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MORAL HAZARD, FINANCIAL CONSTRAINTS AND SHARECROPPING IN EL OULJA

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ABSTRACT

This paper develops a theory of sharecropping which emphasizes the dual role of moral hazard in the provision of effort and financial constraints. The model is compatible with a large variety of contracts as observed in the region of El Oulja in Tunisia.

Using an original set of data including financial data, various tests of the theory are realized. The role of financial constraints in the explanation of which type of contract is selected (as well as its implications that financial constraints affect effort and therefore output) are strongly supported by the data.

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1. Introduction

Following A. Smith, all the economists until G. Johnson (1950) have considered sharecropping as a "practice which is hurtful to the whole society," an unexplained failure of the invisible hand that should be either discouraged by taxation (A. Smith) or slightly improved by appropriate sharing of variable factors (Schickele (1941) and Heady (1947)).

G. Johnson (1950) starts from the empirical observation that "the deviations from optimum (induced by crop share contracts) are not immediately obvious from a cursory examination of American farms operating under different types of tenure arrangements." He then argues that the landlord can approach the desired intensity of cultivation

— by detailed contracting and monitoring,
— by providing other inputs and keeping the size of the individual unit small to decrease (by an income effect) the farmer's marginal disutility of labor,
— by the use of short term leases (game theory has only recently formalized this idea in repeated moral hazard models).

However, he admits that theory does not quite explain why sharecropping contracts can do as well as rental contracts.

The next step[1] in the understanding of sharecropping was achieved by stressing the risk aversion of tenants. The rental contract does not provide an appropriate sharing of risk. Sharecropping results from the trade-off between incentives and risk sharing (Stiglitz (1974), see also Newbery (1977)). A positive role for sharecropping was finally found as a second best way of inducing effort by risk averse tenants. Braverman and Stiglitz (1982) extended this insight by showing, as second best theory suggests, that the landlord should intervene in all the markets (credit market or input market) in which the tenant transacts to mitigate the inefficiency resulting from the above trade-off.

In this paper we would like to argue that too much emphasis has been put on risk aversion as an explanation of sharecropping. Instead, we would like to stress the combination of moral hazard and financial constraints as an explanation of sharecropping.

Section 2 describes the data we will be using to support our theory. Section 3 provides a model with financial constraints only, which is confronted with data. A more satisfactory model with moral hazard and financial constraints is constructed in Section 4. Production functions including an effort variable are estimated. Risk aversion is discussed in Section 5. Section 6 extends the analysis and the estimations to the case where the landlord's financial constraint may be binding. Section 7 provides some comments on the historical increase of sharecropping since 1970. Our findings are summarized in section 8.

2. *The Data*

The survey carried out with the help of the Tunisian National Institute for Statistics has been conducted in September-October 1986 in a rural area known as El Oulja, 40 miles west of Tunis. One hundred families have been concerned with the survey which includes three types of data.

(i) General information about the families with, in particular, the number of days worked in agriculture.

(ii) Information for each plot of land defined as a piece of land where only one type of crop is carried out each season. Data include size of plot, type of crop, type of labor contract used (either wage contract, fix rent contract or sharecropping contract), production levels, precise amounts of labor inputs as well as precise amounts of other inputs.

(iii) Wealth and income data for each family.

3. *Contracting with Financial Constraints*

The production function of an elementary piece of land, called a plot, is written:

$$\tilde{y} = f(le, x) + \tilde{\varepsilon} \qquad f \text{ increasing and concave} \tag{1}$$

where $\tilde{y}$ is output, l is the amount of labor input, e is the average level of effort applied to these units of labor ($le = \hat{l}$ is labor in efficiency units), x is the amount of other material inputs, and $\tilde{\varepsilon}$ is a zero mean random variable.

Land is owned by landlords who contract with tenants to organize production. A general contract is defined by three numbers (α, β, r) which are, respectively, the share of the product kept by the tenant, the share of material inputs paid by the tenant and the sure payment made by the tenant to the landlord. This general form of contract encompasses all types of contracts used.

A pure rental contract (RC) is associated with $\alpha = 1$, $\beta = 1$, and $r > 0$.

A pure wage contract (WC) is associated with $\alpha = 0$, $\beta = 0$, and $r < 0$.

A pure sharecropping contract ($SC, \alpha;\beta$) is associated with $\alpha \in (0, 1)$, $\beta \in (0, 1)$ and $r = 0$.[2]

If we denote $\psi(le)$, $\psi' > 0$, $\psi'' > 0$ the disutility of labor for the tenant, his utility level for a contract (α, β, r) is, assuming risk neutrality:

$$\alpha f(le, x) - \beta x - \psi(le) - r.$$

Assuming also risk neutrality for the landlord, the efficient contracts are the solution of the program:

$$\text{Max } (1-\alpha) f(\hat{l}, x) - (1-\beta)x + r \tag{2}$$

S.T.

$$\alpha f(\hat{l},x) - \beta x - \psi(\hat{l}) - r = \bar{u} \qquad (\lambda) \tag{3}$$

where $\bar{u}$ is the alternative level of utility that the tenant can achieve. The interior first order conditions of this program are

$$(1-\alpha)\,\frac{\partial f}{\partial \hat{l}}\,(\hat{l},x) + \lambda\left[\,\alpha\,\frac{\partial f}{\partial \hat{l}}\,(\hat{l},x) - \psi'(\hat{l})\right] = 0 \tag{4}$$

$$(1-\alpha)\,\frac{\partial f}{\partial x}\,(\hat{l},x) - (1-\beta) + \lambda\left[\,\alpha\frac{\partial f}{\partial x}\,(\hat{l},x) - \beta\right] = 0 \tag{5}$$

$$1 - \lambda = 0 \tag{6}$$

or

$$\frac{\partial f}{\partial \hat{l}}\,(\hat{l},x) = \psi'(\hat{l}) \text{ and } \frac{\partial f}{\partial x}\,(\hat{l},x) = 1 \tag{7}$$

i.e., the efficient allocation of resources.

If $\hat{l}^*, x^*$ denote the efficient allocation of resources (α, β, r) must be chosen so that:

$$\alpha f(\hat{l}^*,x^*) - \beta x^* - \psi(\hat{l}^*) - r = \bar{u} \tag{8}$$

i.e.,

$\alpha = 1, \beta = 1$	$r = f(\hat{l}^*,x^*) - \beta x^* - \psi(\hat{l}^*) - \bar{u}$	for a RC
$\alpha = 0, \beta = 0$	$r = -\bar{u} - \psi(\hat{l}^*)$	for a WC

any combination α, β satisfying (8) with $r = 0$ for a SC. Any type of contract can therefore fulfill these conditions.

Let us assume that because of imperfections in the credit market, the working capital R of the tenant is limited. In defining an optimal contract, we must add the constraint:[3]

$$\beta x^* + r \le R \tag{9}$$

If we normalize by choosing $r = 0$, we see that (9) imposes

$$\alpha \le \frac{\bar{u} + R - \psi(\hat{l}^*)}{f(\hat{l}^*,x^*)} \tag{10}$$

Rental contracts and sharecropping contracts with a high share of the product given to the tenant are excluded by the financial constraint. An extremely poor tenant may even be pushed down to a wage contract. If tenants prefer contracts with the largest sharing of contract (which is a measure of their liberty), (9) and (10) will be tight. (10) predicts a positive correlation between α and R. Indeed we find an extremely significant correlation

$$\underset{}{\alpha} = \underset{(8.9)}{376.4} + \underset{(7.6)}{0.034}\, R \tag{11}$$

$R^2 = .48 \qquad n = 65$

However, the above model suggests that the financial constraint does not interfere with an efficient allocation of resources. But, we find an extremely positive correlation between production and β

$$y = \underset{(4.55)}{-32.4} + \underset{(11.56)}{1.31}\ \beta \tag{12}$$

for the contracts with $\alpha = 1/2$ ($n = 12$).

Observe that in this section we have assumed that landlords were able to monitor perfectly effort and could choose the level of efficiency units of labor. We pursue the analysis in the next section by assuming that effort levels are unobservable.

4. Contracting with Financial Constraints and Moral Hazard

We continue to assume that material inputs x and labor, l, are observable and consequently can be chosen by the landlord. However, e is chosen by the tenant, hence, the constraint.[4]

$$\alpha \frac{\partial f}{\partial \hat{l}} (le, x) = \psi'(le) \tag{13}$$

If there was no financial constraint, risk neutrality would enable the landlord to achieve an efficient allocation of resources by choosing a rental contract ($\alpha = 1$). Then, the tenant benefits of all of his effort and chooses a socially optimal level.

Let us now state the landlord's optimization program when both a financial constraint for the tenant and the moral hazard constraint (13) exist.

$$\text{Max } (1-\alpha) f(le, x) - (1-\beta)x + r \tag{14}$$

S.T.

$$\alpha f(le, x) - \beta x - r - \psi(le) \geq \bar{u} \tag{15}$$

$$R - \beta x - r \geq 0 \tag{16}$$

$$\alpha \frac{\partial f}{\partial \hat{l}}(le, x) - \psi'(le) = 0 \tag{17}$$

As we assume now that the financial constraint is binding, (16) can be used to substitute the value of r to give:

$$\underset{(\alpha,\, le,\, x)}{\text{Max}} \quad (1-\alpha) f(le, x) - x + R \tag{18}$$

S.T.

$$\alpha f(le, x) - \psi(le) \geq \bar{u} + R \qquad (\lambda) \tag{19}$$

$$\alpha \frac{\partial f}{\partial \hat{l}}(le, x) - \psi'(le) = 0 \qquad (\mu) \tag{20}$$

We obtain the first order conditions:

$$(1-\alpha)\frac{\partial f}{\partial \hat{l}}(le, x) + \lambda \left[\alpha \frac{\partial f}{\partial \hat{l}}(le, x) - \psi'(le) \right] + \mu \left[\alpha \frac{\partial^2 f}{\partial \hat{l}^2}(le, x) - \psi''(le) \right] = 0 \tag{21}$$

$$(1-\alpha)\frac{\partial f}{\partial x}(le, x) - 1 + \lambda\alpha \frac{\partial f}{\partial x}(le, x) + \mu\alpha \frac{\partial^2 f}{\partial \hat{l}\partial x}(le, x) = 0 \tag{22}$$

$$-f(le, x) + \lambda f(le, x) + \mu \frac{\partial f}{\partial \hat{l}}(le, x) = 0 \tag{23}$$

Using (23) in (21) (22), we finally get, leaving out arguments in the functions:

$$\frac{\partial f}{\partial l} = \psi' + \mu(\psi'' - \alpha \frac{\partial^2 f}{\partial \hat{l}^2}) \tag{24}$$

$$\frac{\partial f}{\partial x} = \frac{1 - \mu\alpha \dfrac{\partial^2 f}{\partial \hat{l}\partial x}}{1 - \mu\alpha \dfrac{\partial f}{\partial \hat{l}}/f} \tag{25}$$

The allocation is now inefficient. Because $\mu > 0$,[5] the quantity of labor in efficiency units is too low; the quantity of material inputs is also too low (if labor and material inputs are not complementary) with an ambiguous result if they are complementary.

The financial constraint puts a limit to the tenant's personal investment. The only way then to constrain the tenant to his individual rationality level $\bar{u}$ is to decrease his share of output. But this decreases his level of effort, creating the inefficiency. Note that for R low enough, the landlord might prefer to not saturate the individual rationality constraint ($\lambda = 0$) and leave to the tenant a share of output inducing a minimal level of effort.

Actually, there is an alternative to this last policy which is to bear the costs required by a careful monitoring.

So, we may expect (if we assume momentarily that the tenant's IR level of utility is independent of his working capital), that the level of utility of the landlord is decreasing when the tenant's working capital R decreases (and therefore the share of output he gets decreases). There comes a point at which the landlord prefers to switch to a wage contract with the associated monitoring costs (see figure 1).[6]

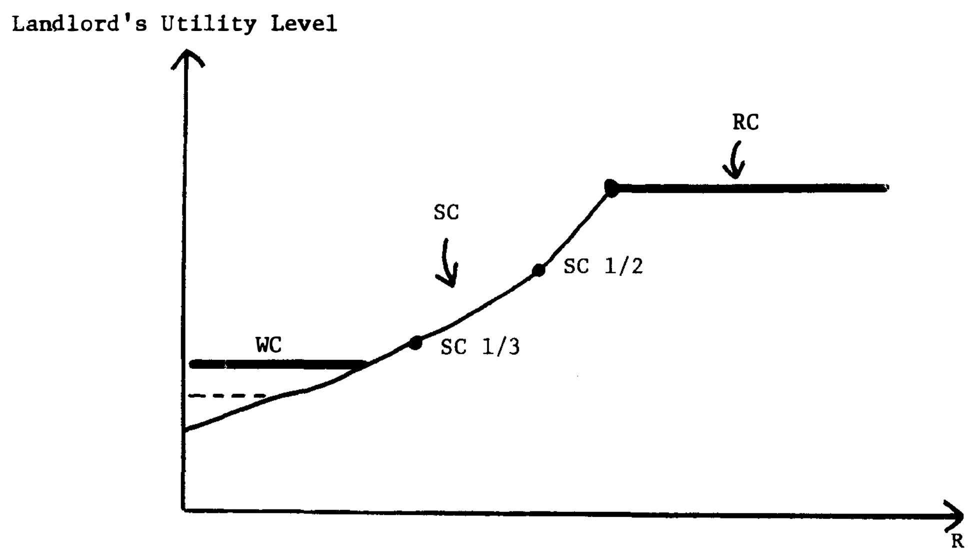

FIGURE 1

Remark 1: In practice the landlord will apply a level of monitoring which increases continuously as the share left to the tenant decreases and the incentive problem worsens.

Remark 2: We may also expect (depending on the relative numbers of landlords and tenants) that the tenants with a lot of working capital will be able to extract more income than the others. In figure 1 we have assumed that the bargaining power was in the hands of landlords, tenants being all kept at the $\bar{u}$ level. The other extreme situation would be the one where landlords would be kept at the same level and the increase of utility due to more effort (due to higher shares (due to higher working capital)) would benefit tenants.

The model so obtained is therefore compatible with the coexistence of all types of contracts, with a positive correlation between the working capital and the share of output retained by the tenant, and with an inefficiency decreasing with that same share.

Consider a Cobb-Douglas specification of the production function

$$\text{Log}\, y = a \text{Log}\, l + a \text{ Log}\, e + b \text{ Log}\, x$$

From the theory above, e is an increasing function of R, $\psi(R)$.

$$\text{Log}\, y = a \text{Log}\, l + b \text{ Log}\, x + a \text{ Log}\, \psi(R)$$

As it is difficult to be more specific about the function ψ we will estimate various functional forms of the type

$$\text{Log}\, y = a \text{Log}\, l + b \text{ Log}\, x + c\, \phi(R)$$

and test the significance of c.

$$\underset{}{\text{Log}\, y} = \underset{(-16.8)}{-2.49} + \underset{(2.29)}{.32} \text{ Log}\, l + \underset{(3.77)}{.49} \text{ Log}\, x + \underset{(13.52)}{.21} \text{ Log}\, R$$

$$n = 37 \qquad R^2 = .99$$

If we restrict the analysis to fixed rent contracts, effort should always be at its optimal value and output be independent of wealth. Indeed, we get,

$$\text{Log}\, y = \underset{(-6.2)}{-3.3} + \underset{(2.2)}{.37} \text{ Log}\, l + \underset{(2.7)}{.46} \text{ Log}\, x + \underset{(1.4)}{.25} \text{ Log}\, R$$

$$n = 20 \qquad R^2 = 0.97$$

For share contracts only we obtain:

$$\text{Log}\, y = \underset{(-16.2)}{-2.4} + \underset{(3.7)}{.48} \text{ Log}\, l + \underset{(3.3)}{.43} \text{ Log}\, x + \underset{(4.4)}{.10} \text{ Log}\, R$$

$$n = 17 \qquad R^2 = 0.99$$

Then regressions suggest that a 100% increase in working capital of tenants (made possible for example by a better credit system) would yield a 10% increase of production. These efficiency gains would come from a new structuring of contracts with higher sharing coefficients for tenants.

The above regressions have been run using production per plot ignoring the size of the plot (which would be all right if labor and land were strict complement for example a production function such as $y = [\min(t, le)]^a x^b$ where t stands for land). To allow for more general production functions ($y = (le)^a x^b t^c$) we also run the regression measuring inputs and output per unit of surface (here hectare).

For share contracts we obtain (assuming constant return to scale):

$$\underset{}{\text{Log}\,(y/t)} = \underset{(-4.1)}{-1.9} + \underset{(3.9)}{0.54}\ \text{Log}\,(l/t) + \underset{(2.0)}{0.34}\ \text{Log}\,(x/t) + \underset{(4.9)}{0.07}\ \text{Log}\,R$$

$$R^2 = 0.98$$

The significance of $\log R$ is reinforced under this specification of the production function.

5. Risk Aversion and Moral Hazard

An alternative explanation of the positive correlation between α and working capital can be given if tenants are risk averse. As risk aversion decreases in general with wealth, agents with more wealth and therefore more working capital will take more risk by signing contracts in which they retain a higher share of the random output.

This effect certainly happens, but variations in risk aversion would have to be considerable to explain the coexistence of all types of contracts. We will argue below that risk aversion is not a major factor explaining the form of contracts.

If risk aversion mattered, the type of contract would depend on the riskiness of the crop. We ran the regression of the type of contract on working capital for crops which are known to be associated with quite different levels of risk.[7] We find strikingly similar coefficients of R.

Green vegetable

$$\alpha = \underset{(4.2)}{226} + \underset{(5.1)}{0.044}\,R \qquad n = 34 \qquad R^2 = 0.45$$

Potatoes

$$\alpha = \underset{(4.2)}{221} + \underset{(5.4)}{0.043}\,R \qquad n = 31 \qquad R^2 = 0.46$$

Onions

$$\alpha = \underset{(3.5)}{208} + \underset{(5.1)}{0.045}\,R \qquad n = 31 \qquad R^2 = 0.47$$

We see a slightly smaller intercept for onions which is the riskiest crop, but for the same level of working capital the effect of the larger riskiness is of the order of 15 which is extremely little in the scale of α which goes from 1 to 1000.

6. Financial Constraints of the Landlords.

If the tenant does not have any financial constraint, the optimal contract is the rental contract. It remains the solution even if the landlord has financial constraints since this contract does not require any financial participation of the landlord.

Let us consider now the case where the tenant's financial constraint is binding. If W denotes the available working capital of the landowner, his optimization program is:

$$\mathrm{Max}(1-\alpha)f(le,x)-(1-\beta)x+r$$

$$\alpha f(le,x)-\beta x-r-\psi(le)\geq\bar{u}$$

$$R-\beta x-r\geq 0$$

$$\alpha\frac{\partial f}{\partial\hat{l}}(le,x)-\psi'(le)=0$$

$$W-(1-\beta)x+r\geq 0$$

From the two tight financial constraints we derive:

$$x=R+W$$

$$r=(1-\beta)R-\beta W$$

The maximization program is reduced to:

$$\mathrm{Max}(1-\alpha)f(le,R+W)-W$$

$$\alpha f(le,R+W)-R-\psi(le)\geq\bar{u}\qquad(\lambda)\tag{26}$$

$$\alpha\frac{\partial f}{\partial\hat{l}}(le,R+W)-\psi'(le)=0\qquad(\mu)\tag{27}$$

with first order conditions:

$$(1-\alpha)\frac{\partial f}{\partial \hat{l}}(le, R+W)+\lambda\left[\alpha\frac{\partial f}{\partial \hat{l}}(le, R+W)-\psi'(le)\right] \tag{28}$$

$$+\mu\left[\alpha\frac{\partial^2 f}{\partial \hat{l}^2}(le, R+W)-\psi''(le)\right]=0$$

$$-f(le, R+W)+\lambda f(le, R+W)+\mu\frac{\partial f}{\partial \hat{l}}(le, R+W)=0 \tag{29}$$

After substitution of (29) into (28), we obtain the same equation to define the marginal productivity of labor as in Section 4. However, material inputs are now constrained by the joint working capital of the landlord and the tenant.

We must distinguish two cases:

Case 1. (26) is binding. Differentiating (26) (27), we get:

$$d\alpha=\alpha\frac{\partial f/\partial x}{f}(-dx)$$

$$d\hat{l}=\frac{1}{\alpha\dfrac{\partial^2 f}{\partial \hat{l}^2}-\psi''}\left[\alpha\frac{\partial^2 f}{\partial \hat{l}\partial x}-\frac{\partial f}{\partial \hat{l}}\cdot\alpha\frac{\partial f/\partial x}{f}\right](-dx)$$

So, starting from the situation with no financial constraint of the landlord and decreasing the material inputs ($dx<0$), we see that α increases as long as (26) (27) remain binding.

The effect on the labor allocation depends on the sign of $\frac{\partial^2 f}{\partial \hat{l}\partial x}$. If labor and material inputs are not complementary $\left(\frac{\partial^2 f}{\partial \hat{l}\partial x}<0\right)$, labor is increased. The effect is ambiguous if they are complementary. It is null for a Cobb-Douglas production function. However, the efficiency of the production process decreases as it is more constrained.

Case 2. When the wealth of the landlord is very small, he may prefer not to set the tenant at his IR utility level to avoid too adverse incentive effects. We do not consider further this extreme case which yields ambiguous answers for both the effect on α and $\hat{l}$.

The main prediction appears to be that the landlord's wealth should have a negative effect on the share left to the tenant and a positive effect on production when the contract is a share contract and no effect for a rent contract.

For rent contracts (production per hectare) we obtain:

$$\underset{}{\text{Log}\, y/t} = \underset{(-14.7)}{-2.36} + \underset{(3.5)}{0.47}\,\text{Log}\,(l/t) + \underset{(3.3)}{0.44}\,\text{Log}\,(x/t)$$

$$+ \underset{(2.6)}{0.09}\,Log\ R + \underset{(0.4)}{0.008}\,\text{Log}\,W \qquad R^2 = 0.99$$

If we relax the assumption of constant return to scale (i.e., a production function of the type $y = k \cdot (le)^a x^b t^c$) we obtain for rent contracts:

$$\text{Log}\,(y/t) = \underset{(-1.02)}{-0.3} + \underset{(6.8)}{0.41}\,\text{Log}\,(l/t) + \underset{(1.7)}{0.13}\,\text{Log}\,(x/t)$$

$$\underset{(-7.6)}{-0.14}\,\text{Log}\,t + \underset{(5.6)}{0.085}\,\text{Log}\,R + \underset{(5.3)}{0.054}\,\text{Log}\,W \qquad R^2 = 0.99$$

This estimation rejects the assumption of constant return to scale and yields, $\hat{a} + \hat{b} + \hat{c} = 0.86$, i.e. decreasing returns to scale.

Finally, we obtain the expected signs in the regression explaining shares.

$$\alpha = \underset{(17.3)}{584} + \underset{(8.00)}{0.024}\,R - \underset{(-8.4)}{0.020}\,W \qquad n = 60 \qquad R^2 = 0.73$$

Since α takes only a few values (0, 1/3, 1/2, 1) we also estimate this equation by a Tobit-maximum likelihood method and we find similar results:

$$\alpha = \underset{(14.2)}{585} + \underset{(6.8)}{0.025}\,R - \underset{(-11.0)}{0.026}\,W$$

As α is measured between 0 and 1000, we find that α is about 1/2 with corrections due to financial constraints of either the tenant or the landlord. It is interesting to note that if we assumed that tenant and landlord had the same constant absolute risk aversion (without any financial constraint) the optimal α would be 1/2. A more complete theory would include risk aversion to justify a certain level of α modified by financial constraints.

To confirm our view that *levels* of risk aversion are low, we estimate the share equations for crops with different risks, including the landlord's wealth. We obtain:

Green vegetable

$$\alpha = \underset{(10.7)}{489.2} + \underset{(5.7)}{0.031}\,R - \underset{(-7.1)}{0.019}\,W \qquad R^2 = 0.80 \qquad n = 29$$ [8]

(and with a Tobit specification)

$$\underset{(7.2)}{\alpha = 488} \; \underset{(6.9)}{+ 0.037 R} \; \underset{(-8.6)}{- 0.030 W}$$

Potatoes

$$\underset{(10)}{\alpha = 488.4} \; \underset{(5.9)}{+ 0.031 R} \; \underset{(-6.7)}{- 0.018 W} \qquad R^2 = 0.77 \qquad n = 31$$ [8]

(and with a Tobit specification)

$$\underset{(7.1)}{\alpha = 485.0} \; \underset{(7.2)}{+ 0.038 R} \; \underset{(-7.1)}{- 0.027 W}$$

Onions

$$\underset{(9.9)}{\alpha = 537.1} \; \underset{(5.3)}{+ 0.031 R} \; \underset{(-7.1)}{- 0.020 W} \qquad R^2 = 0.82 \qquad n = 26$$ [8]

(and with a Tobit specification)

$$\underset{(7.1)}{\alpha = 536} \; \underset{(6.3)}{+ 0.037 R} \; \underset{(-8.2)}{- 0.032 W}$$

7. Historical Evolution of Sharecropping

The next piece of evidence that can be explained by our hypothesis is the evolution of the proportion of share contracts from 12.1% before 1970 to 73.8% after 1970, the other contracts being wage contracts.

A major phenomenon since 1970 is a tremendous increase in the government controlled wage rate. The great increase in sharecropping appears therefore as the adjustment process by which the minimum wage is bypassed.

For our sample of sharecroppers, the effective wage rate is 1.8 Dinar per day when the wage rate is 3.5. In figure 1, it amounts to push down the utility level which can be obtained by the landlord below to the dotted line, increasing the area of sharecropping.

The workers who have very little capital do not see however their welfare increase because some unemployment of their labor force appears as a consequence of this wage rate above the market level. The other inefficiency created is the use of sharing contracts with very low shares for the tenant which either imply a very low effort level or give rise to more monitoring expenses.

8. Conclusion

We developed a theory of sharecropping which emphasizes the dual role of moral hazard and financial constraints. The unobservability of effort requires the use of incentive contracts to induce good effort levels. This can easily be achieved with rental-contracts which leave to tenants all the proceeds of their effort. However, tenants' financial constraints make these contracts often impossible. The poorer the tenant the smaller the share of the crop he will retain and therefore the less effort he will provide.

The special feature of our data which includes financial elements has enabled us to give some empirical evidence to this theory. Working capital appears as a significant explanation of the type of contract chosen by a tenant and of the level of production achieved on a plot. The alternative explanation related to a level of risk aversion decreasing with wealth does not appear to provide an explanation of the large variations in the observed sharing rules.

Footnotes

1. The solution proposed by Cheung (1968) amounts to assume that labor intensity can be chosen by the tenant. Bardhan and Srinivasan (1971), in an otherwise unsatisfactory model, correctly stress that the landlord cannot decide how much labor the sharecropper puts in his land. Shaban (1987) provides empirical evidence against the idea that landlords can completely monitor effort.
2. As material inputs are assumed observable, there is no useful distinction between αx and r when r is positive. Only $\alpha x + r$ matters. Then we can normalize by setting $r = 0$.
3. The role of landlords' financial constraints will be examined in Section 6.
4. As f is concave in $\hat{l}$ and ψ convex, the first order condition (13) is sufficient to characterize the choice of effort level.
5. Look at (21), use (20), the concavity of f and the convexity of ψ.
6. Actually, we observe only the value of 1/2 and 1/3 for the parameter α. The adjustment of (8) can be realized by r, β being then determined by (9). Also in practice, all plots do not have the same productivity and require different values of the parameter for the same financial constraints.
7. Farmers rank the riskiness of crops as follows: green vegetables (low risk), potatoes (medium risk), onions (high risk).
8. The number of observations is smaller than in previous sections. Some wage earners had to be dropped from the sample because our data did not enable us to find their associated landlord.

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