to Chileans in a not too distant past, may have been less likely to become or remain established in recent years.

The theoretical argument that repeated interaction improves contract enforcement also needs to be examined carefully. There is by now a large literature on multiperiod agency relationships and sovereign debt contracting that makes clear that, while reputational equilibria can be sustained in many circumstances, in other situations they cannot. Many of the results concerning the value of repeated trading relationships in the presence of moral hazard rest on strong implicit assumptions that the lender/principal can perfectly control the borrower's access to outside opportunities (e.g., Bulow and Rogoff, 1989; Fellingnam and Newman, 1985; Rogerson, 1985). These assumptions are unrealistic in a competitive lending market. The threat of contract termination will appear fairly hollow unless the lender is able credibly to demonstrate both that it is in her interest to carry through with the threatened cutoff and that she has the means to impede a non-renewed borrower from replacing the lost contract with a new relation established on similar terms with another intermediary. There must be costs to the borrower for switching between contracts or relationship-specific investments and rents that the borrower may stand to lose.

However, limited liability constraints give rise to enforcement rents that might be credibly threatened (Bolton and Scharfstein, 1990; Dutta, Ray and Sengupta, 1989;

Singh, 1983). The following extension of the one-period models of the previous sections demonstrates how this might allow some borrowers to lower, but not necessarily eliminate, their collateral requirements.

4.1 Contingent renewal – Ex-post Moral Hazard case

Consider first the problem of ex-post moral hazard in the absence of ex-ante moral hazard, before putting the two problems together. Each period the borrower has access to the same new investment project requiring a fixed investment I. If the borrower chooses the diligent action choice $\overline{\pi}$ in either period, the project produces either a success or failure project outcome for net expected return $E(x|\overline{\pi}) - \gamma I$ in that period.

Absent a strong enforcement authority, neither the borrower nor the lender can commit to incredible promises. That is, any promises made in the first period regarding second period contract terms must be individually rational in the second period, otherwise they will not be kept when that time arrives. This is the criterion of subgame perfection. Given this requirement, when a borrower enters the second and last period with collateral assets worth A, the contract established will be simply that of the one-shot contract examined in the last section. The borrower's expected payoff

in the second and last period denoted $W(A)$ will then simply be:

$$W(A) = \begin{cases} E(x_i|\overline{\pi}) - \gamma I & \text{if } A \geq A^T(\theta) \\ 0 & \text{otherwise} \end{cases}$$

The borrower's collateral holdings will evolve over time according to his realized returns and the loan repayments and consumption that he takes out of these returns each period. Without much loss of generality, assume that the borrower allocates all of his net returns at the end of the first period to collateral buildup and consumes only at the end of the last period, so $A_i = A + s_i$. The analysis would not change much by allowing consumption between periods. When $A_i \geq A^T(\theta)$ the borrower is fully financed in the second period, but if $A_i < A^T(\theta)$ no funding will be forthcoming from any lender.

Let R_f and R_s denote the first period current rewards to the lender, and $s_s = x_s - R_s$ and $s_f = x_f - R_f$ be the corresponding returns inside the contract when the borrower reports a project outcome x_s and x_f respectively. Through mis-reporting the borrower may potentially earn additional profits on the pirated produce. Let $\beta_i \in [0,1]$ $i = s, f$ be the probability with which the first period lender will renew financing for the borrower into the second period following a reported outcome of x_i in the first period. As will become clear, in this model the β_i will be determined completely by the choice of other terms of the contract, and are therefore primarily for expositional purposes. The borrower's time discount factor is assumed to be δ.

Following a successful harvest the borrower has the choice of truthfully reporting his harvest or not. If he reports untruthfully, he will receive the payoff $s_f + \theta\Delta x$ and will be able to build collateral[11] to $A + s_f + \theta\Delta x$. If the borrower reports truthfully, collateral builds up to $A + s_s$. Using the Revelation Principle (Myerson, 1979), however, we can focus (without loss of generality) on contracts where the borrower has no inducement to lie. I will therefore list only the two collateral build equations that hold under the true reporting equilibrium outcome. Following an outcome x_i in the first period, second period collateral holdings, denoted A_i, evolve to $A_i = A + s_i$.

The borrower's two-period expected returns can now be calculated. When a borrower starts with assets A and truthfully reports his outcome in the first period, his total two-period expected payoff in current dollars, denoted $W_2(A)$ is given by:

$$W_2(A) = \pi \cdot [s_s + \beta_s \delta W_1(A_s)] + (1 - \pi) \cdot \left[s_f + \beta_f \delta W_1(A_f)\right] \tag{16}$$

The borrower's return in each state of nature in the first period following each report is now made up of two components: his current rewards given by s_i, plus a *continuation value* given by $\delta W_2(A_i)$. The first period truth reporting constraint that

[11] A lender might be able to infer from observing the borrower's collateral position in the next period whether the borrower reported truthfully in the previous period. This knowledge would be of use to first period contracting if the lender can establish a claim or lien on property so amassed. By earlier assumption, however, such claims cannot be easily verified or enforced, so they are of little use.

the borrower truthfully report success can now be written as:

$$s_s + \beta_s \delta W_1(A_s) \geq s_f + \beta_f \delta W_1(A_f) + \theta \Delta x \tag{17}$$

The first period contract design problem, knowing that optimal choices will be made in the second period, involves choosing $s_s, s_f, \beta_s, \beta_f$ to maximize (16) subject to truth reporting constraint (17), the collateral build up equations, the first period limited liability constraint $R_i \leq x_i + A$, and the investor's participation decision $E(R_i|\pi) \geq \gamma I$. To find a solution, manipulate the truth reporting constraint (17) to obtain:

$$s_s - s_f \geq \theta \Delta x - \delta \left[\beta_s W_1(A_s) - \beta_f W_1(A_f)\right] \tag{18}$$

It is clear from this expression that the addition of another period relaxes the incentive compatibility constraint relative to the one period case (expression (10) above) so long as $\beta_s W_1(A_s) > \beta_f W_1(A_f)$.

The following restrictions apply to the contract renewal parameters β_i. If the first period rewards are such that the borrower enters the second period with $A_f \geq A^T(\theta)$, then clearly any non-renewal threat (anything other than $\beta_f = 1$) in the first period is hollow because the borrower could simply turn to another lender and obtain an equivalent loan contract with his available collateral. Likewise, if the borrower enters the second period with $A_f < A^T(\theta)$, then $\beta_f = 0$ is the only feasible solution, since in the absence of an external enforcement authority a lender would walk away from

any promise he might have made to renew because, come the second period, he can only lose money in expected terms by continuing to contract with the borrower. By similar reasoning $\beta_s = 1$ if $A_s \geq A^T(\theta)$ and $\beta_s = 0$ otherwise. The only possibility for relaxing the first period truth reporting constraint arises therefore when $\beta_s = 1$ and $\beta_f = 0$ which is associated with $A_s \geq A^T(\theta)$ and $A_f < A^T(\theta)$ and therefore with $W_1(A_s) = E(x_i|\overline{\pi}) - \gamma I$ and $W(A_f) = 0$. Using this and the by now familiar method for deriving the collateral requirement leads to the following proposition.[12]

Proposition 6 *In a two period model lenders will be willing to make loans of size I to borrowers who can post first period collateral $A^{2T}(\theta) < A^T(\theta)$ where*

$$A^{2T}(\theta) = A^T(\theta) - \overline{\pi}\delta\left[E(x_i|\overline{\pi}) - \gamma I\right] \tag{19}$$

The first period collateral requirement is therefore reduced for certain borrowers via the threat of losing access to the credit market.

4.2 Contingent renewal – Ex-ante Moral Hazard

It is worth noting that the amount by which the first period collateral requirement is reduced in (19) is independent of θ. The amount of the reduction $\overline{\pi}\delta\left[E(x_i|\overline{\pi}) - \gamma I\right]$ is equal to the increase in the present discounted value of the future earnings the

[12] Using $\beta_s = 1$ and $\beta_f = 0$ and the truth reporting constraint obtain $E(s_i|\overline{\pi}) = s_f + \overline{\pi}\theta\Delta x - \overline{\pi}\frac{1}{\delta}W(A_s)$. Substituting this expression into the investor break-even condition when collateral use is minimized gives $E(s_i|\overline{\pi}) = E(x_i|\overline{\pi}) - \gamma I$ which allows us to solve for $A^{2T}(\theta) = -s_f$ which is given in the proposition below.

borrower obtains from having access to a loan contract in the next period. In a sense the borrower is pledging those extra expected earnings to augment his first period collateral holdings. This allows the lender to economize on first period monetary incentives that have to be provided through the contract and hence to economize on the non-crop collateral that otherwise would have been required as 'stick' to make the borrower meet the truth reporting constraint.

Had the agency problem examined been ex-ante moral hazard instead of ex-post moral hazard, the first period collateral requirement would have been lowered in an analogous fashion, although the problem is slightly complicated by the the presence of a monitoring expense. For the case where no monitoring technology is available and the borrower's private benefit from taking a low action is $B(0)$, it is easy to show that the first period collateral requirement on a bank loan is lowered from $\underline{A}(0)$ to

$$\underline{A}^2(0) = \underline{A}(0) - \overline{\pi}\delta\left[\beta_s W_1(A_s) - \beta_f W_1(A_f)\right] \tag{20}$$

$$= \underline{A}(0) - \overline{\pi}\delta\left[E(x_i|\overline{\pi}) - \gamma I\right] \tag{21}$$

where, as above $\beta_s = 1$ and $\beta_f = 0$ is the only solution that makes sense in a competitive lending environment with renegotiation. If we allow for monitoring, then the solution changes only slightly. All borrowers who choose monitoring in the first of two periods will use all their available collateral, or else they would have opted for a cheaper un-monitored loan. Thus when their projects fail in the first

period, they are left with $A_f = 0$ entering into the second period and $\beta_s = 1$ and $\beta_f = 0$. A new expression for a first period minimum collateral requirement is given by $\underline{A}^2(c) = \overline{\pi}\frac{B(c)}{\Delta\pi} - (1 + \delta\overline{\pi})[E(x|\overline{\pi}) - \gamma I - c]$. Compared to the one-shot $\underline{A}(c)$, this function has a lower intercept and is everywhere steeper. A new absolute minimum collateral requirement $\overline{c}_2$ is found at $\overline{\pi}\frac{B_c(\overline{c}_2)}{\Delta\pi} = -(1+\delta\overline{\pi})$. Compared to the one period loan solution $\overline{c}_2 < \overline{c}$ and $\underline{A}(\overline{c}_2) \leq \underline{A}(\overline{c})$ – the multiperiod setting lowers monitoring costs and expands access.

All the main insights of the one period model with both types of moral hazard extend naturally to the two period model. Using the recursive formulation of the contracting problem described above, where continuation values depend on the stock of accumulated collateral, the analysis can easily be extended to any number of continuation periods. A longer contracting horizon helps ameliorate, but need not completely obviate, the need for non-crop collateral.

The dynamic evolution of this initial configuration will be clearly path dependent and can be interesting. Luck matters: two identical borrowers with the same initial asset holdings could easily follow two entirely different financing paths, with one borrower who has had a string of bad outcomes forced toward increasingly expensive monitored finance and eventually to exit the production sector entirely for lack of collateral (e.g., to become an agricultural laborer), while another identical but more lucky farmer is able to graduate to less costly forms of bank financing.

5 Traders and Moneylenders in context

In crops such as sugar beet, tobacco, tomatoes for agroindustrial purposes and fresh fruit for export, generous credit advances covering up to one hundred percent or more of variable production costs are frequently provided through contracts that use interlinked terms, monitored lending and other devices that serve as collateral substitutes. Yet in the "traditional" crops such as wheat, beans and potatoes, forward delivery contracts are rare or entirely absent, especially for smaller farmers. The only available private credit for these crops are heavily collateralized bank loans, loans from the state lending bank, or whatever informal finance and self-finance these farmers might arrange. Some crops grown under contract such as rice or barley do offer tied credit, but these lending relationships tend to be far less deep: farmers are asked to finance a larger residual fraction of the required production costs through other external financing sources or via retained earnings.

Why have intermediary lenders in crops such as sugar beet been able to establish such deep lending relationships with borrowers while in other crops these relationships are shallow or nonexistent? And why do not product buyers who operate in crops such as wheat and beans – which have traditionally been crops with an important participation by small farmers – imitate the collateral substituting mechanisms that have been used so successfully by intermediaries in these other crops to reach precisely the farmers who are most likely to be willing to pay a premium for additional credit?

The problem is clearly <u>not</u> for lack of intermediaries in these other sectors. In-

formal farm product middlemen agents and product brokers are very thick on the ground in Chile, especially for widely produced crops such as wheat. Frequently referred to as *camioneros* or *conchenchos*[13] these traveling intermediaries can be easily spotted traveling back country roads during the height of the harvest season, purchasing produce from farmers through farm gate sales, and transporting the produce to market.

Although these informal middlemen no longer provide credit to farmers in traditional crops, interesting intermediary structures emerge in these marketing channels. For example, traders usually use a combination of their own capital and capital advanced from a larger product broker or flour mill to whom they deliver their farm purchases. Although farmers often complain of the supposedly crooked practices of many middlemen (low prices, biased scales, etc.), entry into the sector is so highly competitive that farmers can usually choose amongst several different buyers. Many middlemen are in fact simply small or medium and farmers who see an arbitrage opportunity and use their own pickup or hired truck to transport the produce to market. Middlemen agents are often part-time farmers or the sons or relatives of farmers in the area where they purchase farm produce.

The available historical record and personal interviews with farmers and intermediaries indicate that a quarter century ago it was much more common to find this sort

[13]The term *camioneros* (literally "truckers") refers to the fact that these middlemen often travel to the farmers' gates to purchase, weigh, and transport the produce to market or another delivery point. I have found no publishable English expression to translate the term *conchenchos*, but it is not a kind term.

of informal trader providing credit advances to small farmers through arrangements known as *compras en verde*.[14] This term refers literally to the fact that the farmer's crop was "purchased green," that is, prior to harvest. Bauer (1975) and Salazar (1985) report that during different periods in Chilean history credit from traders to tenants and smal farmers played a central role in the marketing of wheat and other crops. Traders were much maligned for supposedly exploiting monopsony power and lending at usurious interest rates. Since a large part of farm production place on sub-tenancies in the interior of large estates, it was often the landlord himself who acted as middleman providing credit to the farmer through an interlinked tenancy arrangement (including sharecrops) and collecting out of the the harvest delivered to him from all internal subtenancies and which was then sold on the market. Nisbet (1967) reports on the lending practices of landlords and traders.

It appears then that the shake up of the agrarian reform and the rapid liberalization and deregulation of the economy that followed the military coup of 1973 led many of these informal intermediaries to stop offering informal linked credit to the smallest farmers, even as new tied credit instruments and larger amounts of finance became available through formally established contract farming arrangements in several of the new export and agroindustry sectors. My interpretation of why this

[14] Although there is a considerable literature on Chilean agrarian organization prior to the agrarian reform period in the mid-seventies, most of this literature focuses on land tenure and the labor relations on the large farm estates, with little reference to how credit markets operated for tenants and small farmers. From my own interviews with farmers old enough to remember the pre-agrarian reform period, it appears that the practice of obtaining credit through *compras en verde* was fairly commonplace.

occurred is formalized in the model described above and was amply confirmed by my conversations with farmers and intermediaries.

One practical element of the problem, not formalized above, is that many of the purchases that middlemen make from small (and medium) farmers are transacted informally – either with no legal record of transaction or with false invoicing – in order to avoid paying Chile's high 18 percent value added tax. This creates a catch-22 situation for traders. Because traders avoid the tax they have no legal basis upon which to rest claim against a farmer who did not repay a credit advance. If on the other hand they worked with a legally established delivery contract, they would pay a tax that other informal competitors on the produce market avoid.

This sort of problem is not faced by the successful contract farming firms in the area such as the sugar beet agroindustry because they enjoy either monopsony or oligopsony power in the market and therefore do not face as serious a pirate sale problem. In the fresh fruit export market there is more competition amongst buyers, but the problem has been avoided in part by dealing with larger farmers where legal enforcement mechanisms (including non-crop collateral) are available to dissuade opportunistic pirating behavior.

While the problem of pirate sales may seem specific to rural lending, every lender has a story to tell of a borrower who she may have suspected untruthfully reported a project failure or other exogenous hardship as an excuse to obtain loan forgiveness or a rescheduling. More importantly, the absence of observed instances of strategic

default does not at all indicate that the problem does not exist or that it does not impose costs on the lending activity.

6 Conclusion

The problem of "pirate sales" is by no means unique to Chilean agriculture. In a survey evaluation of several decades of experience of contract farming in Kenya, Steven Jaffee underscores just how costly the problem of leakage has become in parts of Africa:

> *[T]he experience of Kenyan horticulture graphically illustrates the vulnerability of contract farming schemes in the face of competition ... where alternative market outlets exist, leakage of the contracted crop may be significant, particularly when the project is located in a central and easily accessible area. When this occurs, one of the most important functions of the scheme extension staff becomes the monitoring of harvests and the policing of post-harvest crop movements. ... [S]uch crop leakage can result in termination of a contract farming scheme.* Jaffee (1994; p. 136).

Other mechanisms and institutions that have developed in different parts of the world to address this type of situation may still emerge in Chile and elsewhere. It is not uncommon, for instance, to find lenders even in initially fairly competitive environments arriving at informal cartel-like arrangements to exchange information about their borrowers and to not violate another lender's exclusive claims to the returns from the borrower's projects (Bell, 1989; Fafchamps et al., 1994; Hoff and Stiglitz, 1994). Such agreements are in fact already evident in the fruit export sector in Chile. Interviewed market participants there described how, after several initial

years of serious pirate sales, an informal market developed amongst exporting firms to buy and sell fresh fruit amongst themselves rather than secretly pirating each other in the fields.

The model and examples may serve as a warning to those who might simplistically believe that the lives of peasant farmers are always necessarily improved when market forces or government intervention breaks up the local monopoly of moneylenders. Increased competition in Chile did in fact chase out informal moneylenders who might have been charging high interest rates, but in the resulting new configuration without them lending options may have become more limited for an already marginal group of borrowers.

Still further from the rural scene, there may also perhaps be lessons for Asia in the aftermath of the recent financial crisis. A fashionable diagnosis of the Asian financial problem is that the crisis developed because of a supposed lack of competition, weak regulation, and the permanent expectation of government bailouts. This supposedly led to too close a relationship between banks and firms, and to collusion and corruption in the choice of investment projects and collateral guarantees. This may indeed be true. But the policy prescription that often follows this diagnosis, that financial markets should become more like those in the United States and the United Kingdom where firms rely more heavily on the bond market, may not necessarily be the most wise.

The potential danger is that these prescriptions call for the rather immediate restructuring of a complex system of contracts which had until recently heavily relied on monitored lending. Monitored lending, which by definition requires a close involvement between lender and borrower, is often part of an effective enforcement strategy to ameliorate incentive problems and therefore to channel finance toward profitable firms and their projects in situations where they might otherwise have been too small, too young, or too cash strapped to be financed because of collateral rationing.

The analysis also suggests that a rush toward financial market liberalization may cause harm in unexpected places unless it is accompanied by the creation and maintenance of an effective legal enforcement authority or other mechanisms to allow agents to define and enforce property rights in situations where these rights had been held in place by local monopsony or oligopsony situations or other informal mechanisms that are disrupted by the reforms. Only time, and further empirical research, will tell the net effect of the currently fashionable prescribed reforms.

References

[1] Aleem, I. (1994) "Imperfect Information, Screening, and the Costs of Informal Lending: A Study of a Rural Credit Market in Pakistan, Chapter 7, in Hoff, et al. (eds) *The Economics of Rural Organization*, Oxford University Press, Washington.

[2] Bauer, A. (1975), *Chilean Rural Society from the Spanish Conquest to 1930*, Cambridge University Press

[3] Bell, C. (1988) "Credit Markets and Interlinked Transactions," Chapter 16 in Chenery and Srinivasan (eds.), Handbook of Development Economics, Vol I, New Holland, New York.

[4] Binswanger, H. and M. Rozensweig (1986) "Behavioral and Material Determinants of Production Relations in Agriculture," *Journal of Development Studies*, 22(3), 503-39.

[5] Bolton, P., Scharfstein, D. (1990), "A Theory of Predation based on Agency Problems in Financial Contracting," *American Economic Review*, 80, 94-106.

[6] Braverman, A. and J. Stiglitz (1982) "Sharecropping and the Interlinking of Agrarian Markets," *American Economic Review*, 72, 695-715.

[7] Bulow, J. and K. Rogoff (1989) "Sovereign Debt: Is to Forgive to Forget?" *American Economic Review*, 79(1), 43-50.

[8] Carter, M. B. Barham, D. Mesbah, and D. Stanley (1993) "Agro-Exports and the Rural Resource Poor in Latin AMerica: Policy Options for Achieving Broadly-Based Growth," Agricultural Economics Staff Papers No. 364, University of Wisconsin-Madison.

[9] Conning, J (1999) "Outreach, Sustainability and Leverage in monitored and peer monitored lending," *Journal of Development Economics*, 60(1), 51-77.

[10] Cox, M. (1990) *Politica Agraria en Chile: del crecimiento excluyente al desarollo equitativo,* Santiago: CEDRA.

[11] Echeñique, J. and N. Rolando (1989) *La Pequena Agricultura: Una Reserva de Potencialidades y una Deuda Social*, AGRARIA, Santiago, Chile.

[12] Echeñique, J. (1993), Las Modalidades y Proyecciones de la Articulacion entre la Agroindustria yla Pequena Agricultura en Chile, AGRARIA, manuscript, Santiago, Chile.

[13] Fellingham, J. and P.D.Newman (1985), "Contracts without Memory in Multiperiod Agency Models," *Journal of Economic Theory*, 37, 340-355.

[14] Freixas, X. and J.-C. Rochet (1997). *Microeconomics of banking*. Cambridge, Mass., MIT Press.

[15] Fuentes, G. (1996) "The use of Village Agents in Rural Credit Delivery," manuscript, Loyola Marymount University.

[16] Gale, D. and M. Hellwig (1985), "Incentive-Compatible Debt Contracts: The One- Period Problem," *Review of Economic Studies*, 52, 647-663.

[17] Glover, D. and K. Kusterer (1990) *Small Farmers, big business: contract farming and rural Development*, London.

[18] Hart, G. (1986) "Interlocking Transactions: Obstacles, Precursors or Instruments of Agrarian Capitalism?," *Journal of Development Economics*, 23, 177-.

[19] Hoff, K and J. Stiglitz (1992) "A Theory of Imperfect Competition in Rural Credit Markets in Developing Countries," Department of Economics Working paper, University of Maryland, manuscript.

[20] Hoshi, T., D. Scharfstein, et al. (1993). The Choice Between Public and Private Debt: An Analysis of Post-Deregulation Corporate Financing in Japan, NBER working paper.

[21] Jaffee, S (1994) "Contract Farming in the Shadow of Competitive Markets: The Experience of Kenyan Horticulture," chapter 3 in Little and Watts (eds.), *Living Under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa*, University of Wisconsin Press.

[22] Korovkin, T. (1992), "Peasants, Grapes and Corporations: The Growth of Contract Farming in a Chilean Community," *Journal of Peasant Studies,* 19(2), 228-254.

[23] Little, P. and M. Watts (1994) *Living Under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa*, University of Wisconsin Press.

[24] Marchant, R (1995) "Antecedentes sobre el Financiamiento de la Agricultura," ODEPA Publication, Ministry of Agriculture, Santiago.

[25] Myerson, R. (1979) "Incentive Compatibility and the Bargaining Problem," *Econometrica*, 47(1), 61-73.

[26] Nisbet, C. (1968), "Interest Rates and Imperfect Competition in the Informal Credit Market of Rural Chile," *Economic Development and Cultural Change.*

[27] Ortega, E. (1987) *Transformaciones Agrarias y Campesinado: de la participacion a la exclusion*, CIEPLAN, Santiago, Chile.

[28] Petersen, M. and R.G. Rajan (1995) "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics*

[29] Ray, D., Sengupta, K. (1989), "Interlinkages and the Pattern of Competition," Chapter 13 in Bardhan, P (ed.) *The Economic Theory of Agrarian Institutions*, Oxford University Press

[30] Salazar, G (1985) *Labradores, Peones y Proletarios: Formación y crisis de la sociedad popular chilena del siglo XIX*, Ediciones Sur, Santiago.

[31] Singh, N.(1983), "The Possibility of Nonrenewal of a Contract as an Incentive Device in Multiperiod Principal-Agent Models," UC Santa Cruz discussion paper No. 117.

[32] Stiglitz and P. Weiss (1983) "Incentive Effects of Terminations: Applications to the Credit and Labor Markets," *American Economic Review*, 73(5), 912-927.

[33] Townsend, R. "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory*, 21: 265-293.

[34] Williams, S. and R. Karen eds. (1981), *Agribusiness and the Small Scale Farmer: A Dynamic Partnership for Development*, Westview Press, Boulder.

[35] Williamson, S. (1987), "Costly Monitoring, Loan Contracts, and Equilibrium Credit Rationing," *Quarterly Journal of Economics.*

Figure 1: Minimum Collateral Requirement and Monitoring Intensity

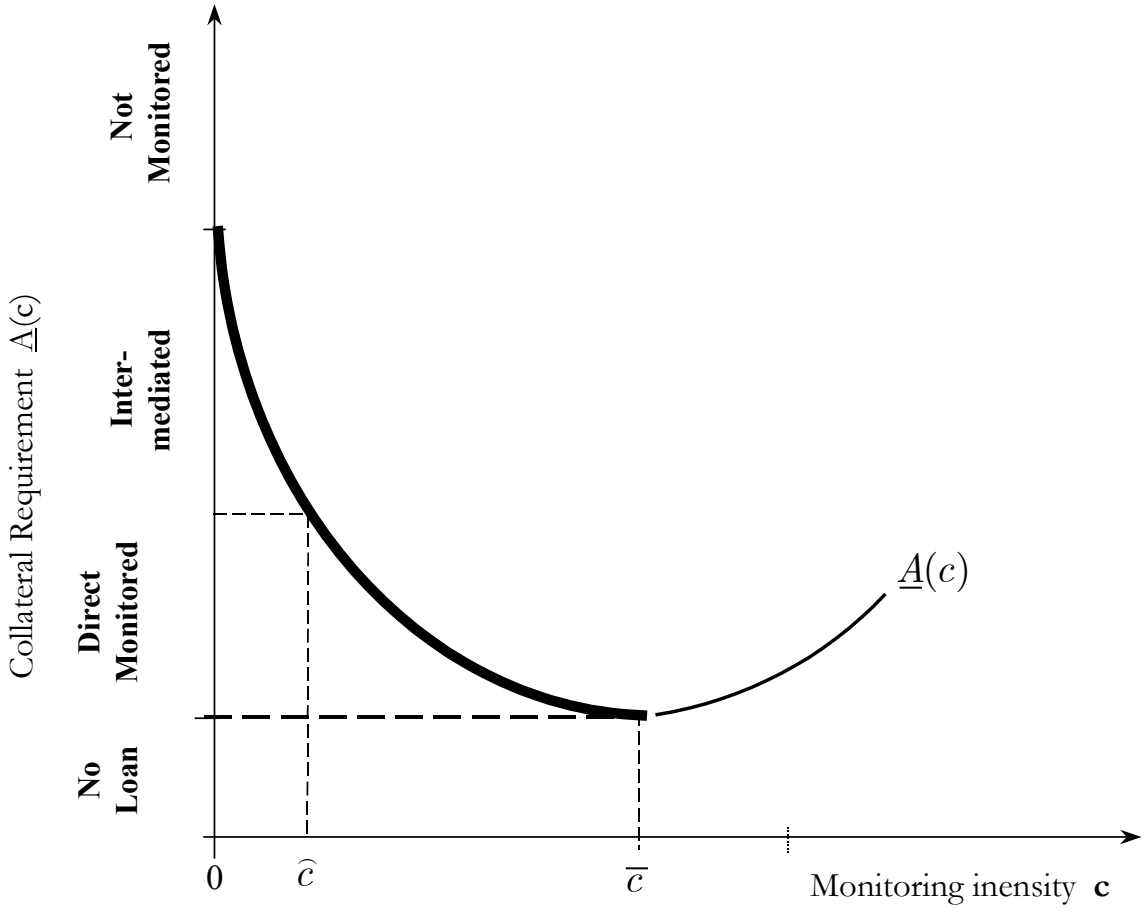
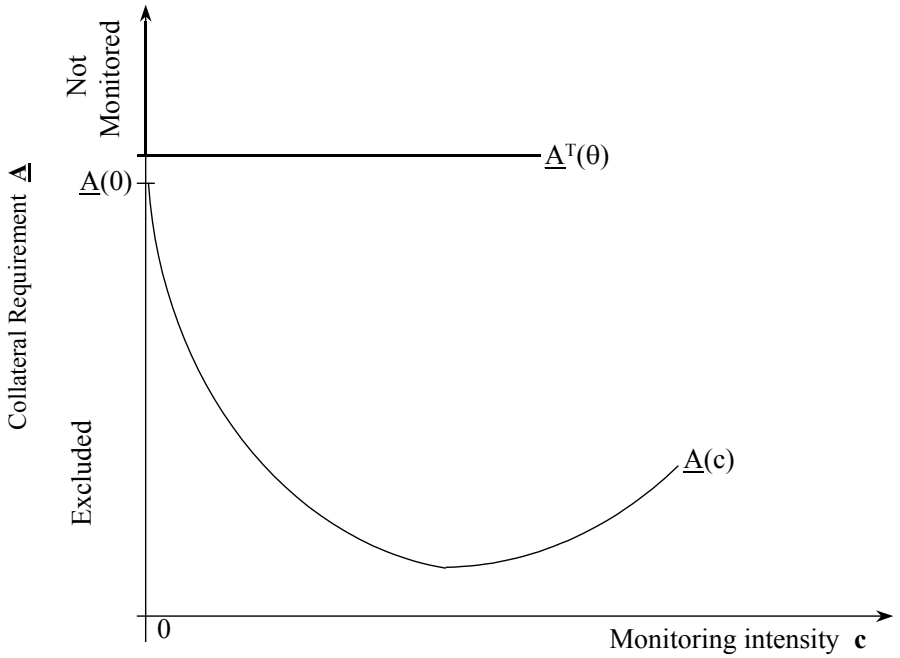
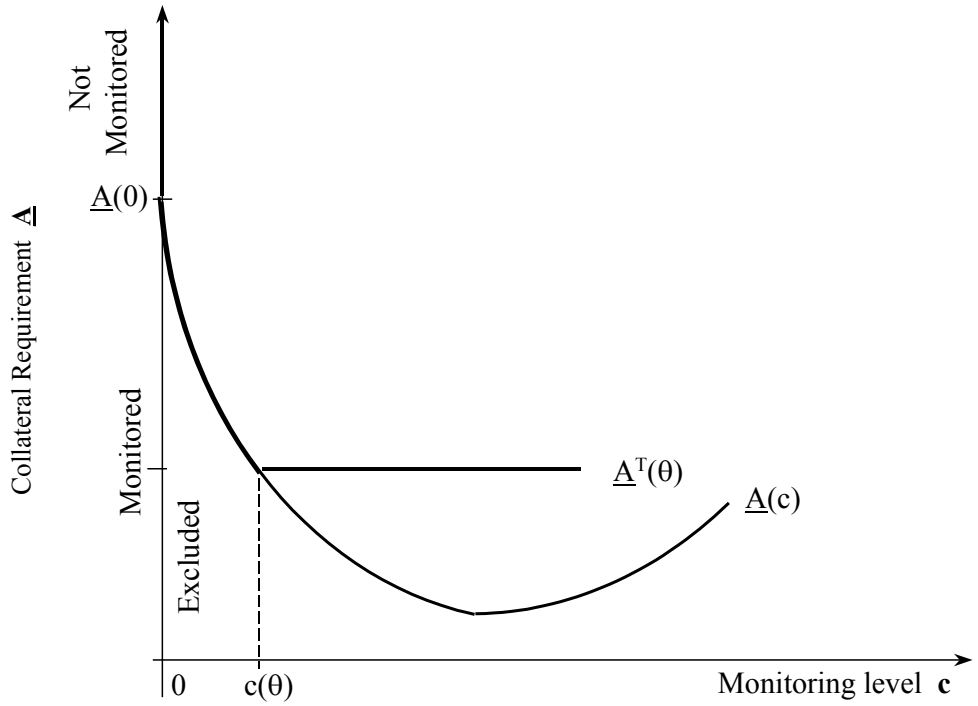


Figure 2: No scope for monitored contracts



When markets are competitive (θ is high) there will be little or no scope for monitored lending.

Figure 3: Scope for Monitored Contracts



When markets are more concentrated (θ is low) there is more scope for monitored contracts to work