Who Benefits from Subsidised Credit? A Tale of Two Agents

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INTRODUCTION

Sri Lanka's rural sector, as in many developing countries, is financed significantly by an informal credit market. Policy-makers have devoted much attention to the apparently high interest rates prevailing in this market. In order to address the problems of rural indebtedness and stagnation, therefore, State-supported credit schemes have involved ***subsidised*** interest rates.

Some of the recent literature challenges two commonly-held views; that informal interest rates[1] are "high", and that informal lenders operate as (local) ***monopolists***. According to Sanderatne [1989a, 1989b][2], lenders constitute a varied group such as friends and relatives, professional and semi-professional money-lenders, traders, and landlords. The nature of the credit "contract" is seen to vary according to the type of lender (and borrower). ***Interest-free*** loans often constitute the bulk of credit volume.

Do zero-interest credit transactions carry hidden costs? Where the parties consist of friends or relatives, the literature does not ascribe a ***profit*** motive to the lender . However it is acknowledged that in the case of ***inter-linked*** market transactions, the return to lending can accrue in a market other than that for credit. For example, Sanderatne [1989a] sees landlords varying the terms of tenancy contracts to yield a gain from providing cultivation credit to tenants[3]. In such cases, the true interest rate would be positive[4].

Inter-linked transactions are usually based on long-standing relationships, which may act as a barrier to the entry of new sellers. Such a barrier would then confer a degree of monopoly power on the existing seller, or lender. One possible result would be high interest rates. There are, of course, other plausible explanations for the latter. Examples are, high opportunity costs of loan funds, default risk and low elasticity of demand for credit.

The existence of monopoly power is of more than academic interest for the following reason. It can give rise to ***strategic*** behaviour by informal lenders in response to changes in the market. This, in turn, may reduce the likelihood of government policy measures achieving their goals. Official pronouncements by policy makers show no recognition of this possibility.

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1 Discussion is usually in terms of *nominal* rather than *real* rates. Informal rates are compared with unsubsidised rates charged by commercial banks.

2 Also see Fernando [1987].

3 Another instance is when sellers of consumption goods on credit "over-price" their products.

4 At least, in nominal terms.

As an example, consider a farmer who purchases inputs on credit from a particular shop-keeper. Suppose a bank offers a cultivation loan on "soft" terms. What happens if it finances only part of the farmer's working capital? He will still be dependent on the shop-keeper's credit for the balance. However, provided there is no change in prices, the farmer's net income - after loan repayment - will be higher. But the shop-keeper may seek to capture some of this increased income by raising the prices of his inputs. The bank then benefits the shop-keeper, and perhaps not the farmer at all.

The relevance of this example for the Sri Lankan rural sector may be questioned. It is well-known that banks typically finance only part of production costs[5]. For the sake of argument, however, suppose all such costs were covered; the above story holds as long as bank clients are dependent on informal credit sources for ***consumption*** and ***sudden contingency*** needs. It becomes even more plausible due to the inelastic nature of credit demand for the latter types of requirements.

Another issue emerges when more than one credit source is involved: Which lender will receive priority in loan repayment? A stylised fact in Sri Lanka is that ***informal*** lenders are repaid first (see Sanderatne [1989a]). Then higher ***informal debt*** will increase the default probability on ***formal*** sector loans[6]. However, for one class of borrowers, this probability does not change. They are those ***intending to default all along***. (Their default probability is equal to one). They may be classified as ***intentional defaulters*** or ***dishonest borrowers***[7]. Since their ***retained*** incomes are higher (than those of honest borrowers), they should make attractive clients for informal lenders!

The objective of this paper is to provide a formal example of the above type of borrower-lender interaction. Two agents are involved, as follows. There is an informal

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5 Harriss [1977] provides an interesting story from Hambantota. Whenever a (State) bank raised the credit ceiling for hiring of tractors, charges for the latter also went up. The reason was that sellers of this service were also offering credit; hence, acting oligopolistically, they made sure that they were not pushed out of the credit market.

6 There are two effects. First, repayment of informal debt lowers borrower incomes, inducing some to default on the formal sector. Second, in anticipation of this problem, some borrowers may decline the formal sector loan; they would forego credit rather than be "forced" into defaulting. Then the proportion of borrowers *willing to default* increases (an "adverse selection" effect). For a fuller treatment, see Abayasekara [1990].

7 The term *wilful* defaulter is often used to describe a borrower who refuses to repay despite a "satisfactory" income level. Piyatissa [1981] refers to a Central Bank survey of defaults in 1972, in which almost 20% of defaulters *stated openly* that they had no intention of repaying. The terminology used in this paper is more satisfactory because it clearly indicates the borrower's intention *at the time of loan receipt*.

lender[8] (hereafter, "lender") who is a ***monopolist***, and a producer, who is a ***dishonest borrower*** (with regard to the formal sector). There is also a formal sector financial institution ("bank"), which, however, only plays a passive role. It channels a government credit package to interested borrowers. Note that there is no claim that the informal rural credit market is (largely) monopolistic. The idea is to show an inconsistency between a categorisation of the market and the expected policy outcome.

The paper is organised as follows. Section I introduces a model of informal credit. Section II depicts the lender's response to the availability of bank credit. Section III imposes a constraint on the (informal) lender's optimising strategy, and section IV offers some conclusions.

SECTION I: A MODEL OF INFORMAL CREDIT

Consider production within a one-period frame-work. Investment is perfectly indivisible and takes place at the beginning of the period. Let it be equal to unity without loss of generality. The lender is endowed with one unit[9] whereas the producer has no investible funds of his own; he borrows the entire unit from the former. Output, x, which is observed at the end of the period, is a random variable such that $0 \leq x \leq w$. Let the probability density function of x be f(x), and its cumulative distribution, F(x). f(x) and F(x) are assumed known to both borrower and lender.

If r_l is the interest rate, the end-of-period debt is equal to $R_l = (1+r_l)$. The borrower does not possess acceptable collateral, and so the lender provides the following ***default clause***; whenever $x < R_l$, the borrower is in default, and the lender appropriates x[10]. When $x \geq R_l$, complete loan repayment takes place, leaving the borrower with a surplus equal to $(x-R_l)$.

The producer has alternative employment yielding the (certain) return, A. Thus A functions as his reservation income. The lender's (certain) opportunity cost of funds is i (per unit). By assuming both parties to be risk-neutral, their utilities can be defined in terms of profit or income.

The lender's expected gross return from lending to the producer is given by

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[8] It is assumed here that only credit is involved. Braverman and Srinivasan [1981] model a landlord-tenant relationship. They achieve similar results (but without uncertainty).

[9] The results are the same if the lender's resources are greater than one. If they are *less*, then the borrower needs to access another credit source.

[10] Hence the borrower obtains a zero surplus. It must then be assumed that he has other means of meeting basic consumption needs.

$$\int_0^{R_1} xf(x)\,dx + \int_{R_1}^{w} R_1 f(x)\,dx$$

or

$$\{\int_0^{R_1} xf(x)\,dx + R_1[1 - F(R_1)]\}.$$

His gross return from the alternative investment is equal to (1+i). The producer's utility (expected income), U_1, is equal to[11]

$$\int_{R_1}^{w} (x - R_1) f(x)\,dx$$

which can be expressed as

$$\{E(x) - \int_0^{R_1} xf(x)\,dx - R_1[1 - F(R_1)]\}.$$

If EP_1 denotes the lender's expected net profit (from lending to the producer), the latter's strategy is as follows.

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[11] Recall that when $x < R_1$, the borrower forfeits his entire output to the lender.

$$\underset{R_1}{Max}\ EP_1 = \int_0^{R_1} xf(x)\,dx + R_1[1 - F(R_1)] - (1+i) \qquad (1)$$

subject to[12]

$$U_1 = E(x) - \int_0^{R_1} xf(x)\,dx - R_1[1 - F(R_1)] \geq A \qquad (2)$$

EP_1 is monotonic increasing and U_1 is monotonic decreasing in R_1. In fact, $d(EP_1)/dR_1 = [1 - F(R_1)] = -dU_1/dR_1$[13]; i.e., choosing R_1 constitutes a ***zero-sum game*** between lender and borrower. The profit-maximising value, R_1^* is determined by pushing the borrower down to his reservation income, A, so that

$$U_1(R_1^*) = E(x) - \int_0^{R_1^*} xf(x)\,dx - R_1^*[1 - F(R_1^*)] = A \qquad (3)$$

Hence $R_1^* = R_1^*(A)$, the functional relationship being negative; the higher (lower) the value of A, the lower (higher) the value of R_1^*[14]. The credit transaction takes place only if $EP_1(R_1^*) \geq 0$.

SECTION II: LENDING BY BOTH BANK AND INFORMAL LENDER

Suppose the bank offers a loan amount, $(1\text{-}s)$ (with $s < 1$) at a fixed interest rate, r_b. If $R_b = (1+r_b)$, accepting the bank loan results nominally in a debt of $(1\text{-}s)R_b$. However, since the borrower is ***dishonest***, the bank loan does not really entail any obligation; it is in effect a ***grant***.

The producer now demands a loan equal to s from the lender. Let r_2 be the interest

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[12] Also note the constraint that (1) should be non-negative in equilibrium.

[13] See equations (A3) and (A4) in the Mathematical Appendix.

[14] For a formal proof, see (A5) and below in the Mathematical Appendix.

rate on such a loan[15]. Then, if $R_2 = (1+r_2)$, the producer's debt to the lender is sR_2.

The latter's gross earnings from lending is equal to[16]

$$\{ \int_0^{sR_2} xf(x)\,dx + sR_2[1 - F(sR_2)] \}$$

He also earns an amount equal to $(1-s)(1+i)$ from investing his balance endowment elsewhere. If EP_2 is the lender's expected net profit, his strategy is given by

$$\underset{R_2}{Max}\ EP_2 = (1-s)(1+i) + \int_0^{sR_2} x(fx)\,dx + sR_2[1 - F(sR_2)] - (1+i) \quad (4)$$

subject to[17]

$$U_2 = E(x) - \int_0^{sR_2} xf(x)\,dx - sR_2[1 - F(sR_2)] \geq \bar{A} \quad (5)$$

As before, this is a zero-sum game. If there is no upper bound on the value of R_2 (other than that of (5)), the profit-maximising level is R_2^*, defined by

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[15] In principle, the lender can make a counter offer, setting *both* the (new) loan size and interest rate. However, he cannot supply *less than* s, given the investment indivisibility assumption. Also, for reasons of profitability - as shown below - he will not offer *more than* s, even if the bank was willing to accommodate him. Hence I shall model the interest rate as his sole decision variable for the present.

[16] This is clearly seen by substituting sR_2 for R_1 in (1). Similarly, the borrower's utility is derived by doing the same substitution in (2).

[17] The formulation of (5) assumes that there is no penalty of default (on the bank). If it is explicitly included in the model, the producer's return with and without default can be compared. A high penalty (therefore inducing repayment) implies an *honest* borrower, and a low penalty, a *dishonest* one. Since only the latter type is considered in this paper, the simplest possibility, viz., a zero penalty has been assumed.

$$U_2(R_2^*) = E(x) - \int_0^{sR_2^*} xf(x)\,dx - sR_2^*[1 - F(sR_2^*)] = A \quad (6)$$

(6) shows that the borrower remains at his reservation utility (income) level ***even after borrowing from the bank***. The benefit of the bank "grant" must then have accrued entirely to the informal lender. This is easily seen by comparing the latter's expected profit maxima in the two situations. Let $EP_1(R_1^*)$ and $EP_2(R_2^*)$ be denoted by EP_1^* and EP_2^*, respectively.

From (1) and (3),

$$EP_1^* = E(x) - A - (1+i) \quad (7)$$

From (4) and (6),

$$EP_2^* = (1-s)(1+i) + E(x) - A - (1+i) \quad (8)$$

Subtracting (7) from (8) yields

$$EP_2^* - EP_1^* = (1-s)(1+i) > 0 \quad (9)$$

provided $s < 1$.

When the lender's share, s is exactly one, the lender is back in the first situation, viz., monopoly of total credit. Note however, the important result revealed in (9); ***the smaller the value of s, the greater the increase in the lender's expected profit***. This means that the lender ***prefers to lend a smaller share of the total credit requirement***[18]! The reasoning is straightforward, as follows. Whatever his share of total credit, the lender is able to extract the producer's surplus (above A). By lending smaller amounts, however, he has additional funds left for investment elsewhere. Thus he earns ***an*** additional income (net) at the rate of i per unit. This is seen by comparing (7) and (8); the smaller his exposure to the producer's project, the higher the ***extra*** income.

The above result is generated by the lender's relative freedom to raise the interest rate. If this is a landlord-tenant (credit) transaction, the former must be able to raise his share of output. A boutique-keeper lender must be able to charge higher prices for the producer's inputs, or pay lower prices for the latter's output.

In actual fact, some restriction may exist on the lender's ability to change the terms of the contract[19]. This may be socially determined. For example, if the customary share of the landlord is one-third (of the harvest), it is unlikely that it could be raised to, say, nine-tenths. Even with an informal monopoly lender, then, subsidised bank credit may benefit a producer ***given an exogenous restriction of the above type***. In section III, I consider this possibility.

SECTION III: RESTRICTION ON INFORMAL INTEREST RATE

Suppose the lender's interest rate is subject to a ceiling of r_m (with $R_m = (1+r_m)$).

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[18] Provided, of course, that it is positive. If $s = 0$, the lender forfeits the producer's surplus.

[19] I.e., a restriction other than that of (2) or (5).

The lender's expected profit from lending s at r_m, is

$$EP_3 = (1 - s)(1 + i) + \int_0^{sR_m} xf(x)\,dx + sR_m[1 - F(sR_m)] - (1 + i) \quad (10)$$

Such a contract may or may not be acceptable to the lender. If r_m is binding, lender preferences may now be incorporated by ***treating s as his decision variable***. His offer of s - s^* - will vary between ***one*** and ***zero***. Differentiating (10) with respect to s,

$$\frac{d(EP_3)}{ds} = -(1 + i) + R_m[1 - F(sR_m)] \quad (11)$$

The second derivative is

$$\frac{d^2(EP_3)}{ds^2} = -R_m^2 f(sR_m) < 0 \quad (12)$$

Provided it exists, an interior solution for s, $s^*(r_m,i)$ is yielded by equating (11) with zero.

More to the point, what happens if s^* does not equal the demanded value of s? Denoting the latter by $\underline{s}$, s^* may be greater or smaller than $\underline{s}$[20]. The latter is not feasible (for the borrower). Suppose $s^* > \underline{s}$. Then the producer's total borrowing would exceed the required unit. Due to the higher (unproductive) debt, he would also be giving up a portion of his income to the lender. If he refuses the offer, the lender, in turn, may threaten to withold credit completely. The outcome will depend on the ***credibility*** of such threats[21], and the bargaining power of the parties.

In the following simple analysis, I consider two sets of factors: 1) The effective range for r_m, and 2) the existence or otherwise of an interior solution for s^*.

(a) $R_m < R_1^* (< R_2^*)$

Here the lender's profit maximisation even under pure monopoly is restricted. Hence the producer is not driven down to his reservation income level. When the bank comes in, the lender compares his expected profit, $EP_3(s,R_m)$, with his pure monopoly profit, $EP_1(1,R_m)$.

Consider the figures below. In 1a, the profit-maximising value of s is s^* (< 1). 1b represents a corner solution, with EP_3 maximised at $s = 1$.

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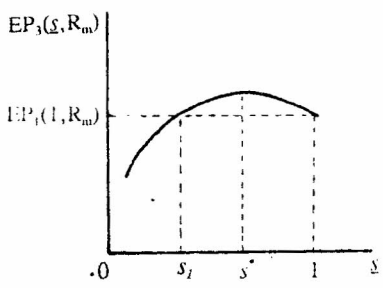
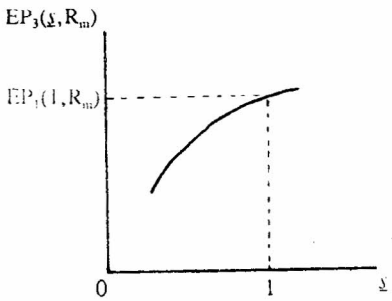
[20] See section II in the mathematical appendix.

[21] For instance, suppose the lender can still earn a positive net profit at $\underline{s}$. His threat has less credibility, and the borrower may call his "bluff".



[Figure 1a]



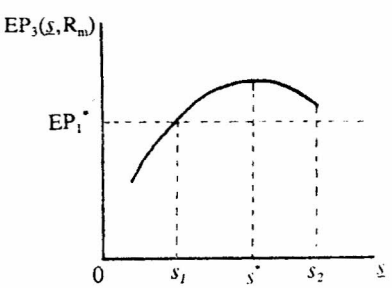
[Figure 1b]

In figure 1a, suppose $s_1 \leq s \leq 1$. The lender - while aiming for s^* - is prepared to bargain over the whole range. Hence s is a feasible outcome. If $s < s_1$, however, he will exert pressure on the producer to borrow the whole unit from him. Thus the producer will potentially benefit from subsidised credit only if $s_1 \leq s \leq 1$[22].

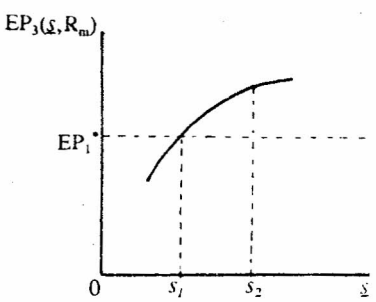
In 1b, there is no value of s (< 1) for the lender that dominates the pure monopoly situation.

(b) $R_1^* < R_m < R_2^*$

The lender is able to set R_1^* as a pure monopolist. In providing s, however, he cannot set the previous optimal rate, R_2^*. Let s_2 denote the loan amount at which R_m becomes binding[23]
. Then the lender's choices can be depicted as follows.



[Figure 2a]



[Figure 2b]

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22 The presence of two lenders creates opposing forces on borrower utility. See the discussion in Section III of the Mathematical Appendix.

23 I.e. when s falls below s_2, the lender can no longer charge R_2^*.

In both 2a and 2b, suppose s is such that $s_1 \leq s \leq s_2$. Then, since the lender can do no worse than his monopoly position (EP_1^*), $\underline{s}$ is a feasible outcome. If his share is below s_1, however, he will prefer to lend the entire unit.

SECTION IV: CONCLUSIONS

Rural informal lenders in Sri Lanka are often thought to possess monopoly power. This is unlikely to be true of the entire sector, although particular instances may exist, e.g., with inter-linked transactions. Given such power, however, informal lenders may engage in strategic responses to government-sponsored credit programs. In this paper, I have attempted to model such a response.

Formal credit supply alone usually fulfills only part of credit demand. Thus borrowers remain dependent on informal lenders. Suppose, by setting loan terms, an informal lender can keep a borrower at the latter's reservation utility level. Any benefits to the borrower from formal credit are then appropriated by the informal lender.

The specific results of the model depend on the strong assumption of investment indivisibility. However, where credit demand for a variety of needs is inelastic (with respect to the interest rate), similar results can be anticipated.

Informal lending does not take place in a social vacuum. There may be various constraints - "moral" or otherwise - on the lender's ability to change his loan terms. In such situations, formal credit ***may*** benefit borrowers. This is true when the informal lender himself finds it relatively profitable to lend the amount demanded. If his share of credit is too small, however, he can make counter-offers to borrowers. One such instance is when he threatens to withold credit unless he is allowed to retain his monopoly. The actual outcome depends on the credibility of threats and the parties' bargaining powers, etc. Borrowers may or may not end up with higher utility (or income).

Special assumptions limit the applicability of the model. For instance, borrowers and lenders may be risk-***averse***, rather than risk-***neutral***. Again, actual contracts may not contain the default clause modelled here. The purpose of the model, however, is to show that policy prescriptions must match the diagnosis.

MATHEMATICAL APPENDIX

Section I: Pure Monopoly

$$EP_1 = \int_0^{R_1} xf(x)\,dx + R_1[1 - F(R_1)] - (1 + i) \quad \text{(A1)}$$

$$U_1 = E(x) - \int_0^{R_2} xf(x)\,dx - R_1[1 - F(R_1)] \quad \text{(A2)}$$

Differentiating with respect to R_1,

$$d(EP_1)/dR_1 = R_1f(R_1) - R_1f(R_1) + [1 - F(R_1)]$$
$$= [1 - F(R_1)] > 0, \text{ provided } R_1 < w \quad \text{(A3)}$$

$$dU_1/dR_1 = -R_1 f(R_1) + R_1 f(R_1) - [1 - F(R_1)]$$
$$= -[1 - F(R_1)] < 0 \qquad \text{(A4)}$$

$$U_1(R_1^*) = E(x) - \int_0^{R_1^*} xf(x)\,dx - R_1^*[1 - F(R_1^*)] = A \qquad \text{(A5)}$$

Totally differentiating (A5),

$-[1 - F(R_1^*)]dR_1^* = dA$, so that

$$\frac{dR_1^*}{dA} = \frac{(-1)}{[1 - F(R_1^*)]} < 0 \qquad \text{(A6)}$$

Section II: Lender Preferences for s, given r_m

From (11),

$$\frac{d(EP_3)}{ds} \gtrless 0 \quad iff. \quad R_m[1 - F(sR_m)] \gtrless (1 + i) \qquad \text{(A7)}$$

Consider the left hand side of the second expression in (13); it is the expected gross return from lending, at the margin, ***in states of no default***. If this is higher (lower) than the alternative return, the lender desires a larger (smaller) loan fraction.

Section III: Producer Utility Levels at R_m

Pure informal sector monopoly yields

$$U_a(R_m) = E(x) - \int_0^{R_m} xf(x)\,dx - R_m[1 - F(R_m)] \qquad \text{(A8)}$$

Borrowing s from informal lender yields

$$U_b(s, R_m) = E(x) - \int_0^{sR_m} xf(x)\,dx - sR_m[1 - F(sR_m)] \qquad \text{(A9)}$$

Subtracting (A8) from (A9) yields

$$U_b - U_a = \int_{sR_m}^{R_m} xf(x)\,dx + R_m[1 - F(R_m)] - sR_m[1 - F(sR_m)] \qquad \text{(A10)}$$

The meanings of the terms in (A10) are as follows. The first term denotes the gain to the

borrower because of a drop in default probability. Since he owes less to the lender, his expected payment on account of default is also less.

The second and third terms both represent expected payments in states where default does not occur. The difference in their values cannot be signed unambiguously. Consider the drop in default probability from borrowing s instead of 1. The producer has a greater expectation that he will have to repay the whole
loan; this is an "adverse" effect. However, he pays only sR_m instead of R_m; i.e., the total debt is also less.

A ***sufficient*** condition for $(U_b - U_a) > 0$ is given by

$$R_m[1 - F(R_m)] - sR_m[1 - F(sR_m)] > 0, \text{ or}$$

$$s < \frac{1 - F(R_m)}{1 - F(sR_m)}$$

I.e., when s is less than the ratio of the respective probabilities of ***not defaulting*** on the informal lender.

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