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RESISTANCE TO INNOVATION AND ECONOMIC DEPENDENCE

IN

SOUTHEAST BRAZIL

by

Pasquale L. Scandizzo

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"The first and the most elementary effect of poverty is to enforce the very attitudes and behavior that make it self-perpetuating" — John Kenneth Galbraith

Introduction

The objective of this paper is to analyze some effects of economic dependence between sharecroppers and landlords on technological progress in Southeastern Brazil.

The approach adopted parallels Bhaduri's contribution on the study of rural backwardness in West Bengal. Unlike Bhaduri's model, however, risk is explicitly taken into account and the case of land and labor augmenting technological progress is considered.

The results indicate that under certain conditions sharecroppers and landlords are both likely to oppose technological progress. The sharecroppers would oppose it because, although producing higher expected incomes it would also be associated with an increase in riskiness of the farming operation. More interestingly, the landlords would oppose it too, because of the consequent weakening of the dependence bond with their sharecroppers. The landlords, in fact, benefit from the dependence relationship through usury and monopolistic marketing.

The analysis also demonstrates that different types of innovations are likely to suscitate opposite responses from the parties involved. Land augmenting innovations would be favored by sharecroppers in a regime of increasing interest rates, but would be likely to fail to be supported by

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landlords. Labor augmenting innovations, on the other hand, would be accepted by sharecroppers only for sufficiently low interest rates, but would generally be promoted by landlords. In light of this, it is concluded that the labor augmenting technological progress is the most likely to be accepted without major conflicts between landlords and tenants in Northeastern Brazil.

II. Sharecroppers in the Sertão

Most of the interior of Northeastern Brazil consists of a harsh, semiarid, drought prone backland called the Sertão. The agriculture characteristic of this part of the world is extremely primitive and based on a mixture of swidden (slash and burn) and long term fallow ecotypes.1/ The backwardness of the Sertão farmer is certainly dramatic: not only modern inputs, but even the most primitive forms of plowing are virtually unknown. The basic tool used is the hoe and only a minimal part of the farm population has experience with anything more sophisticated than a manual planting tool.

Farmers' resistance to technological change has been explained with different arguments: from a regressive value system to active pragmatism and response to risk.2/ Although these arguments may help to understand why small farmers do not innovate, they do not provide any justification as to why large landowners, much less risk prone, relatively well educated and well endowed with money, do not invest in technological change and do not try to diffuse it among the scores of peasants working for them.

In the Sertão the most widespread form of land tenure arrangement is sharecropping, whereby medium and large landowners divide their

1/ For the definition of agricultural ecotypes, see Wolf (p. 32).
land among a number of (generally) landless peasants in exchange for a share of the crop. In the large fazendas, part of the land regulated by this form of contract is incorporated in a large unit which is run by the owner and/or by an administrator. In this case, sharecropping is much closer to a form of labor contract than to a land rental contract.

III. Perpetual Indebtedness and Economic Dependence

The sharecropper is typically involved in the production of one cash crop: cotton, and a number of subsistence crops (corn, beans and manioc). In its most diffused form, the sharecropping contract is very simple since it involves only the transfer of a share of the net harvest of the cash crop to the landlord. No inputs are generally provided and the sharecropper is free to plant as much subsistence crops as he wishes. Production of the cash crop, however, has to be kept at a level considered satisfactory by the landlord.

There are three main ways in which the sharecropper can be said to depend on the landlord. First the landlord obviously controls the use of land. Second, he is the sole intermediary between him and the market. Third, he is the main source of credit when cash or food is needed.

The granting of credit and the purchasing of the harvest are closely related. Two or three months before harvesting, when prices are at their highest and the sharecroppers are out of cash and food, the owner will buy crops green, at approximately one half of their market value when ripe. Alternatively,

1/ In the areas where commercial agriculture is more developed, there is often an active market for staples and a share of the subsistence crop (though in general smaller than the share of the cash crop) is also due to the landlord.

2/ Net harvest is defined as total harvest minus seed for planting for next year.

3/ Also provided with the land is often housing, and in large fazendas, a primitive infrastructure.
he will sell on credit staples at current market prices, which may be sever21
times greater than after harvest prices.

Because of the high interest rates, the comparatively low prices for the product and the wild oscillation of production due to pests, diseases and periodical droughts, the sharecropper is often caught in a relation of perpetual indebtedness and dependence on the landlord. This relation is, however, not forced upon the farmers, but accepted by them as a sort of social form of insurance against the extreme risks of the environment. As Johnson (1970, p. 127) points out: "In short, the landlord is expected by the moradores to give more than merely rights to land. Far from hating the existence of a "company store" or the purchase of green crops at cut rate prices, the workers regard these practices as the only alternative to great potential suffering... In the face of great uncertainties, a worker has no ties that can assure him as much protection as a firm tie to the landlord can."

IV. Technological Progress

To a casual observer it may seem that technology in the Sertão is so primitive that it would take only a minimum of initiative by workers or landowners to produce almost immediate increases in productivity. Indeed, local extension agents have assisted in introducing plowing, proper spacing in planting and use of selected seed on several farms. These farms are, however, a small minority and innovations tend to be limited to the few, medium-sized farms, which are directly reached by the extension programs.

In the large units the resistance to technological innovation seems to come almost equally from the workers as well as the landowners. The workers resist innovations mostly by refusing to apply additional labor to techniques with uncertain results such as plowing or spacing. The owners simply fail
to reinvest their profits in improvements of their property, whose capital endowment is kept at the minimum level compatible with the going technology.

The main element to explain resistance to change of the sharecroppers is undoubtedly risk. Most of the new techniques, including use of modern inputs such as fertilizers, selected seed etc., are riskier in the sense that the higher expected returns are counterbalanced by higher variability. Furthermore, without access to a modern capital market, the workers are in no condition to invest in innovations. The lack of initiative of the landlords in this respect is more difficult to explain. In questioning large landowners, one finds that they are involved in other more "dynamic" activities such as commerce and construction, and that they consider their farms more as an asset than as a productive unit. More traditional landlords, on the other hand, tend also to consider a farm a static rent generating asset and they would rather invest in beautification than in technological improvements.

The mathematical model in the next part of this paper will try to capture these two elements of the resistance to technological innovation: (1) the risk aversion and the progressive financial weakness of the sharecroppers; (2) the interest of the landlord in maintaining the status quo. The hypothesis underlying the model will be that the relation of economic dependence between landlords and sharecroppers is exploitative and tends to delay economic progress.
V. The Model: The Sharecropper's Side

Some of the symbols used are the following:

\( z_t \) = "net worth" of available stock of output of the sharecropper

\( c_t \) = value of consumption of sharecropper

\( x_t \) = value of production

\( r \) = share of production retained by sharecropper

\( i \) = interest rate "imposed" by landlord on credit

\( L \) = labor endowment of sharecropper

\( \omega \) = opportunity cost (e.g. wage rate) of sharecropper's labor

All the variables without the time subscript are assumed to be non-stochastic and independent of time. Production is regulated by the following stochastic production function:

\[
x_t = \varepsilon_t F(L)
\]

where \( \varepsilon_t \) is the realization at time \( t \) of a random variable \( \varepsilon \) (which may be taken to represent yield) with mean \( \mu \) and variance \( \sigma^2 \). As Badhuri suggests, rather than on income, consumption may be assumed to depend on the balance of the available output in each period:

\[
c_t = b z_t + b_0
\]

Since land and farm capital are predetermined, fixed by the landlord and/or institutional constraints, and as modern inputs are assumed to be available in the base situation, the production function specified contains only the labor variable. The sharecropper maximizes his expected utility by setting a value for this variable, say \( L^* \). The available stock of output can then be defined as:
\[ z_t = r e_t F(L^*) - (1+i)(c_{t-1} - z_{t-1}) + \omega(L - L^*) \]  

Substituting (2) into (3), taking expectations on both sides and solving the difference equation:

\[ Ez_t = Ez + (Ez_0 - Ez)[((1+i)(1-b))]^t \]

where \( Ez \) indicates the asymptotic value of expected net worth and is equal to

\[ Ez = \frac{r u F(L^*) + \omega L - (1+i)b_0 - \omega L^*}{1 - (1+i)(1-b)} \]

and \( Ez_0 \) indicates the expected value of initial net worth. The condition for convergence of (5) is \( i < \frac{b}{1-b} \). If the rate of interest imposed by the landlord respects this limit, there will be a steady state for farmer's expected output balance. The steady state will be characterized by a constant level of indebtedness provided that \( r F(L^*) + \omega = (1+i)b_0 + \omega L^* \). In this case, in fact

\[ ED = Ez - Ez = (b-1)Ez + b_0 = (b-1) \frac{[r u F(L^*) + \omega L - (1+i)b_0 - \omega L^*]}{1 - (1+i)(1-b)} + b_0 \]

where \( ED \) indicates the asymptotic value of expected indebtedness. Thus, the expected long run level of indebtedness of the peasant will be positive if:

\[ ru F(L^*) + \omega (L - L^*) < (1+i)b_0 \]

or, in words, if the average amount of produce retained by the sharecropper, plus the amount he earns from wage labor is less than the value of a loan to satisfy the minimum consumption needs. Notice that in the opposite case, i.e., when \( r u F(L^*) + \omega (L - L^*) > (1+i)b_0 \), the peasant will not borrow.

1/ \( Ez_t = ru F(L^*) + \omega (L - L^*) + (1+i)b_0, Ez_{t-1} - (1+i)b_0 \)

2/ I assume that the peasant is not able himself to lend at a rate of interest \( \geq i \). Thus, if \( rz F + \omega (L - L^*) > (1+i)b_0 \), the peasant will be able to consume above the minimum level \( b_0 \) without borrowing.
Notice also that the limit established for \( i \) is most likely to be respected if propensity to consume is high. Since \( \lim_{b \to 1} \frac{b}{1-b} = \infty \), it is clear that, as \( b \) approaches 1, the constraint on \( i \) is lifted and any value of the interest rate becomes compatible with convergence and a positive value of steady state expected net worth. For \( b = 0.5 \), only values of \( i \) less than 50 percent would ensure convergence.

If \( i > \frac{b}{1-b} \), equation (4) will diverge. In this case expected indebtedment will be:

\[
\bar{H}_t = \bar{ED} + (ED_0 - \bar{ED})f(1+i)(1-b)t
\]

where \( \bar{H} \) is formally described again by (6) and \( ED_0 \) stands for expected value of initial indebtedment. In particular, \( ruF(L^*) + \omega(L-L^*) < (1+i)b_0 \), the term \( ED_0 - \bar{ED} \) will be necessarily positive since

\[
ED_0 - \bar{ED} = ED_0 + (1-\epsilon) \frac{[(1+i)b_0 - ruF(L^*) - \omega(L-L^*)]}{(1+i)(1-b)-1} + b_0 > 0 \quad (9)
\]

so that peasant debts will grow without limit. The same result will hold if initial debts plus minimum consumption \( ED_0 + b_0 \) exceed asymptotic indebtedment, i.e., \( ED_0 + b_0 > \bar{ED} \).

Both (8) and (9) make clear the role that an increment in production or consumption could play. Technological progress could increase \( ruF(L^*) \) over \( (1+i)b_0 \), liberating the farmer of his dependence from the Landlord, and so could suppression of consumption related to ceremonial or other social requirements.
VI. The Problem of Uncertainty

First, we obtain the expression for variance of output balance as defined in equation (3). Applying the variance operator $V$ to both sides of this equation and solving the resulting difference equation yields:

$$V(z_t) = \bar{V}_z + (Vz_0 - \bar{V}_z)[1 - ((1+i)(1-b))^2]$$

(10)

where $\bar{V}_z$ indicates the asymptotic value of variance $V(z_t)$ and is equal to:

$$\bar{V}_z = \frac{r\sigma^2[F(L^*)]^2}{1 - (1+i)^2(1-b)^2}$$

(11)

and $Vz_0$ is the variance of output balance at time zero. As it is readily seen by inspection of (10) and (11), the conditions for convergence of variance are the same as for the expected value of $z_t$.

Assume now that sharecropper's behavior conforms to a utility function linear in the expected value and the standard deviation of output balance. In absence of other restrictions and with a sufficiently long time horizon, maximizing a linear function of the two statistics defined as in (4) and (10) is equivalent to maximizing the same function of their asymptotic terms.

Algebraically, we can state the problem as follows:

$$\text{Max } \bar{E}U = \bar{E}z - \phi(\bar{V}_z)^{1/2}$$

(12)

$$= rF(\lambda L)(\frac{\mu}{1-(1+i)(1-b)} - \phi \frac{\sigma}{\sqrt{1-(1+i)^2(1-b)^2}}) \frac{\omega L + (1+i)b_0}{1-(1+i)(1-b)}$$

where $\phi > 0$ is a risk aversion coefficient and $\lambda$ is a multiplier for labor augmenting technical progress.

Assuming the size of the plot as given, first order conditions for the maximization of (12) are:
Consider first the case of neutral (or, in the context, land augmenting) technical progress. Such a case can be represented by an increase of the expected value of yield per acre. Differentiating equation (13) w.r.t. we obtain:

$$\frac{d\bar{E}}{dL} = \frac{\mu}{1-(1+i)(1-b)} \phi \frac{\sigma}{\sqrt{1-(1+i)^2(1-b)^2}}$$

where \( R = (1+i)(1-b) \).

For technical progress to be advantageous to the sharecropper, we must have:

$$\frac{rF'}{1-R} - \frac{rF'}{\sqrt{1-R^2}} \frac{d\sigma}{d\mu} + rF'' \left( \frac{\mu}{1-R} - \phi \frac{\sigma}{\sqrt{1-R^2}} \right) \frac{dL}{d\mu} = 0 \quad (14)$$

Substituting the value of \( \frac{dL}{d\mu} \) given by equation (14) into equation (15) and solving for \( \frac{dc}{d\mu} \), we obtain:

$$\frac{dc}{d\mu} \leq \frac{\sqrt{1-(1+i)^2(1-b)^2}}{1-(1+i)(1-b)} G(i,b) \quad (16)$$

Thus, land augmenting technological progress will be beneficial only if the associated increase in risk (if any) as measured by the yield standard deviation is less than a function of the interest rate and the propensity to consume.

From (16), it is clear that \( G(i,b) \) is an increasing function of and a decreasing function of \( b \). In fact, differentiating both sides of (16)
we obtain:

\[
\frac{\partial G(i,b)}{\partial i} = \frac{(1-R^2)^{1/2}(1-b)(1-R^2)^{-1/2}(1-b)^2(1+i)(1-R)}{(1-R)^2} \tag{17}
\]

\[
\frac{\partial G(i,b)}{\partial b} = \frac{(1-R^2)^{-1/2}(1-b)(1+i)^2(1-R)-(1-R^2)^{1/2}(1+i)}{(1-R)^2} \tag{18}
\]

From (17) and (18) we can see that \( \frac{\partial G(i,b)}{\partial i} > 0 \) and \( \frac{\partial G(i,b)}{\partial b} < 0 \) if the condition of convergence \((1+i)(1-b) < 1\) is respected. Reverse inequalities will hold in the divergence case. This result may seem paradoxical. Inspection of equation (12), however, provides a simple explanation. From this formula one can readily see that introduction of credit in the model has a different impact on the marginal utilities of mean and standard deviation of yield (or sharecropper's revenue). The multipliers of \( \mu \) and \( \sigma \) in the term in parentheses, in fact, imply that increases in the interest rate would, within the convergence limits, both increase the risk term and the mean term. For a given \( \phi \), however, the increases in the weight of the mean \( \phi \) would be greater than the increases in the weight of the standard deviation.

This result is entirely a consequence of the indebtedment mechanism described: as the cost of his credit increases, the sharecropper's risk aversion increases less proportionately than his need.\(^1\)

From this summary analysis we can conclude that land augmenting technological progress can be made more attractive to the sharecropper by

\(^1\) In terms of the land augmenting innovation examined, one can also say that in equilibrium the need for repayment affects differently wealth statistics. Thus, a unit increase in mean yield would make him richer of \( 1/1 - (1+i)(1-b) \) in terms of expected wealth, while his risk measure would increase only of \( 1/ \sqrt{1 - (1+i)^2(1-b)^2} \).
a policy of high interest rates when the same policy does not result in
a condition of progressive indebtedment.

Consider now the case of labor augmenting technological progress.

Differentiating the both sides of equation (13) w.r.t. $\lambda$ we obtain:

$$r \left( \frac{\mu}{1-R} - \phi \frac{\sigma}{\sqrt{1-R^2}} \right) (F'+F'') \frac{dL}{d\lambda} - \frac{rF'}{\sqrt{1-R^2}} \frac{d\sigma}{d\lambda} = 0 \quad (19)$$

where we have assumed $\lambda=1$ in the initial position. In order for the innovation to be adopted, it must be:

$$\frac{dE}{d\lambda} = \left[ rF' \left( \frac{\mu}{1-R} - \phi \frac{\sigma}{\sqrt{1-R^2}} \right) - \frac{\omega}{1-R} \right] \frac{dL}{d\lambda} + \frac{\omega}{1-R} + \frac{rF'}{\sqrt{1-R^2}} \frac{d\sigma}{d\lambda} \geq 0 \quad (20)$$

Solving disequation (20) after substituting the value of $dL/d\lambda$ obtained from equation (19) yields, as the "acceptance" condition:

$$\frac{d\sigma}{d\lambda} < \frac{\sqrt{1-(1+i)^2(1-b)^2}}{1-(1+i)(1-b)} \left[ \frac{(F'+F'')\omega L}{rF'-\frac{\omega}{1-R}} \right] \quad (21)$$

where $\alpha = \frac{\mu}{1-R} - \phi \frac{\sigma}{\sqrt{1-R^2}}$. If we take $\alpha=0$ (i.e., we consider the limit of the variation over the present value of variance), expression (21) simplifies to:

$$\frac{d\sigma}{d\lambda} < \frac{\sqrt{1-(1+i)^2(1-b)^2}}{1-(1+i)(1-b)} \left[ \frac{\omega L (F'+F'')}{rF'-\omega} \right] = M(i, \delta) \quad (22)$$
Taking the partial derivatives of $M$ w.r. to $i$ and $b$, we obtain:

$$\frac{\partial M}{\partial i} = \frac{[\omega L(F'F'')]^2}{rF' - \omega} \cdot \frac{(1+i)(1-b)^2}{\sqrt{1-(1+i)^2(1-b)^2}}$$  \hspace{1cm} (23)$$

$$\frac{\partial M}{\partial b} = \frac{[\omega L(F'F'')]^2}{rF' - \omega} \cdot \frac{(1+i)^2(1-b)}{\sqrt{1-(1+i)^2(1-b)^2}}$$  \hspace{1cm} (24)$$

Thus, for $F'F'' > 0$, $M$ is a decreasing function of the interest rate and an increasing function of the propensity to consume. In this case, higher rates of interest will discourage farmers' adoption of the new techniques and so will, somewhat paradoxically, low propensities to consume. This result runs counter to the one obtained for land augmenting innovation. It is due to the fact that in the model increases in labor productivity per se do not affect the mean of land productivity, but only its variance. Analogous results are obtained if one assumes that labor productivity increases are associated with increases in the coefficient of variation of yield.

From the analysis above it follows that land augmenting and labor augmenting innovations may play quite a different role, in the system of dependence described.

"Land augmenting" technological progress would be acceptable to risk averters sharecroppers even under a regime of high financial dependence from the landlords. Provided that the increasing interest rates do not cause bankrupt, adoption rates in this case would indeed be higher the higher the interest rates.

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1/ The result may be taken qualitatively to hold for the so-called "landesque" and "laboresque" innovations described by Sen and the "biological" and "mechanical" innovations described by Hayami and Ruttan.
"Labor augmenting" technological progress, on the other hand, will be attractive only if interest rates are sufficiently low to make the undertaking profitable in the face of increasing risks.

I. The Landowner's Side

Consider now the point of view of the landlord. The expected income of the landlord from a single sharecropper under the assumption that both the contract share and the plot size are given, can be defined as:

\[ E_y_t = (1-r)pF(L) + r\mu(p-1)F(L) + i[E_{t-1} - E_{t-1}] \]  

where \( p \) is the ratio between the price that the landlord obtains in the free market and the price he pays to the sharecropper, and \( i \) is the net interest he is able to charge on the loans. Simplifying and substituting (2) and (4) into (25) yields:

\[ E_y_t = \bar{E}_y + (E_{y0} - \bar{E}_y)((1+i)(1-b)]^{t-1} \]  

\[ \bar{E}_y = (p-r)pF(L) - i(1-b)\bar{E}z + \bar{b}_0 \]  

Assume first \( i < \frac{b}{1-b} \). In this case equilibrium income converges in mean to \( \bar{E}_y \). If the landlord is risk neutral, he will accept technical progress to the extent that the corresponding increase in production increases his expected income. In the case of land augmenting technological progress:

\[ \frac{d\bar{E}_y}{du} = (p-r)pF(L) - i(1-b)\frac{d\bar{E}z}{du} \geq 0 \]
Figure 1

Non-acceptance area

Acceptance area
Substituting the explicit expression for $\frac{d\bar{E}z}{d\mu}$ obtained from (5) yields the two alternative condition: 1/

$$i < \frac{b}{1-b} \left[ \frac{p-r}{1+(p-r)} \right] \text{ or } (p-r) > \frac{(1-b)i}{b(1-b)}$$  \hspace{1cm} (29)

Thus, only if the interest rate is sufficiently low and/or the price margins that the landlord exacts from the sharecropper are high enough, he will be in favor of land augmenting technical progress. The relation between $p$ and $i$ is demonstrated graphically in Figure 1. The curve shown in the figure is the limit between the acceptance (area below the curve) and the non-acceptance area (above the curve). In the figure, the curve is drawn for a value of the propensity to consume equal to 0.8. As the figure demonstrates, for values of the interest rates of the order of magnitude observed in practice, landlords are not likely to favor neutral technological progress unless they can renegotiate some of the terms of the contract. 2/

But what if $i > \frac{b}{1-b}$? This is a case either of very high interest rates or of very strong requirements from the part of the sharecropper to keep a large stock of output unconsumed. The asymptotic equilibrium associated with $\bar{E}z$ is now unstable and any increase in productivity will move the farmer further on his exponential growth path (expression (4)) and the

1/ For simplicity, we assume $\frac{dL}{d\mu} = 0$, i.e., from expression (16):

$$\frac{d\sigma}{d\mu} = \frac{1}{\frac{1-R}{1-R}} \frac{\sqrt{1-R^2}}{1-R}$$

2/ Even if they can, upper bounds on the new terms are likely to exist. Thus, it is reasonable to assume that the share of the crop cannot go beyond $0.60 + 0.65$, the sharecroppers would be motivated to divert increasing quantities of their produce to other buyers.
landowner to the corresponding path described by equation (26). Differentiating this last equation w.r.t. \( \mu \) yields:

\[
\frac{dE_y}{d\mu} = (p-r) \frac{i(1-b)}{1-(1+i)(1-b)} [1-\{(1+i)(1-b)\}^{t-1}] \quad (30)
\]

This derivative has to be \( \geq 0 \) for an increase in \( \mu \) to be profitable to the landlord. Simplifying and solving for \( p \):

\[
p - r + \frac{i(1-b)[(1+i)(1-b)]^{t-1-1}}{(1+i)(1-b) - 1}
\]

Therefore, in the case considered, any profit that the landlord may have from technological progress will vanish very rapidly as \( t \) grows, as the autonomous increase in production will progressively free the sharecropper from his dependence bond.

In the case of labour augmenting technological progress the results are somewhat similar. In this case, to avoid triviality we have to consider explicitly the variation in labour input of the sharecropper as obtained in (19). Assuming \( \frac{d\sigma}{d\lambda} = 1 \), the expression for the variation of asymptotic income of the landlord is

\[
\frac{dE_y}{d\lambda} = \frac{[(p-r)\mu F'(1-R) - i(1-b)(rF'\omega)]\sigma F' + \frac{\omega}{1-R} L}{\mu \sqrt{1-R^2} - \phi(1-R)} \quad (32)
\]

The value of this expression has to exceed zero for the innovation to be attractive to the landlord. A sufficient condition for this is that the first term in (32) be greater than zero, i.e.:

\[
p > \frac{i(1-b)\omega^* + br}{1 - (1+i)(1-b)}
\]
where \( \omega^* = \frac{\omega}{\lambda F} \) is given by condition (13). For plausible values of the parameters involved and reasonably high rates of interest, this condition is less restrictive than the condition found for land augmenting technological progress. For example, for \( r = 0.5 \), \( \alpha = 0 \), \( \beta = 1 \), \( b = 0.8 \), and \( i = 1.5 \), \( \omega^* \) could be as low as 1.1 and technological progress still benefit the landlord. This lower bound for \( \omega^* \) increases very rapidly, however, with increases in \( i \). For example, for the same values of the other parameters and \( i = 3 \), \( \omega^* \) should be at least 2.90 for the innovation to be attractive.

Thus labor augmenting technological progress is more likely to be attractive to the landlord and he could be motivated to decrease the rates of interest imposed on loans to make it more attractive to the sharecropper.

VIII. Conclusions

The results presented suggest a number of qualitative conclusions. First, the willingness of the sharecropper to undertake risky technological progress is bound to be low because of his weak economic positions. Second, the risks as well as this weakness are compounded by the high interest rates imposed by the landlord.

From the other side, the landlord may have incentive in productivity increases only if the consequent increase in income does not weaken the bound of dependence that links the sharecropper to him. If this occurs, the landlord may be in condition to achieve better economic results by combining usury and marketing with his land renting activity.

In a situation characterized by periodic droughts and scarce or none financial solvability of the workers, as in the Northeast Brazil, usurp may generate, therefore, a vicious circle. From one side, in fact, the landlord will tend to impose high interest rates which will weaken the sharecropper's economic position and may decrease his willingness in undertaking risks.
in production. The same high interest rates, on the other hand, may produce a situation of dependence, exploitation and rent which will make unprofitable for the landlord to accept technological progress.

The analysis presented suggests also that a conflict of interests between landlords and sharecroppers is more likely to arise in the case of land rather than labor augmenting innovations. Land augmenting innovations, in fact, although presumably favored by workers under a regime of increasing interest rates, would be likely to be opposed by landlords for the reasons suggested above. Landlords would have, on the contrary, a definite incentive in promoting labor augmenting innovations by decreasing the rates of interest or providing alternative incentives to the sharecroppers.

This conclusion is particularly relevant for Northeast Brazil, since the agriculture of this region is very primitive: essentially "a man and a hoe" affair. Therefore, the possibility of both types of innovations exists and, interestingly, "laboresque" innovations need not be confined to extreme labor saving forms of modernization, as they include a whole range of intermediate technologies such as plowing, using of draft animals in traditional operations, clearing by mechanical means, removing the stumps, etc.¹/

¹/ There is considerable evidence that "mechanical" innovations in the northeast are associated with small increments in expected yields and significant increases in production risks. This is especially true for fertilization and "selected" varieties, but also for the use of some pesticides and weed control chemicals.

The adoption of slightly more modern agricultural practices of the mechanical type, on the other hand, appears to have a considerable effect on labor productivity without sensible increases in risk. For example, preliminary results of the IBRD-SUDENE survey and a 1975 IBRD study show that labor productivity of farmers using animal traction is roughly twice as much the productivity of other farmers. The increases in risk associated with such an increase in labor productivity seem to be insignificant.
REFERENCES


