Chapter - Four

4.1. Introduction and Survey of Literature

In agricultural economies sharecropping coexists with self-cultivation (with or without wage labour) and fixed rent arrangements. There are reasons that explain the existence of sharecropping: (i) trade-off between risk sharing and transaction cost, (ii) uncertainty in labour market along with production uncertainty, (iii) market imperfections for inputs like capital besides land, (iv) non-enforceability of contractual provision of inputs and differing monitoring cost, (v) screening of workers of different qualities and abilities, (vi) non-marketability of some inputs like supervision, management and draft animals like bullocks and plough and (vii) cost-sharing. Among these reasons, risk sharing was assigned considerable weight by Cheung (1969). The main idea behind this particular explanation of sharecropping can be put in the following way: in the absence of insurance facilities cultivation of land with own (family) labour involves risk associated with production like the variability of output and fluctuation in input and output prices. In this case the cultivator has to bear all the risks of production. Cultivation with hired
labour carries additional risks of hiring labour such as non-availability of labour in busy seasons. In this case the landlord has to bear the entire risk of production including the risk of non-availability of labour. In the case of renting of land (fixed cash or kind rent) the landlord can avoid the risk of variability of yield and/or fluctuation in output and input prices but he faces the problem of risk of default of rent and of risk of probability of not being able to regain the possession of land. In this case the tenant has to bear all the risks associated with production. Given that the tenant is risk averse and the landlord is either risk-averse or risk neutral\(^1\), the optimal way of sharing risk is sharecropping. Under sharecropping risks in agricultural production are shared between landlord and tenant in proportion to their output share (Raj, 1970; Pant, 1980). Granted that risk sharing can explain sharecropping, we expect a positive relationship between risk sharing and the incidence of sharecropping. That is, the greater the risk in agricultural production, the higher will be the incidence of sharecropping. Before considering this hypothesis, let us present a brief survey of the literature on the association between sharecropping and risk sharing.

\(^1\) Risk neutrality of landlord follows from landlord's possession of wealth and/or access to the capital market.
The early issue on sharecropping is the inefficiency issue raised by Smith (1776) and Marshall (1920) and this issue has already been considered in detail previously. Dissatisfied with inefficiency issue on sharecropping, Johnson (1950) prescribed "three techniques available to the landlord" by which sharecropping could be made efficient: (i) to specify in detail in a contract what the tenant must do - the amounts of labour to be used, the method of cultivation to be adopted and the amounts of fertiliser to be applied; (ii) to share in the cost of cultivation in the same proportion as in the sharing of output; iii) to grant only a short term lease with a periodic review of the performance of the tenant implying the threat of eviction of tenants (Johnson, 1950). Among these three techniques, Johnson emphasized short term lease which, according to him, "resulted in a reasonably efficient utilisation of land":

Cheung (1969) in his seminal account, challenged the traditional view that sharecropping is inefficient and argued that it could be made efficient through the direct supervision and monitoring of inputs by the landlord. The landlord is, according to Cheung, so powerful that he can specify in the contract the labour effort by the tenant and can decide on plot size and the rental share. In doing so,

1 Bardhan and Srinivasan (1971) criticised Cheung for not explaining from where landlords got the power to unilaterally determine their tenant's effort [See also Reid, 1977]
Cheung demonstrated that sharecropping, fixed-rent tenancy and ownership cultivation would tend to produce the same result. This is the famous Equivalence Theorem [See also Rakshit (1982)]. However, Cheung admitted that "contracting on a share basis appears to involve higher transaction costs than a fixed rent or wage contract" (Cheung, 1969). Transaction cost includes negotiation cost, enforcement cost (Cheung, 1969; Pant, 1980), the cost of making quick adjustments in the process of production and the cost of commuting between more than one farm (Chao, 1983). Contracts under sharecropping involve negotiations about inputs to be used and shared by the landlord and the tenant and about the pattern of cropping. Given that negotiation costs are absent in fixed rent tenancy, sharecropping involves higher costs. The enforcement cost is usually associated with labour and it requires greater efforts to supervise the use of labour than the use of land. Since under sharecropping rent depends on the actual level of output, sharecroppers often underreport output. The landlord will therefore need to incur supervisory cost to verify the actual level of output. No such contracts are, however, necessary for fixed rent tenancy. Transaction costs are, therefore, higher in sharecropping than in fixed rent contracts. Notwithstanding higher transaction costs
there is one advantage of sharecropping.

This is the risksharing advantage of sharecropping over fixed rent and wage contract. The idea behind the argument is that under fixed rent contract, it is the tenant who bears all the risks of production provided the means to disperse risks are absent. Under fixed wage contract the landlord bears all the risks of production. Hence if both landlords and tenants are risk averse, neither arrangement is desirable from risk reducing point of view. A sharecropping contract assigns some risks to each contracting parties - the tenant and the landlord - and might be preferable. Combining transaction costs and risk dispersion considerations, Cheung suggested that "a share contract would be chosen rather than a fixed rent and wage contract if higher transaction cost is at least compensated for by the gains from risk dispersion". Cheung (1969) with examples from China predicted that sharecropping would be most prevalent for crops with higher variances in yield and sharecontracts are expected to be more widespread in areas characterised by a high degree of uncertainty than in areas of relative certainty.

This hypothesis initiated empirical tests by economists. Rao (1971) rejected the simple correlation between risk and sharecropping as too simplistic. According
to him the crucial factor in situations of uncertainty and incomplete knowledge is the scope for entrepreneurial decision making, for example, in product and factor substitution. Where such scope is significant making high entrepreneurial profit possible, crop sharing arrangements will not be common; the preference will be for fixed rents or wage contracts on the parts of tenants and landlords respectively. Rao observed this by considering the rice zone and the tobacco zone of West Godavari district of Andhra Pradesh. Pant (1981) in a study done in India reached a similar conclusion by rejecting the hypothesis that risksharing is the principal motivation behind sharecropping.

Stiglitz (1974) and Newbery (1977) made valuable contribution to the literature by generalising Cheung's basic results. Reid (1976) and Newbery and Stiglitz (1979) have demonstrated that if tenants and landlords enter into a suitable mix of wage and fixed rent contracts, they can achieve the same division of risk and the same pattern of returns as they would achieve under sharecontract and the risksharing advantage of sharecropping is spurious. Thus risksharing by itself is not sufficient to explain the existence of sharecropping when wage and fixed rent tenancy
contracts are mixed costlessly.

But as Rakshit (1982) points out, the conclusion holds "only if the production and input cost functions of the landlords and the tenants are identical and if production conditions display constant returns to scale. A violation of any of these three conditions, all of which are extremely stringent for less developed countries, may make share tenancy a viable, or even the dominant, form of land use". Besides, Newbery (1977) and Newbery and Stiglitz (1979) have established that if there are multiple sources of risk, sharecontract is an improvement over a combination of fixed-rent and wage contracts. An example of multiple risk is that along with production uncertainty in the product market there is an additional risk in the labour market which arises from the discrepancy between the demand for and supply of agricultural labour in periods of slack and busy seasons. During the slack season there is an excess supply of labour and it is unlikely that labour market will guarantee full employment and a predictable wage. Similarly in the busy season when there is an excess demand for labour full employment of labour is ensured but the wage rate is uncertain. There is some randomness in the wage rate which causes output to be random. Thus if labour market is risky and if production risk is multiplicative, then if
share contracts are added, the economy will achieve production efficiency and sharecropping in this case offers an additional risk advantage over a combination of fixed rent and wage contracts.

Apart from riskiness in the labour market, share contracts may improve risk sharing if there are nontradeable (or, non-marketable) inputs such as management, supervision and the services of draft animals like bullocks and plough (Bardhan, 1989b; Pant, 1983; Eswaran and Kotwal, 1985). The reason for absence of these markets may be moral hazard. Bell (1976, 1977) in his study of Purnea district of Bihar observed that households having surplus bullocks in relation to their landholding would prefer leasing in land because surplus bullocks cannot be sold; on the other hand, households with more land in relation to their bullock holding would lease out their surplus land. Bliss and Stern (1982) noted similar observation in the Palanpur village of Uttar Pradesh. The non-existence of a market for bullock hire services provided a possible motivation for sharecropping. Bliss and Stern (1982) also viewed sharecropping as an arrangement that involves the pooling of managerial and cultivating skill. Cultivation involves various types of work and hence requires entrepreneurial and managerial ability. However the market for management very
rarely exists in Indian conditions (Pant, 1983). When management is a non-marketable input, a household deficient in management (that is, it is inexperienced in cultivation and incapable in supervising and managing the land) may find it profitable to lease out land to a tenant who is better endowed with managerial ability. Reid (1977) found rationale for sharecropping in the cooperation between landlord and tenant on management and supervision which is difficult to specify. In this sense, sharecropping is regarded as a partnership in which each partner provides the unmarketed factor input in which he is better endowed (Eswaran and Kotwal, 1985). In sharecropping arrangement, the landlord provides management and the tenant supervision and in doing so there is the problem of moral hazard of shirking which arises from the unobservability of supervision and management. The problem can be mitigated if both parties are residual claimants. This is accomplished under sharecropping (Eswaran and Kotwal, 1985). The motivation for tenancy can also be explained in terms of size and composition of cultivating households (Pant, 1983). Pant noted that children below a certain age cannot work for wage employment, women are also not permitted to work and members from higher castes do not offer their labour services even if they own land. Bliss and Stern (1982) found
that 'Thakur' households (belonging to high caste in Palanpur) do not hire out their labour services. Thus age, sex and caste composition may act as barriers to entry in the labour force and this suggests a rationale for tenancy. Pant in his empirical study on six villages in Maharastra and Andra Pradesh got the regression result that households with a large number of workers relative to landownership and with ownership of bullocks leased in more land (Pant, 1983).

Before concluding the survey it may be mentioned that in recent literature there is a growing awareness that risk sharing by itself fails to explain sharecropping. Hirshleifer and Riley (1979) have shown that sharecropping is a very inflexible and suboptimal instrument of risk sharing. Kotwal (1985) has demonstrated that consumption credit, on the other hand, is a much more convenient and flexible instrument of distributing risk. Consumption credit, Kotwal argues, distributes risk associated with the randomness of weather from the risk averse tenant to the wealthier landlord without diminishing the tenant's incentive to work.

4.2 Two Types of Uncertainty and the Test

Empirically there seems to be no conclusive evidence on the relationship between risk sharing and sharecropping.
For example, Cheung (1969) noted that sharecropping in China was associated with a high degree of uncertainty and risk. As noted earlier, Rao and Pant failed to discover this association for India as they have offered their own explanation for it. Again, in a recent study, Singh [Bardhan (ed.), 1989b] observed that sharecroppers sometimes produce risky cash crops. We are thus confronted with conflicting evidence which lead us to examine the hypothesis that sharecropping exists to enable risksharing: the incidence of sharecropping is greater for the crop which has higher risk of production. We have taken data on the percentage of area under sharecropping and the percentage of area under risky crops for 41 villages which are more or less homogeneous in respect of irrigation. The lack of irrigation produces uncertainty and risk. So we take more or less equally irrigated villages to neutralise this factor.

Traditional agriculture is subject to risk and uncertainty. This risk and uncertainty arise from various sources. One source is uncertainty in production. The second source is uncertainty and risk regarding availability of essential inputs like labour, fertiliser, water etc. at the right time and in adequate amounts, failing which production will be affected. The third source is
uncertainty and risk arising from market conditions which is reflected in the variability of input prices and output prices. Thus there are two major types of uncertainty: (i) one in respect of production, and (ii) other in respect of prices. Let us first consider the uncertainty of the first type – namely, production uncertainty.

**Production uncertainty**: Agricultural production in less developed countries is affected considerably by the intensity and time distribution of erratic monsoon, floods, droughts, pests, insects etc. Agricultural production will be low in a drought year or because of floods and damages caused by insects so that the variance of yield will be larger. A crop with larger variance is said to be risky\(^1\) compared to a crop with smaller variance. Variance of yield of different crops can be compared on the basis of data on yield of different crops. Calculation of the coefficients of variation for the period 1976-77 to 1983-84 is done below.

---

\(^1\) On the identification of riskier crops, the extent of risk aversion and risk premium, See Mythili (1992).
Table 4.1  Yield rate of different crops in West Bengal (Kgs/hectare)

<table>
<thead>
<tr>
<th>Years</th>
<th>Rice</th>
<th>Potato</th>
</tr>
</thead>
<tbody>
<tr>
<td>1976-77</td>
<td>1143</td>
<td>14410</td>
</tr>
<tr>
<td>1977-78</td>
<td>1382</td>
<td>15152</td>
</tr>
<tr>
<td>1978-79</td>
<td>1401</td>
<td>15144</td>
</tr>
<tr>
<td>1979-80</td>
<td>1200</td>
<td>18612</td>
</tr>
<tr>
<td>1980-81</td>
<td>1442</td>
<td>17057</td>
</tr>
<tr>
<td>1981-82</td>
<td>1120</td>
<td>16500</td>
</tr>
<tr>
<td>1982-83</td>
<td>1018</td>
<td>20013</td>
</tr>
<tr>
<td>1983-84</td>
<td>1478</td>
<td>21008</td>
</tr>
</tbody>
</table>

Source: Directorate of Agriculture, Socio-Economic and Evaluation Branch, Government of West Bengal.

Table 4.2  Coefficient of variation of yield rate of different crops

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>12.7</td>
</tr>
<tr>
<td>Potato</td>
<td>13</td>
</tr>
</tbody>
</table>

Taking coefficient of variation as an index of risk, we see that potato is the riskier crop. In addition to yield
variance we also use some other criteria to judge riskiness.
These are:

(a) Which crop is affected more by fluctuations in weather conditions. It has been observed by tenants, landlords and people engaged in agriculture that variance of yield in potato is more than that in rice. This is so because right from the land preparation to harvesting, if there is any change in weather condition (different from normal weather condition) at any stage, production of potato yield is subject to changes more than the production of rice.

(b) Which crop is more affected by non-availability of timely supply of labour and other inputs. By the method of interview of tenants and landlords and by crosschecking, it is learnt that from land preparation to harvesting, 1 bigha of rice production requires 21 units labour (measured in mandays) while 1 bigha of potato production requires 27 units labour so that labour requirement per bigha of potato is more than that of rice. Also, availability of timeliness of labour is more important in potato than in rice. It is true that non-availability of labour in time is a potent threat to agricultural production irrespective of any crop. But potato is more adversely affected by
seasonal variation in labour than rice. Experience of landlord and tenants says that due to non-availability of labour in time, yield of potato is reduced by 50 per cent or even more than yield of potato if labour is available in time, while yield of rice is reduced by 30 per cent. Therefore, timeliness of labour is more important in potato cultivation than in rice cultivation.

It has been observed that potato requires not only assured supply of water but it also requires water in proper amounts. If the distribution of water supply is not normal, yield of potato is affected more than that of rice.

It has been observed that the fertiliser requirement per bigha in rice cultivation is as follows:

D.A.P. - 20 kg in the time of land preparation
+ Potash - 10 kg
+ Urea - 10 kg in the time of weeding

and the fertiliser requirement per bigha in potato cultivation is as follows:

D.A.P. - 100 - 125 kg in the time of land preparation
+ Potash - 60 kg
+ Urea - 25 kg in the time of drawing 'buko' and 'kani' (in local language),
or, 10:26:26 = 160 kg + urea - 35 kg.

The data show that fertiliser requirement is more in potato cultivation than in rice cultivation.

If, for some reasons, there is shortage of fertiliser, yield of potato is affected more than yield of rice as is clear from the following table.

Table 4.3 Yield of different crops under availability and non-availability of chemical fertiliser

<table>
<thead>
<tr>
<th>Chemical fertiliser available</th>
<th>Chemical fertiliser non-available</th>
<th>Percentage reduction in output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Yield of rice per bigha</td>
<td>1) Yield of HYV rice per bigha</td>
<td></td>
</tr>
<tr>
<td>18 mds (HYV rice)</td>
<td>10 mds</td>
<td>44</td>
</tr>
<tr>
<td>2) Yield of traditional rice per bigha</td>
<td>Yield of traditional rice per bigha</td>
<td></td>
</tr>
<tr>
<td>10 mds</td>
<td>7 mds</td>
<td>30</td>
</tr>
<tr>
<td>2) Yield of potato per bigha</td>
<td>2) Yield of potato per bigha</td>
<td></td>
</tr>
<tr>
<td>75 mds</td>
<td>30 mds</td>
<td>52</td>
</tr>
</tbody>
</table>

The table makes it clear that yield of HYV rice is reduced by 44 per cent, that of traditional rice is reduced by 30

1 Organic manures and oilcake are used
per cent and that of potato is reduced by 52 per cent if fertiliser is not available compared to situation when fertiliser is available. Thus by considering all relevant aspects and by judging on the above criteria, variance in yield of potato is higher than variance in yield of rice (both types - HYV and traditional) so that production uncertainty is more in potato. Potato is the risky crop on the basis of production uncertainty.

**Price uncertainty**: Here, the riskiness of a crop is judged on the basis of variability of prices of competing output and variability of prices of major inputs like fertiliser. The following table gives data on prices of competing output for ten consecutive years. It should be mentioned here that we take immediate post-harvest prices, thereby neglecting the influence of storage cost. We take immediate post-harvest price because tenants are forced to sell their output immediately after harvest due to lack of capital. Consider now the following table.
### Table 4.4 Output prices

<table>
<thead>
<tr>
<th>Year</th>
<th>Potato (in Rs. per 60 kg packet)</th>
<th>Traditional rice (in Rs. per 60 kg packet)</th>
<th>HYV rice (in Rs. per 60 kg packet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982-83</td>
<td>55</td>
<td>110</td>
<td>85</td>
</tr>
<tr>
<td>1983-84</td>
<td>68</td>
<td>120</td>
<td>90</td>
</tr>
<tr>
<td>1984-85</td>
<td>45</td>
<td>130</td>
<td>100</td>
</tr>
<tr>
<td>1985-86</td>
<td>51</td>
<td>150</td>
<td>120</td>
</tr>
<tr>
<td>1986-87</td>
<td>85</td>
<td>155</td>
<td>130</td>
</tr>
<tr>
<td>1987-88</td>
<td>70</td>
<td>165</td>
<td>135</td>
</tr>
<tr>
<td>1988-89</td>
<td>98</td>
<td>175</td>
<td>140</td>
</tr>
<tr>
<td>1989-90</td>
<td>98</td>
<td>185</td>
<td>150</td>
</tr>
<tr>
<td>1990-91</td>
<td>105</td>
<td>190</td>
<td>170</td>
</tr>
<tr>
<td>1991-92</td>
<td>110</td>
<td>200</td>
<td>180</td>
</tr>
</tbody>
</table>

Source: Sridharpur Cooperative Bank (Regd. No. 204 of 1918), 1992 and Private Agency, and Markets

We have calculated the coefficients of variation in output prices on the basis of above data.

### Table 4.5 Coefficients of variation of output prices of crops

<table>
<thead>
<tr>
<th>Crops</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>28.79</td>
</tr>
<tr>
<td>Traditional rice</td>
<td>18.40</td>
</tr>
<tr>
<td>HYV rice</td>
<td>23.39</td>
</tr>
</tbody>
</table>

Judged on the basis of the coefficient of variation potato is the riskiest crop.
We now consider riskiness of a crop in respect of prices of fertiliser. Production of potato requires mainly the fertiliser 10:26:26\(^1\) while production of rice requires mainly the fertiliser DAP. The following table shows the figures for fertiliser prices for five consecutive years.

Table 4.6 Prices of fertilisers

<table>
<thead>
<tr>
<th>Year</th>
<th>10:26:26 (in Rs. per metric ton)</th>
<th>DAP (in Rs. per metric ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987-91</td>
<td>2900</td>
<td>3600</td>
</tr>
<tr>
<td>1991-92</td>
<td>3448</td>
<td>4676</td>
</tr>
</tbody>
</table>

Source: Sridharpur Cooperative Bank (Regd.No.204 of 1919), 1992

On the basis of above data, coefficient of variations of fertiliser prices are calculated as the following table shows.

Table 4.7 Coefficients of variation of fertiliser prices

<table>
<thead>
<tr>
<th>Fertiliser</th>
<th>Coefficient of Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:26:26</td>
<td>14.04</td>
</tr>
<tr>
<td>DAP</td>
<td>13</td>
</tr>
</tbody>
</table>

\(^1\) Alternatively, production of potato requires DAP with potash.
Judged on the basis of coefficient of variation of fertiliser prices, potato may be taken as the risky crop. Thus on both the criteria of production and price uncertainty potato is the risky crop and the identification of risky crop is complete. We note one thing in this connection. In villages where both potato and HYV rice are cropped, potato is considered risky but in villages where potato cannot be cultivated due to unfavourable soil condition, HYV rice is the riskier crop compared to traditional rice. Taking all the sample villages together: potato is the risky crop in - Sridharpur, Dakinipara, Sripur, Mirzapur, Parbatipur, Kashiara; HYV rice in Chetua, Sarra, Baidyapur, Berela and Debagram; and traditional rice in - Kirnahar and Bagason.

We now consider the correlation between the percentages of net sown area under sharecropping and area under the risky crop on the basis of data furnished in the following table.
# Table 4.8 Area under sharecropping and the risky crop

<table>
<thead>
<tr>
<th>Areas</th>
<th>Percentage of net sown area under sharecropping</th>
<th>Percentage of net sown area under the risky crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sridharpur (1)</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>2. Dakinipara (1)</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>3. Sripur (1)</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>4. Chetua (1)</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>5. Sarra (1)</td>
<td>6</td>
<td>85</td>
</tr>
<tr>
<td>6. Baidyapur (1)</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>7. Mirzapur (1)</td>
<td>18</td>
<td>70</td>
</tr>
<tr>
<td>8. Kirnahar (7)</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>9. Parbatipur (10)</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>10. Bagason (1)</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>11. Kashiara (1)</td>
<td>6</td>
<td>80</td>
</tr>
<tr>
<td>12. Berela (1)</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>13. Debagram (14)</td>
<td>60</td>
<td>33</td>
</tr>
</tbody>
</table>

Total no. of villages = 41

No. of villages in a particular area is shown in parenthesis

**Note**: The figures in the table pertain to each village in the respective areas; for example, for each of the seven villages in Kirnahar area, the observations are approximately (50,70).
We have calculated the correlation coefficient between percentage of net sown area under sharecropping and percentage of net sown area under the risky crop. The correlation coefficient is found to be 0.427 which is positive. This implies that sharecropping is positively correlated with risk sharing.

We can now test the null hypothesis \( H_0 : \rho = 0 \) against alternative hypothesis \( H_1 : \rho > 0 \) where \( \rho \) is the population correlation coefficient. Under usual assumptions the relevant statistic is \( t \) with \( n-2=39 \) degrees of freedom. The calculated value is obtained as \( t=2.98 \) while tabulated values of \( t \) under 5 per cent and 1 per cent level of significance are 2.021 and 2.704 respectively. Comparing the values we conclude that the observed value of \( t \) is significant at both 1 per cent and 5 per cent levels. That is, \( H_0 \) is rejected and the population correlation coefficient may be supposed to be positive. This supports the hypothesis of risk sharing as an important factor explaining sharecropping.

In the introductory section we pointed out that management being a non-marketed input a household that is deficient in management and supervision will find it worthwhile to lease out to tenants. The next section
carries out an indirect test by relating sharecropping to the residence and activity status of the landlord. The assumption is that a landlord who is non-resident and/or engaged in non-agricultural activities will be poorly endowed with managerial/supervisory skill.

### 4.3 Share Tenancy and Managerial Inputs

The following table gives data on percentage of net sown area under sharecropping, percentage of non-resident landlords villagewise and percentage of landlords engaged in non-agricultural activities.

Table 4.9 Share cropped area, status and non-agricultural activities of landlords (all in percentages)

<table>
<thead>
<tr>
<th>Area</th>
<th>Area under sharecropping (X)</th>
<th>Non-resident landlord (X₁)</th>
<th>Landlord (X₂) engaged in non-agricultural activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sridharpur</td>
<td>20</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>2. Dakinipara</td>
<td>20</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3. Sripur</td>
<td>27</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>4. Chetua</td>
<td>20</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>5. Sarra</td>
<td>6</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>6. Baidyapur</td>
<td>50</td>
<td>0</td>
<td>60</td>
</tr>
<tr>
<td>7. Mirzapur</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8. Kirnahar</td>
<td>50</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>9. Parbatipur</td>
<td>7</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>
From the above table we find that in the case of majority of our sample villages, most of the landlords are resident. So we ignore the factor, namely, the resident status of the landlord. We form the regression equation

\[ Y_i = b_0 + b_1 X_i + U_i, \]

where \( Y \) : percentage of net sown area under sharecropping,

\( X \) : percentage of landlords engaged in non-agricultural activities,

and \( U \) : a random disturbance term.

The estimated relationship is \( \hat{Y}_i = \hat{b}_0 + \hat{b}_1 \hat{X}_i + e \), where \( e \) is the estimate of \( u \). The estimated regression line is \( \hat{Y}_i = \hat{b}_0 + \hat{b}_1 \hat{X}_i \). Table 4.9 is reproduced in a slightly modified form.

<table>
<thead>
<tr>
<th>Area</th>
<th>Area under sharecropping ( Y )</th>
<th>Non-resident landlord ( X_1 )</th>
<th>Landlord ( (X_2) ) engaged in non-agricultural activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Bagason</td>
<td>15</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>11. Kashiara</td>
<td>6</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>12. Berela</td>
<td>15</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>13. Debagram</td>
<td>60</td>
<td>0</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 4.9 contd.
Table 4.10 Net sown area and non-agricultural activities of landlord (in percentage)

<table>
<thead>
<tr>
<th>Area (No. of villages)</th>
<th>Landlords engaged in non-agricultural activities (X)</th>
<th>Area under sharecropping (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sridharpur (1)</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>2. Dakinipara (1)</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>3. Sripur (1)</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>4. Chetua (1)</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>5. Sarra (1)</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>6. Baidyapur (1)</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>7. Mirzapur (1)</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>8. Kirnahar (7)</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>9. Parbatipur (10)</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>10. Bagason (1)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>11. Kashiara (1)</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>12. Berela (1)</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>13. Debagram (14)</td>
<td>30</td>
<td>60</td>
</tr>
</tbody>
</table>

N = Total no. of villages = 41

On the basis of above data, parameters are estimated and the values obtained are: \( \hat{b}_0 = 4.33 \) and \( \hat{b}_1 = 1.56 \).
We then calculate the coefficient of determination, $R^2$ which determines the proportion of variation in $Y$ which is explained by variation in $X$. $R^2$ is found to be 0.6084. This means that 60 per cent of total variation in the incidence of sharecropping can be explained by variations in the non-agricultural activities of the landlord and the remaining 40 per cent of the total variation in the incidence of sharecropping is unaccounted by the regression line and is attributed to the factors included in the disturbance term, $U$. The standard errors of estimate are calculated as $S(\hat{b}_0) = 4.68$, $S(\hat{b}_1) = 0.20$. Thus the regression results may be presented in the summary form as

\[
\hat{Y} = 4.33 + 1.56 X
\]

$S(\hat{b}_1) : (4.68) (0.2)$

$t$ values are: $(0.92) (7.8)$

$R^2_{Y.X} = 0.6084; \quad t_{0.025, 39}=2.021.$

Comparing $t$ values we note that $t(\hat{b}_1) > t_{0.025, 39}=2.021$ so that $\hat{b}_1$ is significant while $t(\hat{b}_0) < t_{0.025, 39}$ so that $\hat{b}_0$ is not statistically significant.

This result conforms to intuition. Landlords engaged in non-agricultural activities may find it difficult to monitor supervision and management and therefore risk
increases for him. In agricultural production attention to detail and constant watch at different stages to ensure proper timing is of vital importance. To mitigate risk and uncertainty, landlords choose sharecropping.